

No. *HD9698 . U52A48

1953



GIVEN BY

U. S. SUPT. OF DOCUMENTS

ATOMIC POWER DEVELOPMENT AND PRIVATE ENTERPRISE

HEARINGS

BEFORE THE

JOINT COMMITTEE ON ATOMIC ENERGY

CONGRESS OF THE UNITED STATES

EIGHTY-THIRD CONGRESS

FIRST SESSION

ON

ATOMIC POWER DEVELOPMENT AND PRIVATE ENTERPRISE

JUNE 24, 25, AND 29; JULY 1, 6, 9, 13, 15, 16, 20, 22, 23, 27, AND 31, 1953

Printed for the use of the Joint Committee on Atomic Energy



9477

ATOMIC POWER DEVELOPMENT AND PRIVATE ENTERPRISE

HEARINGS

BEFORE THE

JOINT COMMITTEE ON ATOMIC ENERGY CONGRESS OF THE UNITED STATES

EIGHTY-THIRD CONGRESS

FIRST SESSION

ON

ATOMIC POWER DEVELOPMENT AND PRIVATE ENTERPRISE

JUNE 24, 25, AND 29; JULY 1, 6, 9, 13, 15, 16, 20, 22, 23, 27, AND 31, 1953

Printed for the use of the Joint Committee on Atomic Energy



UNITED STATES
GOVERNMENT PRINTING OFFICE

* HD 9698
. U52A48
1953

Boston Public Library
Superintendent of Documents

SEP 1 - 1953

JOINT COMMITTEE ON ATOMIC ENERGY

(Created pursuant to Public Law 585, 79th Cong.)

W. STERLING COLE, New York, *Chairman*

BOURKE B. HICKENLOOPER, Iowa, *Vice Chairman*

CARL HINSHAW, California
JAMES E. VAN ZANDT, Pennsylvania
JAMES T. PATTERSON, Connecticut
THOMAS A. JENKINS, Ohio
CARL T. DURHAM, North Carolina
CHET HOLIFIELD, California
MELVIN PRICE, Illinois
PAUL J. KILDAY, Texas

EUGENE D. MILLIKIN, Colorado
WILLIAM F. KNOWLAND, California
JOHN W. BRICKER, Ohio
GUY CORDON, Oregon
RICHARD B. RUSSELL, Georgia
EDWIN C. JOHNSON, Colorado
CLINTON P. ANDERSON, New Mexico
JOHN O. PASTORE, Rhode Island

CORBIN C. ALLARDICE, *Executive Director*

WALTER A. HAMILTON, *Staff Member on Reactor Development, Editor*

LIST OF WITNESSES AND CORRESPONDENTS

	Page
Atwood, J. L., president, North American Aviation, Inc.....	324
Aydelott, J. H., vice president, Association of American Railroads (sub- mitted).....	582
Bacher, Robert F., California Institute of Technology.....	585
Barbour, William E., Jr., president, Tracerlab, Inc. (submitted).....	635
Bechtel, S. D., of the Bechtel Corp.....	585
Beckerley, J. G., Director of Classification, Atomic Energy Commission....	36
Benedict, Manson, Massachusetts Institute of Technology (submitted)....	586
Biemiller, Andrew J., member of the national legislative committee of the American Federation of Labor.....	479
Blum, Robert (submitted).....	587
Bolster, Calvin M., Chief of Naval Research, accompanied by Maj. Gen. Ernest M. Brannon, Judge Advocate General of the Army, and Comdr. D. H. Dickey, patent counsel for the Navy.....	555
Boyer, M. W., General Manager, Atomic Energy Commission.....	562
Braun, C. R., manager, atomic power section, Allis-Chalmers Manufac- turing Co.....	336
Brown, Arnold K., executive vice president, American Machine & Foundry Co.....	313
Brownell, L. E., University of Michigan (submitted).....	595
Buckley, Oliver E., member, General Advisory Committee to the Atomic Energy Commission.....	596
Bugher, John C., Director, Division of Biology and Medicine, Atomic Energy Commission.....	30
Campbell, Joseph, Commissioner, Atomic Energy Commission.....	562
Center, Clark E., Carbide & Carbon Chemicals Co.....	596
Cisler, Walker L., president, Detroit Edison Co.....	134
Coats, J. E., president, Patent Law Association of Los Angeles (sub- mitted).....	619
Cohen, Karl, vice president, Walter Kidde Nuclear Laboratories, Inc.....	259
Collbohm, F. R., director, the Rand Corp.....	625
Costello, J. M., executive vice president, South Carolina Electric & Gas Co. (submitted).....	628
Davidson, W. L., Director, Office of Industrial Development, Atomic Energy Commission.....	26
Davies, C. E., secretary, the American Society of Mechanical Engineers....	581
Davis, Chester L., attorney at law (submitted).....	598
Dean, Gordon, Chairman, Atomic Energy Commission (term expired June 30, 1953).....	5
Dixon, Edgar H., chairman, committee on atomic power, Edison Electric Institute; president, Middle South Utilities, Inc., accompanied by Paul Hallingby, Jr., assistant to the president, Middle South Utilities, Inc....	434
Doan, R. L. (submitted).....	620
Donnell, Alton P., coordinator, Dow-Edison project.....	134
Doty, Dale E., member, accompanied by Francis L. Adams, Chief, Bureau of Power, and Howard E. Wahrenbrock, General Counsel, Bureau of Law, Federal Power Commission.....	114
Ellis, Blyde T., executive manager, National Rural Electric Co-oper- ative Association.....	357
Fairman, J. F., vice president, Consolidated Edison of New York.....	134
Ferguson, Malcolm P., president, Bendix Aviation Corp.....	398
Fermi, Enrico, University of Chicago (submitted).....	601
Fleger, Philip A., Duquesne Light Co.....	600
Ford, John Anson, board of supervisors, County of Los Angeles (sub- mitted).....	611

Gale, Willis, chairman, accompanied by Murray Joslin, vice president, Commonwealth Edison Co.....	Page 205
Gillespie, Tyrone, general counsel, Dow Chemical Co.....	134
Grebe, Dr. John, Dow Chemical Co.....	134
Greenewalt, C. H., president, E. I. du Pont de Nemours & Co.....	599
Griswold, Arthur S., assistant to the president, Detroit Edison Co.....	134
Gwinn, W. P., general manager, Pratt & Whitney Division, United Aircraft Corp. (submitted).....	635
Hafstad, Dr. Lawrence R., Director of the Reactor Division, Atomic Energy Commission.....	13
Haskell, Broderick, Combustion Engineering, Inc.....	598
Haviland, Fred R., Jr., Director of Market Development, Minneapolis- Honeywell Regulator Co. (submitted).....	612
Hayes, Willard C., chairman, committee on laws and rules, American Patent Law Association (submitted).....	580
Hayner, J. H., Henry J. Kaiser Co.....	602
Hootman, James A., technical assistant to the director, National Advisory Committee for Aeronautics.....	548
Hyland, L. A., vice president (engineering), Bendix Aviation Corp.....	398
Iddles, Alfred, president, The Babcock & Wilcox Co.....	377
Kellogg, Fred C., president, Pioneer Service & Engineering Co.....	192
Kingston, Walter E., general manager, Atomic Energy Division, Sylvania Electric Products, Inc.....	527
Lawrence, Ernest O., University of California.....	602
LeBaron, Robert, Assistant to the Secretary of Defense (atomic energy)....	71
Lilienthal, David E., former Chairman, Atomic Energy Committee (sub- mitted).....	603
Lindseth, Elmer, president, Cleveland Electric Illuminating Co.....	134
Loughlin, Eugene S., president, National Association of Railroad and Utilities Commissioners and Chairman, Connecticut Public Utilities Commission.....	582
Malone, Hon. George W., United States Senator from the State of Nevada.....	449, 453
McAfee, J. W., president, Union Electric System, the North American Co., the Electric Energy, Inc. (by Edwin Putzell).....	188
McCune, F. K., general manager, accompanied by Stuart MacMacklin, counsel, Atomic Products Division, General Electric Co.....	301
McKay, Hon. Douglas, Secretary of the Interior.....	98
Menke, John R., president, Nuclear Development Associates, Inc.....	273
Miles, Clarence R., Chamber of Commerce of the United States (sub- mitted).....	597
Mills, Vice Admiral Earle W., president, Foster Wheeler Corp.....	192
Morris, Samuel B., chairman, Atomic Power Policy Committee, ac- companied by Alex Radin, manager, American Public Power Association....	420
Morse, R. H., Jr., president, Fairbanks, Morse & Co. (submitted).....	600
Murphree, E. V., president, Standard Oil Development Co. (submitted)....	630
Myres, Homer S., president, Radioactive Products, Inc. (submitted)....	624
Neumann, John V., University of California.....	612
Newman, James R., former counsel to the Senate Special Committee on Atomic Energy.....	613
Olds, Leland, Public Affairs Institute (submitted).....	513
Ooms, Casper, former United States Patent Commissioner and Chairman of the AEC Patent Compensation Board.....	457
Pierce, Prof. William J., Law School, University of Michigan.....	134
Pigott, R. J. S., president, Engineers Joint Council.....	544
Pike, Sumner T., chairman, Public Utilities Commission, State of Maine....	622
Pitzer, K. S., dean, College of Chemistry, University of California (sub- mitted).....	623
Price, Gwilym A., president, Atomic Power Division, Westinghouse Elec- tric Corp.....	278
Proctor, B. E., Massachusetts Institute of Technology.....	624
Putzell, Edwin J., Jr., secretary, Monsanto Chemical Co.....	171
Rabi, I. I., chairman, General Advisory Committee to the Atomic Energy Commission.....	82
Raleigh, Walter, executive vice president, New England Council.....	415
Rineliffe, R. G., president, Philadelphia Electric Co.....	134
Rowley, Edward R., production manager, National Lead Co.....	390

	Page
Ruebhausen, Oscar M., chairman, special committee on atomic energy, the Association of the Bar of the City of New York-----	469
Ruml, Beardsley-----	642
Searing, Hudson R., Consolidated Edison Co. of New York-----	598
Shugg, Carleton, Electric Boat Division, General Dynamics Corp. (submitted)-----	626
Sigal, Benjamin C., Congress of Industrial Organizations-----	488
Smith, Walter Bedell, Under Secretary of State-----	63
Smyth, Dr. Henry D., Commissioner, Atomic Energy Commission-----	562
Sporn, Philip, president, American Gas & Electric Co. (submitted)-----	628
Starr, Dr. Chauncey, director, Atomic Energy Research Department, North American Aviation, Inc-----	248
Steiger, William A., vice chairman, Committee of Patents, National Association of Manufacturers-----	507
Stevenson, R. S., executive president, by C. R. Braun, manager, atomic-power section, Allis-Chalmers Manufacturing Co-----	336
Strauss, Lewis L., Chairman (effective date July 2, 1953), Atomic Energy Commission-----	562
Suits, Dr. C. G., chairman, subcommittee on atomic energy of the committee on research of the National Association of Manufacturers-----	504
Swisher, Elwood D., international president, United Gas, Coke, and Chemical Workers of America, CIO-----	499
Teller, Edward, radiation laboratory, University of California submitted)-----	632
Thomas, R. W., vice president, Phillips Petroleum Co. (submitted)-----	620
Towe, K. C., president, American Cyanamid Co-----	580
Voorhis, Jerry, executive director, Cooperative League of the U. S. A. (submitted)-----	373
Walker, Dr. Eric, dean, school of engineering, the Pennsylvania State College-----	536
Ward, J. Carleton, Jr., Vitro Corp. of America (submitted)-----	638
Watson, Robert C., Commissioner, United States Patent Office, Department of Commerce (submitted)-----	636
Weaver, Charles H., manager, atomic-power division, Westinghouse Electric Corp-----	278
Weil, Dr. George L., former assistant director, Reactor Development Division, Atomic Energy Commission-----	346
Weinberg, Alvin M., technical director, Oak Ridge National Laboratory, Atomic Energy Commission-----	240
Wigner, Eugene P., professor of physics, Princeton University-----	317
Williams, Hon. Walter, Under Secretary of Commerce-----	104
Wilson, Charles S., chairman, patent committee, Aircraft Industries Association of America, Inc. (submitted)-----	578
Zinn, Walter H., Director, Argonne National Laboratory Commission-----	220

COMPANIES, GOVERNMENT AGENCIES, AND ORGANIZATIONS REPRESENTED AT THE HEARINGS OR REPLYING TO INVITATION TO SUBMIT VIEWS

	Page
Aircraft Industries Association of America, Inc-----	578
Allis-Chalmers Manufacturing Co-----	336
American Bar Association-----	636
American Cyanamid Co-----	580
American Federation of Labor-----	479
American Gas & Electric Co-----	628
American Machine & Foundry Co-----	313
American Patent Law Association-----	580
American Public Power Association-----	420
American Society of Mechanical Engineers-----	581
Army, Department of the-----	555
Association of American Railroads-----	581
Association of the Bar of the city of New York-----	469
Atomic Energy Commission-----	5, 13, 26, 30, 36, 457, 562
Argonne National Laboratory-----	220
Oak Ridge National Laboratory-----	240
Babcock & Wilcox Co., The-----	377

	Page
Bechtel Corp.....	585
Bendix Aviation Corp.....	398
California Institute of Technology.....	585
California, University of.....	602, 612, 623, 632
Carbide & Carbon Chemicals Co.....	240, 596
Chamber of Commerce of the United States.....	597
Chicago, University of.....	601
Combustion Engineering, Inc.....	598
Commerce, Department of.....	104, 636
Commonwealth Edison Co.....	205
Congress of Industrial Organizations.....	483
Connecticut Public Utilities Commission.....	582
Consolidated Edison Co. of New York, Inc.....	598
Cooperative League of the U. S. A.....	373
Defense, Department of.....	71
Detroit Edison Co.....	134
Dow Chemical Co.....	134
Duquesne Light Co.....	600
Edison Electric Institute.....	434
E. I. du Pont de Nemours & Co.....	599
Electric Boat Division, General Dynamics Corp.....	626
Electric Energy, Inc.....	188
Engineers Joint Council.....	544
Fairbanks, Morse & Co.....	600
Federal Power Commission.....	114
Foster Wheeler Corp.....	192
General Advisory Committee to the Atomic Energy Commission.....	82, 596
General Electric Co.....	301
Interior, Department of the.....	98
Kaiser Co., Henry J.....	602
Los Angeles, County of, Board of Supervisors.....	611
Massachusetts Institute of Technology.....	586, 624
Michigan, University of.....	595
Middle South Utilities, Inc.....	434
Minneapolis-Honeywell Regulator Co.....	612
Monsanto Chemical Co.....	171
National Advisory Committee for Aeronautics.....	548
National Association of Manufacturers.....	504, 507
National Association of Railroads and Utilities Commissioners.....	582
National Lead Co.....	390
National Rural Electric Cooperative Association.....	357
Navy, Department of the.....	555
New England Council.....	415
North American Aviation, Inc.....	248, 324
North American Co., The.....	188
Nuclear Development Associates, Inc.....	273
Patent Law Association of Los Angeles.....	619
Pennsylvania State College, The.....	536
Phillips Petroleum Co.....	620
Pioneer Service and Engineering Co.....	192
Princeton University.....	317
Public Affairs Institute.....	613
Public Utilities Commission, State of Maine.....	622
Radioactive Products, Inc.....	624
Rand Corp., The.....	625
South Carolina Electric & Gas Co.....	628
Standard Oil Development Co.....	630
State, Department of.....	63
Sylvania Electric Products, Inc.....	527
Tracerlab, Inc.....	635
Union Electric System.....	188
United Aircraft Corp., Pratt & Whitney Aircraft Division.....	635
United Gas, Coke & Chemical Workers of America, CIO.....	499
Vitro Corp. of America.....	638
Walter Kidde Nuclear Laboratories, Inc.....	259
Westinghouse Electric Corp.....	278
Index.....	643

ATOMIC POWER DEVELOPMENT AND PRIVATE ENTERPRISE

WEDNESDAY, JUNE 24, 1953

CONGRESS OF THE UNITED STATES,
JOINT COMMITTEE ON ATOMIC ENERGY,
Washington, D. C.

The joint committee met at 2 p. m., pursuant to call, in room P-63 of the Capitol, Hon. W. Sterling Cole (chairman of the joint committee) presiding.

Present: Representative Cole (chairman) presiding, Senators Hickenlooper (vice chairman), Bricker, and Pastore; and Representatives Van Zandt, Jenkins, Durham, Holifield, and Price.

Professional staff members present: Corbin C. Allardice, executive director; and Wayne P. Brobeck, Francis P. Cotter, Walter A. Hamilton, Edward L. Heller, J. Kenneth Mansfield, and George Norris, Jr., of the professional staff of the joint committee.

Chairman COLE. The committee will come to order.

The purpose of this meeting of the committee today is to have the Atomic Energy Commission present formally and in public its declaration of policy with respect to the use of atomic energy for the production of industrial electrical energy.

The Chair would like to submit for the record a joint statement by Senator Hickenlooper, the vice chairman, and the chairman, released last week, with respect to the calling of this meeting.

(The statement referred to follows:)

The Joint Committee on Atomic Energy today decided that it could now proceed with public hearings on the problems involved in determining national policy toward the development of atomic energy for power purposes without harming in any way the national security of the United States.

Public hearings on the subject, and continued executive hearings, if necessary, are endorsed and encouraged by the administration as well as by the joint committee.

The Atomic Energy Commission submitted on May 26, at the request of the joint committee, a policy statement on atomic-power development. The legislative provisions outlined in that policy statement are in accord with the views of the National Security Council. The joint committee feels that it is necessary to develop a public understanding of the subject before determining whether a legislative expression of national policy should be made.

The series of public hearings that we are about to begin is directed toward public understanding of the problem. In the next session of Congress we will be able to direct our attention to the question of the desirable legislative language.

Over the past 2 months the Joint Committee on Atomic Energy has held 12 executive hearings on atomic-power development. It has become amply clear to us and, we believe, to our colleagues on the committee that the great promise of utilizing the overwhelming energy locked within nuclei of atoms for the production of power to lessen man's burdens places upon us a responsibility to our fellowmen that is both solemn and joyful.

It is solemn because it goes to the very root of poverty, hunger, strife, and, yes, even of war in the world today. Solemn indeed is the increasing discrepancy between man's requirement for energy in modern civilization and his ability to provide it for the use of an expanding world population.

It is joyful because upon our successful fulfillment of that responsibility there will open to this Nation—and, it is our prayer, to the whole world—a new source of energy. Here is a source of energy truly primordial in nature, the application of which promises to go far toward counterbalancing the depressing influences of world power shortages, of food-population relationships, and of the bitter struggle for existence against overwhelming odds in certain areas of the world.

The question may be asked if this is the time to consider entering into what we choose to term the atomic power race. The battle for the minds of men in which we of the Christian-Judaic-Moslem ethic on the one hand and the Soviet atheistic materialists on the other are engaged makes it so. It is urgent—and we use the term in its truest sense—for our national welfare and for our national defense that we do not lose the momentum that has been gained by \$12 billion expended on the development of atomic energy. It is not enough that this expenditure has bought us the very essential of military defense in the form of our atomic-weapon stockpile. We must do more; we must show ourselves and the world that the industrial vigor of America continues to lead the way to a decent standard of living today, tomorrow, and always for us and for our friends. Not to do so would be proof of suicidal folly.

Chairman COLE. In addition, the Chair has an opening statement which he requests the indulgence of the committee in order to present for the record.

This is the first of a series of public hearings on the possible development of atomic energy for industrial power. The Joint Committee on Atomic Energy plans to hold meetings on this subject throughout the month of July. We hope that when these hearings are concluded the Congress and the American people will have a better understanding of the prospects for atomic-power development, along with a fuller appreciation of the problems which must be solved before we can generate useful quantities of electrical energy from atomic reactors.

Over the past 2 months our committee has devoted more than a dozen executive meetings to this problem. We have taken testimony from ranking officials in the executive branch; we have had before us representatives of the private companies which have participated in atomic-power studies under AEC security clearance. These executive sessions have shed light on many important issues. They have helped us define the key policy questions—the questions which must be answered before the Congress and the administration can formulate a program for maximizing the contribution which industrial atomic power can make to the security and welfare of our Nation.

Last week the joint committee decided it could now proceed with public hearings without jeopardizing the national security. We are taking great pains to avoid the possibility of security breaches. We will, for instance, ask each witness to give us his affirmative assurance in writing that he understands no classified matters are to be discussed in these open hearings.

The purpose of these public hearings is simple. They aim at giving the joint committee, the Congress, and the American people a more comprehensive and accurate understanding of the problems which our Nation faces in developing atomic energy for peacetime power. All the committee members agree that such an understanding must precede any examination of possible changes in the Atomic Energy Act of 1946. In this connection the Director of the Bureau of the Budget has informed us that the executive branch will not be able to transmit fully coordinated legislative recommendations to the Congress in the immediate future.

Our committee hopes that these forthcoming hearings will lay the groundwork for determining what changes in the organic law, if any, should be considered during the next session of the Congress.

Every member of this committee trusts that partisan considerations will not enter into the framing of national policy toward the development of atomic power. As chairman, I can assure the committee and the public that such considerations have played no part whatsoever in the joint committee's deliberations on this problem.

Our Nation's atomic enterprise represents a \$12 billion investment. In developing atomic power, we must not risk the loss of the momentum which has been so dearly bought with Federal funds. At the same time we must guard against overly hasty formulation of national policy. The implications of atomic power for the future well-being of our country are simply too far reaching to permit ill-considered action.

I anticipate that these hearings will reveal wide differences of opinion concerning the content of prudent public policy in this field. It would be surprising if it were otherwise. We are, after all, scarcely 10 years into the atomic age, and we have yet to build the first reactor producing useful amounts of electricity. No man can pretend to a monopoly of wisdom in these matters.

No man can now advance final answers to such fundamental questions as these:

How will the development of atomic power bear upon the military security of the United States?

How will unfolding progress in this area affect America's leadership of the free world?

Whose money should be used to develop atomic power—the taxpayers' or private investors'—and in what proportion?

What type of policy will best protect the public's multi-billion-dollar investment in the national atomic energy program?

How can the genius and skill of the American private enterprise best be enlisted in developing atomic power?

How can we reconcile wider participation of free enterprise with the requirements of atomic security?

Concerning these questions reasonable men can have, and no doubt will have, reasonable differences of opinion.

There is virtually unanimous agreement that large quantities of electricity can be derived from atomic energy. But I do not believe that any person who has lived with this problem expects atomic power to be widely competitive in the United States with electricity generated from low-cost conventional fuels by the day after tomorrow. Yet costs will go down as our knowledge and experience increase. Moreover, present cost estimates are largely speculative, and we will not actually know how much atomic power costs until we produce it.

The revolution which will someday be wrought in our lives by industrial uses of atomic power will not be heralded by the blaring of trumpets. We will not go to sleep one night in the preatomic power age and wake the next morning in a world transformed.

Only a little more than a decade has passed since man first demonstrated the atomic chain reaction. The very fact that we are here today, considering how we will proceed to utilize energy from the atom's core for power, is in itself a remarkable thing. It should give

heart and encouragement to our people and, indeed, to all peoples of the world. It is a mark of tribute to the foresight and creativeness of our scientists, and it is a measure of our industrial might.

I am confident that the second decade of this atomic age will mean as much for our Nation's welfare as the first decade has meant for our Nation's security.

I foresee, moreover, the day—through perhaps only our children or their children will live to see it—when atomic power will change man's material lot as profoundly as it was altered by the invention of the steam engine. I foresee the day when, thanks largely to the help of atomic power, the age-old poverty of Asia and Africa may at least be conquered.

The requirements of national defense have so far forced us to concentrate on military applications of atomic energy. We need not apologize for this necessary emphasis. We produce atomic weapons with deep reluctance; we produce them because the defense of our country and the free world so requires; we produce them because our earnest strivings for international control over all armaments have been rebuffed, time and again, by the Soviet government.

Yet the elemental force of the split atom—the force which protects this Nation in the form of atomic weapons—will someday be harnessed to make this world nearer our hearts' desires. It will be harnessed to allay human wretchedness. It will be harnessed to elevate the dignity of man.

We, of this Nation, have a continuing obligation to remind all men of good will that we are not blind to the peacetime side of atomic energy. I will go further. I will say that we have a positive obligation to show decent people everywhere—by deed as well as by word—that we wish to share the benefits of peacetime atomic energy with all free peoples.

It is the fervent hope—it is the prayer—of all of us on this committee that these hearings will help make this fact known to the world.

The first witness of the meeting this afternoon is Mr. Gordon Dean, Chairman of the Atomic Energy Commission.

Mr. Dean, I am sure you share with me the feeling of some bewilderment in sitting across the table under circumstances such as we have here today. Heretofore you and your associates have visited with the joint committee on frequent occasions behind locked doors guarded by uniformed personnel.

It is quite appropriate, I think, that this last visit which you have with the joint committee—at least, I expect it will be the last—should take place under such circumstances, and that finally you can come out from the dungeon of security and seclusion in which you and your colleagues have worked heretofore, into the broad, glaring, bright light of public scrutiny. A light that is broad and glaring both figuratively as well as literally today.

Let me say to you, Mr. Dean, speaking for myself, and as a result of my experience through the years on this committee, that as you leave your post as Chairman, you carry with you the deep respect, admiration, and appreciation, I am sure, of every member of the committee.

To me, it is a remarkable accomplishment you have made. It has also been a source of great encouragement personally. When I consider that a farmer can come from the State of California and take hold of this gigantic atomic energy program and, under his guidance,

carry it to the degree of accomplishment which you have done, with the minimum of criticism that has been directed to the operations since you have taken over, I am heartened as a farmer from New York to attempt to fulfill my own responsibilities in the program.

I pay my deepest respects to you. The country owes you a great debt of gratitude for the fine job you have done.

With that, we will turn it over to you, Mr. Dean, to give us the statement that you are prepared to submit.

STATEMENT OF GORDON DEAN, CHAIRMAN OF THE UNITED STATES ATOMIC ENERGY COMMISSION

Mr. DEAN. You have been most kind, Mr. Chairman, particularly in these last remarks, and most generous. I wish to assure you on my last appearance before the joint committee how sincerely I have appreciated the association between the members of the Commission and the staff on the one hand, and the members of the joint committee on the other. It has been an altogether pleasant relationship, and I hope it has been productive of many good things that we have worked out in common.

One of the things about a chairman who has to front for a commission of this kind is that he must not only take criticism for some things he does not do, but he must also take credit; and I assure you that taking the credit is a lot of fun.

I would also like to say, at the opening, that I think I can safely say that those of us on the Commission subscribe to every single word of your opening statement concerning atomic power.

I think perhaps the document with which we should commence is the Statement of Policy on Nuclear Power Development which was shaped up by the Commission in the course of the last few months. Before reading it into the record, I should like, however, to read a very short preface to that Statement of Policy on Nuclear Power Development.

From the time the first self-sustaining nuclear chain reactor was demonstrated 10 years ago, the eventual technical feasibility of nuclear power has been accepted. Developments in nuclear reactors since that time, including submarine powerplants and production of token quantities of electric power by the experimental breeder reactor at Arco and the homogeneous reactor experiment at Oak Ridge, have served to reinforce confidence in the ultimate commercial practicability of nuclear power. Additional evidence of this confidence is reflected in the increasing interest on the part of industry to contribute more fully to this development.

However, the general availability in this country of relatively inexpensive sources of energy such as coal, oil, and hydropower, places a severe economic requirement on competitive nuclear power. A nuclear plant built on the basis of today's technology could not compete with conventional power. Yet it would be misleading to evaluate the future prospects for economic nuclear power on the basis of estimates of near-future performance. We must understand that the nuclear reactor research of the past years served specialized military needs and was not aimed specifically at the production of economic power. Although a difficult development period lies ahead, there

is considerable optimism that economic nuclear power can be attained within a few years.

It is the judgment of the Commission that now is the time to announce a positive policy designed to recognize the development of economic nuclear power as a national objective. An important element of this policy is to promote and encourage free competition and private investment in the development work, while at the same time accepting on the part of Government certain responsibilities for furthering technical progress in this field to provide a necessary basis for such development.

While we conclude that atomic power has not yet been developed to the point of economic use, and that the time is not yet at hand for the report called for in section 7 (b) of the Atomic Energy Act, we do believe it is imperative that we create a favorable atmosphere which will hasten that day. We believe that the United States should continue in its present position of leadership among those nations striving to promote the peacetime applications of atomic energy. As a nation we should not delay the development of this great potential source of energy for constructive purposes until circumstances force us to attempt its practical realization on a short-time scale.

To this end, the Atomic Energy Commission has endorsed, as a basis for discussion with other executive agencies and the Congress, the attached statement of policy on the development of nuclear power.

I should like to read the policy statement itself.

1. We believe the attainment of economically competitive nuclear power to be a goal of national importance. Reactor technology has progressed to the point where realization of this goal seems achievable in the foreseeable future if the Nation continues to support a strong development effort. It would be a major setback to the position of this country in the world to allow its present leadership in nuclear power development to pass out of its hands.

2. Accordingly, we recognize it as a responsibility of the Commission to continue research and development in this field and to promote the construction of experimental reactors which appear to contribute substantially to the power reactor art and constitute useful contributions to the design of economic units.

3. In addition, it is the conviction of the Commission that progress toward economic nuclear power can be further advanced through participation in the development program by qualified and interested groups outside the Commission.

4. We recognize the need for reasonable incentives to encourage wider participation in power reactor development and propose the following moves to attain this end:

(a) Interim legislation to permit ownership and operation of nuclear power facilities by groups other than the Commission.

(b) Interim legislation to permit lease or sale of fissionable material under safeguards adequate to assure national security.

(c) Interim legislation which would permit owners of reactors to use and transfer fissionable and byproduct materials not purchased by the Commission, subject to regulation by the Commission in the interest of security and public safety.

(d) The performance of such research and development work in Commission laboratories, relevant to specific power projects, as the Commission deems warranted in the national interest.

(e) More liberal patent rights than are presently granted to outside groups as may seem appropriate to the Commission and consistent with existing law.

(f) Consideration of a progressively adjusted code for safety and exclusion area requirements as may appear reasonable in the light of operational experience with reactors. Competent State authorities will be encouraged to assume increasing responsibility for safety aspects of reactor operation. Financial responsibility associated with reactor operation will be assigned to the owners, in keeping with normal industrial practice.

(g) Giving full recognition to the importance reactor technology to our national security, a progressively liberalized information policy in the power reactor field as increasing activity justifies.

5. It is the objective of this policy to further the development of nuclear plants which are economically independent of Government commitments to purchase weapons-grade plutonium.

6. We view the next few years as a period of development looking toward the realization of practical nuclear power. On this basis we conclude that the time is not yet at hand for the report called for in section 7 (b) of the Atomic Energy Act of 1946.

I should now like to make a brief statement concerning why the Commission saw fit at this time to draft such a statement, and I think there are three points that might be made:

1. It has emerged from several years of experience with reactors of one sort or another.

We have had, as you know, production reactors in operation since the early days of World War II. We have had, in addition, experience with various experimental reactors such as the materials-testing reactor, the breeder reactor at Arco, experiments at Oak Ridge, and we have also had considerable work on long-range reactor projects such as breeder reactors and homogeneous reactors.

All of these have developed to the place where we think the time has come to make such a statement.

I should also like to point out that what we do here is quite consistent with the directives to the Atomic Energy Commission as they are set forth in the Atomic Energy Act of 1946, and I should like to refer to several sections of that act.

Section 1 (a) of the act states:

Research and experimentation in the field of nuclear chain reaction have attained the stage at which the release of atomic energy on a large scale is practical. The significance of the atomic bomb for military purposes is evident. The effect of the use of atomic energy for civilian purposes upon the social, economic, and political structures of today cannot now be determined.

This was written in 1946.

It is a field in which unknown factors are involved. Therefore, any legislation will necessarily be subject to revision from time to time. It is reasonable to anticipate, however, that tapping this new source of energy will cause profound changes in our present way of life. Accordingly, it is hereby declared to be the policy of the people of the United States that, subject at all times to the paramount objective of assuring the common defense and security, the development and utilization of atomic energy shall, so far as practicable, be directed toward improving the public welfare, increasing the standard of living, strengthening free competition in private enterprise, and promoting world peace.

In addition to this provision of the act, section 3 (a) provides in part as follows:

The Commission is directed to exercise its powers in such manner as to insure the continued conduct of research and development activities in the fields specified below by private or public institutions or persons and to assist in the acquisition of an everexpanding fund of theoretical and practical knowledge in such fields. The Commission is authorized to conduct research and development activities relating to—

It then lists four separate fields, and the fourth one listed in the act reads as follows:

Utilization of fissionable and radioactive materials and processes entailed in the production of such materials for all other purposes, including industrial uses * * *

There is another provision of the act which anticipates the day when economical power from the atom would be available, and I refer to section 7 (b) of the act. It reads:

(b) REPORT TO CONGRESS.—Whenever in its opinion any industrial, commercial, or other nonmilitary use of fissionable material or atomic energy has been sufficiently developed to be of practical value, the Commission shall prepare a report to the President stating all the facts with respect to such use, the Commission's estimate of the social, political, economic, and international effects of such use and the Commission's recommendations for necessary or desirable supplemental legislation. * * * The President shall then transmit this report to the Congress together with his recommendations * * *.

The Commission has reported the current state of development to the joint committee. It has done this in several executive sessions, as the chairman of the committee has pointed out. It has explained to the joint committee why it is not following at this time the procedure set forth in section 7 (b), and I think it is important that we make the record very clear at this point precisely why this procedure is not followed.

Section 7 (b) obviously envisaged a day when methods of securing power had been sufficiently developed—and it uses that phrase—that they can be said to have a “practical value.” We understand these words to mean a nonmilitary value and a value which is practical in the sense of economics. We have not reached this point in reactor technology. We see it on the near horizon, but the time is not here. As we have stated in our power policy statement, we see the next few years as a period of development looking toward the realization of practical nuclear power. On this basis we conclude that the time described in section 7 (b) is not yet at hand.

It is the obligation of the Commission under the act to keep the joint committee fully and currently advised. It is also the obligation of the Commission under section 17 of the act to “submit to the Congress in January and July of each year a report concerning the activities of the Commission.” This same section also provides:

The Commission shall include in such report and shall at such other times as it deems desirable submit to the Congress such recommendations for additional legislation as the Commission deems necessary or desirable.

It was pursuant to these several provisions of the act that the Commission has reported in executive session to the joint committee. Your committee felt that the issues raised in these reports were of sufficient interest to justify a public hearing, and we are here in response to an invitation from your committee.

So much, then, for the legislative basis for coming forward with a power policy statement and recommendations to the committee.

A third point that I should like to make, which has to do generally with the question of why a power policy statement at this time, has to do with the recent interest on the part of a group of industrial concerns.

Approximately a year and a half ago, the Commission, at the request of several American industrial concerns, cleared the appropriate officials and employees of these companies in order that they might determine the state of the reactor art of this country and judge whether the time is emerging for the entry of private capital into the field of reactors designed to produce power.

I understand that these groups will be called before your committee at public sessions, and you will hear directly from them their experience with this 1½-year survey.

In general, I think it is fair to say that each of the groups is anxious to continue its joint studies with our people, and that not one of the groups was pessimistic.

One of the reasons why the Commission is emphasizing the development of power reactors and why, during a period of development, it is anxious to bring into the picture, in the interest of speeding development, the brains of American industry, stems from the challenge of meeting the enormous and increasing demands for energy of our industrial society. The potentialities of energy through uranium are best illustrated by comparison with coal. One pound of uranium—that is, a cube approximately 1 inch by 1 inch by 1 inch—has within it potentially releasable energy equal to 2,600,000 pounds of coal.

Uranium is distributed occasionally in the earth's surface in fairly rich deposits, but even where this is not the case it is widely distributed in low concentrations throughout most of the earth's surface. In fact, if the cost of extraction were not a problem, the amount of uranium in any ton of granite has the same energy potential as that of a ton of coal.

I think it might be well at this point to give some indication of the energy reserves as they are estimated throughout the world. Someone has come up with a symbol which we shall call 1Q, and it simply is a unit, and is equal to 10^{18} B. t. u.'s. These figures, I think, will be of interest to the committee.

They show that from the year 1 to 1860 the world used 6Q.

From the year 1860 to 1947, a much more contracted period, the world used 4Q.

In the year 1950, the world used ½Q in the 1 single year.

In the year 2000, by best estimates, the world will use 1Q.

The world reserves of oil and gas are estimated at something on the order of 8Q.

The world reserves of coal, something on the order of 72Q.

The world reserves of uranium, assuming that you want to mine uranium at a cost of something on the order of \$100 per pound, considerably more than we now pay, would be on the order of 1,700Q.

Senator BRICKER. That is the utilization of what part of the potential power?

Mr. DEAN. This assumes a complete utilization, Senator, of all of the atoms in the uranium.

Therefore, if we can accept these figures—and we must admit, I am sure, that there is considerable crystalballing involved in any such estimates—the world reserves of uranium are 23 times the world's reserves of all fossil fuels—petroleum, gas, and coal.

Now, I should like, if there is a chart available here, to show you the estimated demands for this energy.

We have referred to the fuels themselves—

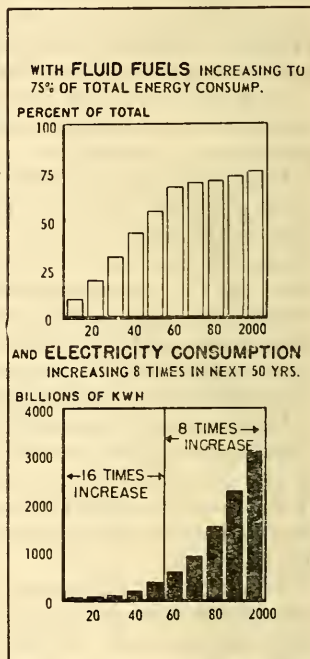
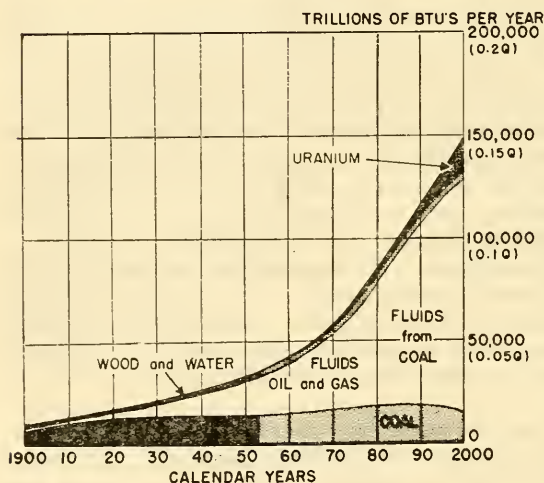
Representative VAN ZANDT. May I ask a question there?

Did you say "graphite" or "granite"?

Mr. DEAN. "Granite"; yes, sir.

(The chart referred to follows:)

US CONSUMPTION OF PRIMARY ENERGY in the 20th Century may look like this



Mr. DEAN. This little chart which has been prepared shows the United States consumption of primary energy in the 20th century, and what it may look like—again some crystalballing is involved. You will notice down here it carries it from the year 1900 over to the year 2000.

The solid portion here represents what is behind us, and in other words, we are over here into the year 1953 at this point [indicating].

You can see from this chart that the coal is represented in the bottom in black and gray, and your estimated reserves of oil and gas in yellow, and the fluids from coal estimated in this period over in here [indicating].

Someone has figured that by 1960, you might have a contribution of a percentage—let us say it is very small—from uranium, and going on up to the year 2000, where it might be something on the order of 10 to 12 percent, furnishing 10 to 12 percent of the total energy.

This gives you a rough picture of what the picture will look like. There will always be some kind of requirement, of course, for the fluid fuels; and as your petroleum runs out, that is indicated by this, you have got to go to coal in order to get fluids from coal.

I think two conclusions might be drawn from the chart. One is that you never are going to be in conflict with hydropower, for two reasons: One is, you need all of the increment you can get from new energy sources; and, furthermore, the obvious fact that hydro is cheaper. Certainly that conclusion could be drawn from it.

Are there any questions on it that I can answer?

Chairman COLE. I am curious to know why it is necessary to bring in a dollar cost of uranium in order to evaluate its energy release.

Mr. DEAN. Simply because, if you doubled the prices you are willing to pay and, therefore, mine it at much more expense, you would get more uranium. So, you have to make a cutoff point at which you are willing to quit mining. So, the figure that I have used here is not the total amount of uranium.

Representative HOLIFIELD. Do your figures take into consideration the present yield of B. t. u. from coal and oil in that computation, or a possible increase in the efficiency of utilization of coal and oil?

Mr. DEAN. It makes the assumption, Mr. Holifield, that a reasonable increase in efficiency will be obtained.

Representative HOLIFIELD. And the same energy release from a pound of uranium as exists today? Or does this include an estimate of an increase in yield?

Mr. DEAN. It includes, as Senator Bricker asked the question, what assumptions we made as to the release of energy from uranium in your breeding process, assuming you are utilizing all of the atoms of uranium.

Representative HOLIFIELD. Of course, that assumption is not yet realized, is it?

Mr. DEAN. No, and we are not in the year 2000, either.

Representative HOLIFIELD. We are not able to estimate what the B. t. u. return from coal and oil will be in the year 2000.

Mr. DEAN. And we could double that if you wanted to make an arbitrary assumption. I do not know what the engineers would say on that.

Dr. HAFSTAD. That would be also a guess.

Senator BRICKER. I was interested in your estimate of the utilization of fluids from coal. The process is already perfected and available, and it is only a dollar question now as to the cost of making these fluids.

Mr. DEAN. Well, I think, since you referred to that point, one other thing is illustrated. That is the fact that you are not in competition with coal. Your petroleum reserves will run out and you are going to call on coal to fill in for gasoline or whatever the other requirements are.

Senator BRICKER. These processes are already known, and there may be others developed, of course.

Mr. DEAN. And pilot-planted; yes.

Senator BRICKER. Even now, utilization is a question of what it costs to make it.

Mr. DEAN. Frankly, one thing that is not on this chart at all, there is a question whether it should be on. But this is a very difficult thing to crystal-ball. I simply bring out these figures because they show how challenging is the problem of getting economical power from the atom. It is possible in terms of world reserves of uranium, and the dividends are very high if you can get the complete burn-up of the uranium. Some people would say, and some very competent people have said, that by the time you reach the year 2000, let us say, you are going to have a substantial contribution from solar energy.

Now, we have not made any indication or allowance for solar energy as a contributor in the years ahead; that is, except in the form of wood as a fuel. But one of the difficulties here is an engineering difficulty. I think it is very hard to make assumptions as to how much of the world energy will come directly from solar energy. It involves such problems as great tracking devices which would be centered on the sun, with complicated thermocouplers, with some kind of engineering devices which would store the heat through the night as the sun went down, and many, many other problems. We have made no assumptions as to solar energy's contribution in the years ahead.

There is one other point that I should like to make before I turn this over to Dr. Hafstad.

Chairman COLE. If you will permit the Chair to interrupt for the purpose of identifying Dr. Beckerley, who is sitting alongside Chairman Dean.

Dr. Beckerley is the classification expert for the Commission, and I suggest we on the committee, as well as whoever might be the witness, keep Dr. Beckerley in the corner of his eye; and, if Dr. Beckerley should stand up, that is the signal for everybody to shut up.

Mr. DEAN. He is a very effective policeman, and has many times pulled my coattails.

The next point I should like to raise in very general terms has to do with the question of diverting, in a time of national stress, certain amounts of uranium in order to pursue an industrial-power program. Certainly for the next few years, no intelligent person would suggest the diversion from our weapons strength of any appreciable amount of uranium simply in order to produce power from reactors. But I think you must also realize that during the course of the past few years the Commission has, and I am sure wisely, diverted amounts of uranium for research in its own laboratories, for development and for fueling its various military experimental reactors. The amounts that would be used during the course of the next 5 years or so are comparable to what it has been spending, let us say, in the past 5 years. So, we are not changing the picture in that respect.

Before the large industrial groups, or whoever may come in to take advantage of this new power, are able to raise the money, perfect designs of reactors, and construct these reactors, and be ready to install the uranium as a fuel, several more years will undoubtedly elapse. We are not, therefore, talking about a movement which will hurt our stockpile; and, even when considerable power is developed, the amount of uranium required will not be consequential.

Those are all of the statements that I planned to make. Mr. Chairman, at the outset. We have 3 other witnesses from the Commission, or 4, I should say. The first one I should like to call is Dr. Hafstad,

who is Director of our Division of Reactor Development, who will try and explain some things the committee is already familiar with; namely, how you get power from uranium.

Chairman COLE. We are happy to see you again, and happy for the opportunity of publicly acknowledging the great contributions which you have rendered in this entire program.

Dr. HAFSTAD. Thank you, Mr. Chairman.

STATEMENT OF DR. LAWRENCE R. HAFSTAD, DIRECTOR OF THE REACTOR DIVISION OF THE UNITED STATES ATOMIC ENERGY COMMISSION

Dr. HAFSTAD. The subject we are discussing is a fairly technical one, and over the next several days during these hearings, we will be using quite a number of technical terms. I think in order that everybody can realize what we are talking about and what the issues are, I would like to take a few minutes to drop back and tell a little bit about the fission process, and about reactors and how they work, and what their limitations are, and the present status we have reached, in order that the rest of the testimony will fall into place.

We have to know a few elementary physics facts, but I want to hasten to say that we do not have to know a lot of physics to understand reactors. The things that we need to carry in mind, however, are that there is such a thing as a neutron, and this is one of the elementary particles of matter; and there is such a thing as the fission process, and most of us have learned from newspaper reading and magazine articles, and so on—

Chairman COLE. Would you speak up a little bit? I am afraid the people in the back of the room are not able to hear you, and I do not think that you should be misled by those gadgets in front of you, because I do not believe they are connected with any amplifiers.

Dr. HAFSTAD. I will try to speak louder.

The thing that I wanted to emphasize, then, is that in the fission process, which we all have to be aware of, one neutron can collide with one fissionable atom, produce a fission process, which means a splitting of this atom or this nucleus, and the release of this enormous amount of energy.

Now, this is where the energy comes from. It is the beginning of the release of energy that we are talking about. Actually, in this case, part of the mass of the atom itself, of the nucleus, is converted into energy, and this is where the famous "E equals MC squared" equation comes into the picture, and we are actually getting energy at the expense of matter in the nucleus of the atom.

In the fission process, one neutron collides with a fissionable nucleus, splits the nucleus of the atom, and releases this energy.

The next important point that we have to note is that his splitting process releases, in addition, two or more neutrons for each atom split. It is this fact which makes the chain reaction possible. If we can so arrange our material that each of these new neutrons that are produced collide with another fissionable atom, we will have two fission processes where we had only one before. And each of these two in turn releases two more neutrons, and we have the sequence of events, 1, 2, 4, 8, 16, and so on, new neutrons produced, and along with

each neutron a large amount of energy which is available in the form of heat.

Now, this is the chain reaction, and this we have to understand if we are going to understand the implications of atomic energy.

From the chain reaction we can move in two different directions. We can adjust or control this chain reaction to go faster and faster and release the energy very suddenly, in which case we have an explosion. This is the route that leads toward the atom bomb. The other route is to take exactly the same chain reaction, again depending upon our knowledge of control, and slow down this reaction in order that exactly the same amount of energy is released, but over a longer period of time, in a controllable way.

It is this controllable chain reaction which we are discussing here today. The controllable chain reaction is the basis of the reactor, and the reactor is the machine for converting nuclear energy, if you like, into useful work of any kind.

Now, a reactor produces several different things. It produces these neutrons which I have mentioned, and they can be used in a number of different ways to produce new fissionable materials. They can be used to produce isotopes, which are useful in research, and so on.

The reactor can be used to produce heat, because these neutrons as they fly out of the nucleus are traveling with high velocity, and so are the fission fragments that are produced, and these also represent a large amount of heat. They also produce many new elements. The fission fragments are themselves new elements, and the process represents an actual transmutation in the sense of the old alchemists. And you remember, those of us who went to school some time ago thought of chemical elements as being unchangeable.

Transmutation of chemical elements is what is going on in these nuclear reactions. We change uranium into elements like krypton and beryllium, and elements in the middle of the periodic table. It is an actual change of the chemical element.

Chairman COLE. The atomic weapon is a reactor?

Dr. HAFSTAD. An atomic weapon is a reactor designed to react very rapidly. It is exactly the same process.

Chairman COLE. Without any degree of control, once it starts?

Dr. HAFSTAD. In fact, it is tailored so that it will go extremely rapidly, whereas the kind of power reactors we are talking about is the same chain reaction, but so adjusted and tailored that it can be held at a low temperature and release the same amount of energy over a long period of time.

The yield, then, from a reactor—neutrons, heat, and fission products, which happens to be the name we give to these new elements that are formed—I would like to spend a few moments on those, because as I have indicated, they are new elements, and they are elements which are radioactive. They are elements which have all of the properties of radium, and most of us know of radium as a very rare material which emits some sort of rays which are useful in taking X-ray pictures, let us say, in industry, or treating tumors, or taking X-ray pictures in medical work to get pictures of bone structure, and so on. And these are gamma rays, which are emitted from radium. Exactly the same kind of rays are emitted from these fission products.

These new elements that are formed are radioactive in exactly the same way as radium. In addition, they emit other forms of radiation

which are not so well known, alpha and beta rays. Alpha rays are heavy, positive rays; and beta rays are light, negatively charged rays and other neutrons.

So we have a host of radiations which are emitted from these fission products.

Now we come to the question of building a reactor to utilize this energy and this heat. We would like to arrange this reactor, then, to yield energy continuously, so we have to create some kind of a structure.

One of the first things that we run into in building this reactor is that we have difficulty with the materials problems. The materials that go into a reactor must be very carefully chosen. They must stand high temperature if you want to extract temperature, and they must stand radiation bombardment, this neutron bombardment from the chain reaction that we are talking about, and they must not absorb neutrons. If they do absorb neutrons, then the number of neutrons available to keep the chain reaction going is correspondingly reduced, and the chain reaction slows down and might even stop.

Here is where the fission products come in, because even though you start out with a reactor in which no neutron-absorbing properties are present, in the chain reaction itself you form these fission products, and many of these new elements are of the kind that absorb neutrons, and therefore slow down or poison the reaction. So we have to watch out for the problem of accumulation of fission products in the reactor, and plan our design accordingly.

So we have a very difficult materials selection problem, as far as reactor design is concerned. If we overcome that, however, then we have the problem of heat extraction, because before we can utilize this energy we have to drive a turbine and turn a screw on a ship or turn an electrical generator in order to get the electric power out. So within the reactor we have to introduce heat-removing equipment, and the second major problem, then, is the heat exchange or heat transfer problem, as we call it.

We have to circulate material through the reactor, absorb the heat energy, carry it out of the reactor, and use this heat in turning a turbine to drive an electrical generator, and eventually then get the energy out in the form of electrical energy on our transmission lines. All of this has to be done with the nuclear reactor in order to get useful power.

It is important to realize that at the present time, science knows of no way to short-circuit this complicated procedure. It is often suggested that it would be very helpful if we could go directly from the fission process into electrical energy in some way.

Senator BRICKER. There is constant research going on in that field?

Dr. HAFSTAD. We are alert to this possibility, and we explore all new suggestions which show any promise of meeting this particular solution to the problem; but as yet, nothing has been uncovered, and it seems that we have to do it the hard way.

I have brought a few charts along which I think will help to indicate what we can do and apparently can't do with these reactors as a source of energy. I want to stress the fact that they are heat sources; that the uranium is a fuel, and a fuel only, as far as competing with coal and oil and other fuels. This means that even though uranium were extremely cheap, it will not make a revolu-

tionary impact on our power costs, because all we can do is to reduce the fuel cost of electric power, and we cannot and do not in any way reduce the distribution costs.

It is for this reason we say with considerable confidence that we believe nuclear energy will be a supplementary fuel source or energy source, rather than have a revolutionary impact on our industrial society.

We do believe that we can compete within the next few decades, at least begin to compete with the conventional fuels.

I would like now to show one of the charts which will indicate that.

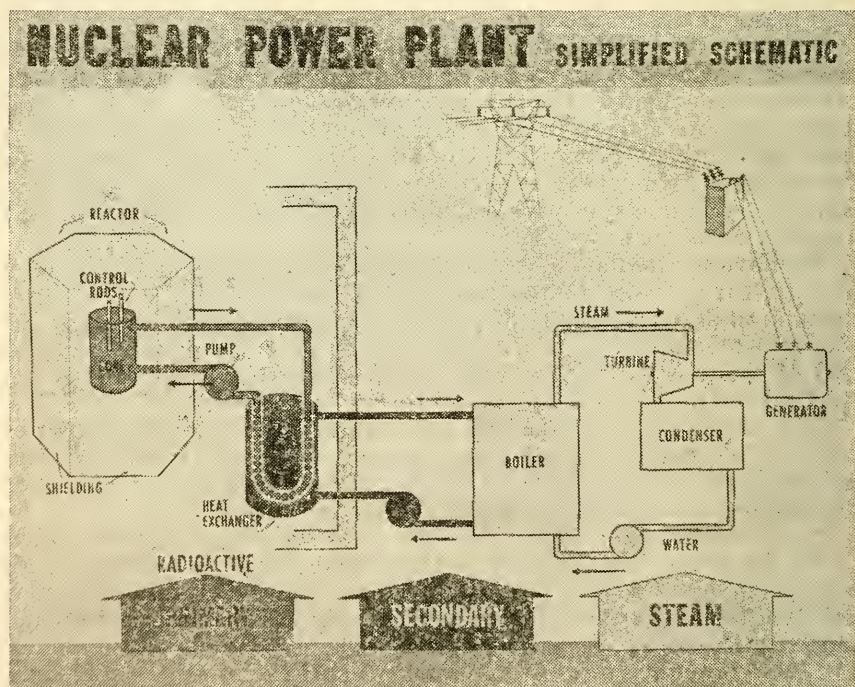
Representative DURHAM. I would like to ask a question. There has been some concern expressed on the part of some, I have noticed in the press, that if these reactors were established in numerous numbers around the country, there would be some danger. In your opinion, is there any dangerous release of poisonous things detrimental to the public?

Dr. HAFSTAD. This is a problem we are fully alert to, and I will turn it over to Dr. Bugher.

Mr. DEAN. Dr. Bugher is going to testify on that very point, Mr. Durham.

Dr. HAFSTAD. With your permission, I will return to this one chart here, which I think might be helpful to you.

(The chart referred to follows:)



Dr. HAFSTAD. The first of these is to emphasize what I have told you—that the reactor is a heat source, and that the problem is to extract the heat from the reactor, which must be shielded because of these radiations which I mentioned. This shield is made necessary

by these damaging radiations which I mentioned, and here is the reactor itself shielded as a heat source, and the heat is pumped out here through this heat exchanger and back in here [indicating]. This is what we call our primary loop, because going through the atmosphere of neutrons it becomes radioactive itself, and again must be shielded, as indicated here [indicating]. The heat then is carried through—

Chairman COLE. Just a moment. I see the red flag is flashing, is it not? If not, we will ask Dr. Beckerley not to stand up.

Dr. HAFSTAD. From here on, the system is conventional, because we have a boiler, a steam plant, and everything else is the same as with conventional plants.

What we replace, then, is what I call the fire pot and boiler of a conventional steam plant.

Senator BRICKER. If you were able to utilize that heat, directly, it would change the whole chart and the whole process.

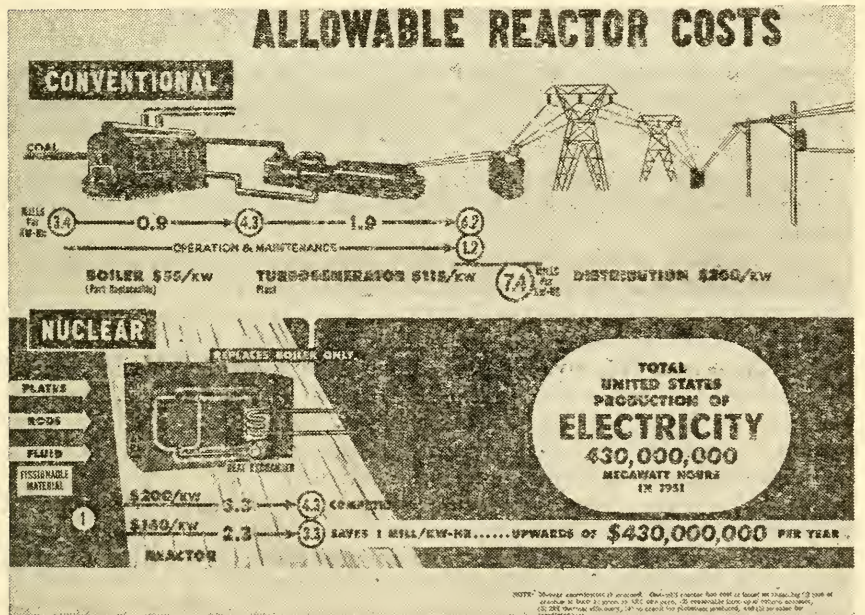
Dr. HAFSTAD. It would change the chart.

Senator BRICKER. And costs, and everything else.

Dr. HAFSTAD. It would change the costs enormously, because there is about 20 to 25 percent efficiency in this process of transferring heat, and if we could go directly we would save that particular loss

Now, this is a new chart.

(The chart referred to follows:)



Dr. HAFSTAD. Here is a more detailed presentation of the sort of thing, where we first presented the conventional powerplant along the top. We assume the coal input at an average cost of 3.4 mills per kilowatt-hour. We are talking costs to the producer, and not to the consumer.

Then you have the boiler apparatus at this stage, and by the time you get out of there your costs are up to 4.3 mills.

Then you go through your electrical generating equipment, and add 1.9 mills, and you are up in the neighborhood of 6.2 mills when you go out to the transmission line.

Now, these are average figures from the Federal Power Commission, and are used for comparison purposes.

We can cut in at this point here, since this is the part we replace by nuclear energy, and back down here and say, "In order to compete, how much money can we afford to spend for the boiler equipment?" We can estimate our costs as to fuel from the cost of uranium, and guess that this is about one mill, let us say, for comparison purposes. In order to compete with this plant, then, we have to design our reactor and heat transfer equipment to come under \$200 per kilowatt of installed capacity.

If we do that, we are barely competitive. If we can do better than that and this is the problem for the engineers, to beat the costs down and the capital cost is the big item in this business—if we could beat this cost down to, say, \$140 per kilowatt-hour, then our power costs at this point would be 3.3 mills instead of 4.3.

This does not sound like much until you convert it in terms of the enormous demand of this Nation, which happens to be 430 million megawatt-hours, and you come out with \$430 million for each mill that you save.

Senator HICKENLOOPER. A megawatt is 1 million watts?

Dr. HAFSTAD. Yes, sir.

Senator HICKENLOOPER. So it would not be a million megawatts.

Dr. HAFSTAD. This says 430 million megawatt-hours, and this is what it ought to be, that is, in that field. A megawatt-hour is a million.

Representative HOLIFIELD. Can you give us the firm cost at this time of a conventional capital investment installation for electrical production?

Dr. HAFSTAD. The comparative cost—and this is an average figure—would be \$55 per kilowatt, for this part of the plant.

Representative HOLIFIELD. Now can you give me the firm capital investment for corresponding nuclear kilowatts?

Dr. HAFSTAD. No, sir. This we are unable to do at the present time, and I think the best that I could state would be that our engineering estimates, which are essentially paper studies, have now reached the stage where, according to those paper studies, estimates of construction costs begin to be competitive.

Now, I use that wording because these are estimates, and most of us have learned that usually your actual costs run over your estimates. That is why we say we are not yet competitive. We will not really know until such a plant has been built and operated.

Representative HOLIFIELD. Does your cost of fuel at 1 mill per kilowatt-hour, below there, include the cost of cleaning the fuel?

Dr. HAFSTAD. That would come in over here as part of your fuel cost. This does not, as presented here, include that.

Representative HOLIFIELD. That is an unknown factor?

Dr. HAFSTAD. This is one of the big unknowns in the picture; yes.

Chairman COLE. Will you explain that expression which has been attributed to you, a megawatt per megadollar, or some such thing as that?

Dr. HAFSTAD. This is a figure which I used several years ago, because in surveying the situation as it was in 1949, one of the first questions would be: How close are we to competing with the conventional power costs?

The index which we use is this figure of capital costs per kilowatt-hour, which we can take in these charts as about \$150 per kilowatt. Looking over the costs of reactors, they appeared to be in the neighborhood of \$1,000 per kilowatt capacity. That is \$1,000 per kilowatt, and that is \$1 million per megawatt. So the expression was, "A megabuck for a megawatt was the cost of a reactor."

What we have presented here indicates essentially what our goal is, and I think that the reason we have some confidence at the present time in our estimates as of the moment arises from the fact that we have now built and operated a number of reactors over the last several years. Each of these has essentially been an experiment in itself, and an experiment in several ways.

First, it is to see whether it would work at all, because we could not guarantee in a field like this that things would work. All of our reactors have worked.

The second thing is to see whether we came close as far as construction costs were concerned, and whether large new unknowns appeared in the picture, unknowns in the technical sense, which caused us unexpected difficulties.

I think we can say that we have not run into any major unknowns. There have been the usual troubles. There are always troubles in a large, new technical development. But none of them have been of the kind which we would call a major unknown.

It is these two facts which give us considerable confidence that the technology has now arrived at the stage where we can, with some confidence, begin to estimate the costs of powerplants.

It is not enough, however, to come close in estimating the cost of electric powerplants. You have to be "on the nose," and this we are not yet able to do. This is why we say that until some examples of these large plants have been built and operated, we do not know, and we have no illusions that we know the actual costs.

I think that is really all that I have to say at the present time, unless there are questions.

Chairman COLE. Are there any questions of Dr. Hafstad?

Representative DURHAM. I think that you have given us a very fine exposition of the subject.

There is one thing that I would like to have your expression on, and that is this fuel problem. Sticking to that point on the neutrons controlling the amount of electric power you can get out of it, would you care to comment on what increase you can expect or hope to expect as a result of research, on your present development?

Dr. HAFSTAD. You come immediately to the breeder problem in this case, because that is the one which pays the big dividends.

Representative DURHAM. That is what I hoped you would speak about.

Dr. HAFSTAD. It is such an important development that it might justify taking a few minutes to talk about it.

The important thing here is that, as I mentioned, in the fission process two or more neutrons are released per fission. One of these neutrons is needed to replace the original neutron that you started with, and one of them could be available to create one new atom of fissionable material, and you still have a little bit over, on the average, a half a neutron per fission to take care of absorption in your structural materials, leakage through the walls of the reactor, and so forth.

Now, if our engineers are sufficiently ingenious to design their reactors to hold these neutron losses down, then we have the exciting possibility of creating 1 new fissionable atom for each 1 which is destroyed in the process. This can go on as long as there is fertile material from which to create the new fissionable material.

Here I have to get technical again and remind everybody that there are two kinds of uranium in nature. U-238 is one, which is available in large quantities, and it is not fissionable, and U-235, seven-tenths of 1 percent in natural uranium, which is fissionable.

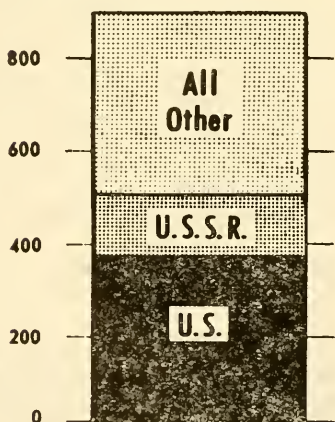
Now, the breeding process which I described can go on until all of the U-238, which is useless at the present time, is converted into a fissionable material, in this case plutonium.

This is the thing which multiplies by a large factor, theoretically as high as 140, the amount of fissionable material available to us, and it is the factor which makes possible these enormous reserves of energy in the uranium ore.

I have a chart to show on that, too, which I think will dramatize it a little bit.

(The chart referred to follows:)

BILLIONS OF KW - HRS



Obtainable from
200 to
28,000
 tons of
 Uranium
 depending on
 the extent of
REGENERATION

Dr. HAFSTAD. This chart shows the world consumption of electric power in the year 1950. From here up to here [indicating] is the United States, which takes the largest part of it, the U. S. S. R. about this amount here, and all of the rest of the world this amount [indicating].

I will turn it around so the gentlemen in the back of the room can see.

Now, the important thing is that this enormous demand for energy for the whole world here can be obtained from only 200 tons of uranium if we have the breeding process working. And this is possible because of this enormous multiplication factor that the chairman mentioned here; from each pound of uranium you can get as much energy as from 2,600,000 pounds of coal.

Senator BRICKER. If you do not have the loss you talk about in your other chart?

Dr. HAFSTAD. If you do not have the breeding process, then depending upon the extent to which you use all available U-235, or have partial breeding and use a little bit more, you could get the same amount of energy here from 28,000 tons of uranium, of natural uranium, without depending upon the breeding process.

Senator BRICKER. Is that calculated on the utilization of all of the energy? It does not take into consideration—

Dr. HAFSTAD. This is all of the energy in the natural available U-235, and this is all of the energy available in all of the uranium.

Representative HOLIFIELD. I think it should be made clear that complete breeding of all of the uranium 238 has not been arrived at yet.

Dr. HAFSTAD. And it is a theoretical upper limit, and I would go on and say it never will be arrived at. But we will approach it, and we are confident that we have solved the main problems, and we are on the way to this.

Representative HOLIFIELD. At the present time the degree of breeding is a matter of secret classification?

Dr. HAFSTAD. The exact numbers on breeding are still classified.

Senator BRICKER. This figure showing the electric power production from the amount of uranium stated here—does this take into consideration your previous chart on the utilization of only 25 percent in the transition of the heat to ultimate electricity?

Dr. HAFSTAD. Yes; it does. This allows for efficient conversion.

Senator BRICKER. It allows for that?

Dr. HAFSTAD. Yes.

Chairman COLE. I find there is a bit of misunderstanding on this question of the breeder process, and I read in the press about the process being one in which you come out with more than what you put in.

Now, is that correct, or does it mean that it is simply a more efficient process for obtaining the greatest amount of use of what you put in?

Dr. HAFSTAD. Well, let us see if we can answer it this way. Let us imagine a plutonium reactor in which you put plutonium in the core. Then you surround the core, which is the central part of this, with what we call a blanket. This is a volume in which we put U-238. Let us assume we get some U-238 from Oak Ridge or somewhere, where we have essentially pure U-238.

Now, after running that for some years—and the exact figure on this would be classified information again—but after running this for a number of years we shut the reactor down and take the core out and measure how much plutonium was burned up in the core, and we say there is a loss of, let us say, 1 pound of the plutonium burned up in the core.

Then we take the blanket out separately, and chemically process that and see how much new plutonium was produced in the blanket.

Now, depending upon the ingenuity of the design, it is entirely possible and we expect that you will pull out more than 1 pound of plutonium from the blanket which you can use to replace that which was burned up in the core.

However, there is still a hitch in this. In order to extract this, you do have a chemical processing step to go through, and this is a complicated chemical process. So, even though you produce this material in the blanket, what you are really interested in is not how much was in the blanket; it is how much do you get out of the chemical processing plant to put back into the new reactor when you get around to it.

I think this is the subtle point and the place where you get into arguments as to whether or not and to what extent this is feasible. We are quite sure from the numbers already at hand that we will produce more plutonium in the blanket than we burn up in the core. We cannot guarantee that we will be able to carry through the chemical processing and have it available to put back into the core. This remains to be proved.

Representative DURHAM. But the breeding process has worked?

Dr. HAFSTAD. The breeding process itself has worked, and we are confident of it.

Mr. DEAN. I think, to answer Mr. Cole's question very simply, you do not get out more material than you put in. You get out more good material, because you put in some otherwise useless material or junk.

Chairman COLE. Dr. Hafstad, I understand your division has been in the course of making a study of the whole field of reactor design and problems connected with it. Can you tell us how soon that study will be completed and available?

Dr. HAFSTAD. We have continuous studies underway, and we had hoped to submit to the committee today a report which was essentially unclassified, and therefore of general usefulness, on the status of all of the different reactors that we have been working on. I trust this will be available in a matter of days or weeks at the most.

Chairman COLE. Of course, such a report as that will be very helpful in connection with these hearings for public discussion.

Dr. HAFSTAD. I believe it would be, personally, and contains quite a lot of information.

Representative DURHAM. Doctor, how do you feel and what contribution do you feel will be made by private industry throughout the country in this development of these reactors?

Dr. HAFSTAD. Well, I think I would approach the problem by saying that we have reached the stage in the technology where quite a number of different reactor designs look good, and it would be instructive to carry through a number of these different approaches. We are unable at the present time, merely by making paper studies and analyses and so on, to pick which particular reactor design is going to be the winner.

It is like guessing whether the 1955 Chevrolet or the Ford is going to be the best automobile. It is pretty hard to tell in advance.

We have to carry through a number of different designs in order to see which one proves the most helpful.

Now, if private industry comes in, it would be my expectation that different companies would hit upon different reactor designs to exploit and would exploit these with all of the ingenuity that they can devise.

In this way the best of these reactor designs would probably turn out to be competitive.

It does not make any difference to me, as a technical man, whether these different reactor designs are financed by private industry or by government, but it is important that we do not try at the present time to say that one particular reactor design is it. We might guess wrong and set the whole program back if we do not exploit several different promising approaches.

Chairman COLE. Therefore, it is desirable to encourage a variety of types?

Dr. HAFSTAD. I say that without hesitation.

Chairman COLE. Even to the point of encouraging private capital to be made available?

Dr. HAFSTAD. In my judgment, it is necessary to explore several promising types of reactor designs.

Representative DURHAM. Do you feel that these study groups over the past year or more, which we have heard here before the committee, have made a contribution so far to the development of the reactor?

Dr. HAFSTAD. Very definitely, and I think largely because they are professional engineers, used to analyzing costs. This is a type of thing which we are not accustomed to, since we started out as reactor builders. So that, working back from costs of powerplants, and so on, these studies have been very helpful and instructive to us.

Representative DURHAM. You are primarily concerned with the weapons development?

Dr. HAFSTAD. That is right.

Representative DURHAM. And not the costs?

Dr. HAFSTAD. That is right. And so they have supplemented that side of our technical knowledge.

Chairman COLE. Thank you very much, Doctor.

Senator HICKENLOOPER. Dr. Hafstad, may I ask just one additional question. At this moment, can adequate information be turned over to private competitive operations, on experimentation and research and development on various types of reactors, can adequate information be turned over to private, more or less unsupervised experimentation without seriously invading the necessary secrecy essential to the national security in our weapons program?

Dr. HAFSTAD. This is a question which goes to the heart of the problem that we face at the present time. I believe that what is happening is that this reactor information is moving into the category of less sensitive information, and we have to take a look at what is going on across the water, so to speak.

Certainly all the reactor information, in my judgment, could not be declassified and turned over to industry, because part of it comes into the category which we must retain.

Senator HICKENLOOPER. The next question is: Can private industry, in your opinion, or will private industry be warranted in going ahead with experimentation independently on reactors when they cannot have accessible the full scope of reactor information which will be necessary? Are they going to put their money in it if they can only have part of the information?

Dr. HAFSTAD. I think the answer to that is a flat "No," they cannot afford to put private money into it on the basis of what is presently

unclassified information or declassified information. A mechanism would have to be devised so that industry were given access to at least the less sensitive categories of reactor information.

Representative HOLIFIELD. Dr. Hafstad, could private industry go ahead under the present contract arrangement and build these different types of reactors without violation of security?

Dr. HAFSTAD. That would be the pattern in which we have operated to date, and the answer would be "Yes."

Senator HICKENLOOPER. But, by the same token, if they go the contract route—and I mean if they are merely subcontractors to build certain installations—they operate for pay and they do not put their own money in it, and any patents or developments which may result from the work they do under a contract arrangement belongs to the Government exclusively, and they have no interest in it or they have no ownership in those things.

Dr. HAFSTAD. That is a question of incentive.

Senator HICKENLOOPER. Yes. Well, I am talking about private enterprise getting into this field, because if private enterprise gets into it independently, then there must be a profit motive and there must be the fact that they have got to see their way clear eventually to get their costs returned to them and make it a venture which will pay its way.

Dr. HAFSTAD. If we expect them to work hard at it and make some contribution, they must have an incentive. That is about what it amounts to.

Senator PASTORE. For the information of the public, in spite of all of the difficulties that you have pointed out, and all of the problems that beset us, do you think we have reached a time when we should start building the plants?

Dr. HAFSTAD. When we should start building a plant? In my judgment, yes, because we have reached the stage where interminable engineering arguments across the table never get settled and will not until the plant is built and operated.

Senator PASTORE. Now, my next question is: Who do you think should start doing that—the Government, private industry alone, or a joint effort on the part of both?

Dr. HAFSTAD. I believe that is a policy question which I would prefer to turn over to the Chairman.

Senator PASTORE. I think he has answered that question.

Mr. DEAN. I think that the approach the Commission has made to that question is this: that it looks as though the next 4 or 5 years would be a period largely of development. This means the building of reactor prototypes, experimental reactors. It does not mean large reactors which would produce large quantities of power and therefore economical power, because as the size of the reactor goes up the price of the power comes down. But it does mean prototypes or experimental reactors which would test out design, from which you could make extrapolations.

It is our conviction that these prototypes will not be built with private money during the course of the next 2 or 3 or 4 years, to set an arbitrary date. Therefore, there is still on the Commission the burden of going ahead with an intelligent experimental reactor program of one type or another.

This, however, is not to say that in the matter of 3 or 4 years, if industry has been brought in by joint studies, has worked with our

people and so forth, they will not be prepared to go with large sums of private capital into very large reactors based upon the designs which have been tested out by the Commission.

That is, in brief, the approach that we have toward this thing.

Senator PASTORE. Well, it is sort of a delaying action, nonetheless. I mean, if we assume now that this is the time for us to commence, but, because we are afraid private industry will not invest the money, because the return is not there, we are to keep on experimenting for 3 or 4 more years, are we not actually wasting 3 or 4 more years?

Mr. DEAN. No; I think the two can go along simultaneously. It does not mean because the Government is going to and should build reactors, prototypes, experimental reactors, in the next few years, that you exclude private industry in the meantime from making studies upon which it can later make its own designs and determine whether it is going to put in its own capital. Unless it has assurance, in our opinion, that some day it can get into this business, own and operate and build these large ones, and that assurance can be given early, they are not going to waste their time with development money and lots of other things.

Senator PASTORE. Do you think we might risk preeminence in this field if we followed that policy?

Mr. DEAN. I think we would risk preeminence if we do not take American industry into this field very soon.

Senator PASTORE. No, no. I realize that. I am for private enterprise, and I think, myself, that they should be involved in a joint effort. There should be a partnership. And I think there are lots of brains and know-how in private industry that ought to be utilized. I am speaking now of this waiting period of 3 years. Do you think we chance losing preeminence in these 3 years if we wait the 3 years for the reasons that have been stated?

Mr. DEAN. Perhaps I do not understand your question. Wait to do what?

Senator PASTORE. You say that because private industry feels at the moment that there would not be sufficient return, because we have not perfected this experimentation that you are talking about, and Government is in a better position to risk this capital, that industry cannot be expected to invest, naturally we have to wait and go on for 3 or 4 more years before we get into this thing with the cooperation of industry.

Mr. DEAN. I don't regard it as a wait, Senator, for this reason: Whether private industry builds these experimental prototypes or whether the Government builds them, they are going to have to be built. So, when I speak of the period of development of prototypes and experimental reactors, it is not a wait. It is just a necessity. One or the other or both has got to do it. You don't lose anything, in other words.

Perhaps it is applicable to the last two questions that have been put both by the chairman and by Senator Pastore that I now call on Mr. W. L. Davidson, who heads our Division of Industrial Participation, and who can describe to you briefly the various groups that have come into the Commission during the year and a half since his office has been created.

Senator PASTORE. Before you get to that, may I ask you a further question, please?

The reason for my asking you the question is this: I am of the belief that the public generally feels—and that brings us down to the efficacy of these public hearings that we are holding—the public generally feels that we are going to have this generation of this current through atomic energy tomorrow. You see what I mean?

Mr. DEAN. Yes, sir.

Senator PASTORE. Now, I think we have to make the public understand what our difficulties are and just what a waiting period we are going to have.

Now, up in the part of the country that I come from, New England, we talk a lot about electric power and hydroelectric power, and there are a lot of people who feel that we are going to have atomic energy to do this, and that we are going to have it pretty quick. That is not the case, is it?

Mr. DEAN. That is quite true. You are quite right. I think if you will examine the statement that we have tried to make on this thing, you will realize that nowhere in the Commission have we ever suggested that economical power is right around the corner. It is not.

Senator PASTORE. I realize that.

Mr. DEAN. What we have tried to emphasize is that it is a terrifically challenging goal to achieve, and that there are going to be some very difficult technological problems on the road to achieving it. But the time to lick these problems is today. That is about what we have said in substance.

Senator PASTORE. But you will agree with me that there are a lot of people who do not know the intricacies that are involved, that think just the opposite.

Mr. DEAN. That impression certainly prevails in many quarters.

Senator BRICKER. That comes from the failure on the part of the published articles to give the technical difficulties that are apparent to those who are studying in the field today.

Mr. DEAN. It is hard to do, Senator, as you can appreciate, because for one who has not had to lick the very difficult technological problems—and they only lick them inside the Commission under our present setup—it is difficult for him to conceive what those problems are and how much time would be consumed in licking them.

Representative HOLIFIELD. Mr. Chairman, while I have some other questions along the line of Senator Pastore's questions, I will withhold them until the balance of the presentation.

Chairman COLE. Will you sit down, Dr. Davidson, and will you give us the benefit of your experience in this problem?

STATEMENT OF W. L. DAVIDSON, DIRECTOR, OFFICE OF INDUSTRIAL DEVELOPMENT, ATOMIC ENERGY COMMISSION

Mr. DAVIDSON. With your permission, Mr. Chairman, I would like to offer the following statement expressing our evaluation, that is, the evaluation of the Office of Industrial Development, of the interest exhibited by American industry and industry's desire to participate in the development of commercial applications of nuclear energy, particularly in fields related to the generation of electric energy utilizing nuclear fuel.

For the benefit of the committee, I might just give a small amount of background information here, which will set in proper perspective

the function that this Office is supposed to play in the activities of the AEC.

Our Office, a subdivision of the General Manager's Office, commenced operations May 1, 1952, about 14 months ago.

The reasons underlying the creation of this Office are aptly expressed in the following extract from the AEC press release of that date, and I quote:

The Commission's establishment of an Industrial Development Office has important long-range implications looking to the day when industry will carry on its own a substantial part of the national atomic-energy program, with opportunity for real initiative. This Office will provide a single point of contact with positive responsibility to foster wider industrial participation in the Commission's program, and the development, as may be possible, of a more normal competitive approach to the problems and potentials of the atomic-energy business.

In fulfilling our role as a contact point within AEC for industry, particularly those firms not previously in touch with the Commission, we were approached by over 350 industrial groups during our first year of operation. The exact number is easy to remember. It is the exact number of days in the year, 365. These contacts ranged all the way from individuals with limited financial reserves to large corporations boasting annual sales running into hundreds of millions of dollars.

The nature of the problems posed and the interest shown have been quite varied. However, it is possible to classify these contacts into five broad categories.

Out of this group of 365, some 35 were firms who desired to vend standards products to AEC. These concerns manufactured a particular article of chemical and wondered if within the broad AEC program there might not be a market for such product or service. By and large, this group had negligible interest in nuclear power per se.

A second group comprising 89 concerns approached us on the basis of offering research and development assistance to the Commission. A majority of these firms were interested in nuclear power, at least indirectly.

A third group of 87 requests were for technical information most of which related to some phase of nuclear power.

There were 30 visitors to our office who hoped to start a business in some phase of atomic energy. The intended areas ranged all the way from power reactors through research reactors and isotope-producing reactors to the chemical processing of spent-fuel elements, acting as a wholesaler for fission products, manufacturing radiation instruments, and many other facets of atomic science not yet explored.

Sixty-nine visitors were looking for general information on AEC policies and plan, as these policies might affect their business. An additional 53 requests solicited speeches and articles on atomic-energy matters for presentation to technical and business groups.

The discussions with these various representatives of American business, in Washington and in the field, leads to the following assessment of industrial interest and intent in nuclear science and technology.

I want to emphasize here that this is an assessment, because in trying to evaluate what 365 companies have in mind you have trouble doing that with mathematical precision. So, in that sense it is an estimate. It is our conviction of their interests and intents. But I don't claim necessary precise value to it.

There are 10 such conclusions that I wish to read.

1. American industry is keenly and actively interested in exploring possible commercial applications of nuclear science. Dollarwise, most of this interest centers on the generation of electrical energy utilizing nuclear fuel.

2. Only the largest firms aspire to construct, own, and operate nuclear powerplants. The majority of industrial groups, at least those contacting our office, desire to become components manufacturers or specialize in services of various kinds to a nuclear-power industry, and these include such things as architect-engineering work, fuel fabrication, chemical processing, and control-systems design. Other groups hope to find worthwhile uses for the byproducts of reactor operation. A study made by our staff estimated that well over two-thirds of the companies in this country, employing more than 50 research engineers and scientists, have experience or capabilities which could be directly useful in nuclear-power development.

This simply epitomizes in my mind the wide variety of problems that must be contended with here in this broad field of nuclear power.

3. The motives underlying industrial interest in the atomic-energy area are manifold. They include—

(a) A desire to diversify into a new and potentially profitable field.

(b) The fear that atomic development may one day make their present operations obsolete.

(c) A hope that atomic-energy advances and techniques can be used to improve or cut costs of present products.

(d) The possibility of finding outlets for their products or services in a future atomic-power business.

4. American industry feels that atomic science and technology constitute a field it simply cannot afford to ignore. This interest will remain whether the Atomic Energy Act is revised or left unchanged. Prudent industrial management, however, cannot be expected to invest large sums in nuclear-power development under the present restrictive ground rules. Hence, in the event the Atomic Energy Act remains unchanged, industry will attempt to accumulate nuclear know-how much as it does today; that is, through Government-sponsored research and development contracts and operation of Government facilities, rather than through self-financed projects. A great deal of the present activity by the study teams is premised on the anticipation of a revision in the Atomic Energy Act. If there is no enabling legislation, interest by these groups will surely decrease, though it will not disappear.

5. If the Atomic Energy Act is changed to meet the objective of greater industrial participation, industry can be expected to devote considerable talent and resources to nuclear projects.

6. The extent of self-financed private participation under revised legislation will not be tremendous at the outset, owing to the overriding poor economic outlook for most nuclear ventures at the present time. As the technology advances through industry-sponsored research and the Commission's own program, private investment will increase proportionately.

7. In the light of the preceding statement, it is exceedingly doubtful that any industrial group would be willing to underwrite the early construction of a nuclear-power reactor, even assuming a revision of the act. With new legislation and a Government-sponsored proto-

type reactor demonstrating power costs even marginally economic, it is felt several private groups would then strongly consider financing full-scale projects.

8. The basis of our proposed policy is that industry will participate freely in nuclear-power development under patent provisions which recognize and fully protect the public interest in technology developed at taxpayer's expense. Industry will argue strenuously for patent rights to those inventions which are clearly the product of privately financed activities.

9. Secrecy and compartmentalization of classified information are undoubtedly responsible, to a large degree, for the nebulous state of knowledge possessed by a majority of industry as to the status and promise of nuclear power. Most industrialists accept this as a necessary consequence of giving prime consideration to the common defense and security. Some feel, however, that a realistic appraisal of the situation would permit more information to be made public.

Finally, a significant number of American companies deemed capable of making substantial contributions to nuclear-power development are currently serving as contractors to the Commission's reactor program. The Commission's policy would permit an expansion of this number to the end that we would have an even stronger national atomic-energy program.

Chairman COLE. Thank you very much, Mr. Davidson.

Do the committee members have any questions they want to submit to Mr. Davidson?

Representative HOLIFIELD. I assume your statement, Mr. Davidson, has the approval of the Commission?

Mr. DAVIDSON. Yes, sir. It has been reviewed by the proper authorities.

I should reiterate: This is an estimate of the Office of Industrial Development. I am not positive that every single Commissioner or every staff member would subscribe to all these conclusions. However, this is an attempt to be as objective as possible in assessing the interest and convictions of these industrial groups which have been in contact with our Office.

Representative HOLIFIELD. In section 7 you say that, even though the new legislation were enacted, and without going into the question of what kind of legislation, and "a Government-sponsored prototype reactor demonstrating power costs even marginally economic," even then there would be a very light participation by the industrial group?

Mr. DAVIDSON. No; I said it was felt that under those conditions several groups would then strongly consider financing full-scale projects.

Representative HOLIFIELD. But you say:

It is exceedingly doubtful that any industrial group would be willing to underwrite the early construction of a nuclear power reactor, even assuming a revision of the act.

Mr. DAVIDSON. That is on account of the very poor economics of the situation today.

Representative HOLIFIELD. Then, if that be the case, the only way we can get a power reactor built would be with Government funds or a great percentage of Government funds.

Mr. DAVIDSON. Speaking of prototypes, I think this is the case.

Representative HOLIFIELD. Let us speak of a practical 2,000-kilowatt-hour producing reactor.

Mr. DAVIDSON. You mean 200,000 kilowatt?

Representative HOLIFIELD. 200,000. Excuse me.

Mr. DAVIDSON. My conclusion as of today is that no group would do that.

Representative HOLIFIELD. That was my understanding. I wanted to verify that.

Chairman COLE. Thank you very much, Mr. Davidson.

Mr. DEAN. Are you ready for the next witness, Mr. Chairman? It is Dr. Bugher, who heads our Division of Biology and Medicine and will discuss some of the health and safety aspects of the business which were raised by earlier questions.

Chairman COLE. Dr. Bugher, we will be happy to hear you. You may proceed.

STATEMENT OF JOHN C. BUGHER, DIRECTOR, DIVISION OF BIOLOGY AND MEDICINE, ATOMIC ENERGY COMMISSION

Dr. BUGHER. It is obvious that the successful development of commercial power from nuclear fuels must be consistent with the standards of public health and safety. Since reactors for the production of fissionable material have been satisfactorily operated for more than a decade, it followed that power reactors, which, as Dr. Hafstad explained, depend upon the same fundamental principle, using the same nuclear reactions, may also be constructed and operated without significant, radiation hazard.

Dr. Hafstad has also explained something of the magnitude of the radiation values involved and has developed the fact that we must deal not only with high intensities of gamma and neutron radiation within the reactor during the process of uranium fission but also with the complex of elements called fission products, the fragments of the uranium nucleus which result from the fission resulting from this reaction and which continue their radioactive course at different rates. Some of them have a very slow rate of decomposition and persist in their radioactivity over a long period of time.

Senator BRICKER. Are all of these products radioactive? Those in the middle of the periodic table? Are they also radioactive?

Dr. BUGHER. They are practically all radioactive in the very beginning, and most of them go through a succession of radioactive disintegrations to reach a stable state and later appear as ordinary elements.

Senator BRICKER. I was thinking of krypton and barium particularly. In the first radioactive state, then, are those in the isotope form?

Dr. BUGHER. They are in the isotope form, but many of the isotopes are not those that ordinarily occur in nature, so they are not stable. And ultimately they degrade to isotopic forms that are stable, that are normally found.

Senator BRICKER. That is the normal krypton, barium, and other products?

Dr. BUGHER. Yes, sir.

Approximately 11 percent of the total energy of the reaction is ultimately released in radioactivity from the derived fission products.

These materials constitute the waste products of the reactors and must be removed from time to time in order that the fission process may proceed economically.

What, then, is the present status of our knowledge of the health hazards involved in this complex business, and how do we stand in our technology of protecting the operators and the public generally from the dangers inherent in large concentrations of radioactive materials?

To give a bit of the background of this problem, I would like to in a very brief manner go into a bit of history. Since the isolation of radium, for the first time in 1899, only a very few pounds of this highly radioactive element have been accumulated. The public is generally aware of the fact that this small amount of the element radium has not only been of immeasurable value in medicine, but in careless hands it has been a source of injury to many people. We now are dealing, when we speak of the production of large amounts of power from nuclear fission, with the creation in a single reactor of huge amounts of radioactivity, comparable to that of many tons of radium, instead of pounds.

When the first reactors were planned by the Manhattan Engineer District, the scientists and engineers were faced by problems of unprecedented magnitude concerning which there was very meager information. The nature of the issues faced in 1942 was expressed by the Commission's semiannual report to the Congress of July 1950—that is, the Eighth Semiannual Report, as follows—and I wish to quote two paragraphs from that report. This was expressing the situation and the problem as faced by the Manhattan Engineer District scientists in 1942 and thereabouts.

In place of a few radium dial painters doing standardized work and an occasional operator of a testing machine, thousands of workers soon were to perform hundreds of tasks in the vicinity of materials releasing much more radiation than men had known before. In place of a few doctors and hospital and laboratory technicians handling minute quantities of radium and 15,000- to 50,000-volt X-ray machines, hundreds of scientists and technicians were to do laboratory work with material thousands of times more radioactive than radium and with particle accelerators with voltages running to tens of millions.

Instead of about 3 pounds of radium under human control in the entire world, there would be radioactive materials equivalent to millions of pounds of radium. There would be not one kind of radio material but literally hundreds comprising nearly every known element and others previously unknown, such as plutonium. Instead of X-rays, the chief danger of which had been a skin burn, there would be gamma rays and neutrons able to deliver heavily damaging radiation deep within the body.

I must interject here, with regard to the forecast, at that time, only a little more than 10 years ago, that particle accelerators would be in use running to tens of millions of electron volts, and we actually now are in the neighborhood of 4 billion electron volts, with particle accelerators, in that short span of time.

Under these circumstances, referring to the circumstances of 1942, and pending the inauguration of a vigorous research program, it was necessary to establish criteria of radiological safety of a very conservative character. These considerations, plus those of security and the necessity for dispersal of huge installations, required the isolation of the operations within large tracts of land. With the experience gained by actual operation, and with the accumulation of knowledge as research has progressed, it has been possible to achieve a certain

degree of relaxation of some of the original criteria. The performance record of the plants is such that there have been very few radiation accidents, and the general health of the people fully engaged in the atomic-energy program is certainly as good as that in any other section of our national economy.

Senator HICKENLOOPER. May I ask you, Dr. Bugher, if it is not a fact that there have been no radiation injuries in the Government operation except injuries resulting from nonconformance to anticipated conditions, on which rules had been made; in other words, violations of rules, or carelessness in areas where the safeguards had already been set up?

Dr. BUGHER. Generally speaking, that has been the case, with a very few exceptions, which go back to the very early days, when people were conducting experiments, for example, of a critical nature, concerning which there were no rules at that time. And a few accidents did occur then. Those no longer occur, because the procedures are more clearly established.

Chairman COLE. Doctor, is it not also a fact that the accident rate in the overall AEC program, both for radiation hazard as well as occupation hazard, has been immeasurably better than the same record of accidents in industry?

Dr. BUGHER. Yes. The general frequency of accidents, nonradiation accidents, in the plants, is only about half the frequency of the same accidents generally in industry, which is a reflection of the fact that constant emphasis on safety has its fruits in many other fields than just radiation.

Chairman COLE. I think the safety work of the Commission's program has been remarkably fine.

Dr. BUGHER. The great amount of high-energy radiation emitted during the fission process makes the immediate vicinity of a reactor of great hazard to the operators unless the device is adequately shielded. Such shielding, therefore, as Dr. Hafstad has explained, is included by the engineers as an integral part of the reactor installation. The problem in practice is essentially one of determining the amount of shielding which is adequate to protect the health of the operators.

As the fission process proceeds, there is always a continued accumulation of the fission products, and ultimately the fuel must be processed in some manner so that these atomic waste products may be removed and the purified fissionable material returned to the power cycle. The separation of fission products involves a highly complicated chemical technology and extremely high levels of radiation. Here again these problems have been met satisfactorily in the several different schemes of chemical separation now in operation, and the operating personnel of such plants enjoy excellent protection from the health and safety standpoint.

From the point of view of the public safety of populations within close proximity to reactors, it is to be remembered that at any one time a reactor, whether for production or power purposes—and by production, I mean production of fissionable material here—will contain large amounts of radioactive materials which would be definitely dangerous to the public if they were scattered about in a haphazard fashion. The planning of reactors and their design must, therefore, always stress the fact that human failure may sooner or later occur in any situation, and the system must be designed to be self-limiting in case

of operational accidents or misjudgment. That this may be successfully achieved has been demonstrated by the reactor accidents at the Argonne National Laboratory and at Chalk River, Canada, where despite the occurrence of an excessive power burst, in the latter instance resulting in serious damage to the reactor, there was no significant radiation injury to any of the personnel, and the contamination resulting was confined to the reactor buildings themselves and no health problems occurred outside these buildings.

Thus it would appear that throughout the history of the Manhattan Engineer District and the Atomic Energy Commission an increasing number of reactors for production purposes have been operated successfully without endangering either the operating personnel or any portion of the general public. We have at hand both the knowledge and experience to assure us that reactors for primary power may be safely operated at the present time. As such a program continues to develop and undergo the gradual evolution which may be anticipated, the research program likewise must be steadily prosecuted in order that criteria of safety may be continually examined and new knowledge accumulated relative to the requirements for radiation protection. We would not anticipate any abrupt or revolutionary change in the criteria of reactor operation generally, but a steady development as knowledge of the art increases.

In other words, medically the situation is somewhat comparable to the engineering problem, of a steady development and evolution rather than revolutionary change at some particular date.

The standards of radiological safety in this field are primarily the responsibility of the Atomic Energy Commission. The decisions as to permissible levels of exposure are never capricious; in these matters we are assisted and advised by the outstanding radiologists of the country, some of whom are conducting research as a part of the general research program of the Commission, and others who bring to us the benefits of experience gained in other fields.

In summary, we find that while we have yet much to learn concerning the mechanism of radiation injury, the manner in which radiation injures living things, particularly people, we have sufficient practical knowledge to insure safe operation of power reactors of the types now contemplated. For the longer view, we are confident that our research programs, vigorously prosecuted, will enable us to maintain sound safety criteria for future developments.

Chairman COLE. Thank you, Doctor. I think now it is appropriate for Senator Hickenlooper to raise the questions which he had.

Are there any questions? Somebody raised the question of Mr. Dean which he deferred to you with respect to the health hazard. Mr. Durham, I believe.

Dr. BUGHER. Yes. I believe the question was: To what extent are the reactors likely to endanger the public within the immediate neighborhood?

The problem is almost the same as we have in the power reactors at the various installations now operating. I mean the production reactors. In the event of a serious disaster, the locality could be very seriously contaminated and would not be suitable for occupation by people for quite a period of time. The problem, therefore, of design is one in which such a complete disaster could not occur, but where operational accidents might result only in very localized contamina-

tion. Our best and only example of course, so far, is in the case of the reactor at Chalk River, which the Canadians have informed the press and the public generally about.

Representative DURHAM. What effect would weather conditions have on that?

Dr. BUGHER. The local distribution of contaminating material in such an event would be more or less dependent upon the immediate weather. That is to say, rain would certainly change the distribution. But we would anticipate that in case of a reactor accident of any major character, the deposition would be within a few miles of the reactor itself. It would not have a very remotely borne mass of contamination.

Representative HOLIFIELD. Will the gentleman yield on that point?

Is it not true that at the time of the Chalk River explosion the weather conditions were ideal, so that the contamination went up into the air and was dispersed, whereas if there had been a dense fog or a heavy rainfall, a blowing type of rainfall, it would have been more concentrated on the ground areas and more dangerous?

Dr. BUGHER. They felt that at the very beginning, but we are informed that as they studied the situation later and became more aware of what had happened, they said they would not have been particularly worried even though a heavy rain had occurred at the time.

Representative HOLIFIELD. There must not have been very much contamination by radiated dust in the air at the time.

Dr. BUGHER. That is right. There was very little that came from the reactor itself.

Chairman COLE. In the normal operation of a power reactor, Doctor, is there any hazard to the health of either the nearby community or distant communities, irrespective of the number of reactors that there might be?

Dr. BUGHER. With the normal operation of any of the designs now in sight, the problem of safety of the operators or the nearby people is entirely one of shielding, which is a straightforward engineering problem. The system is a closed system, and the problem of fission product activity does not really come into the picture until at such time as the fuel may be processed for removal of these products.

Chairman COLE. Then there are no products discharged into the air which are contaminated and which might jeopardize the health?

Dr. BUGHER. No. These are all closed systems.

Chairman COLE. The only hazard is in connection with the person engaged in the plant, the employees, or, in the event of a catastrophe, some unforeseen miscalculation in the immediate neighborhood?

Dr. BUGHER. Yes. That is a good statement of it.

Chairman COLE. Can you tell us any of the developments which you anticipate might be made available to medicine and thereby to the health and improvement of our people through an encouragement and an enlargement of this reactor field?

Dr. BUGHER. It is one of the most attractive areas in medicine today, that the small reactors may have a direct application to medical problems, particularly in the field of cancer treatment, where the neutron radiation itself, which ordinarily is confined within the reactor, may be drawn out for specific purposes with extremely promising results.

The second big area of utilization of the reactor is in the production of radioactive isotopes, particularly those whose half-life is short, which can be utilized in a number of diseases with considerable advantage. So that even small reactors which are not primarily designed for power production of any magnitude offer considerable value in this field, and it may be said that the medical profession then profits as a byproduct, you might say, from the very great amount of engineering research which goes into the power reactor design.

Chairman COLE. I have noticed that you emphasize that the benefits might be made available by the use of small reactors. Could that be interpreted to mean that the larger the reactors, the more numerous they are, the more opportunities you have for greater benefits? Does the volume of the benefits increase with the size of the reactors, or can medicine get all the help it wants out of nuclear power from the small reactors?

Dr. BUGHER. I think medically the needs are not for large reactors. As I understand the engineering problem, it is the economics of power that make the large reactors attractive in that field. But by the same token, the smaller ones are more useful medically, more flexible, and have in many ways more attraction from the standpoint of the usual medical center. The power levels are not high in such case, but the radiation uses are very adequate.

Chairman COLE. You seem to establish two categories of benefits from the reactor program, one through the use of manufactured isotopes for use in treatment and analysis of ailments, and so forth, and then your first category, as I understood it, meant that the patient would have to go to the reactor itself and be exposed to the radiation.

Dr. BUGHER. Yes. That is the problem there, which implies that with time, and as the reactor technology advances, we should anticipate for that purpose small, extremely safe, and relatively simple reactors for these specific medical purposes.

Representative DURHAM. Doctor, this is a little bit beside the point, but since you have discussed this, let me ask, Has the study that has been made through the Commission as a result of the explosions at Hiroshima and Nagasaki been of great value in arriving at some conclusions today as to what might happen if we should develop hundreds of these reactors throughout the country?

Dr. BUGHER. The subsequent medical histories of the survivors in Japan of the two cities is of great value to these peacetime applications. We prosecuted it in fact fundamentally with that reference. And it is a combined scientific effort in the medical field of both the Japanese and the American Governments. It will give us extremely valuable information as to the problems and long-term effects of radiation on people.

Chairman COLE. Are there any further questions?

If not, thank you very, very much.

Representative DURHAM. In line with the statement the Chairman made with regard to the services that have been performed by those who have taken part in this program, I am sure he joins with me in expressing commendation for the services rendered to the country and the world at large by the present Chairman.

Chairman COLE. You are speaking, when you refer to the "present Chairman," of the Chairman of the Atomic Energy Commission.

Representative DURHAM. I am speaking of the Chairman of the Atomic Energy Commission.

Representative PRICE. I concur in the statement. I know the committee is unanimous in its regard for Mr. Dean.

Mr. DEAN. We have one more witness, and he is going to briefly allude to some of the problems encountered in connection with the control of power reactor information. He is Dr. J. G. Beckerley, Director of Classification.

STATEMENT OF J. G. BECKERLEY, DIRECTOR OF CLASSIFICATION, ATOMIC ENERGY COMMISSION

Dr. BECKERLEY. Mr. Chairman, there is no doubt in my mind that any expansion of industrial and public participation in the development of nuclear power can be accomplished without adversely affecting the national security.

As the Commission's policy statement indicates, the distribution of classified information as well as the declassification of technical data on nuclear power must necessarily be geared to the increase in activity and interest in the field on the part of American industry and public. This process of liberalizing reactor information distribution in proportion to increasing activity is based upon a policy of weighing value to the United States versus value to unfriendly nations in determining the dissemination of technical data.

I should like to review briefly the current declassification program as it pertains to nuclear reactor information. Additionally, I should like to indicate a probable course which Commission declassification policy may take.

The basis for secrecy in atomic energy matters stems from the Atomic Energy Act itself. Under section 10 of the act power reactor information is "born" classified and remains in this state until the Commission determines that the information, in the words of the statute, "may be published without adversely affecting the common defense and security." The reason reactor data has security implications lies in the fact that nuclear reactors are capable of producing fissionable material for atomic weapons. A second reason that reactor data may be security information is the fact that nuclear fuels may be used for military propulsion purposes. Reactor information also may have security significance because of its relationship to fissionable materials production capacity. This latter is clearly an intelligence factor whereas the first 2 concerns technical use of the data by unfriendly nations in their own programs.

It is clear that the Commission must release at least as much reactor data as other nations have developed and published. This means that as other nations develop nuclear reactors and publish data thereon, it is pointless to withhold from publication similar data developed in this country. This is, of course, a minimum declassification requirement.

Actually, in order to assure a strong United States atomic energy program it is necessary to release more data than that which is known to other nations. A large body of engineers, scientists, and technicians in this country must be prepared to participate in the developing atomic energy program. The declassification of information

necessary to the basic training in a new technology is essential to the national security. This amounts to an investment of technical information in the coming generation of nuclear scientists and engineers.

In 1945 the Manhattan District set up a committee under the late Dr. R. C. Tolman to recommend a basic declassification policy. One of the recommendations made by this committee, which has been a part of declassification policy during the past 7 years, is that basic science should be declassified first and technology later. Under this policy the Commission has withheld from publication essentially all important and unique reactor technology, while it has permitted publication of the underlying basic science and engineering.

Let me indicate a few examples of what has been released under this policy. All biological and medical data of any possible significance in the health problems associated with nuclear reactor and chemical processing operations has been released. In fact, practically all of this work is done on a completely open basis following the usual tradition of unhindered scientific publication. In 1950 the United States, as well as Canada and the United Kingdom with whom we share common basic declassification rules, agreed to release all information concerning the design and operation of a number of low power nuclear reactors. One consequence of this action is that certain research reactors for basic scientific endeavors can be operated as unclassified facilities. In 1951 further numerical data were released supporting this policy so that theoretical studies and training could be carried out on a completely open basis.

The declassification of low power reactors is slowly but surely resulting in benefits to the project in terms of a better trained new generation of scientists, engineers and technicians. "Classified" training cannot do the complete job. When you consider that no "home work" can be done under such conditions nor can the trainees discuss their course with nonproject experts and when you consider that the trainees discipline themselves not even to think about the classified technology except when on the job, then it is easy to appreciate that such training has its limitations. It is clear that we will always have classified on-the-job training. It is quite wasteful, however, to extend such training to relatively elementary and basic engineering.

Under the present declassification policy in the reactor field we have released certain technological data of substantial off-project usefulness. An example of this is liquid metal technology. Almost all basic work on the problems of handling liquid metal for reactor coolant applications has been declassified. Equipment developed for such purpose is, for the most part, publicly available. While this technology is of use in the reactor business it is clear that the application of liquid metal techniques to other industrial problems is of such importance that the national security would be adversely affected under a restrictive publication policy or in other words, our national security would be weakened by failure to publish.

Another technology which is, for the most part, declassifiable is that concerned with remote handling equipment and systems. This is a field of engineering which is a challenge to mechanical and electrical ingenuity and one for which we are drawing on the immense body of know-how in servomechanisms and similar developments through-

out American industry. Remote handling technology is an essential part in the health and safety program. When fully developed the technology will be applicable to many nonatomic activities, such as, for example, the handling of dangerous chemicals or biological materials.

Although the above-mentioned information is released, it has been our policy to withhold from publication the really unique reactor information. Relatively little has been released about those nuclear constants which are very difficult to measure and which are essential to the design of advanced reactors. The distortion and corrosion of fuel elements in nuclear reactors is an extremely important problem in the reactor business and one about which we have said almost nothing. The fabrication of fuel elements and their performance under intense thermal and nuclear irradiation involve rather extensive know-how. We have released very few technical details on these, in the belief that the data are critical to our business and cannot be understood without time-consuming activities involving unique facilities.

In essence, many of our reactors are considered as "black box" heat sources. By this I mean that we say as little as possible about the contents of the box and are relatively open about the equipment exterior to the box. This concept has been developed over the past several years and has proved to be extremely useful. Of course, it is apparent that we will have to, as the scope of the nuclear-power program increases, release data on the "black box" design and performance, since this is at the heart of the new technology. In fact, it is in this "black box" that the greatest opportunities for ingenuity exist. To date, we have never given all the details on any of these "black box" reactor cores except for the low power units where the effect of temperatures, radiation fields, and corrosion are less important.

Although we shall continue to withhold the critical details of reactor core technology, it is essential that we declassify more and more information on what can be done in a reactor core without divulging precisely how it can be done. This means, for example, that we should find it possible to discuss engineering evaluation of core performance; that is, degree of burn up, lifetime of fuel elements, corrosion resistance, et cetera.

In looking ahead I believe that we should continue the development of reactor core technology on a classified basis until it becomes apparent that classification is handicapping the full development of nuclear power to an extent which outweighs its possible value to unfriendly nations. In the development of this technology on a classified basis, it is essential that we distribute the data broadly, so that a maximum fraction of the United States technical community may contribute the ideas and ingenuity essential to rapid progress. This will increase only very slightly the possibility of compromise of the information.

With respect to the contributing technology to the reactor business—for example, the development of reactor materials such as zirconium and its alloys and heavy water—undoubtedly the Commission will find it more and more desirable to release data on this technology so that the contributing industries will be relatively free to undertake their own research and development and to advance under the usual incentives of free enterprise. We have already moved in this direction rather substantially. The manufacturers of radiation detection instruments, special components such as liquid metal pumps, etcetera,

are developing and improving their products. Since the end of the war there have developed a number of new industries based on declassified data.

In releasing technical information or distributing classified information more broadly, there are bound to be real and basic difficulties. One consequence of withholding release of reactor core technology will be the continuance under secrecy order of a large body of patent applications. This, of course, results in some very basic problems which it is not proposed to discuss here at this time.

Additionally, there will always be the feeling that an important new technology such as this should be as unfettered by security and secrecy paraphernalia as possible. It is certainly true that we slow down our rate of progress in withholding significant technical information from publication. However, the basic question is one of relative values; that is, as long as we feel that we are retarding unfriendly nations in their efforts in this field—by making them perform the work themselves—we can afford to take a measure of slowdown in our own progress.

Naturally, it is a delicate balance and one which must be continually worked on. It is a balance which is very hard to strike, since it is never clear to any of us just how useful our reactor information is to an unfriendly nation. But as long as the present unfriendly international competition exists we must withhold from our competitors many of those "trade secrets" which we have worked so hard to develop.

Chairman COLE. Thank you very much, Dr. Beckerley.

I was especially impressed by your opening statement, which I feel is important enough to reemphasize, in which you say there is no doubt in your mind that any expansion of industrial and public participation in the development of nuclear power can be accomplished without adversely affecting the national security. That is a phase of this problem which has given us a good bit of concern. That reassurance from you, in view of your connection with the program, and your knowledge of the problem, is heartening.

Representative DURHAM. You are speaking as a physicist, Doctor?

Dr. BECKERLEY. Yes, I trained as a physicist and worked in an industrial research laboratory for a number of years.

Representative DURHAM. Do you have a doctor's degree?

Dr. BECKERLEY. Yes, sir.

Representative DURHAM. There was one other point that you made there. It was pointed out in your statement here that the publishing of these improvements in the process of manufacturing or whatever it should happen to be would, of course, immediately be made null and void if we had to clamp secrecy on in this country. At the present time, in your opinion, is there anything being published in England that declassifies any matter that we have classified? I mean, is there anything being published in England on reactors that we have classified in this country, that unclassifies what we have classified?

Dr. BECKERLEY. With respect to Great Britain and Canada, we share common rules of declassification.

Representative DURHAM. We have no control over what they publish, do we?

Dr. BECKERLEY. In the normal course of events, for example, if the rules are not clear—

Representative DURHAM. Well, I will reframe my question. Is there anything being published throughout the world now of that kind to your knowledge?

Dr. BECKERLEY. My answer to that is "No," taking into account the French program, the Belgian program, the Norwegian program. They have not published anything which we have held classified, not to my knowledge.

Representative HOLIFIELD. Dr. Beckerley, referring to the first paragraph of your statement, will you please state that in an affirmative way? Will you please state exactly what you mean by that?

Dr. BECKERLEY. It has just been called to my attention that there is a typographical error here. It should be "an expansion." Because obviously an expansion which was so large that it interfered with other defense activities would clearly negate this sentence here. What I mean here is any reasonable expansion which is possible with the funds and people available. I do not feel that expansion itself will involve any disclosure of data, any loss of security whatsoever.

Representative HOLIFIELD. Of course, that statement is worthless, because it does not rest upon any foundation of a known element. Now, what do you mean by it? Tell us how much of an expansion of industrial and public participation can be accomplished without adversely affecting the national security. That is a very vague statement, if I understand it right.

Dr. BECKERLEY. I think you have a point there, sir. That is why the following sentences are intended to clarify that. What I mean is that in any expansion of any effort in this field you have two courses which must be followed. One is to disseminate the information more broadly on a classified basis. The other is to declassify certain information. And with these two courses available, I feel that one can develop a program in such a way as to enhance the national security rather than to lose any security.

Representative HOLIFIELD. Now, I want to understand this, because I think it is very important, in view of your last sentence of your statement, in which you say:

But as long as the present unfriendly international competition exists we must withhold from our competitor many of those "trade secrets" which we have worked so hard to develop.

Dr. BECKERLEY. Yes, sir.

Representative HOLIFIELD. Do you believe that a widespread participation by private industry in owning and operating civilian power reactors at this time could be accomplished without widening the base of security risk?

Dr. BECKERLEY. I say that the security risk is relatively speaking rather small. In other words, the participation is on a classified basis. You are dealing with cleared people. They observe the normal security procedures to assure the safeguarding of information. And if this is done, then I can see no reason why we should lose any security thereby.

I am thinking in terms, for example, of the present industrial group participation. I do not think we have lost any security whatsoever by having had these groups come in, study all of our classified data, develop reports, and then come to conclusions which have been beneficial to the Commission and to the public as a whole.

Representative HOLIFIELD. Of course, you withheld a great deal of information from these groups in certain fields.

Dr. BECKERLEY. So far as I know, in the reactor field there has been relatively little withheld from them. In the weapons field, of course, this is another matter. In this statement, of course, I am referring strictly to reactor information.

Representative DURHAM. The materials there are common, are they not?

Dr. BECKERLEY. The materials are common; yes, sir. But when I speak of weapons, I am speaking of what to do with the fissionable material to make it into a weapon.

Representative DURHAM. Your statement there covered up to the complete manufacturing of fissionable material?

Dr. BECKERLEY. Yes, sir. I am thinking in terms of right up from the uranium to fissionable material, that entire process.

Representative DURHAM. You would have to have that to develop power?

Dr. BECKERLEY. Not necessarily. I mean, you can have reactors which are so designed that they burn the fissionable material as they produce it.

Representative DURHAM. But they would be producing material, of course?

Dr. BECKERLEY. A breeder reactor would be excluded from that category; yes, sir.

Chairman COLE. Thank you very much, Dr. Beckerley.

Now, if you will take your previous post over there as the flag man: Are there any questions the members wish to present to Mr. Dean? You have completed your presentation?

Mr. DEAN. We have completed our presentation, Mr. Chairman.

Representative HOLIFIELD. Mr. Chairman?

Mr. Dean, I certainly want to add my commendation to the commendations which you and the rest of the Commission have received today for the long and arduous job which you have undertaken over the past few years. I can say with a great deal of satisfaction that never in those years have I had any serious difference with the Commission.

However, I find myself in the position of differing somewhat, not on a personal basis, certainly, but on a basis of the principles involved, with the policy statement in the recent draft of the legislation which you have presented. I wish to explore some of the reasons for that difference.

First I would like to ask you approximately what the cost of a civilian power reactor of 200,000 kilowatt-hour capacity would be.

Mr. DEAN. Well, it is a little hard to say.

Representative HOLIFIELD. The approximate cost.

Mr. DEAN. It is in the order, say, of somewhere between a hundred million dollars, \$125 million, something on this order.

Representative HOLIFIELD. Now, your Commission has interviewed the representative groups, you might say, in American industry, numbering well over a hundred, I understand, and they are now consolidated into five different study groups. I would like to ask you this question: Has private industry offered to build such a reactor with all private funds?

Mr. DEAN. We have had expressions of interest by certain of the industrial groups in building a reactor entirely with their own funds. However, this is not to be built in 1953. And there are qualifications put upon their offer. I cannot recall them. But some of the qualifications are, for example, that the Atomic Energy Commission will continue to assist these groups in licking certain problems in the course of the next few years before they would be willing to go ahead and build. And other qualifications have been written in. I can get these into the record so that we will have them exactly. There are groups, therefore, that have come in and expressed an interest. Eventually, not saying what year and what day, they will be building a reactor entirely from their own funds, with no support from Government, and with no subsidy in the form of plutonium purchases.

Representative HOLIFIELD. Of course, you have put that on the basis of an indeterminate date.

Mr. DEAN. I have to.

Representative HOLIFIELD. You have to. It makes the offer contingent upon unknown factors. So I take it a proper answer to the question would be that at the present time no private industry has come forward and offered to build a reactor with their own private funds without certain concessions.

Mr. DEAN. Without certain problems having been licked with the assistance of the Commission, is what I would say.

Representative HOLIFIELD. Not only certain problems being licked, but they have also inferred, if not asked for, certain rights of amortization, certain rights in the sale of plutonium back to the Government, and certain patent rights. Some of the groups have not asked for all of those, but all of the groups have asked for some of those, I believe.

Mr. DEAN. Oh, I suppose you will find those requests in 1 group or another. However, to get the record straight, one group to which I have referred—I prefer not to name it, because we have not blessed one group over the other—has never asked for any concessions as far as plutonium purchases are concerned; therefore, no subsidy.

Representative HOLIFIELD. But they have asked for amortization privileges?

Mr. DEAN. I don't believe any amortization privileges have been requested by this particular group.

Representative HOLIFIELD. They have not offered, however, to put that money up, without the Government participating with them on it.

Mr. DEAN. In some cases there is no participation by the Government at all. In one group they asked for Government participation. We put up the reactor. They put up the rest of the plant. In certain other cases they don't want us to put up any of it. But they want a little more time to make sure they are in a position to put up \$100 million or \$125 million.

Representative HOLIFIELD. And, of course, they want guaranties as to the supply of uranium over a period of, let us say, 20 or 30 years?

Mr. DEAN. They would have to have this. Because you don't put up a \$125 million plant without knowing that you are going to get fuel for the period that that plant exists.

Representative HOLIFIELD. That is right.

Now, you recommended certain legislation to the President to make possible private industry participation which is not now allowable under the Atomic Energy Act, have you not?

Mr. DEAN. That is correct.

Representative HOLIFIELD. That legislation is not under consideration before this committee at this time, for certain reasons. However, in commenting upon some of your policy statements, some of the points in your policy statements, it indicates that changes in the act are necessary so that private industry can own, produce, and utilize fissionable material.

Mr. DEAN. That is correct.

Representative HOLIFIELD. Do you consider that a basic change in the Atomic Energy Act?

Mr. DEAN. Oh, it is obviously a basic change; but under the present terms of the act no industrial concern or anyone else other than the Commission can own a reactor. No one else other than the Commission can own fissionable material.

Representative HOLIFIELD. Now, that change is being advocated in order to allow private industry to make industrial application of the benefits of it?

Mr. DEAN. In the power field.

Representative HOLIFIELD. In the power field. In view of that fact, why is it that the Commission has not made a determination, as required by the act, that we are approaching the time of practical value?

Mr. DEAN. I tried to cover that in my opening statement. The act does not say "when you are approaching the time of practical value." Section 7 (b) of the act says:

Whenever in its opinion any industrial, commercial, or other nonmilitary use of fissionable material or atomic energy has—

and these are the important words—

been sufficiently developed to be of practical value, the Commission shall * * *.

The whole purpose of our presentation, the theory on which we make it at this time, is that it has not been sufficiently developed to be of practical value, and before it has been developed to the point where it is of practical value—and by that I mean economic value, not military value—you have to go through the period of development that is referred to in 7 (b). It seems to us quite clear that the 7 (b) day as contemplated in the act has not arrived.

Representative HOLIFIELD. I agree with you, of course, that the 7 (b) day has not arrived. But, nevertheless, notwithstanding the fact that you have not made that finding of value and that the day has not arrived, you have presented to the President a draft of legislation which is a basic change in the act and which is to enable that participation in the act which was envisaged to occur only when the 7 (b) day arrived. So you are, in effect, evading that provision by going ahead and acting as though it does exist in your recommendation for basic legislative changes.

Mr. DEAN. I would like to make two comments. There is no evasion of 7 (b) if you take it literally. It says, "sufficiently developed to be of practical value." You have agreed just now, and we certainly

agree, that it has not been sufficiently developed to be of practical value. If this be the case, 7 (b) does not come into play.

Now, so far as the spirit of the act is concerned, as distinguished from the language of the act, what is contemplated? What do you want? What you want is a Commission that, when it sees a significant development in this field, will come up and make this known. To whom? The act says, "to the joint committee." This we have done. And you think it apparently of sufficient importance to have public hearings on it.

Now, there is certainly no intent to evade 7 (b). We are not afraid of 7 (b) or anything about it, because we have taken practically the same course of action. However, I don't think it is quite correct to say that we are evading 7 (b), when you admit it doesn't apply.

Representative HOLIFIELD. Well, it does not apply, but you are going ahead as though the time envisaged has arrived, and yet you refuse to accept the responsibilities of the rest of 7 (b), which has to do with presenting to the President and to the Congress an estimate of the social, political, economic, and international effects of such use. You are making an industrial application law possible without taking the responsibility of making the analysis, it seems to me.

Mr. DEAN. Well, may I suggest respectfully that we are not going ahead as though 7 (b) applied.

Representative HOLIFIELD. You are not in accepting your responsibilities, but you are in recommending legislation to make a basic change in the act.

Mr. DEAN. The statute itself in several places—and this I tried to stress in my opening statement—said, "If ever you think it is a good idea to amend this act, get up here to the Congress and suggest it." And that is what we are doing.

Representative HOLIFIELD. That is true. And you have done that many times. But not in the field of industrial application or in the field of civilian power for practical use.

Mr. DEAN. But do we not have to answer the question, Mr. Holifield, whether 7 (b) applies or does not apply? If you admit it does not apply, I do not know why you suggest that the Commission somehow evaded 7 (b).

Representative HOLIFIELD. I admit that the time has not arrived when practical application of civilian power is economically feasible or practical.

Mr. DEAN. And I think that is what 7 (b) meant. Is that not what it meant?

Representative HOLIFIELD. I think so. And it said for you to do certain things. Now, you have gone ahead and proposed legislation which will achieve the same purpose as though you had arrived at that finding of practical value.

Mr. DEAN. I do not think that is quite a correct statement. We are really suggesting here not legislation for all times to settle all problems, and no one could agree more with the chairman of your committee than myself when he said, in his opening statement, that we will not get all of these problems licked in the course of a week or a month or even a year. And no one is smart enough to know all the answers. We have approached this as interim legislation, not permanent legislation that would be forever applicable.

Representative HOLIFIELD. All right. Now, you have spoken of incentives. We will leave that point. You have spoken of incentives. In this interim legislation do you anticipate giving to industry the right to stake out areas of private interest such as that evidenced by patent rights or discriminatory opportunity to cooperate in further experimental work?

Mr. DEAN. Well, there are two questions. One is, Do we propose a change in the patent procedure of the act? The answer is "No." We do not. We specifically state that it should be left in the same way for a period of time. So far as proposing anything discriminatory, I fail to detect it.

Representative HOLIFIELD. All right. Let us consider the Patent Act. There are certain groups of industry that have appeared before this committee that have put in as one of their stipulations that they be allowed to obtain patents during this interim period beginning with the status that now exists and the status that would exist at the time when a civilian power reactor becomes economically practicable. They have asked for those patent rights. And your thought is, then, that they should not have those patent rights?

Mr. DEAN. We have, as you will notice from our policy statement, specifically stayed away from any suggestions as to how you answer the patent question. We have not suggested that the law be changed. We have suggested simply that probably during this interim period the Commission should, as a matter of Commission policy, but known to the Congress, liberalize what it can already do in the way of clauses with these industrial concerns and their contracts—liberalize it within the limits of the act. We have not suggested anything more.

Representative HOLIFIELD. You do not intend to suggest any further granting of patent rights in this interim period?

Mr. DEAN. I don't personally. Let me suggest that the question of patent rights is a very difficult one, and I think you and I would probably be after the same kind of answer. We don't want patent privileges given to somebody where he hasn't really made a contribution. We don't want slight extrapolations made by people walking through a lab after our people have collected information but not recorded the discoveries for 7 years. Neither, on the other hand, do we feel it is fair to say to a private industrial concern that comes in with its own money, "You cannot have the patents you develop while you are using your own money." Now, somewhere in any patent policy you try to achieve those two things. We have not suggested the answer.

Representative PRICE. But would you exclude others from the benefit of this patent that the private company discovered?

Mr. DEAN. The Government, in the first place, is never excluded, Mr. Price.

Representative HOLIFIELD. You spoke of some agreement you had with these companies that came into the program, that they would make available to all industry any patent that they came upon.

Mr. DEAN. This is certainly one method. And I am not suggesting it is the correct answer, or an incorrect answer. I think the question of cross-licensing—

Representative HOLIFIELD. It is not a new idea.

Mr. DEAN. No; it is a very common arrangement.

Representative HOLIFIELD. Industry has worked together on such a basis before.

Mr. DEAN. I would like to correct one impression that some people may have, and that is that somehow it is proposed by the Commission or by someone else that an industrial concern could come in, walk off with a patent, and somehow the public, the Commission, or the other branches of the Government, would lose rights under that patent. No one anywhere has ever proposed this, even in industry.

Representative HOLIFIELD. No, but you have been silent on the subject in your legislative draft. You have not taken that subject under consideration in your legislative draft, and you have left that responsibility upon this committee. And it is a responsibility that this committee cannot meet if it follows the other points of your legislative proposals.

Mr. DEAN. Mr. Holifield, I know of no suggestion by the Commission or anyone else that the Government ever be denied the rights under a patent.

Representative HOLIFIELD. Now, let us clarify that point. That is true, that the Government retains its right to use any patent that is obtained.

Mr. DEAN. Right. That is my point.

Representative HOLIFIELD. But if a private industry comes in, there must of necessity be a very few industries which come in during this interim period of development, and if those companies obtain patent rights, they are available to the Government, but they are not available to the rest of American industry, and therefore, they are restrictive, and in the nature of promoting monopoly and restrictive trade practices, and not in the nature of strengthening free competition as the act calls for.

Mr. DEAN. I could not argue with you. Because certainly nothing we have suggested is designed to create a monopoly. Nothing that we have suggested.

Representative HOLIFIELD. But this is one of the incentives that we talked about, getting private industry into the program. And that is one of the incentives that they demand.

Mr. DEAN. They demand not any change in the law; they do demand some liberalization of the patent rights. We have not spelled those out.

Representative HOLIFIELD. Well, I will say we have not. And that is the thing that I want spelled out before you start changing the law and putting a limited number of people into this program. I want it spelled out as to what incentive it is going to be necessary to give them, and what field of private interest they are going to stake out in this project which has cost the taxpayers \$12 billion.

Mr. DEAN. Well, you have many alternatives. And furthermore, I don't write laws. This is the responsibility of the Congress.

Representative HOLIFIELD. That is right.

Mr. DEAN. You can have cross-licensing arrangements. You could have them with or without royalties. There are innumerable arrangements that could be made.

Representative HOLIFIELD. What good would a patent be without royalties?

Mr. DEAN. What would it be?

Representative HOLIFIELD. What good would it be without royalties?

Mr. DEAN. It would be wonderful if you had no cross-licensing.

Representative HOLIFIELD. Then it would be a restrictive patent, of course. You certainly are not advocating that we give any of these companies restrictive patents during the interim period?

Mr. DEAN. Let me say again I am not advocating anything so far as the patent provisions are concerned.

Representative HOLIFIELD. All right. Then you are leaving a correlated field which is completely dependent upon the other legislative proposals you have made; you are leaving it now on the shoulders of the committee, without taking any responsibility in that field.

Mr. DEAN. Well, if I knew the answer, Mr. Holifield, to this particular problem, I would be quite happy to spell it out now. I think this is something that is going to have to take an awful lot of thought and not too much fast guessing as to the answer.

Representative HOLIFIELD. This committee is very aware of its responsibility along that line, from the fact that \$12 billion of the people's money has been expended bringing this technology up to date, and that is no reason for allowing it to be the base for a few private industries to get in and obtain restrictive patents while the rest of the American industry pay through the nose for the advantageous privileges which could be obtained during this interim period. That is one of the problems.

Mr. DEAN. That is one of the problems. And I am not suggesting that such a condition prevail.

Representative HOLIFIELD. All right. Let me ask you another question.

In a recent issue of Fortune magazine it estimated that about 3.5 percent of the total electrical energy consumption in the United States is consumed in the atomic-energy program.

Mr. DEAN. That is true.

Representative HOLIFIELD. Under that situation, why would it not be wise for the Government to explore and develop the possibilities of power production in its present atomic facilities in order to relieve the huge drain on private industry at the present time and to lessen the cost of atomic armaments?

Mr. DEAN. Well, in the first place, you are not going to develop anywhere near the total amount, in reactors, of electric power that we now consume.

Representative HOLIFIELD. That is right.

Mr. DEAN. We could only make at most, in the years immediately ahead, a small contribution to that. We have discussed it inside the Commission. It presents a lot of problems. We have discussed the possibility of putting a reactor down, all-power reactor, at some site where we now use inordinate amounts of electric energy produced by coal. This is something the Commission is not ready to make a recommendation on. I think it is quite feasible for perhaps the CVR reactor to go down at the site where we now use up a lot of juice.

Representative HOLIFIELD. And the Atomic Energy Act provides that if there is a byproduct of electrical energy from any of these facilities, the Government can use it or can sell it.

MR. DEAN. Oh, we would be permitted to sell any power that we generated.

Representative HOLIFIELD. Or to use any power?

MR. DEAN. Or to use it. Oh, quite.

Representative HOLIFIELD. So, therefore, it would be quite practical and feasible for the Government, if there is a byproduct of power which is not economical considered by itself, if there is a byproduct of power from either any reactor now in existence or any new and improved type of reactor which could be built, and it would be entirely within the act and the purport and intent of the act, for atomic-energy facilities themselves to use that power to the extent that it is available.

MR. DEAN. That is right. I think you would have two considerations there. One is: Is this a sensible thing to do, to build a reactor of this design looking toward economical power? You answer that question first. Then you find that the answer to that question, if you built it today, is that it is going to cost us a little bit more in power than what we could get from coal in that area. In the case of the Portsmouth plant—you might still wish to do it and feed that juice in, because you would justify it as a developmental project.

Representative HOLIFIELD. And you could also justify it if it was a dual purpose, in that you were producing plutonium.

MR. DEAN. I couldn't personally.

Representative HOLIFIELD. No, the Government could justify it.

MR. DEAN. I think it would have a hard time.

Representative HOLIFIELD. It would have a hard time justifying a dual-purpose reactor? How about these people in private industry that have come to us and said that they had predicated their plans on a dual-purpose type of reactor, planning to sell to the Government plutonium and to have electricity as a byproduct?

MR. DEAN. This is not entirely their fault. I think I ought to straighten the record out on that. When we first talked to these industrial concerns, almost 2 years ago, I think there was some feeling in the Commission, and I perhaps shared it, that the only way that you could get quickly to economical power was to build a dual-purpose reactor, one that would produce both power and plutonium. The only way you could ever hope to finance this was to give a subsidy in the form of the price for plutonium.

I think the thinking has changed considerably in the course of the 2-year period. I think, therefore, that you cannot say that these are the only things these companies are interested in, because when the proposals were originally discussed we encouraged them to think along these lines. So when they came back with their answers, it was somewhat in response to a little encouragement from the Commission to work out plans along that line.

Representative HOLIFIELD. Well, they are still thinking along that line.

MR. DEAN. Some are; some aren't.

Representative HOLIFIELD. I know that there was a big article in the Parade magazine section of the Washington Post on April 19, 1953, in which Dr. Charles Allen Thomas, of Monsanto, ended up his interview on this subject after describing imaginary atomic kitchen stoves, with a paragraph in which he indicated that he would like to sell plutonium to the Government at a profitable rate.

Under the passage of the recent authorization bill in the House—and I realize I may be out of order in asking this question, as it has not passed in the Senate yet—what would the Commission's intent be as to developing the land-based power reactor? Would it be in the nature of a prototype, with the \$7-million fund allowance?

Mr. DEAN. This would be in the nature of a rather large prototype, one that was originally thought of as being a propulsion unit for an aircraft-carrier reactor, or a large ship. It is an equally interesting approach to economical power. It would be land based when first built.

Representative HOLIFIELD. If the Government goes ahead with that project, and if it does develop an economically feasible reactor or a near economically feasible reactor, then the product of that development would be owned by the American people?

Mr. DEAN. That is correct.

Representative HOLIFIELD. If, on the other hand, the Government went ahead with several of these different reactor types, prototypes, of the size such as this, at a cost of, let us say, \$10 or \$15 million apiece, out of that research and development they would undoubtedly bring forward the science of reactor technology?

Mr. DEAN. That is correct.

Representative HOLIFIELD. And if they did that, with this small additional expenditure, in addition to the \$12 billion that has already been spent, some of which I realize has military value which has not been spent on civilian reactor development, we would be in a position then to turn over to all of private industry at the same time and on an equal basis an economically practical civilian-type reactor, would we not?

Mr. DEAN. Yes; but, of course, you have lost something in the meantime.

Representative HOLIFIELD. What have we lost?

Mr. DEAN. You have lost the inventive genius—I am not talking about patents; I am talking about know-how and brains and technical skills—you have lost the inventive genius of American labs, American industrial concerns. You have lost the competition in ideas which would come about if they were in the program. You will lose it if they are excluded. And you will have to fall back on the Atomic Energy Commission, which today has virtually a monopoly—but not entirely on the brains, simply on some of the information—for the development during the 3- or 4-year period. Then you start from scratch to get American industry in, and you have lost 3 or 4 years of their participation.

Representative HOLIFIELD. All right. Now let us analyze that. During the past 7 years we have utilized American industry on a contract basis. And I believe that we have made wonderful strides forward toward the goal that we set, which was a more economical production of plutonium, U-235, the development of military weapons, and I believe that there has been no lack of incentive on the part of industry, because they realize that they are trying for the same objectives we are all trying for, which is the safety and security of our Nation in a very troubled world.

Now, do you not believe that under the contractual arrangement we have made great progress in the last 7 years?

Mr. DEAN. Oh, of course, we have.

Representative HOLIFIELD. Now, if we turn those same types of contractual relations toward another goal; that is, the production of civilian power, do you have any reason to believe that American industry will not be just as patriotic and just as willing to go ahead and to acquire the know-how and to exert their engineering talent and brains along that line as they have in the past?

Mr. DEAN. There can be no question about their remaining just as patriotic and devoting their know-how so far as it applies to that contract. But to say that a contract system of operation is adequate in which the only people who get the know-how are people who get a contract to do a specific job—and it won't be all to build power reactors; we have many other contractors who are not engaged in this business—to say that satisfies the entry on a free competitive basis which is one of the objectives of the act, seems to me to fail completely. What you do every time you pick a contractor in this business is to exclude about 15 others from getting into that business at that particular point.

Representative HOLIFIELD. You are going to do the same thing under any kind of new arrangement.

Mr. DEAN. I don't visualize this at all. It seems to me that your problem here is to let in anybody that looks qualified in this business, that comes up with good intentions, has a desire to build, has a reasonably decent staff of engineers and physicists, and let them in on the same basis we have let them in on in the last year or two. That is the first step.

Representative PRICE. Mr. Dean, how many companies that have come in have wanted to build a reactor?

Mr. DEAN. With their own money?

Representative PRICE. Yes.

Mr. DEAN. No one.

Representative PRICE. That is what Mr. Holifield was driving at.

Mr. DEAN. Oh, I misunderstood Mr. Holifield, then. I thought he was suggesting that the answer to that problem is to continue the contract relationship.

Representative HOLIFIELD. Well, it is unless they will put up the money. If they want to put up all the money without any patent strings or any plutonium-sales strings or any other strings on the part of the Government, then that is a different proposition.

Mr. DEAN. I misunderstood you. During the period of development, particularly if the Commission is the one to build these prototype reactors, and I think it is almost inevitable for the next 3 or 4 years, we would let them out on contracts, so that one man would be a contractor to build, to operate, one type of reactor, another man to build and operate another.

Representative HOLIFIELD. Well, I am in favor of that type of program, and you admit yourself that is the only program that is practicable in the next 3 or 4 years, and then I asked you why you want the law changed now. Why do you not wait until the end of that period and then have the law changed at that time?

Mr. DEAN. I don't see why you are afraid to change the law at this point if you are willing to change it 3 years from now.

Representative HOLIFIELD. Because of the concessions which private industry will require at this time in the change of the law. And I

do not think it is time to give them those concessions. I do not think they have earned them as a matter of right.

MR. DEAN. I do not think it is time here today to assume that they are going to insist on certain concessions or that they should get all the concessions they might ask for. It seems to me this is the sort of thing that should be spelled out in the public hearings. I cannot testify for those people. All I can do is give you a consensus of their opinions as I meet with them. Because I think only when they appear here on the witness stand and explain it will you know what the concessions are which they ask and those which should be granted.

Representative HOLIFIELD. This point will be explored.

Representative PRICE. Let us look at this. If you went the new route, and you just broke off now and you made a contract tomorrow for your military reactor and for your power reactor, would it increase progress immediately, or would it slow down the program?

MR. DEAN. My first answer is that you will not get that right away, so you have no alternative. But to continue in the case of military reactors, for example no concern today is going to come up with their own money to build a submarine force. This is going to be military by GE or Westinghouse or some other group.

Representative PRICE. The reason I asked you that question is because the prevailing opinion seemingly in many quarters is that private industry is ready now to take over these projects.

MR. DEAN. Well, I have heard someone say—I do not know who—

Representative PRICE. Well, I saw a newspaper story which quoted a spokesman for the Defense Establishment saying that.

MR. DEAN. That private industry was ready to take over the CVR? This is nonsense.

Representative PRICE. I wanted you to put that in the record.

MR. DEAN. Well, I have said it.

Representative PRICE. This statement comes to the public with the cloak of official sanction as an official statement from Washington from the Department of Defense. It is made as a statement from a spokesman for the Department of Defense.

MR. DEAN. Maybe my answer was too positive. I believe it so strongly that I think I should have been positive. I think the answer is to go to the outfit that is now the contract operator for the CVR and ask them, "Will you come up with the number of dollars required to build this, your own dollars?" And the answer will be "No."

Representative PRICE. We all realize that private industry and the AEC together have done a wonderful job.

MR. DEAN. No question about it.

Representative PRICE. And to say now you want to turn it over in this way would indicate that perhaps AEC has been a hindrance.

I think the industry has cooperated fully with AEC, and AEC has cooperated fully with private industry. And I think it has been a very good program up to this point.

MR. DEAN. I think it has been a very good program, and let me assure this committee that this could never have been accomplished without the contract system of operations and without calling on American industry and their brains to get in and operate on this type of a basis.

Representative HOLIFIELD. And without financing it with the tax moneys.

Mr. DEAN. Up to this time that is true.

Representative PRICE. As you say, the statement which was supposed to have emanated from the Department of Defense to the effect that private industry can produce reactors now, was sheer nonsense.

Mr. DEAN. I was referring to this specific one.

Representative PRICE. I think we are referring to the same statement.

Mr. DEAN. It was a large reactor. It would have called for an outlay of a large amount of money. But the stakes are too big to ask for the putting up of a hundred million dollars or whatever the amount is, a large figure, to produce what is necessary to produce that amount of power.

Representative HOLIFIELD. Let us just for a moment, before we terminate this enjoyable interchange, consider the basis of information which all these study groups are resting their report on, the report which they have recently put out.

Is it not true that their people, their scientists, their engineers, have obtained practically all of their information from physicists and engineers that are in the employ of the United States Government, either by contract or directly?

Mr. DEAN. Yes. They had to be let into the program to see what the monopolists had acquired in the way of available reactor designs.

Representative HOLIFIELD. That is true.

Mr. DEAN. But I would like to qualify that somewhat by saying this also. The men who came in to meet with out people at Argonne or Oak Ridge or Knolls Lab or Bettis or the other reactor labs were competent scientists in their own right, some of whom may have been in the program earlier and left, some of whom were never in, and they are men who bring some amazingly ingenious ideas into the study. So I think these have to be put in balance when you are talking about a study group. It is true they come in and see what we have, but they come in as competent men equipped to come up with some good ideas themselves.

Representative HOLIFIELD. That is true. And if they came in on a contractual basis, they would come in as they have in the past on their contractual relations with the AEC. And I want to say that I think the AEC has handled this program in the right way, by giving jobs to private industry to do. I want to see that. But as to the timing of when you start changing the way of doing the job, and the concessions that you have to make in this interim period, that is the point—and also the security problem, the patent problem—those are problems which this committee is quite concerned with.

Mr. DEAN. It should be. Those are troublesome problems. I hope nothing I have said indicates that I have glossed over these as not being problems at all. These have taken up months of discussion within the Commission, and we are only a few people who have thought it out. Many others would have to go into it. They are not easy problems.

Representative HOLIFIELD. I would make the complaint, that in your legislative draft you did not tackle this patent problem, but left it out, and I consider it a key to the whole problem; and the other

legislative recommendations you make are completely contingent on that field, and you left that field to this committee.

Mr. DEAN. I don't think they are completely contingent upon it. But I think it is a very important problem. As we explained to your committee I think in joint session, the Commission is now tackling and asking to be considered as a separate document its recommendations on the patent policy. But you do not reach up in the air and come out with the right answer. You just have to kick it around for many a month. And it has many an angle. And we were not ready at the time we made this to say precisely what would be the answers to the patent question.

Representative HOLIFIELD. Of course, my idea is that if you make a basic change in the legislation without considering this point, you are leaving out the key to the whole problem of private industry participation for the future. If you can leave out the latent problem and make all this information available to all of industry so that we will have real competition, then I am ready to change some of the legislation.

Mr. DEAN. Well, there is no intention on our part to duck it. There is no intention on our part to throw it on to your shoulders as distinguished from our shoulders. We just did not feel, at the time we brought this in, that we had the complete answer on the patent thing. And I do not think it is too important that the Commission have the complete answer. I think, by the time your hearings are over, the difficulties and perhaps the solutions are going to be suggested by the many witnesses that will come.

Representative HOLIFIELD. That is all, Mr. Chairman.

Representative PRICE. Mr. Dean, we have had a long and interesting afternoon of discussion, without having gone into what is probably the one thing the American people want most to know. How far does the Commission think we are from economic electric power?

Mr. DEAN. We have 25 members of the staff here, and you might have 25 guesses.

Representative PRICE. The reason I ask that question is because of the many articles, newspaper stories, and so on; so many people think it is a year away or 2 years away. What is the guess on how far away we are from industrial use of this power?

Mr. DEAN. You are talking about economical power from a reactor. It depends somewhat on what the competitive fuel is at the place where you build the reactor. Consequently, if you are putting it up in Brazil, it is one thing. Consequently, if you are putting it up in Belgium or the United Kingdom, which have heavy coal costs, it is another. If you are putting it up in the Arctic Circle, you are willing perhaps to pay 4 cents for it. If you are putting it down in the middle of Chicago or in the coalfields of the Ohio Valley, that is the toughest test. It is always a question of what we mean when we talk about economically competitive electrical power from the atom.

I think our people, from what they see now, from what design engineering they have done, think that within a matter of a very few years—and I don't like to be too specific, and if you are willing to put up a large reactor—because if you put up a small one, you are going to get more costly power—you will have economical power. You have got to build your experimental reactors first. But it is not very far off.

Dr. Hafstad perhaps knows more than anybody else in the business on this.

What did I say that was wrong, Doctor?

Dr. HAFSTAD. I would say the same thing.

Representative PRICE. I think that is the thing that the general public wants to know.

Mr. DEAN. I appreciate that.

Representative PRICE. They would like to get some idea from this hearing as to how far away we are from it.

Mr. DEAN. You are certainly less than 10 years. But that doesn't answer your question.

Representative HOLIFIELD. Thank you, Mr. Dean, for your responses.

Mr. DEAN. Thank you.

Chairman COLE. Mr. Dean, I have 2 or 3 questions I would like to ask you.

First, has the Commission's power policy been presented to the President?

Mr. DEAN. The power-policy statement was presented to the National Security Council, and the legislative proposals, not the language, because this came later, but the objectives of the legislation, such as owning, operating, and so forth, were blessed by the National Security Council.

Chairman COLE. And at that meeting, when the policy was presented, I assume the President was in attendance?

Mr. DEAN. That is correct.

Chairman COLE. So that we have the affirmative response that the Commission's power policy has been presented to the President and he has indicated no disagreement?

Mr. DEAN. So far as it represents legislative goals. Now, I would not want to hold the President to all the language of our preface in the early part of the statement. That is purely a Commission statement. But so far as the "so what" of it, what you do with it, this has been blessed by the National Security Council.

Chairman COLE. That is, the legislative proposals have been endorsed?

Mr. DEAN. The goals. The portions of the statement—I could mark them very readily—it is paragraph 4, really, that touches the goals, and it is divided into several parts.

Chairman COLE. Can you indicate whether the attitude of the National Security Council represents an affirmative endorsement of the Commission's policy, or simply a negative acquiescence?

Dr. DEAN. I would say so far as the legislative goals are concerned, and the desire to get a legislation change to accommodate industry, it is blessed by the National Security Council.

Chairman COLE. Have the policy statement or the legislative proposals separately or both been considered by the Joint Chiefs of Staff?

Mr. DEAN. The Chiefs have had the policy statement. We do not usually deal directly with the Chiefs. That is done by clearance through the Secretary of Defense, who sits on the NSC, and the Chairman of the Joint Chiefs also sits on the NSC. So, in that sense it is blessed. I don't know whether there is any separate blessing by the Chiefs, as such.

Chairman COLE. I had a number of questions to submit to you. The hour now is very late, and it involves so much detail that I do not think I will present them to you at this time. I prefer to submit them to you in writing so, when you go off on this long and extended and happy vacation, which I hope you get and to which you certainly are entitled, you can take that document along and mull it over so that we can get the benefit of your reactions and answers to these questions. I am soliciting your judgment and not the judgment of whoever might be your successor as Chairman of the Commission, because he will have an opportunity at a later time.

(Chairman Cole's questions and Mr. Dean's replies follow :)

CONGRESS OF THE UNITED STATES,
JOINT COMMITTEE ON ATOMIC ENERGY,
June 25, 1953.

Mr. GORDON DEAN,
Chairman, United States Atomic Energy Commission,
Washington, D. C.

DEAR MR. DEAN: On behalf of the entire joint committee I wish to thank you and your associates for your valuable presentation at yesterday's public hearing on the possible development of atomic power.

As I indicated at the close of the meeting, we would indeed be grateful for your detailed written comments on several issues which strike us as going to the heart of this problem. My thought was that we could incorporate this letter and your reply thereto into the public record of the atomic-power meetings. We would accordingly be most appreciative if we could hear from you before the end of this present series of open hearings.

I hope you will feel free to include in your letter any collateral observations which you think may serve to put this entire matter into proper perspective.

I. The committee members are of course keenly aware that our national atomic enterprise represents a \$12 billion investment of the taxpayers' money, and they would naturally view with disfavor any program which resulted in private gain at the public's expense. In other words, they seek emphatic assurance that the Commission's proposals for interim legislation would in no sense open the door to the possibility of an "atomic giveaway."

1. Could you therefore outline precisely what private enterprise would secure—in information, patent rights, materials, and otherwise—under the Commission's proposals which it cannot now receive under existing legislation?

2. What would be the quid pro quo for these additional benefits? That is, what returns might the American people secure from a program for encouraging private participation in atomic-power development?

3. If the proposals were written into national policy, do you believe they would result in a net gain to the public?

II. The Atomic Energy Act of 1946 declares that "subject at all times to the paramount objective of assuring the common defense and security, the development and utilization of atomic energy shall, so far as practicable, be directed toward improving the public welfare, increasing the standard of living, strengthening free competition in private enterprise, and promoting world peace." I am sure the members of our committee would be deeply concerned if steps were taken which permitted a few large companies to secure a monopolistic foothold in the atomic-power field, with the result that small firms would find few, if any, opportunities for entry.

1. Is the state of the reactor art such that you anticipate only large companies, with large sums of money available for investment, will be able to enter the atomic-power field over the next several years?

2. If this is the case, might such companies secure a position of such dominance as to discourage free competition in the atomic-power industry?

3. Can you suggest any particular approach to the vexing question of patent rights which might best help avert the danger of monopolistic control, while at the same time providing adequate incentive for private investment?

4. If private investment in this field reached the point where further diversion of material could not be made from our weapons stockpile, how could the Commission decide between applicants for such materials without being open to charges of favoritism?

III. The joint committee has heard widely varying estimates concerning what privately financed development of atomic power will mean in the way of profits.

Some maintain that, over the next several years at least, the benefits to private enterprise would consist largely in the know-how acquired by pioneering in this new technological field; others see in atomic power a possible bonanza.

How do you personally estimate the prospects in this respect?

IV. The committee has heard it suggested that a different legislative atmosphere would result in a flourishing atomic-power industry in the relatively near future. It has also heard it suggested that widespread private participation in this field will not come about for many years.

1. Assuming no Federal purchase of products and no changes in the existing law, when do you estimate that useful atomic power will become a reality?

2. By how much might this date be advanced if the Commission's policy proposals were written into law?

3. How large a program do you envisage in speaking about atomic-power development over the next several years? Are you thinking, for instance, in terms of 1 prototype reactor in 5 years—or can you imagine 10 full-scale plants being constructed in 10 years?

4. Has any private group come to the Commission with a firm proposal for building an atomic powerplant at private expense without some type of Federal assistance?

V. Our committee has detected in some quarters the fear that Federal regulations and controls of atomic-power development may be so extensive and rigorous as to discourage the investment of private capital.

1. Have you encountered such fears, and do you believe they have basis in fact?

2. If so, is it possible to allay such apprehensions and at the same time provide appropriate Governmental safeguards over the development of atomic power?

VI. So long as we live in a troubled world, the requirements of military defense must naturally continue to have first claim upon our fissionable materials and uranium raw materials. I take it for granted that the joint committee will wish to be unequivocally assured that any possible stepup in the tempo of atomic development would not jeopardize the continued expansion of our weapons stockpile.

1. The President and his constituted advisers in the Defense Establishment must of course evaluate the military significance of diversion of materials from our weapons stockpile. Is it your personal belief, however, that the materials required to support a power-development program of the size envisaged by the Commission would represent a minor diversion from our weapons requirements—or would you regard this diversion as significant?

2. Do you regard it as likely that the rate and tempo of atomic-power development during—say—the next decade might be such that it could be sustained only by major diversions from our atomic stockpile?

VII. We understand the Commission proposals to contemplate private ownership of both atomic plants and fissionable materials.

1. Has the Commission considered what constitutional authority it would invoke to regulate atomic powerplants containing privately owned fuel?

2. What advantages do you see in outright private ownership of fissionable material, as contrasted with leasing arrangements?

3. Would leasing arrangements be equally satisfactory to private industry and at the same time provide a better basis for governmental regulation?

Thank you very much indeed for giving your attention to these questions. I feel sure that your answers will greatly aid the committee in its deliberations on this most important problem.

Sincerely yours,

(Signed) STERLING COLE, *Chairman.*

LEHMAN BROS.,
New York 4, August 3, 1953.

HON. STERLING COLE,

Chairman, Joint Congressional Committee on Atomic Energy,
Capitol Building, Washington, D. C.

MY DEAR CHAIRMAN COLE: I shall attempt to address myself to the inquiries set forth in your letter of June 25. Before doing so, I should like to express my sincere appreciation for the cordial treatment accorded the Commission witnesses when we appeared before your committee. I have since followed the hearings with great interest and I am impressed by the fact that you have called before

you practically all of the people who have been close to this problem and who have attempted to peer into the future of power from nuclear reactors.

As to the first item in your letter, in which you ask for assurance that the Commission's proposals for interim legislation would in no sense open the door to the possibility of an "atomic giveaway," I have separately transmitted to you a reply to the "giveaway" fear, which I think adequately covers the matter. You may wish to insert it in the record at this point as though it had been incorporated in this letter.

In this general connection you ask what private industry would get under the Commission proposals which it cannot get under existing law. I think we must consider three separate subjects—information, materials, and patents.

As for information, any responsible private concern, wishing to design, build, own, and operate a reactor, would receive precisely the information that is now available to an industrial contractor to the Commission. Company A, B, or C would get what is today available only to a very few contractors such as General Electric, Du Pont, and Westinghouse.

As for materials, the private concern would get sufficient uranium, under a licensing arrangement with the Commission, with which to fuel and refuel its reactor. It could get this uranium either by sale, lease, loan, or any other suitable transfer device.

As for patents, the Commission had made no specific recommendation at the time of our hearing in June. It presents the most difficult problem. The objectives in any plan for patent relaxation, when private capital enters the power field, were set out in my testimony before your committee; namely, fairness to the American public which has invested heavily in our atomic-energy program, and incentives to private capital to enter the field. I do not know how the dual objective can best be accomplished. My mind is open on the subject. I rather lean to some form of compulsory licensing with reasonable royalties, the Government always retaining to itself the right to utilize the discovery without payment of royalty.

You next inquire as to what the quid pro quo would be to the American people for these additional benefits. It seems to me that the benefits to the people of the United States would be those fruits which always come from the research, technological developments, know-how, and the construction and operating skills of American industry. Some of the fruits may be usable in fields unrelated to electric power from reactor heat. No one knows. But I think it safe to predict that more benefits will come as more people participate.

Your letter quite properly expresses the concern of the members of your committee lest any change in the law "permit a few large companies to secure a monopolistic foothold in the atomic-power field" with the result that small firms would find few, if any, opportunities for entry. I share your concern but I firmly believe that the proposed changes in the legislation will tend to avoid such a possibility. The approach, I think, must be one of comparing what we have today under present legislation with what we might have under the legislative changes suggested. Today we have a Government monopoly. Control of the new force is entirely within the Government. There is also virtually a monopoly of information (except for those private companies which, under contract with the Commission, are designing, constructing, and operating reactors).

In this connection you ask four specific questions:

1. Is the state of the reactor art now such that you anticipate that only large companies, with large sums of money available for investment, will be able to enter the atomic-power field over the next several years? I think here we must be clear as to our terms. If "enter the field" means design, build, own, and operate a reactor for power, then it is clearly an undertaking requiring large sums of money. I think it fair to say that the state of the art is such, and the technological problems yet to solve so difficult, that only large companies with strong research and engineering talents can swing the primary responsibility. I visualize the contributions of smaller concerns to be that of subcontractors, suppliers of parts, and suppliers (as in the case of industrial laboratories) of ideas.

2. You ask whether, if this be the case, the large companies might secure a position of dominance as to discourage free competition in the atomic-power industry. I do not fear such dominance. There is little that a power supplier can dominate when the rates at which he sells power are subject to regulation by utility commissions. I think the size of the capital outlay required to build large central-station atomic powerplants will be such that smaller concerns will be quite content to let the big companies take the risks.

3. The third question deals with patents. I have mentioned this topic previously.

4. The fourth question assumes a situation in which private investment in this field will reach a point where further diversions of material could not be made from our weapons stockpile, and inquiries as to how the Commission could then decide between applicants for such materials without being open to charges of favoritism. I cannot personally make such an assumption. Our weapons stockpile even today is impressive. Each year it becomes increasingly so, at almost a compounded rate. If, as I believe, the next 4 or 5 years are to be years of development of prototypes (not full-scale powerplants) there will be no substantial requirements from industry for uranium. Therefore we must add 4 or 5 years of output to our present stockpile. At that time it becomes truly impressive. It will be at about this date that industry would then begin to be in a position to suggest its requirements. Assume that 4 or 5 large (200,000 kilowatts) reactors are to be constructed at that time. The requirements for uranium do not appear until after the reactors are completed. This will run something on the order of 3 years more before we will be called upon to fill the requirements. By that date our annual rate of production is sufficient to meet all needs—military and commercial. The Commission will never, in my opinion, be faced with the problem you pose. If I am wrong in my assumption, however, and the Commission should be faced with such a problem with the inevitable charges of favoritism, I think the only answer is to be sure we have on the Commission men who are not subject to improper influence; require that they publish in advance the criteria which they propose to apply to applicants, and make sure they follow these criteria. I think it would be a mistake to attempt to write such criteria into law today.

You next inquire whether the benefits to private enterprise would consist largely in know-how acquired by pioneering in this new technological field, or whether there will actually be bonanzas. In the power field, I do not see bonanzas; I see simply someday more and cheaper power, a blessing which can be widely spread usewise and geographically. I think there are possibilities for bonanzas in certain areas. I think there should be. Some examples would include the people who locate rich uranium deposits; the chemists who discover processing for extracting uranium; the chemists who find less expensive methods of chemical processing of fuel elements; the engineers who solve the mechanical problems which today result in reactor shutdowns, and so forth. I do not fear bonanzas of this type. I would encourage them.

In the next question you inquire when useful atomic power may become a reality if there are no changes in the law. This, of course, calls for a crystal ball and I do not possess one. "Useful atomic power" means to me "power from a reactor which is competitive with available substitute fuels." The incentive to "useful atomic power" is greatest in areas of high fuel costs—countries other than the United States. If the law is not changed and if Congress doesn't appropriate funds for the construction of power-reactor prototypes in the years immediately ahead, the first "useful atomic power" will come from a reactor designed and built in Canada or the United Kingdom. If Congress backs the Commission's prototype-development program and doesn't change the law, the first full-scale power reactor might be built by the Government within 10 years.

If the Commission's proposals are written into law, the date of the first full-scale economical power reactor might be advanced, in this country at least, by as much as 3 or 4 years.

In the next question you ask as to the possible scale of an atomic-power industry in this country. Does it mean one prototype in 5 years or 10 full scale in 10 years? I visualize a program over the next 5 years of something like 4 or 5 prototypes of different design, built by the Commission with funds supplied primarily by the Government with some participation by private capital. It will be during this period that the designs for the larger, more costly plants will be developed. In the second 5-year period I visualize 4 or 5 large-scale power units actually built with private funds.

You ask whether any private group has come to the Commission with a firm proposal for building an atomic powerplant at private expense without some type of Federal assistance? The answer is "No." None has, and I think for good reasons. Until the law is changed the proposal would be academic. But even with a change in the law, the scientists and engineers in industry will have to have access to some of the accumulated knowledge stored in the national laboratories before they can formulate specific proposals and roll on their own. Furthermore, as I have stressed we have not yet licked all the developmental problems and won't for a few years. But in a few years these problems will

be licked—licked fastest by permitting industry into the program. When they have been licked, the specific offers will come.

You state that the committee has detected fears in certain quarters that Federal regulations and controls of atomic-power development may be so extensive and rigorous as to discourage the investment of private capital. I too have heard such fears expressed. I do not think they stem from any behavior on the part of the present Commission or its staff or field offices. They stem from the fear of Government control as they have seen it exercised in other departments of Government. I think for some time to come the Commission must be given wide authority and great discretion. Necessity almost dictates this. The controls and regulations will be just as fair and honest and workable as the people who formulate them. If the Commission can continue to attract well-informed, honest men who have no axes to grind and who are imbued with a sense of the high importance of their work, I think the fears are unfounded.

You inquire whether any step-up in the tempo of atomic development will jeopardize the continued expansion of our weapons stockpile. I have touched briefly on this matter in answer to another question. I think your committee should be assured that the national security will not be jeopardized but in the long run strengthened by the step-up in atomic power. I do not regard the materials necessary to support a power program such as that envisaged by the Commission to be substantial in amount. Not a bomb will be decommissioned under our proposals. Certain amounts of fissionable material or normal uranium would be diverted to the power program just as today we divert certain amounts of material for research, development, and testing, and just as we divert such materials for fueling military reactors such as submarine reactors. But the amounts are not substantial. Furthermore, as our stockpile grows we can afford larger diversions—larger in amount and larger in ratio.

You ask whether the Commission has considered what constitutional authority it would invoke to regulate atomic powerplants containing privately owned fuel. I would prefer to have a complete answer to this question furnished to your committee in the form of a legal opinion by the Commission legal staff. The chief items of regulation would be in the field of safety. Most of the safety regulations should ultimately be provided in the form of State laws and municipal ordinances. Prohibitions against export present no legal problems; the same would hold for transfers to an unfriendly power. If it were wise to regulate shipments in interstate commerce this could readily be done under the commerce clause. If upon analysis the transfer of title to the fuel elements presents legal problems, one could always fall back upon the device of licensing the concern to burn up the fuel element, retaining title, with the consequent right to insert conditions in the license, to the fuel element.

Your last two questions deal with the relative merits of "licensing" and "selling" fuel elements. The advantage in outright ownership by private concerns is that they are freed from what might at some stage develop into redtape. Furthermore some concerns may well want to do more than simply "burn up" the fuel. They may wish to dispose of fission products. Selling outright is for them a much cleaner method. The Government naturally turns to the device of licensing simply because it permits any number of regulatory clauses. I think if the committee can satisfy itself that outright sale still affords the necessary governmental control, it should lean toward "sale." I personally feel that legal ways can be found to combine that control with sale.

In closing I should like to observe that we are in a new field, dealing with a new force. No one can anticipate accurately the future of this field. I think our principal objective should be to turn America loose. Let us not put too many bonds about our arms and legs simply because there are possibilities of discrimination or unfairness in administration of our laws and regulations. In short, give good people a chance to run with the ball. I know your committee appreciates fully the importance of this.

With great respect,

(Signed) GORDON DEAN.

Representative DURHAM. Sometime last year a letter was sent to the Commission asking them or requesting them to prepare to come up and present their policy. I would like to ask that that be made part of today's record.

Chairman COLE. Very well. I think it would be appropriate for that letter to be the initial insertion in the record at our next meeting;

to indicate, which I think to be the fact, that the policy of the Commission was not something which was conceived and generated entirely and exclusively within the Commission offices; but, on the other hand, that it was something which was shared to some extent at least, by an initial inquiry, an impetus, a suggestion, and a request, from the joint committee.

Mr. DEAN. Oh, that is quite true, Mr. Chairman, quite true.

Chairman COLE. So, your policy statement is pretty much the response to a request from the joint committee.

Mr. DEAN. This is very true.

Chairman COLE. As to the state of the argument, whether we have reached a point where we might give consideration to enlarging the field of participation.

Mr. DEAN. That is quite true.

Chairman COLE. Very well.

Let me close, now, by again complimenting you on the very fine, outstanding service that you have rendered to your country. I hope you will have a good rest and will make yourself a million—a "mega million."

(Whereupon, at 5:20 p. m., Wednesday, June 24, 1953, the hearing was recessed to reconvene at 2 p. m., Thursday, June 25, 1953.)

ATOMIC POWER DEVELOPMENT AND PRIVATE ENTERPRISE

THURSDAY, JUNE 25, 1953

CONGRESS OF THE UNITED STATES,
JOINT COMMITTEE ON ATOMIC ENERGY,
Washington, D. C.

The joint committee met at 2 p. m., pursuant to recess, in room P-63 of the Capitol, Hon. W. Sterling Cole, chairman of the joint committee, presiding.

Present: Representative Cole (chairman), Senators Hickenlooper (vice chairman), Bricker, and Pastore; Representatives Hinshaw, Van Zandt, Holifield, and Price.

Professional staff members present: Corbin C. Allardice, executive director; and Wayne P. Brobeck, Francis P. Cotter, Walter A. Hamilton, Edward L. Heller, J. Kenneth Mansfield, and George Norris, Jr., of the professional staff of the joint committee.

Chairman COLE. The meeting will come to order.

At the outset, the Chair wishes to file with the committee here and with the reporter for inclusion in the committee hearings a letter dated August 19, 1952, directed to the Commission by Mr. Carl Durham as chairman of the Joint Committee on Atomic Energy. Also, the reply of Mr. Gordon Dean, as chairman of the Commission, dated September 4, 1952.

Subsequently, on March 18, 1953, at a meeting of the Subcommittee on Reactor Development of the Atomic Energy Committee, the subject of the Commission's decision on power policy was under discussion, and at that time it was indicated by Mr. Dean that the report to the committee might be available in approximately 2 weeks.

A memorandum has been prepared by Mr. Walter Hamilton of the committee staff including excerpts of that testimony, which the Chair would like also to insert in the record.

And then on May 15, 1953, I, as chairman of the committee, directed a further communication to the Atomic Energy Commission.

These documents are inserted for the record for the purpose of indicating that the joint committee has had a continuing interest in the possibility of industrial use of atomic power for well over a year, and that the policy statement submitted to the committee of the Congress by the Commission was one which was solicited by the committee as early as a year ago.

(The material referred to is as follows:)

CONGRESS OF THE UNITED STATES,
JOINT COMMITTEE ON ATOMIC ENERGY,
August 19, 1952.

ATOMIC ENERGY COMMISSION,
Washington, D. C.

(Attention: Mr. Gordon Dean, Chairman.)

GENTLEMEN: As you know, the joint committee, on October 19 of last year, reported to the Congress in part as follows:

"The committee is keenly interested in the current study program involving eight private industrial firms. These are exploring the possibility of offering to build reactors wholly or partly at their own expense, with the dual purpose of producing power for sale to the public and plutonium for sale to the Government. It is recommended that the complex factors entering into such a possibility be brought rapidly to a point of crystallization, so that they may be properly evaluated and judged."

The purpose of this letter is first, to advise that I shall recommend to the joint committee that it hold a series of meetings on "industrial participation" early during the next session of Congress; and, second, to request a written statement of the Commission's policy views in this area as soon as feasible.

Thank you for your cooperation.

Sincerely yours,

CARL T. DURHAM, *Chairman.*

UNITED STATES ATOMIC ENERGY COMMISSION,
Washington, D. C., September 4, 1952.

HON. CARL T. DURHAM,
Chairman, Joint Committee on Atomic Energy, House of Representatives.

DEAR MR. DURHAM: This will acknowledge receipt of your letter of August 19 advising the Atomic Energy Commission that you intend to recommend to the joint committee that it hold a series of meetings on industrial participation early during the next session of Congress, and requesting a written statement of the Commission's policy views in this area as soon as feasible.

The problems of the industrial participation program are being studied in a series of Commission meetings now underway, and Commission policy in this field should be crystallized to the point where profitable discussions with the joint committee are possible by the first of the year. We would suggest that our policy report to the committee be made at that time.

Sincerely yours,

UNITED STATES ATOMIC ENERGY COMMISSION,
GORDON DEAN, *Chairman.*

MARCH 25, 1953.

Memorandum to the file.
From Walter A. Hamilton.

On March 18, 1953, the staff contacted the Commission by telephone, at the request of Mr. Carl Hinshaw, chairman of the Reactor Development Subcommittee, and arranged to have Chairman Dean meet with the subcommittee on March 24 for the purpose of presenting an AEC recommendation on policy concerning atomic power development.

The following are excerpts from the testimony on March 24:

"Mr. HINSHAW. Mr. Dean, you have a statement you wanted to make in connection with the development of atomic energy for power purposes.

"Mr. DEAN. Mr. Chairman, I do not have anything formal. I thought I might give you very briefly a short statement of where we stand on this, then see how we play it from there."

* * * * *

"Mr. DEAN. * * * I would hope that this policy statement might be all finished up and in pretty good shape within the matter of something like 2 or 3 weeks. And I am very sorry I do not have it completed and all agreed to so that I can hand it to you today. But I give this just simply by way of background. If this committee should decide to hold such [open] hearings, we are very anxious to be of any assistance we can."

* * * * *

"Representative DURHAM (acting chairman of the full committee). You think it will be 2 or 3 weeks yet before you will be able [to present this power policy statement]?"

"Mr. DEAN. We have not actually yet put our names on the policy statement inside the Commission. I can speed it along just as fast as possible, but I am just giving a guess; I think it might be 2 weeks before we could say everybody is all set to go on it.

"Representative DURHAM. I should think that is a reasonable time. I think the letter [containing the original request] for such a power policy statement went to you sometime last year, did it not?"

"Mr. DEAN. Yes."

MAY 15, 1953.

UNITED STATES ATOMIC ENERGY COMMISSION,
Washington, D. C.

(Attention: Mr. Gordon Dean, Chairman.)

GENTLEMEN: It would be appreciated if the Commission could present its atomic power policy statement to the joint committee in executive session on May 26 at 3 p. m. The statement should be coordinated within the executive branch prior to its presentation in accordance with the commitment made by Mr. Dean to the Reactor Development Subcommittee on March 24.

It would also be helpful if you could make available at the same time the Commission's recommendations for legislative changes deemed necessary to permit private industrial participation in the field of atomic power development.

Sincerely yours,

STERLING COLE, *Chairman.*

Chairman COLE. The first witness for this afternoon is Gen. Bedell Smith, representing the State Department.

Perhaps this will involve some repetition, General Smith, since you have already appeared before the joint committee expressing the State Department's views on the Commission's power policy. I note that you have a statement, and I will turn the meeting over to you.

STATEMENT OF WALTER BEDELL SMITH, UNDER SECRETARY OF STATE

General SMITH. Thank you, Mr. Chairman.

As a general proposition, the Department of State believes that atomic energy should become integrated into the national economy as rapidly as, and to the extent that, security considerations permit.

Since legislation designed to promote the development of nuclear power in the United States concerns domestic matters primarily, the Department does not consider that it should comment on the details of such legislation. Legislation to this end, however, does have important implications for our relationships with other nations, and therefore I am very grateful for the opportunity to comment on these implications.

It is of paramount importance to our international relationships generally that the United States maintain and improve its leadership in atomic energy development. It is important, therefore, that we press ahead with the development of nuclear power. There is every reason to believe we will be the first to have nuclear power if we are prepared to move with vigor in this direction. It would be very damaging to the position of the United States if another country were to be first in this field of endeavor, and it would be especially damaging if the Soviet Union were to precede us in the development of atomic power. If this were to happen, the Soviet Union would cite their achievement as proof of their propaganda line that the United

States is interested in atomic energy only for destructive purposes while the Soviet Union is interested in developing it for peaceful purposes.

On the positive side, by being first to develop nuclear power, we will have further demonstrated to all the world that we are intensely interested in the peaceful aspects of atomic energy with all its implications for the future of mankind. This achievement would provide additional and positive evidence of the humanitarian policies of this Government and of its desire to further the economic well-being of the free world.

As you know, Mr. Chairman and gentlemen, this Government has long and vigorously supported the United Nations plan or any other no less effective plan for the international control of atomic energy. President Eisenhower, in his speech of April 16, reemphasized the willingness of the United States to enter, at an appropriate time, into solemn agreements in the field of disarmament providing for effective safeguards, including "the international control of atomic energy to promote its use for peaceful purposes only, and to insure the prohibition of atomic weapons."

The United Nations plan, as you know, has a twofold purpose. On the one hand, it would promote and foster the development of atomic energy for peaceful purposes only. Efforts to hasten the day when atomic power will be economically feasible are consistent with this purpose.

On the other hand, in order to insure against the misuse of atomic energy, the United Nations plan provides for safeguards which would effectively prohibit the manufacture, possession, or use of atomic weapons. In considering legislation designed to foster the development of nuclear power, it would be well to recall the nature of the principal safeguards against violations and evasions which are provided in the United Nations plan.

This United Nations plan provides for an international system of inspection designed primarily to prevent and detect clandestine operations in the field of atomic energy. This inspection system would guard against the possibility of an atomic energy program being developed outside the international control system.

The other major safeguards are designed to meet the danger of diversion of fissionable materials from known plants. And, gentlemen, this is a very real danger and a difficult problem to cope with, because, starting with the mines, the processes and facilities involved in developing atomic energy for peaceful or for military uses are, as you know better than anybody else, identical and similar up to a very advanced stage. To guard against the danger of diversion of materials from these facilities, the United Nations plan provides for the international ownership of source and fissionable materials, and international ownership, operation, and management of facilities making or using these materials in dangerous quantities.

Because the technology of atomic energy is a changing art, dangerous facilities were not precisely defined in the United Nations plan, but were defined as those which, if misused, would be a threat to international security. In the United Nations plan, the international control agency would determine, in the light of the state of knowledge at the time, which facilities are dangerous, and accordingly, what kinds of control are required.

The safeguards of the United Nations plan closely parallel those provided in our existing domestic legislation. To the extent that new legislation results in some relaxation or modification of domestic controls and safeguards, questions will arise as to whether we should modify our position on international control of atomic energy.

We are continually examining new developments in the field of atomic energy that might have a bearing on the problem of international control. If, in the course of developing a domestic program of nuclear power, we acquire experience which would call for modifications in our position on international control of atomic energy, we would not hesitate to modify our position accordingly. Such experience may well provide useful guidance if and when a system of effective international control can one day be negotiated.

You know, gentlemen, that because of Soviet intransigence, the present prospect for international control of atomic energy is dim. However, we must at all times be prepared to enter into an arrangement no less effective than the United Nations plan for the international control of atomic energy. Therefore, I would strongly urge that any legislation that is considered should take account of this Government's continuing interest in bringing about effective international control; because not to do so would, in our view, be a very grave mistake.

You know that an important part of the uranium ore needed for the United States atomic energy program is derived from foreign sources. This ore has been made available to the United States as a part of the common defense effort of the free world. The growing need of the United States for uranium to supply and expand our atomic weapons program is well understood and well appreciated.

There always has been a natural and understandable interest on the part of foreign governments supplying uranium ore to the United States to assure that they will be able to enjoy the peaceful uses of atomic energy when the state of world conditions and atomic technology permit.

Enactment by the United States Congress of legislation designed to promote the development of atomic power will tend to increase the natural interest of all foreign countries in participating in this development and in the many benefits which are hoped for from it. This will be especially true in the case of those nations which produce uranium ore.

We believe that legislation designed to foster the development of atomic power in the United States should include provisions which—recognizing this perfectly natural aspiration of foreign countries—would enable the United States to make available, in appropriate cases and under suitable safeguards, information and material to assist them in making progress in the field.

In summary, Mr. Chairman, the Department of State favors legislation which will hasten the day that atomic power can be made a reality. Such legislation would reaffirm our leadership in this field and our desire to develop this source of energy for the greater well-being of mankind. Development of atomic power is consistent with this Government's support of an effective system of international control which would prohibit atomic weapons by ensuring and promoting the use of atomic energy for peaceful purposes only.

Thank you very much, sir.

Chairman COLE. Thank you, General Smith, for a very realistic and forthright statement covering the international aspects of the question of industrial power from nuclear energy.

The Chair has a few questions he would like to submit to the witness and seeks the indulgence of the committee for a moment.

General Smith, in the event of an international control agreement, in case one is reached, would it not involve control by some international agency over private or governmental atomic energy plants in this country?

General SMITH. Yes, Mr. Chairman. That is a very good and a very pertinent question. The answer is that depending upon the facility in question, the United Nations plan does provide controls ranging from licensing through inspection and supervision to transfer of ownership of a facility to the international agency for operation and for management.

Now, in addition, title to all source and fissionable materials would be vested in the international agency itself. The means of control must be adequate, of course, to insure that the fissionable material involved would not be diverted to the manufacture of atomic weapons and thus become a threat to international security. The type of control required, of course, would depend on such factors as the kind and the quantity of fissionable materials involved, the design of the facility, the consequent danger of diversion to improper use. The international control agency would have to take such factors into account in determining the requisite degree of control; and of course it would have to make this determination in the light of the technology which exists at the time.

There is one important factor which I would like to emphasize in connection with your question, if I may, Mr. Chairman. A control system that is not effective is worse than no control system at all. Nobody appreciates that more than this committee, I know. The United States, of course, would not consider entering into any control system which would permit nations secretly to produce atomic weapons. Neither can the United States insist that other nations submit to controls more stringent than we ourselves are prepared to submit to. But we are prepared to go a long way in this.

Chairman COLE. Well, does the present thinking on the question of international control go so far as to envision the possibility that this international control agency conceivably might take over privately owned atomic plants in this country?

General SMITH. Yes, Mr. Chairman; it does. We don't disregard the possibility of that. And I think the time might conceivably come, depending upon our progress, and upon the types of controls which this committee and the Congress might approve, when such a thing would be possible. Because we are dealing with such an enormous thing that, depending upon developments, I think we must have to face the possibility of some form of international control as and when those controls may become effective.

Chairman COLE. You anticipate, then, that in the event it becomes desirable from the standpoint of effective international control, the international agency would own or take over the atomic plants which have been built with private funds in this country, but that before that is done the Congress would have an opportunity of evaluating

the steps that are to be taken, the conditions under which the plants would be taken over by the international agency?

General SMITH. It could only be done, sir, after very careful study and consideration by this committee and by action of the Congress. Until that time, our domestic control must remain vested in this committee, as the trustee for the American people.

Chairman COLE. Is it anticipated that through the provisions concerning inspection there will, in effect, be international access to process, improvements, and atomic know-how, developed by private enterprise?

General SMITH. Not until such inspection is properly authorized and after consultation with this committee and the Congress, and then under suitable control and under suitable security safeguards.

Chairman COLE. Are you prepared to comment on what possible effect such an international control from the standpoint of inspection might have upon the current order, secrecy order, of the President, which is in substance to impound any new discovery, any new patent, in any field of endeavor, including atomic as well as normal activities, to the end that they might be withheld from foreign knowledge as well as foreign use?

General SMITH. Not in detail, Mr. Chairman, except to say that the provisions which prompted that security order must be considered before any type of international control or before any really serious or extensive exchange of information on an international basis would be possible.

Chairman COLE. In your statement you indicated the opportunity available to this country through a successful effort to harness nuclear power to peacetime uses; that it might be made available to foreign countries, principally those in greater need for electrical energy. Now, does that mean that the State Department's present thinking is something along the order of a point 4 program with respect to atomic energy knowledge from an industrial standpoint?

General SMITH. Actually, not in the foreseeable future, Mr. Chairman, although it would be premature at this stage of the game to attempt to be definitive in a matter of this kind. We do, however, see a present need for being able in the appropriate circumstances to make some atomic information and materials available to foreign countries. In general, we would expect to relate this atomic assistance rather closely to considerations in the field of atomic energy. In some instances there might be an immediate advantage to us to make an exchange of this kind with the friendly countries on whom we can rely. Cases might arise in which it is desirable from the point of view of our general relationship with a foreign country to be able to render some assistance in this field.

I don't know whether that adequately answers your question.

Chairman COLE. Well, at least it indicates that at present you do not anticipate a nuclear energy program under the point 4 philosophy.

General SMITH. We certainly don't.

Chairman COLE. Now, with respect to the possibility or likelihood of the exchange of information with foreign countries, what effect would the rules of an international control agency have upon the present provisions of the law? And I have in mind specifically sec-

tion 10, which very rigidly outlines the steps that must be taken before any information in this field is disseminated to anybody.

General SMITH. Section 10 is very useful in specialized cases, Mr. Chairman. But with the wider development of atomic power, we can foresee the need for somewhat greater scope and flexibility than is now provided by section 10 of the present act. And as you proceed with your consideration of that program, I presume you would take that into consideration likewise.

Chairman COLE. Then you presently acknowledge that a full or even a limited dissemination of knowledge to foreign countries, even under the international control philosophy, would require modification of section 10 before anything effectively is done by way of dissemination?

General SMITH. Some modification; yes, sir. And the modification such as it might be would again have to cater to these demands for security, which you realize, of course.

Chairman COLE. Does the State Department have any opinion as to the effect which this new knowledge derived from the success of the breeder process might have in the international aspects of the atomic program?

General SMITH. Well, since that is a matter which involves highly technical considerations, we would rather hesitate to comment in detail. But it seems that it might be perfectly safe to say that as and when the breeder process becomes successful, our supply situation, that you are so thoroughly familiar with, and which you take into account whenever questions like this arise, should tend to become easier.

Chairman COLE. Having in mind that we are in open session, are you in a position to tell us and the public what the State Department knows with respect to the progress that is being made in the nuclear field by foreign countries?

General SMITH. To a certain extent; yes. I think, Mr. Chairman, it would be safe to do that in open session.

Among our allies, the United Kingdom has embarked on an atomic-power program. A full-scale atomic powerplant is being built in Cumberland, Britain. A low-power breeder reactor is being built at Harwell. Design work is proceeding on a full-scale breeder reactor which will be built on a site that has not yet been chosen.

So you see, the United Kingdom is ahead of our other allies in this field.

But in general the atomic-power programs in other friendly countries except for the United Kingdom could best be described, I believe, as being in a preliminary planning stage.

Chairman COLE. What about Russia? What do we know, what can you tell us that we know, about Russian progress in the atomic field?

General SMITH. With your permission, Mr. Chairman, I would like to restrict my comments there to saying that just ordinary prudence requires that we should assume that the Soviet Union is pushing vigorously ahead in every field of atomic energy, including atomic power. Likewise common prudence would suggest to us that in an authoritarian state, where it is possible to concentrate the facilities, which are under the complete control of a government, regardless of public opinion, or regardless of the demand for consumers goods, or regardless

of any other consideration, on a program as vital as this, it could be assumed that those facilities are being so concentrated.

Chairman COLE. General, if you were sitting in the Kremlin in the place of whoever it is that is sitting there at the top, and you had your choice of alternatives of being able truthfully to announce to the world that you had a stockpile of atomic weapons somewhat comparable to that of the United States, that alternative, on the one hand, or, on the other hand, to be able to announce to the world that you had successfully harnessed atomic energy to the generation of industrial electric power, and that you would make that knowledge available to any people in the world that might be ready to join forces with you philosophically and militarily, economically, socially, in any fashion that you want, which of those two choices would you prefer to have?

General SMITH. Mr. Chairman, to answer your question, I have to try to translate myself to a basis of Communist philosophy.

Chairman COLE. Well, having been exposed to that philosophy for some time, I thought perhaps you might partially qualify as an expert.

General SMITH. If I were sitting in the Kremlin, believing as I do about the global ambitions of the Communist Party of the Soviet Union and its leaders, my unquestionable choice would be the first.

Chairman COLE. To have the weapons?

General SMITH. The weapons.

Chairman COLE. Can you comment on what difficulties the State Department sees, or foresees, in the negotiations of this country with foreign countries which have uranium ore, if it is generally known and realized in those foreign countries that this country is about to embark upon a nuclear-power program?

General SMITH. Well, as you know, Mr. Chairman, there has always been, every since we began to make the remarkable progress we have, a perfectly natural and justifiable desire to participate in the benefits which may be derived from the uses of atomic power for civil purposes. Therefore, in order to do so, there will be, of course, a perfectly natural desire by our friends to retain some of their ore. Until this breeder process was discovered we were a little bit concerned about having enough to go around, and how to divide it up. This development gives promise, I may say, of making this situation easier.

That is about all I can say about the question in open session.

Chairman COLE. Do I understand, then, it is your thinking that the knowledge of the fact that this country is about to enter into a developmental stage of nuclear industrial power would facilitate negotiations for the ore with those foreign countries, with the belief that the knowledge that we might learn from this experimentation and development would eventually become available to them and redound to their benefit?

General SMITH. I am inclined to think this would be a consideration, Mr. Chairman, but it would be tempered by the desire to retain the basic material or at least enough of it to get the benefit of it.

Chairman COLE. Of course, they must realize that possession of the basic material is worthless to them unless they know how to put it into harness.

General SMITH. That is right.

Chairman COLE. And if they could realize that by making the basic material available to another person or country which might learn the lessons necessary to place that material into harness, and receive from that country the knowledge of that process, it might serve as inducement to them to continue the supply of the ore to this country?

General SMITH. I think that puts it very well, Mr. Chairman.

Chairman COLE. That is all the questions I have, gentlemen.

Representative HOLIFIELD. Mr. Secretary, was the Department of State consulted by the Atomic Energy Commission before it published its statement of policy on atomic power?

General SMITH. Yes, Mr. Holifield. We were. We are in very close consultation with the Atomic Energy Commission and have been on all phases of this.

Representative HOLIFIELD. Did the Department of State take an official position of approval of that statement of policy?

General SMITH. As far as I recall; yes, sir.

Representative HOLIFIELD. Did they take an official position of approval of the draft of the legislation which accompanied it?

General SMITH. I don't recall whether we did or not.

If Mr. Gordon Arneson, special assistant to the Secretary of State, is here, he can answer that.

Mr. ARNESON. No, sir. We have not taken a position of approval, or disapproval, on the specific legislation. We have submitted some general comments on it to the Bureau of the Budget.

General SMITH. On the specific legislation, Mr. Arneson says we have not taken a position of approval or disapproval.

Representative HOLIFIELD. I notice you confined most of your testimony to the international aspect, which I think is correct, and you specifically eliminated the desire to discuss details of legislation referring to domestic matters.

General SMITH. That is correct, Mr. Holifield. That is a little bit outside of our province and will be covered, I believe, by other very competent witnesses before the committee today.

Representative HOLIFIELD. There are certain phases of this policy which have been enunciated by the AEC which, in my opinion, have a direct bearing on our international relations with certain countries abroad, and I do not feel at liberty to go into the details in questioning you in regard to that matter. Those questions have been asked in executive session, and others will probably be asked along that line. However, I want the record to show that your testimony, as far as this member of the committee is concerned, is incomplete, inconclusive, and unsatisfactory on certain points which I do not believe it wise to bring up in public. That is with no reflection on you, sir. I realize that you are under certain security restrictions, and I respect those, so I hasten to add that there is no criticism of your statement from the standpoint of the wraps that you are under.

General SMITH. Mr. Chairman, if I may, however, I would like to record in this open hearing that I have previously testified in an executive session, and it is possible that some of the points which Mr. Holifield refers to were covered and made somewhat more conclusive in that closed session.

Representative HOLIFIELD. No further questions, Mr. Chairman.

Chairman COLE. Now, on the question of whether the State Department has approved the legislative policy statements of the Commission, is it not true that the State Department is a member of the National Security Council?

General SMITH. The Secretary of State is; yes.

Chairman COLE. Yesterday, Mr. Dean, as chairman, stated that the legislative recommendations of the Commission, which would provide the basis for implementation of the power policy, have been submitted to the National Security Council. And since the Secretary of State is a member of the National Security Council, I think the record should be complete as to whether the State Department, as personified by the Secretary of State, has approved the legislative recommendations of the Atomic Energy Commission on this subject or not.

General SMITH. In that sense, yes. I think the record should show that when the Security Council, as the major agency of coordination in the executive branch, approved the thing, that automatically carries the approval of the Secretary of State and of the State Department, since there is no difference of opinion.

Chairman COLE. Well, are you able to state here now whether or not the State Department is in accord with the policy statement of the Commission on this subject and the legislative recommendations which the Commission made to cover the policy statement?

General SMITH. As approved by the Security Council, yes, indeed, sir.

Chairman COLE. I see there are no other committee members who desire to ask any questions of you, General Smith, so I thank you very much for coming down. Unless you have something further you wish to add at this time, that will be all.

General SMITH. Thank you very much, Mr. Chairman. I have nothing further.

Chairman COLE. The next witness is Mr. LeBaron, Chairman of the Military Liaison Committee and newly appointed assistant to the Secretary of Defense on atomic-energy matters.

Mr. LeBaron, we are happy to greet you here in open session. You are an old friend of the closed session.

I think, at the outset, we should be assured to what extent you speak for the Defense Department on this subject. There are at least two aspects of the Commission's power policy which it has been felt should be thoroughly understood before any consideration is given to the policy statement whatever. The first is the effect such a policy statement, implemented by action, if necessary by legislation, would have on our standing in world affairs. The other is what effect it would have upon our own national security.

Now, we have heard from the State Department, and now we are happy to hear from you as spokesman for the Defense Department.

STATEMENT OF ROBERT LeBARON, ASSISTANT TO THE SECRETARY OF DEFENSE (ATOMIC ENERGY)

Mr. LeBARON. Mr. Chairman, in the first instance, the Department of Defense expresses its strong support of a long-range and vigorous program for the application of atomic energy to industrial purposes, assuming, naturally, that such a program can be made compatible

with military requirements. Our interest in this field is that of a potential customer of fissionable materials and raw materials for use in weapons or military nuclear-propulsion units.

We believe that private industry and a fuller use of the competitive resources of United States industry will serve the Nation to best advantage in the development of atomic power, provided the program adopted is in harmony with our economic system and can be pursued in a manner compatible with our military needs.

We are mindful of the fact that the security of the United States rests in large measure upon its industrial capacity and upon natural resources required for the continued development and application of that capacity.

We recognize that a vigorous and extensive program for the utilization of atomic energy for the production of commercial power may have a pronounced effect upon the availability of fissionable materials for military uses.

Review of many studies and of the current status of investigations directed toward the development of nuclear power indicates that there are two broad avenues of approach, first, development independently of military requirements, and second, power production involving governmental purchase of the fissionable coproduct for military use. Proponents of the "independent" system find themselves faced with overriding military requirements for fissionable materials and for the natural sources thereof, and advocates of the second or "dual purpose" system are plagued by visions of a saturated military market and a cutoff point for military requirements.

In view of the relatively embryonic state of development of atomic energy, the Department of Defense considers it unsound and unrealistic to attempt to establish now a fixed boundary to its military uses, expressed either in terms of quantity of fissionable materials or military purposes to which these are applicable. It feels, however, that there are certain conclusions concerning the development of atomic energy for industrial purposes, in harmony with present and future military needs, which may be expressed in the interests and in support of a compatible military-industrial program. These conclusions are:

1. Any program for the industrial utilization of fissionable materials or the raw sources of these materials must be harmonized with potential military needs.

2. Neither the "power only" nor the "dual purpose" system need necessarily be incompatible with expanding military applications inasmuch as it should be possible, in our judgment, for the processes selected to conform to the conditions that:

- (1) They do not call for a constant drain on, and the ultimate exhaustion of, the natural resources of fissionable materials.

- (2) The coproduct of the power plant operation shall be a useful weapon material, as well as a useful fuel.

- (3) Both the coproduct and the fuel inventory may be withdrawn for military uses, in part or totally, should the military situation so demand.

Fissionable material is a permanent national asset whatever its source of production or the degree of national urgency which determines the rate of production effort in this field. When the stability of the free world is restored we can progressively phase any surplus military inventory into our peacetime economy in a manner which

seems appropriate at such a future time. We should arrange our program so that the reverse course of action also is true, namely, that we can be ready to convert as much civilian inventory into military use as may be necessary in times of national emergency.

I have stated here criteria, which I hope is responsive to the basic and general conditions that you inquire about.

Chairman COLE. Can you tell me, Mr. LeBaron, what is the official position of the Defense Department with respect to the power-policy statement of the Atomic Energy Commission and its legislative recommendations implementing that policy?

Mr. LEBARON. With respect to the power-policy statement, the Defense Department position is entirely analogous to that of the State Department. The Secretary of Defense, as a member of the National Security Council, has agreed with the policy statement which the Commission has sent to your group.

With respect to legislation, we do not have any official view. We have responded to the proposed legislation with various comments and some criticism of the draft in its present form, but I understand that that is still essentially an internal paper in the Bureau of the Budget.

Chairman COLE. When I speak of the legislative recommendations of the Commission, I do not refer to the specific draft of legislation, which is the internal paper to which you refer.

Mr. LEBARON. Yes.

Chairman COLE. I am referring to the general legislative recommendations of the Commission, which Mr. Dean yesterday said had been submitted to the National Security Council and been approved by it. Now, so far today you have indicated that the Defense Department has endorsed only the power policy statement. I would like for the record to be clear as to whether the Defense Department, through its membership in the National Security Council, has endorsed the legislative recommendations of the Commission implementing its power policy.

Mr. LEBARON. Not so far as I am aware.

Chairman COLE. Well, I suggest that you make a note or that somebody make a note to see if we cannot clear up this apparent discrepancy of testimony between the Chairman of the Commission, made yesterday, and what you have told us today.

Mr. LEBARON. Well, to the best of my knowledge, the only official Defense Department position is the position taken in the National Security Council paper. But I will be very happy to investigate that feature.

Chairman COLE. Going back to your statement, Mr. LeBaron, you indicated that the Defense Department expressed strong support for a long-range and vigorous program for the application of atomic energy to industrial purposes "assuming that such a program can be made compatible with military requirements." Now, that is a premise upon which all of us work. My question is: Does the Defense Department feel that a long-range and vigorous program for the application of atomic energy to industrial purposes can be made compatible with our military and national security?

Mr. LEBARON. I think in general the answer is "Yes." We would, of course, have to examine the exact details of the program. But as a general principle, we believe that there can be an aggressive-industrial program and a satisfactory resolution of the needs of that program

for fissionable material with the military weapons needs of the Department.

Chairman COLE. When you expressed that opening thought as you did, it indicated to me a doubt in your mind or in the mind of the Defense Department as to whether an industrial-power program could be made compatible with our national security, when you say "assuming that such a program can be made compatible."

Mr. LEBARON. Well, I would like to clarify that by saying that in principle we are in complete support of a joint military-civilian program; that any limitation that is read into our statement is purely a technical limitation.

Chairman COLE. Is it not correct that the Commission's views on the subject, its power statement views, were predicated upon the condition that at all times the security requirements of fissionable material would be met before there would be any use or distribution or dissemination of material information?

Mr. LEBARON. The answer to that is "Yes."

Chairman COLE. So that you and I and the public generally can assume without question that this inquiry into the possibility of industrial nuclear power is predicated upon the requirement at all times that our national security needs come first. Can we not agree on that?

Mr. LEBARON. Yes; that is correct.

Chairman COLE. And then in the next paragraph of your statement, Mr. LeBaron, you indicate that private industry and a fuller use of competitive resources of United States industry will serve the Nation to best advantage in the development of atomic power, "provided the program adopted is in harmony with our economic system and can be pursued in a manner compatible with military needs." There again I am impressed with a feeling of doubt on your part, or on the part of the Defense Department, as to whether it can be processed in harmony with our military requirements.

Mr. LEBARON. Well, I would like to elaborate that point by saying that in the first place we do not intend the statement to imply any doubt. I would like to point out, however, that the methods by which these programs are developed are outside our province of activity, but that they are important to us. And consequently I think it is desirable that we make it clear that after the methods have been determined, we have again a technical program of resolving this with compatible military needs. But on the basic premise, there is no doubt about our complete support for the course of action which is proposed here.

Chairman COLE. Now, the last sentence of your statement on the first page: Would you amplify that? What do you mean when you say you recognize that a vigorous program of atomic industrial power may have a pronounced effect upon the availability of fissionable materials for military uses? Do you mean that a vigorous program of atomic industrial power might jeopardize our security requirements, or that a vigorous atomic-industrial-power program might enhance our military potential?

Mr. LEBARON. Let me amplify that by saying that we have predicated our statement on the premise that the committee and the country in general would naturally be concerned about the possible incompatibility of these two programs. And we want to imply or say in this

statement that we do not think they are incompatible. And we put that statement in there, really as a curtain raiser to our answer, which follows on page 2.

Chairman COLE. I am not certain whether you were present, Mr. LeBaron, when the Joint Chiefs of Staff, the representatives of the Joint Chiefs of Staff, appeared before the joint committee on the subject, or not, but it is my recollection that at their appearance they indicated not only an acquiescence in the Commission's power policy statement, its general legislative recommendations, but they went further and indicated an affirmative desire that the policy statement and the recommendations be implemented by legislation.

Mr. LeBARON. I am aware of that view of the Joint Chiefs, and that is completely in harmony with the Secretary of Defense's view in our Department.

Chairman COLE. My understanding of the Defense Department's position is somewhat clarified, now that you have made that statement. Because it is one thing for a Government agency to come in and say, "Well, we do not have any objections to a proposal of another department," and it is quite another thing for them to come in to Congress and say, "Not only do we not have objections, but we affirmatively urge that the recommendations of the other department be augmented and implemented."

Can you discuss with us possibilities which you see where our security potential can be improved by embarking on at least a developmental program of atomic power?

Mr. LeBARON. The first and most obvious way, of course, is in the development of military nuclear propulsion units. The Department of Defense, particularly the Navy but also the Army and the Air Force, are all interested in the utilization of military nuclear power for logistic purposes. That development will naturally be in the forefront of any long-range commercial development, because in a sense the conditions for the development and the basic engineering practices which are involved will be more or less along the same general lines. So we do have a very direct interest in the development of power, because of this great potential support to our logistic operations.

Chairman COLE. Does not the Defense Department and the military services have great need for electrical energy in out-of-the-way places in the world?

Mr. LeBARON. When I mentioned the Army, that was precisely what I was thinking about. I was thinking about small mobile powerplant stations that operate as stationary units in out-of-the-way places.

Chairman COLE. The staff has handed me the transcript of yesterday's hearings, which I would like to refer to now, apropos of the uncertainty which you have conveyed as to whether the Department of Defense has endorsed the legislative recommendations of the Commission. Again I emphasize: I am not talking about the draft of legislation. I am speaking of the general legislative proposal.

I queried Mr. Dean as follows:

Can you indicate whether the attitude of the National Security Council represents an affirmative endorsement of the Commission's policy, or simply a negative acquiescence?

Mr. DEAN. I would say so far as the legislative goals are concerned and the desire to get a legislation change to accommodate industry, it is blessed by the National Security Council.

That would indicate that the Defense Department, if we can rely on what Mr. Dean said, when the Defense Department sat as a member of the Security Council, did have before it the legislative proposals of a general nature made by the Commission, and indicated its approval.

Mr. LEBARON. Well, I would like to clarify the record by saying that "legislative proposal" I interpreted to mean a draft of legislation. The legislative summary proposals to which you refer here, we have endorsed, as evidenced by a letter from the Secretary of Defense to the committee at an earlier date. I was under the misapprehension that you were talking about an actual legislative draft.

Chairman COLE. I think the record is pretty well clarified.

Do any members have any questions of Mr. LeBaron?

Representative HOLIFIELD. Mr. LeBaron, I did not get to hear you testify, but I have read the statement since I returned, and on this latter question, being in favor of the goal or the objectives is one thing, and being in favor of a legislative draft which seeks to obtain those objectives is a completely different thing. I think every member of this committee is in favor of the objective, if that objective be as wide as possible private industry participation under our security requirements and military requirements. We are all in favor of those objectives. So as far as I know, there is no disagreement on objectives. But the legislative draft which was presented by the AEC to the Security Council and to the President is a thing that is altogether different. And so my question is: Do you favor the legislative draft which was presented?

Mr. LEBARON. I think my testimony before you came in said that we had objected to parts of the legislative draft in our reply to the Bureau of the Budget.

Representative HOLIFIELD. Are those objections of a nature that they can be spread upon the public record at this time?

Mr. LEBARON. I think it would be better to do it in executive session.

Representative HOLIFIELD. You would reserve an answer to that for executive session. Well, in view of that reservation, it puts the committee in a position where they cannot go much further into the matter of how to obtain these objectives without discussing the inadequacies of and the objections to that draft of legislation.

Under the circumstances, I feel foreclosed from asking any further questions of Mr. LeBaron.

Representative PRICE. Mr. LeBaron, there have been some newspaper articles in recent weeks that, in my opinion, since they were credited to official spokesmen in the Department of Defense, throw some confusion on this whole reactor program, in relation to the military reactor and also to the CVR program, the industrial project. I would just like to tie down that statement as to whether it actually reflects the official position of the Defense Establishment. There was an article that appeared in the Washington Post, and one that appeared in the Chicago Tribune, which raised some doubt in my mind as to the exact status of the program as far as the Defense Establishment was concerned.

Now, could you tell me what was the action of the National Security Council concerning the military usefulness of the CVR program?

Mr. LEBARON. Yes, sir. I would be glad to review the actions of the Department of Defense and the philosophy behind those actions.

In the first place, we still have military requirements for both the so-called CVR reactor and for the ANP reactor. Those requirements were not canceled in the Security Council. What happened in that meeting was a judgment by the Secretary that the way of achieving the objectives, the method, the managerial way of carrying out those objectives, was not as sound and as consistent with other parts of the program as it might be.

Consequently, we proposed at that time an alternative course, for the sole purpose of arriving at these desired military end products in a shorter period of time, and with less expenditure of Government funds. At no time have we ever said that we do not want these reactors. We do want them. We want them as promptly as we can.

Representative PRICE. Now, Mr. LeBaron, when you say you want them as promptly as you can: How can you get them as promptly as you can when you, in effect, give up the program?

Mr. LEBARON. Well, I do not think that is really what happened. We didn't really give up any program. We reorganized the program so that the ultimate end, we felt, would be a better end, without as many diversionary exercises. In other words, what we were concerned with was the fact that we were diluting our energies. We were freezing our designs prematurely. And we were doing a great many things which sound business practice in the new development at this stage of the game did not contemplate. In other words, it was largely the judgment of our experienced industrialists that there was a better way to achieve this purpose.

Representative PRICE. It is a little hard to follow that line of reasoning. Do you know who the official spokesman was?

Mr. LEBARON. No; I don't know who it was.

Representative PRICE. Evidently it must have been someone high in the Defense Establishment, and they must have had a consultation with someone who was familiar with this program. You do not have any idea who might have said that?

Mr. LEBARON. No; I don't.

Representative PRICE. But, at the time they were talking about calling a halt to planned expansion, would that not slow down the program somewhat?

Mr. LEBARON. I would like to say unequivocally about those articles that those were not the sentiments of anyone in the Department of Defense that I knew anything about. They were not the views of the Secretary or the Deputy.

Representative PRICE. Was there ever any conversation or discussion about that?

Mr. LEBARON. There were no decisions. Of course, we have all discussed the problem about how to get ahead best with the expansion program. But it is not a correct reflection of the opinion of the Department of Defense that we have been against any basic expansion facilities. Our views have always been directed to the mechanics and the methods of reaching these objectives with the best use of the taxpayers' dollar, and at the same time with the best method of getting the program ahead.

Representative PRICE. That brings forth this question. Was the decision in regard to the reactor programs on the basis of economy, or

was it based on a lack of military interest, say, in an aircraft carrier reactor?

Mr. LEBARON. The prime basis for the decision on the CVR was a managerial decision on how best to accomplish the end desire of the Joint Chiefs of Staff. Economy was the secondary factor. We were looking for reviews from the economy standpoint as a part of the overall review of the budget. But those conditions were definitely secondary to the main business of how we would accomplish the fulfillment of the requirement of the Joint Chiefs.

Representative PRICE. Do you have a feeling now that the program is being carried on at a more rapid pace than it was before you made the decisions? Or have you slowed up at all?

Mr. LEBARON. I don't think we have slowed up at all. I think we are in a much better position today than we were 4 months ago.

Representative PRICE. In what way are you in a better position?

Mr. LEBARON. From this standpoint. We have been talking about the CVR reactor. The keel of that vessel won't be in the water until about 1963. There are 10 years between now and that time, in which all sorts of new developments in technology can happen. If we froze the technology today, 3 years from now we might have a project half completed in which we had invested a large sum of money, which would not only be wasted, in the circumstances—

Representative PRICE. Of course, you would not want to freeze it. You were talking about freezing it.

Mr. LEBARON. Well, in the CVR we were freezing the design, and we were freezing the basis of expansion. That is one of the things we were objecting to.

Representative PRICE. It looks to me like you are doing a better job of freezing under the new program than you were under the old. You had several roads to go under the old.

Mr. LEBARON. Well, let me point out our thinking there. As it stands today, the so-called CVR reactor, which is a natural-uranium pressurized water reactor of the type which it is generally agreed is the natural civilian type, is going forward in an advanced stage. If there is anything of military value that comes out of that, we will be aware of that, and we will have an opportunity to incorporate that in new thinking.

There are other ways in which we will probably ask for added developments from the military need standpoint, which will throw more light on the way in which the whole reactor technology for military propulsion develops. I think it is only common prudence and common sense to say that we should not finalize the way in which we go in that business.

Representative PRICE. My point is that you are closer to finalizing it under your present approach than you were under the old.

Mr. LEBARON. Well, I just don't understand that, sir, in view of the fact of what we have done.

Representative PRICE. It seems to me that you have come to a point where somebody has recommended to the Defense Establishment, "We will go this way. We will just do this one thing." Under the old program you had people going several different ways, with the prospects of somebody arriving at the goal ahead of the other team.

Mr. LEBARON. I don't know any way, any alternate, which has been dropped as a result of the actions of the last 3 or 4 months.

Representative PRICE. All right. What is the difference, then, between the two programs? What was it before you made these recommendations, and since? There must be some difference. There is a difference in approach.

Mr. LeBARON. There is a difference in approach. There is the business that you might want to call resorting the objectives and putting the civilian ideas over into the civilian economy, in other words, to have the military program more strictly conform to military needs. There is a difference of somewhere between 50 and 75 million dollars of expenditure which would have been cranked into the old CVR program in trying to make it fit a naval vessel while you were developing it, which we believe is largely a direction which can be avoided.

Representative PRICE. Let me ask you this question: Was the decision based on a matter of policy, or was it the recommendation of the technical people who were actually doing the job?

Mr. LeBARON. Well, it was the decision of the Secretary and the Deputy Secretary based largely on their managerial experience.

Representative PRICE. Managerial experience does not count too much on this type of program, I don't think. It helps in the administration of it. But in the basic research, I would rather take advice from the technical people who are handling the research problems.

Mr. LeBARON. Well, I use the word "managerial" in the sense that it involved the engineering and technical considerations. I don't really want to go any further than that into the reasons.

Representative HOLIFIELD. Will the gentleman yield?

Mr. LeBARON, was there ever a scientific evaluation of the CVR program that resulted in an evaluation which caused you to want to cancel that in favor of some other type of reactor?

Mr. LeBARON. Not to my knowledge.

Representative HOLIFIELD. Then the present \$7 million appropriation for the construction of a large prototype of a land-based type of reactor is, in your mind, a better way of handling this than to let the same amount of money be spent on a ship-type reactor, on a CVR type?

Mr. LeBARON. Well, I don't want to give the impression that I am evading the answer, but in our philosophy this is at this stage of the game primarily the Commission's responsibility to develop the reactor, and our military judgment on it won't be finalized until the progress is further along the road.

Representative HOLIFIELD. All right. Under the present circumstances, then, they are only going forward with one type of prototype?

Mr. LeBARON. In that specific program, yes.

Representative HOLIFIELD. In that program. I realize they are going ahead with the submarine program.

Mr. LeBARON. And the Commission is also going ahead with a number of other reactor types which may presently develop into something of interest.

Representative HOLIFIELD. Your logic—and if I understand you wrongly, please tell me—is that there is need for further experimentation and development of different types of reactors before you freeze it into a usable full-size reactor?

Mr. LeBARON. That is correct.

Representative HOLIFIELD. Now, as far as you are concerned, it makes no difference to the military who does that type of research and development, as long as it is done?

Mr. LEBARON. That is right. Yes, sir.

Representative HOLIFIELD. Then if the Government proceeds along the line of several different types of reactor development, you would be satisfied?

Mr. LEBARON. Yes.

Representative HOLIFIELD. And if private industry would come in and put up the money to do it, you would be satisfied with that?

Mr. LEBARON. Yes.

Representative PRICE. On that point, Mr. Chairman:

Do you think private industry is ready to come in and take over the CVR program?

Mr. LEBARON. Well, I don't think we are really competent to give you an answer on that, because that depends almost entirely on what happens.

Representative PRICE. The reason I asked you that question is because the spokesman who has been giving stories to newspapermen is quoted in an article in one of the local newspapers here as recently as June 14, intimating that if the Pentagon removed its backing, that is, for the continuation of the program as it is now under AEC, private industry could carry along the development, and atomic power would be developed by private enterprise rather than Government, not only cutting Government expenditure but conforming more to republican principles than present practice. Does this represent your opinion?

Mr. LEBARON. No, sir. In the first place, I think we have to say again that a great many people—

Representative PRICE. You see, the reason I am bringing this out is because there have been these confusing stories in the newspapers, and I think we ought to know just what the situation is. Is private industry ready to come in and do these things? Or does the Government still have to participate, and on a contractual basis bring private enterprise in? Do you know of any company that is ready to come in and do this CVR job?

Mr. LEBARON. Well, it really isn't our business, sir, to have any views on something which is a monopoly business of the Commission. I am very happy to clear up the uncertainty—

Representative PRICE. The reason I ask these questions is because all these statements are supposed to come from the Department of Defense.

Mr. LEBARON. Let me say something in response to that. There have been a barrage of statements about the position of the Department of Defense, and to the best of my knowledge none of them have any real basis of support. They are really trial balloons in an effort to smoke out the views of the Department, by people who want them for some purpose or another. Now, I don't believe that we can take any official cognizance of those newspaper articles in circumstances like this.

Representative PRICE. But sometimes they bring in names and intimate that the stories come from certain sources. This particular article says this, and I would like you to comment on it. It says:

The whole approach of Robert LeBaron, Wilson's assistant on atomic matters and Chairman of the Military Liaison Committee to the AEC, was reduction of the arms budget and getting someone else to assume what the Pentagon regarded as largely a nonmilitary project, the AEC. * * *

Now, they seem to tie you up in it, and that is the reason why I would like to have your opinion.

Mr. LEBARON. Well, let me be very definite about that. I have never made such statements. I do not know Mr. Norris, who wrote it. And if you read his statement, you will find that it ends with the statement, "So the AEC and Congressmen say." And there is no basis for that statement or the views expressed in it. It is a complete matter pulled out of thin air.

Representative PRICE. One of the reasons for these public hearings is to clear up a lot of misunderstandings.

Mr. LEBARON. I understand that legally I have no redress against this statement, because it is a quote of what someone else has said. I did not say it. I have never met Mr. Norris. I do not know him. And the character of most of the statements which have confused this issue, I suspect is such that they are in a similar category. I think I would know if any interviews or any statements were made in the Pentagon, and I am quite sure that most of these things have just come out of thin air.

Chairman COLE. Any further questions of Mr. LeBaron?

Representative HINSHAW. I would like to ask a question of Mr. LeBaron just briefly.

As I understand it, the so-called CVR program is a program for ship propulsion, whether that ship be a naval vessel or the Queen Elizabeth or any other kind of a vessel. It is a matter of propulsion, and not of a particular type of vessel; is that correct?

Mr. LEBARON. That is correct.

Representative HINSHAW. And hence the building of a hull loaded with enough concrete to cause it to go down to the Plimsoll line would be enough of a hull in which to test out such an engine, would it not?

Mr. LEBARON. Well, except that the design, the physical engineering design, of the engine, would have a great deal to do with the design of the hull. In other words, I understand from the Bureau of Ships in the Navy that it was not practical, for example, to put nuclear power plants in existing hulls, because of this fundamental difference in the nature of the structure.

Representative HINSHAW. I was thinking about having a floating test bed, where the engine was not necessarily a vehicle which might ultimately be put to use. You can have a floating test bed without having any particular type of test bed. Therefore, the question of whether a single reactor power source, which is, I suppose, proposed to be built under the CVR program, is to have a floating test bed of one sort or another, is of little consequence. Is that correct?

Mr. LEBARON. That is right.

Representative HINSHAW. Now, heretofore it has been my understanding that it was considered that the CVR program was specifically to provide a single engine for installation as one of a number of engines on a carrier, but that the carrier is not important to the testing of the original prototype. Is that correct?

Mr. LEBARON. Well, I think we are talking about two separate problems, and I am not sure that I understand how we are joining them. The military requirement for the CVR was developed by the the Joint Chiefs of Staff, as I recall, some 2 years ago. The technical developments in the program since that time are such that I would assume and presume that the basis of the original requirement would be subject to review, in the light of present technology.

Representative HINSHAW. Exactly. In other words, we are interested in developing an engine, whatever its end use may be.

Mr. LEBARON. That is correct.

Representative HINSHAW. And we are proceeding along that line in a little bit slower but in a considerably less expensive way than we started out.

Mr. LEBARON. I would also like to point out that from the standpoint of the overall development, by going a little slower, and determining what the ultimate courses of action are at this time, we may be able to close in at the end much faster and much more surely than we would if we had a program spread out too far in the early stages.

Representative HINSHAW. Exactly so. And in the meantime, we are saving the taxpayers something between sixty-five and a hundred million dollars, which is worth while. And as I remember the testimony, this would not seriously slow down the equipping of our fleet in case we wanted to equip it with such engines; in the long run it would not delay that?

Mr. LEBARON. That is correct.

Representative HINSHAW. That is all, Mr. Chairman.

Chairman COLE. Are there any other questions?

Thank you, Mr. LeBaron.

Mr. LEBARON. Thank you.

Chairman COLE. The next witness is Dr. Rabi, Chairman of the General Advisory Committee.

Doctor, we are happy to see you out in the open, too. Would you tell us and the public something about what the General Advisory Committee is, how long you have served as a member of it, how long as chairman, what consideration has been given by the GAC to the question of industrial power, what consideration is given to the power policy statement of the Commission, whether the committee was consulted by the Commission before the policy statement was promulgated, whether the committee has considered the description of legislation necessary to carry out the Commission's power policy?

STATEMENT OF I. I. RABI, CHAIRMAN, GENERAL ADVISORY COMMITTEE, UNITED STATES ATOMIC ENERGY COMMISSION

Dr. RABI. Yes, sir. I will try to answer the question as well as I can remember them. I hope you will prompt me if I should forget some.

The General Advisory Committee, as I remember, has met since January 1947. I happen to be the only member of the General Ad-

visory Committee who was one of the original members of this committee.

The committee, as you are well aware, is set up by the Atomic Energy Act, appointed by the President to advise the Atomic Energy Commission. The chairman of the committee is selected by the committee itself, and until he went off the committee, I think last August, Dr. J. R. Oppenheimer, was the chairman of the committee throughout its life. When Dr. Oppenheimer went off the committee, on the expiration of his term, I was first selected as acting chairman of the committee, and in accordance with our rules the chairman of the committee is reelected every year, and I was elected chairman of the committee at its first meeting, in January of this year.

Chairman COLE. There are nine members of the committee?

Dr. RABl. There are nine members of the committee, and if you wish me to put the names of the members of the committee in the record, I will read them to you. I have them right here.

There is myself as chairman.

There is Dr. Oliver E. Buckley, formerly chairman of the board of the Bell Telephone Laboratories, now retired;

Dr. J. B. Fisk, who is director of physical research at the Bell Telephone Laboratories;

Dr. W. F. Libby, professor of chemistry at the University of Chicago and a member of the Institute of Nuclear Science at that university;

Dr. E. V. Murphree, president, Standard Oil Development Co., and a well-known chemist in his own right;

Also, there is Dr. John von Neumann, a professor at the Institute for Advanced Study, who is a world-famous mathematician;

Dr. J. C. Warner, the president of the Carnegie Institute of Technology, who is a chemist of great repute;

Dr. Walter G. Whitman, presently Chairman of the Research and Development Board of the Department of Defense, and formerly, I presume presently to go back to, the Massachusetts Institute of Technology, where he is head of the department of chemical engineering;

And Dr. Eugene P. Wigner, professor of physics at Princeton University.

I might add that the secretary of the committee is Dr. Richard W. Dodson, who is the chairman of the department of chemistry at the Brookhaven National Laboratory and also a professor of chemistry at Columbia University. His principal field is in radio chemistry. That constitutes the committee.

Chairman COLE. And you are the only member of the committee as presently constituted who has been a member of the committee from the beginning?

Dr. RABl. Yes, sir. I was appointed for a short term originally, and then reappointed for a full term.

Chairman COLE. Thank you. You may proceed with your statement in any way that you wish.

Dr. RABl. Yes, sir. I will read this statement.

The General Advisory Committee from the beginning has discussed the question of nuclear power for industrial purposes. However, the views expressed in this statement are my own and not the collective opinion of the General Advisory Committee, since there was not sufficient notice of this hearing for the committee to meet and agree on a

statement of position. I would like to have that very well understood, for reasons which may come out later.

From my discussions with properly qualified scientists and engineers, I have come to the opinion that, from the technical point of view, the time is ripe to proceed to the design and construction of power-plants to derive heat or electrical energy from nuclear fission. There are many areas of the world, and perhaps even in the United States and its Territories, where nuclear power would be competitive with power derived from combustion of fuel.

The future of nuclear power will depend on the same factors which determined the future of other new industries, such as the electrical industry, the telephone, oil, and chemical industries, and more recently the television industry. These factors were chiefly research, invention, and development, which led to designs and techniques which resulted in improved product and improved service. In due time new materials and methods were developed under the influence of public demand and commercial competition, which brought about lower costs and more efficient operation.

If the same influences are permitted to operate in the field of nuclear power, the nuclear power industry would become an important component of our American economy in the next 25 years. Nuclear power in the foreseeable future will have very strong competition from power derived from the combustion of fuel, and we therefore do not have to fear that a strong monopoly would be set up in the power industry through the possession of some basic patent or secret process. There are many different designs which are possible, and it is not likely that any one design would have an overwhelming advantage. I wish to support the position taken by the Atomic Energy Commission in its Statement of Policy on Nuclear Power Development, with the single exception that although I believe that the construction of experimental power reactors to be desirable, I am not convinced they are a necessary step. More desirable would be the construction of a power reactor with close attention to economy in construction and operation, and which would serve a useful purpose to provide power for some useful demand. The sooner we get started on such a project the better our ultimate position will be in the international competition for leadership in this field.

If organizations outside the Atomic Energy Commission are to make progress in the field of nuclear power, it will be necessary for them to have access to the unique experimental and testing facilities which are now AEC property. In addition, the advice of and consultation with AEC scientists and engineers will be necessary in all stages of the development of suitable designs.

It is vital to the nuclear-power program for the AEC to continue vigorous support of research and development in the fundamental arts which are basic to reactor development. These include basic physics, particularly in the measurement of various neutron cross sections of all nuclear species, fundamental chemistry and metallurgy of the elements and compounds which are important for reactor technology, heat-exchange phenomena, and the health precautions which are so essential in the handling of these dangerous materials.

These and other basic studies and researches will also help the AEC in its other programs in the production of fissionable materials and

their utilization in the weapons program and should result in greater abundance and lower cost.

Finally, I would say the generally optimistic tone of this statement is a result of the great progress which has been made in recent years, mostly in the laboratories supported by the AEC, but with the help and cooperation of scientists and engineers both in industry and in the universities. If this cooperation is maintained, the future of nuclear power is assured, provided wise policies are adopted which will permit the necessary freedom for private initiative and skill to make its full contribution toward providing the public with nuclear power.

Chairman COLE. Thank you, Dr. Rabi.

Are there any questions?

Representative HINSHAW. Mr. Chairman, there is one question that occurs to me in listening to Dr. Rabi's testimony.

It has nothing to do with the testimony itself; but, he being a very eminent scientist, and we having in Los Angeles peculiar conditions known as temperature inversions of the atmosphere, it seems to me from what little I know about the reactors and their various emissions that placing one in a position where temperature inversions are frequent would not be a very good idea, would it?

Dr. RABI. It would depend upon the design of a particular reactor. If you had a design where gases and materials which are injurious to health would not escape, I don't see why it shouldn't be there.

Representative HINSHAW. And such a reactor is practical, is it?

Dr. RABI. I think it could be made to be so. There are such designs in contemplation. And, furthermore, you don't have to go very far away, do you, to put it in the hills somewhere, where the atmospheric conditions are more favorable.

Representative HINSHAW. Thank you very much.

Senator HICKENLOOPER. Dr. Rabi, I think we all realize that power reactors can be built by the Government through contracts. If those remain the property of the Government, then any developments under those circumstances remain the property of the Government.

Now, if private enterprise is to go into the power field, then, under the very law of economics of the private-enterprise system, private enterprise would want to own and control what it put its money into, including any developments and advancements which it made, which would mean the ownership of patents and all those things which would go into a normal operation of that kind.

Also, it would seem to me that private venture would hesitate a long time to put the necessary large amounts of money into building and experimenting with its own private reactors, unless it was assured of having available to it for its use all of the information essential in the development of that enterprise.

Now, do you think at this moment or within the near future private groups can be given all of the information that is in any way essential for the purpose of experimenting with different designs and types of reactors for power, without invading the field of security in the weapons field? Or would the Commission have to hold back certain information that private industry would say, "We think that is essential to us"?

May I just go ahead and qualify that a little more by saying that I know that private companies under atomic contract operate in a

very highly restrictive field. But that is under a specialized operation. What they do is for the Government. I am talking about them divorcing themselves from the Government and then being given for their use the unrestricted use of information which would be essential to them.

Dr. RABI. Well, sir, I will try to answer that as best I can. I do not think we are at a point where most of the information or all of the information necessary to construct a good economical reactor can be given without security restrictions. I think that private industry which goes into this field will have to learn to live with such security restrictions. However, I think that they have had a lot of experience in it. A large fraction of the big industry of the United States has worked under security restrictions, either under the Department of Defense, the Atomic Energy Commission, or others. Therefore, I do not consider the objection to be insuperable. They have taken very strong measures to clear the necessary personnel. They have experience in how to work with these restrictions. It seems to me they could go right ahead if there were a good profit in it.

Senator HICKENLOOPER. It seems to me that you, as a contractor, for instance, for the Commission, and under the proper clearances, as such a contractor for the Commission, can go in and secure information that would be necessary for you to carry out your contract with the Commission. But you are working under a different set of circumstances than if you, as a private individual, want to put your own hard-earned money into developing a type or types of reactors which will be your property. It seems to me there is a difference in the operating methods there.

Dr. RABI. There is a difference. But, nevertheless, I don't see it as an insuperable obstacle. It is some departure from usual procedures, but many industries do operate under conditions of ordinary commercial secrecy, and we have had experience through the years in working with these companies. By "we," I am referring to the Commission. And it seems to me that methods could be worked out which would not be very novel to industry. And, in the last analysis, you would have your reactor, and it is sealed up and guarded as a valuable piece of property always is.

Senator HICKENLOOPER. And still maintain the reasonable safeguards against the disclosure or the leakage of vital information relating to our national security?

Dr. RABI. Yes, sir. I don't see how the source of money would affect the safeguards. Whether the money came from stockholders or whether the money came from the United States Treasury, the procedures could be very similar. And that is why I would think in the legislation appropriate safeguards should be introduced, and a proper system of licensing and reporting and so on should exist, one that is sound technically and would not be too difficult for the companies to manage.

Senator HICKENLOOPER. I presume there would be two methods of procedure. One would be to be selective in the companies or the groups which did this; but, if the Government followed that procedure, then many others might say, "Well, we want to get into this field, too. You can't set up the bars against us."

Dr. RABI. Isn't that true in other fields, sir? If I want a license to run a radio station, I have to show them I am personally of good

character and responsible. Otherwise, my license would be taken away.

Senator HICKENLOOPER. I think there may be some comparison in that. But I think there is a difference in case of a radio station, because it uses the airway and for other reasons is subject to public regulation as a utility.

Now, in this field there might be some different elements that would at least lend some argument to those people that said, "Well, you are exclusive on this thing. You let the A company get into this field, but you will not let us."

Dr. RABI. Well, I feel there won't be crowds standing around with a hundred and a hundred twenty-five million dollars. By the time they have the capital, you pretty much know who they are.

Senator PASTORE. Do you envision, Doctor, for some time to come, private industry embarking on this development solely and strictly on its own, detached from Government? Or do you think that there has got to be a community of participation for a long time to come, principally because of the problems that are involved and the costs that are involved, and therefore you do have this cooperation between private industry and Government that will give us what we need to maintain the security that is required?

Dr. RABI. Exactly, sir. As I said in my statement, they could not go ahead with the design and construction without information from the Government and the use of Government facilities.

Senator PASTORE. From your contacts in this particular area, have you found any inclination on the part of private industry to embark in this on the premise of going it alone?

Dr. RABI. One hears talk about it. I can't say very much about my own particular experience. But as the field develops, it becomes clearer and clearer that the time is rapidly approaching where this could be a profitable enterprise.

Senator PASTORE. Well, now, to follow it up with a further question, which I expect to be my last: On the question of divulging of secret processes and patent rights, how much do we have to get into that if we recognize the fact that Government has to participate because of the costs that are involved and because of the areas that have already been developed by Government that are exclusive to Government? Why must we go so far as to give away all of these patentable rights and secret processes?

Dr. RABI. Well, sir, I would be very glad to answer this question if I understood it. We have argued this matter in the General Advisory Committee for meeting after meeting, and for our next meeting, which occurs in August, we are going to have the counsel of the Commission meet with us to discuss the matter further.

I am in sympathy to a great degree with what you say. It is not very clear to me what connection the desire to sell power has with the establishment of a patent position. However there may be changes in the act which would make it simpler and easier and more in conformity with industrial practice than to proceed—

Senator PASTORE. Well, what I am trying to get at is: Is it the crux of this problem, on the question of initiative, to go forward? You have played it down in your statement.

Dr. RABI. Yes, sir. I have played it down, because I do not understand it.

Senator PASTORE. You do not understand it because you do not feel the same fear as other people do?

Dr. RABI. To some degree. I have the feeling that as soon as this industry will be clearly profitable, there won't be so much worry about the patent feature. And there was one other feature. That is, any company, any group, that goes into this, that puts in their own money and gets the experience, will be so far ahead of others in having the experience and the prestige that I am not quite sure what the value of the patents would be, except for protection against others, or protection of their commercial position.

Senator PASTORE. Of course, the argument as made, at least we hear the rumors of it, on the part of those who are opposed to private industry participating in this program, on the grounds that this is going to lead to monopoly, that they are doing it for an ulterior motive. Now, I do not agree with that at all, because I think there is a lot of know-how in private industry that ought to be utilized in this development.

Dr. RABI. Absolutely.

Senator PASTORE. And I have not yet heard anyone in private industry that has taken the position, the positive position, that they will not do this unless they get certain patent rights that will be made available to them. They seem to be playing that down, too.

I wanted your opinion on it. Do you think it is absolutely essential that we make the concession, in order to get private industry to participate? Or is private industry being limited in its actions only because of the costs involved in the investment it has to make?

Dr. RABI. I am not clear enough on the subject, sir, to be able to answer that question.

Senator PASTORE. I do hope I have made my question clear.

Dr. RABI. The question is entirely clear, but I can't answer it, because I don't understand it well enough. I think we will get to an understanding in the fairly near future as to what the preconditions are for the participation of private industry with full vigor.

Senator PASTORE. The reason why I asked you the question, Doctor, is because that is what has been troubling me right along.

Dr. RABI. It has been troubling us. We have heard from people of very different backgrounds and very different views on this subject.

Senator HICKENLOOPER. Dr. Rabi, I have not heard even any remote suggestion by any person who might be interested in the private development of power that the Government turn over to them as an exclusive property any existing patents. When I mentioned patents a while ago, I meant patents which they under their own investment might later develop in the future, and the costs of which they might reasonably, under the private enterprise theory, have a right to expect to recapture in some way, by being protected on the patents which they develop. I would expect that, within limits, patents which we have now, I mean which belong to the Government, under such a theory, might be turned over, insofar as they could be, without violating the national security, to anybody and everybody that wanted to make use of them. It is only the future development in which the costs of their research might well be claimed as a recapturable item. Having spent it, they would try to get it back in some way so that everybody would start on the same footing.

Senator PASTORE. I am speaking of the same area myself. I am not talking of the patents which the Government had. But even with reference to these future patents, you have got to remember that whatever has been developed has been developed exclusively by private industry because there has been Government participation. And this whole thing is predicated upon a joint effort.

Dr. RABI. My own guess is that if more than one group went into it, they would immediately have cross-licensing arrangements, and it would not be a very serious question. That is just a guess.

Representative HOLIFIELD. Dr. Rabi, in your statement, on page 2, you say there are many different designs, and that you do not fear that a strong monopoly would be set up in the power industry through the possession of some basic patent or secret process.

Dr. RABI. Yes, sir.

Representative HOLIFIELD. You make that observation from the standpoint of your background of knowledge of the reactor field, I suppose.

Dr. RABI. Yes, sir. Right now there are a number of competing designs, and they all look pretty good.

Representative HOLIFIELD. Those designs have been made available to industry?

Dr. RABI. I couldn't answer that question, sir.

Representative HOLIFIELD. I think testimony before the committee has indicated that possibly some designs, according to Dr. Zinn, have been developed by Government, and also the study groups have had access to that type of information, or else their studies would be no good.

Now, it is evident that if those types have been developed by the Government there must be a multitude of ways of building the reactor. It is obvious that none of those designs could be patentable, because the Government has already originated them at its own expense.

Now, I see that you have no fear of a monopoly position on that account. And then if these designs of reactors are so numerous, and they have already been developed to the point of theory at least, that particular incentive should not be too appealing to industry. That is not an incentive, in other words, that should be too appealing to industry to give them an area of patent advantage.

Dr. RABI. I am sorry, sir. I did not quite understand the question.

Representative HOLIFIELD. Well, let me try to state it in a different manner. You indicate that there are so many designs that there is little likelihood of one design having such an overwhelming advantage that a patent would be of extraordinary value. I believe that is your position, is it not?

Dr. RABI. Yes.

Representative HOLIFIELD. Then, if that be the case, the requirement of a patent of that nature would not be an important advantage to an industrial firm.

Dr. RABI. Well, sir, you are taking me a little out of my depth. I have a feeling that these industrial people like patents for their own sake, and they do not feel comfortable without them.

Representative HOLIFIELD. It is like wearing a muffler. They have gotten used to it and hesitate to take it off.

Dr. RABI. But I am not testifying as an expert. This is merely an observation.

Representative HOLIFIELD. As a matter of observation?

Dr. RABI. Yes.

Representative HOLIFIELD. Let us proceed, then, to something that you may have more definite opinions on. Let me ask you if your General Advisory Committee was consulted on the selection of the CVR type of reactor?

Dr. RABI. We were informed, as I remember—and I am speaking purely from memory, and I did not consult the record since I did not anticipate the question—we were informed, but I do not think we were specifically asked about that particular type.

Representative HOLIFIELD. Should that have been a matter of consultation with your group? You have some distinguished scientists, including yourself, who are very knowledgeable on different types of reactors, and I am surprised your group was not consulted.

Dr. RABI. I would not say we were not consulted. It is not the way we operate with the Commission that they consult us on every step. They consult us about various questions which are especially interesting, at the time of the meeting, and we ourselves raise questions with them. But we certainly do not as a normal thing pass on every decision which they make, and we could not possibly do the job, meeting only a few times a year as we do, and being busy with our other concerns.

Representative HOLIFIELD. Let me ask you this—

Dr. RABI. We were not unhappy about the situation.

Representative HOLIFIELD. You were not unhappy?

Dr. RABI. That is right.

Representative HOLIFIELD. Were you happy? Let me put that in a different way, as we are perhaps dealing in terms of the wrong type of descriptive adjectives.

At the time the CVR was selected, was there a strong feeling among scientists that it was the wrong type of reactor for that purpose?

Dr. RABI. For that purpose, no.

Representative HOLIFIELD. Now, since that time, in the 2 intervening years, has there been a strong feeling on the part of a responsible group of scientists that a different type of reactor would be more acceptable?

Dr. RABI. Not to my knowledge, sir.

Representative HOLIFIELD. Not to your knowledge?

Dr. RABI. No.

Representative HOLIFIELD. All right; we will turn from that point to another statement which you made, in which you said:

* * * although I believe that the construction of experimental power reactors to be desirable, I am not convinced they are a necessary step. More desirable would be the construction of a power reactor with close attention to economy in construction and operation, and which would serve a useful purpose to provide power for some useful demand.

Now, I believe, then, that you take the position that we have gone far enough forward in the science of reactor technology that the building of various types of pilot types are no longer desirable, but that we are to the point where an actual large-type reactor should be built. Have I correctly stated your position?

Dr. RABI. If I could restate it, I will say it in this way: That there are designs which the scientists and engineers concerned think could produce useful power, and they would know how to do it and how to start designing it right now.

Representative HOLIFIELD. May I just stop you there and ask you what you mean by the word "useful"? Do you also mean "economical"?

Dr. RABI. Yes, sir.

Representative HOLIFIELD. And competitive with conventional fuels, or near competitive?

Dr. RABI. That is right, just on the borderline or perhaps over. It would take an actual design effort over a period of a year or two; but in design, to show whether it would be competitive or not, a great deal of the material which enters into the cost figures, whether it is competitive or not, are questions of bookkeeping, rates of amortization and questions of that sort, fuel inventory, and it would take a precise design to answer those questions.

Representative HOLIFIELD. Frozen into a constructed reactor?

Dr. RABI. To be frozen into a constructed reactor. But it would take an actual, real design of something which you fully intend to build before you could really answer those questions. In other words, they are expensive, and rather profound study would be required. But the feeling of the people of experience is that it could be done and would be either definitely competitive or just on the edge.

Representative HOLIFIELD. Now, may I ask you if that is just your personal opinion, or if a great many of the top-ranking physicists agree with your position on that?

Dr. RABI. I would say that a great many of the physicists and chemists and engineers who are concerned with these matters agree, and that my opinion is derived from them. They are the experts in this specialty, and not I, but I have confidence in their judgment.

Representative HOLIFIELD. Well, this position, of course, is entirely different from the position, I believe, that Mr. LeBaron took.

Dr. RABI. I am not sure that is the case, sir. I have not studied Mr. LeBaron's statement carefully enough to be able to say whether I really differ. I showed my statement to him before, and he did not express the feeling that there was a difference.

Representative HOLIFIELD. I think the record will be self-explanatory.

That is all, Mr. Chairman.

Chairman COLE. Mr. Price?

Representative PRICE. I have no questions.

Chairman COLE. Dr. Rabi, would you indicate to us what you mean when you say there are many different designs of reactors which are possible? How many is "many"?

Dr. RABI. Well, there are all sorts of variations. I would say half a dozen.

Chairman COLE. Only half a dozen?

Dr. RABI. At least a half a dozen, with different materials, different coolants, and different ways of taking out the energy, and different sorts of cycles. And there are questions of whether one should have a byproduct or not, and all that sort of thing. There are different ideas about chemical processing of the materials, and it is a very wide range.

Chairman COLE. Are you in disagreement with the statement I have read attributed to Dr. Zinn, in which he is said to have stated that if he had the time, he could design and conceive of a wagonload of different types of reactors?

Dr. RABI. I would agree with his statement. He is a very capable physicist and reactor engineer, in my opinion.

Chairman COLE. Well, there is quite a difference between your statement that there are approximately half a dozen or so different types of approach for an economic reactor, and Dr. Zinn's statement wherein he estimates it in terms of wagonloads. It has been my understanding that the field was as broad as the ingenuity and inventiveness and imagination of the scientists themselves.

Dr. RABI. I would agree. It is entirely a matter of classification. When you say there are a half a dozen basic designs or a wagonload of designs, I do not think there is any substantive disagreement.

Chairman COLE. You no doubt were referring, when you said half a dozen as the number, to the basic processes.

Dr. RABI. Yes, sir.

Chairman COLE. And Dr. Zinn no doubt was referring to the frills, the improvements, and the facets of the basic design.

Dr. RABI. Yes, sir.

Chairman COLE. Then in your statement you said, and I will quote just for a moment:

More desirable would be the construction of a power reactor with close attention to economy in construction and operation. * * *

From your observation of the Government's program, and your understanding of our industrial private enterprise system, which, in your opinion, is in a better position to construct a power reactor with more likelihood of success from the standpoint of economy in construction and economy in operation?

Dr. RABI. I have the feeling that the influence of the power industry, which would have to operate a reactor and make a profit, would be such as to make their point of view the more economical one. But again, I am just speaking as a private citizen and not as an expert in the power field.

Chairman COLE. What is your feeling on the Government monopoly approach philosophy, the effect of that upon our scientific progress? Would it slow it down, or, to express it differently, if private enterprise were allowed to join in the art, is it probable that our progress would proceed more rapidly than if private interests were not allowed to enter?

Dr. RABI. Well, sir, I have the feeling that if the international situation was such that private enterprise could have joined in this project in the normal course of events, we would have been further ahead and we would have had nuclear power by this time, perhaps inefficiently and perhaps with a certain waste of natural resources, which has happened in the past, but I think we would have been further along.

Chairman COLE. You have indicated that your feeling is that the time is ripe for engagement in power reactor construction from a developmental stage. Do you feel the art has reached the point where it is possible for exploitation of atomic energy?

Dr. RABI. It was the intent of my statement. I am not sure that any firm that entered the business would make money. They might lose money, and it would depend on how good they were. But it seems to me that that is a normal way in which industries have developed in the United States. Not all automobile companies made money, and some have disappeared. It depends upon management, and the kind

of engineering brains and management brains they bring to bear on the problem.

Chairman COLE. The Commission's statement on the subject indicated an approval of the authority to grant ownership of fissionable material to private organizations which might come in and use it. I am wondering what your feeling is as to whether it is necessary for private industry to actually own the fissionable material, and thereby add to the responsibilities of the Commission to follow that fissionable material wherever it may flow in private ownership, or can the same measure of incentive be accomplished by the Government retaining ownership of the fissionable material at all times and making it available under some contractual arrangement with private capital, through which private capital would operate on the fissionable material, in some instances producing additional fissionable material, and private capital be charged for that amount or the value of the fissionable material which it has consumed. It would seem to me that from the standpoint of the responsibility of the Commission in its accountability measures, it would be easier if it could at all times be the owner, rather than that it had the responsibility of being policeman and having to go out and see where this went in any part of the country, or parts of the world. Do you have any notions on that?

Dr. RABI. Well, sir, I feel that at all times the Government will have to exercise a very strict control over fissionable materials, whether we are in the condition of international tension as we are now, or in times of profound peace, because this is very dangerous material.

Whether it would make a big difference whether there was an appropriate licensing arrangement, or ownership, is very hard to tell. It seems to me that we should be wise enough to be able to operate either way.

I do not see any very great difference between a continuing control and supervision which the Government would have to have, and licensing. It is just about the same sort of thing.

Chairman COLE. What part do you anticipate the National Laboratories would play in this new approach? Would the laboratories be available to any interested capitalist who might want to use them, free of charge; or should the Government make a charge to the user, measured by the costs of that use to the Government? If private capital uses the National Laboratories, should the Government share on a partnership basis which is equitable with the private capitalists in any patents that might evolve from the use of the laboratory?

What part in this will our National Laboratories play, which have cost the Government many, many millions of dollars?

Dr. RABI. Well, sir, those are very specific questions, and I should think that at the beginning, when this industry is in its infancy, facilities should be made available to appropriate parties, provided they can show they have the capacity to use them properly, at very low cost, some cost but very low cost.

As the subject develops, and the industry becomes more profitable, I think those costs should be increased correspondingly, so that they share in the enterprise. When it becomes a large industry, well, their taxes will to some degree support the laboratories, so that there will be sharing of cost within certain limits. These laboratories will also be used by the Government, I am sure, at all times, for its own inter-

est, in fields which are specific governmental interests, such as the Department of Defense and other departments of Government.

Chairman COLE. Are there any further questions?

Representative HOLIFIELD. I would like to ask a question at that point.

If the private industry uses the Government laboratories, as they must, as they are Government-owned laboratories at this time which are peculiar and unique and which private industry does not have, and if the Government puts up the majority of the funds in research and development, should private industry be given patent rights based on a small investment when it is obvious that they would also be based upon all previously acquired technology and a necessary cooperation on the part of Government in this interim period, let us say, of 3 to 5 years?

Dr. RABI. That is a very difficult question, sir, and it can be phrased in various ways—in some ways which look fair, and some ways which look unfair. If you consider the whole body of scientific knowledge which has been developed through the centuries, which is open and yet enabled people to take out patents, one might say from one point of view that it is somewhat unfair. But, on the other hand, as a matter of public policy, we have realized from the beginning of this Republic that it was necessary to give that kind of incentive to inventive genius.

So, I would say, let them have patents, but in such a way that they could not get a monopoly, and they would have to give licenses under a fair royalty return. People have gotten rich on patents, and people have gone to the poorhouse on patents, in the course of years.

Representative HOLIFIELD. Without getting into the whole philosophy of patents, which I realize is a part of our economy, and necessarily so, the patents in the automobile industry and other industries were in the majority of cases built upon individual risk capital and individual experimentation, and not built upon an expenditure of many billions of dollars of the taxpayers' money in that particular field.

Now, we have a unique situation here, and we have a new industry, an industry that has been brought into fruition and brought to a high state of development by the expenditure of tax money. So, we are in a different position than Henry Ford was in at the time he was experimenting in his backyard garage, with his own funds and his own tools and so forth.

It is true that he drew from general knowledge and certain scientific theories of the internal-combustion engine, but we are in a different position today. We have expended billions of dollars bringing this new industry up to the point where it is; and now shall we, for the investment of a very few millions, allow private industry to stake out patent-right areas based on a continued cooperation from Government funds, and based on this great mass of technological information which was paid for by Government funds?

That is the position the committee finds itself in, in passing legislation.

Dr. RABI. I see your point, sir, but I would like to make this comment, at least from my point of view. Most of these billions which were spent were spent for the national defense and security.

Representative HOLIFIELD. That is true.

Dr. RABI. I think on the whole, we have gotten an excellent return from that, for the national defense and security.

Representative HOLIFIELD. That is true.

Dr. RABI. And it does not seem to me to be reasonable to turn around and say this was spent as a background for the power industry. It is true it was a byproduct.

Representative HOLIFIELD. I have not said that.

Dr. RABI. Just as we have the situation that we spent enormous sums of money during the war in the development of radar for the national defense, and later on these techniques became available for further exploitation by private industry, and patents were taken out based on the knowledge which was acquired through public expenditures at the time of war. The whole subject of communications and techniques involving radar is booming, and is very much in the national interest.

Representative HOLIFIELD. But is it not true that such a patent knowledge which has been developed by Government funds is looked upon as free technical information to everyone? Now, I am certainly not against private industry taking out patents, but I am against letting a few people come into this program when it is on the verge of accomplishment, let us say, and in the last few hours of the day collecting an unreasonable or restrictive benefit over other people. It seems to me that we should draw the line, and put everybody on the line at the same time, and let them go forward; and then such additional inventions as they acquire, let them patent them.

Let us not put a few people in through an interim period and give them an advantage and a special opportunity to stake out private patent equities.

Dr. RABI. Well, sir, would you say, then, that we ought to wait until some future peaceful era comes when we can make all of this entirely public, all of this knowledge which was developed by the Government entirely public, and then have a catch-as-catch-can race as to who can develop the most patents fastest?

Representative HOLIFIELD. No, sir. I would be perfectly willing to go ahead just as we have gone ahead for the last 7 years, with the aid of private industry, paying private industry for its contribution, and not only in terms of paying them dollars but paying them in terms of their national security, which should be just as dear to them as it is to you and to me as an individual.

Dr. RABI. Yes, sir.

Representative HOLIFIELD. And letting them participate as they have in the past, until we get to the point where we have something of practical value to offer to American industry, and then, in consideration of our international obligations, and taking into consideration our national-security problems in a troubled world, make available to all companies at the same time the same amount of information which we could under security regulations.

Dr. RABI. There is no difference between us, except I think we are there right now; and, if not now, the next 6 months or a year. I think we are at the point where we should expect, in the normal course of events, if private capital has the initiative it has shown in the past, for it to enter this field.

Representative HOLIFIELD. Well, of course, that is a question whether they are ready to risk their money or not, or whether they want further Government subsidization, and during that further Government subsidization stake out some private equity interests.

Dr. RABI. I would say to them, "Put up or shut up."

Representative HOLIFIELD. I think this committee will say that to them.

Chairman COLE. Is that not just what the Commission proposes, Dr. Rabi, that they will make this information available to anybody who wants to come in, who has the necessary capital to do so, and who will be ready to comply with the restrictions and regulations?

Dr. RABI. That is my understanding.

Chairman COLE. I have not acquired the conception that there was a thought at any time of the Commission picking out John Doe Co., to be allowed to go into this activity to the exclusion of Jim Brown's company. I thought that anybody who has the money and shows that he has the capacity, and indicates that he is ready to comply with the restrictions, will be welcomed into the program.

Dr. RABI. That was my understanding, too, sir.

Chairman COLE. I am glad to hear, Doctor, that your committee is going to meet this summer to discuss the legal aspects of this proposal.

Dr. RABI. We do not have a lawyer on the committee, you understand.

Chairman COLE. I understand, but you are going to have the benefit of some counsel. I hope that you will make available to the committee any conclusions that you may be able to reach after your discussion of the legal aspects.

Let me also suggest that you indicate to the other members of your committee, since you have spoken not in their behalf but simply on your own, that this committee would welcome any expressions that they may individually care to make to the committee on this subject, and we would be happy to receive their statements.

Dr. RABI. I shall write to them to that effect, sir.

Chairman COLE. If there are no other questions, the meeting will adjourn, and the next meeting will be held Monday afternoon when we will hear the Secretary of Commerce, the Secretary of the Interior, and the Chairman of the Federal Power Commission.

(Whereupon, at 4:20 p. m., Thursday, June 25, 1953, the meeting was adjourned until 2 p. m., Monday, June 29, 1953.)

ATOMIC POWER DEVELOPMENT AND PRIVATE ENTERPRISE

MONDAY, JUNE 29, 1953

CONGRESS OF THE UNITED STATES,
JOINT COMMITTEE ON ATOMIC ENERGY,
Washington, D. C.

The joint committee met at 2 p. m., pursuant to recess, in room P-63 of the Capitol, Hon. W. Sterling Cole (chairman of the joint committee) presiding.

Present: Representative Cole (chairman), presiding, Senator Pastore; Representatives Patterson, Durham, Holifield, and Price.

Professional staff members present: Corbin C. Allardice, executive director; and Wayne P. Brobeck, Francis P. Cotter, Walter A. Hamilton, and J. Kenneth Mansfield of the professional staff of the joint committee.

Chairman COLE. The committee will come to order.

This is a continuation of the series of open hearings exploring the problems involved in setting policy on atomic power development. The Atomic Energy Commission has presented its policy recommendation, and on the following day Mr. LeBaron for the Defense Department and Mr. Smith for the State Department gave us their assurances that privately financed atomic power development and ownership should bring the benefits of competition and stimulation. In general, they seemed to think private industry could do more, if allowed to do so, and that we could benefit both at home and abroad, in peacetime and in wartime, if atomic power can be realized.

Dr. Rabi, chairman of the General Advisory Committee, also told us that in his opinion it is time to start building atomic power plants on a businesslike basis.

Today we have invited three additional Federal spokesmen to give us their opinions and views before we start hearing from industry representatives on Wednesday of this week. The Departments of Commerce and Interior have much to do both with formulation and execution of policy regarding regulation and development of power economy and our resources.

Even though there is a special agency to deal with atomic energy, it is the hope of everyone that as the peacetime side of the atom is developed it can be integrated more and more completely into our normal way of living in this country.

By the same token, regulation of the generation of electric power is the function of the Federal Power Commission. We have heard over and over again that atomically generated electricity looks no different to a light bulb or a pump than electricity from coal or oil-fired boilers. But there are some special problems which will confront the Federal

Power Commission when atomic power becomes a reality. We feel that we should start exploring these problems now.

From the experience of all three of these Federal agencies and departments, there may be many parallels to be drawn which will be of benefit in studying and understanding the problems which we may face in atomic power development.

The first witness to be heard today is the Secretary of the Interior, Mr. Douglas McKay.

Mr. McKay, will you come to the table and make yourself comfortable? If you have a formal statement we would be pleased to hear it, or you may proceed in any fashion you wish.

STATEMENT OF HON. DOUGLAS MCKAY, SECRETARY OF THE INTERIOR

Secretary MCKAY. Mr. Chairman, I think I had best read a paragraph from a letter which I addressed to Mr. Jones, executive officer to the President, in response to a letter from him a short time ago.

The Department of the Interior has considered the proposed legislation as far as it could within the very limited time available, and with an understanding that every precaution would be exercised to maintain national security, concurs generally with the stated objectives of the proposed bill. We have not had opportunity to consider carefully the manner in which these objectives could be best accomplished. Furthermore, because of lack of technical and economic information, we are unprepared at this time to comment upon the implications of the bill in terms of its precise impact upon aspects of the national welfare as to which this Department has heavy responsibilities. We plan to explore with the Atomic Energy Commission such matters as the need for protecting fish and wildlife resources, the relationship of the proposed atomic program to the use of other sources of energy, and the effect of such a program upon the utilization of land and water resources generally.

I recognize it is not a very accurate statement, but I am a little at a loss to know much more about it than that. I would be glad to try to answer any questions that you may wish to ask me.

Chairman COLE. Well, is it the feeling of the Department of Interior that it presently has a special interest in the adaptation of atomic energy to the creation of industrial power?

Secretary MCKAY. Yes, definitely. Because we are in the distribution business as to hydro, of course, in many parts of the country; and also, energy in various forms is one of the greatest problems confronting industry today. So we feel definitely that we would be vitally interested in the development of such a program.

Chairman COLE. Has your Department made any particular study of the power policy declared by the Commission with respect to what effect it might have upon the Department, what participation might be expected from the Department in the future, in case a program of industrial power from atomic energy is inaugurated?

Secretary MCKAY. Well, not particularly, sir. We have not had the information available with which to make a study on it. In a general way we have considered it, of course.

Chairman COLE. Then you are not now, at least, in a position to indicate what your position would be with respect to the distribution of any electric power that might be generated from an atomic reactor, whether it should be tied in with your waterpower systems, or whether it could be independently operated?

Secretary McKAY. Well, as we see it now, we believe that it might be in both categories. There might be some in some of the existing electrical systems. Furthermore, we feel that if atomic energy becomes useful and economically feasible in the generation of power, private enterprise should be licensed in some way, under the direction of the Atomic Energy Commission, to see that it would be utilized in the interest of the people. We feel it would require a big expansion program and would need the help of everybody to get it going as rapidly as possible.

Chairman COLE. Do you have any official or personal views as to whether industrial power should be sponsored exclusively by the Federal Government, much after the same fashion as the generation of power from our great hydroelectric generating plants; or should private capital be encouraged to move into the atomic field to the exclusion of Government.

Secretary McKAY. Well, I personally do not believe in monopolies either on the part of the Government or on the part of private enterprise. I think private enterprise should be encouraged to move into this field.

Another thing, too: I think it is not only the power companies, but it is industry. Many industrial plants generate their own electricity. So that if this is feasible and a saving in their operation, from which the people will ultimately benefit, I think industry should be encouraged to explore the possibilities and to invest some money in the possibilities.

Senator PASTORE. Mr. McKay, on that point, how would the small user be protected? It is pretty well understood generally that a further exploration or experimentation on the part of private industry can be undertaken only by those very large industries. Now, my personal opinion, like yours, is that private industry ought to be encouraged to the utmost in engaging in these experiments. But then, on the other hand, if we recognize the fact that it is an experiment that can be undertaken only by very large industry, what can we do—or have you any opinion—as to the utilization of this power on the part of small industry?

Secretary McKAY. Well, Mr. Pastore, I believe the Government might do some work, might build a sort of powerplant, perhaps, but I think if atomic energy is to be economically competitive, small business will get the advantage of it if it is distributed through a power company. If that is the going way of distributing it in a particular locality, any savings brought about by atomic energy would be brought about through the savings in energy or at least through stopping rising costs.

Senator PASTORE. The reason why I put that question to you was just for the purpose of getting your opinion on it, Mr. McKay, and not to engage in any debate on it. There have been some observations made here that possibly industry in and of itself might not apply the proper initiative to this effort, unless it was given some rights to the patents or licenses. Now, that being the case, if we got into that field, would that not automatically exclude the small industry?

Secretary McKAY. Well, it is not my understanding from this bill that there would be any exclusive patent. There would be an exclusive

license, of course, to those who have applied and qualified, which must be guarded by the Commission in order to safeguard the public interest. But I would not think you would wish to issue an exclusive patent to any special group, because this is a program developed by the Federal Government with taxpayers' money, and I think any benefits which come by a peacetime operation should be given freely under the proper supervision to those who qualify.

Senator PASTORE. Am I fair in stating that it is your opinion that if Government money is used in any way, shape, or form in conjunction with a private industry endeavor in order to further experiment, anything which results from that experimentation, while there has been participation on the part of private industry, becomes the common property of all?

Secretary MCKAY. That is my opinion.

One other thing I might add, Governor, is: Suppose the Atomic Energy Commission were to build a sort of pilot plant on this in a locality where the Department of the Interior is distributing electrical energy. We might possibly take over the distribution. I think in a thing like that, where all people's money goes into the development, it should be spread over as wide a field as possible to give as many people as possible the advantage of it. It is a little different when private capital has a patent on something.

Senator PASTORE. Incidentally, let me say it is the first time I have seen you since the Governors' Conference in 1950, and I am very happy to see you again.

Secretary MCKAY. Very happy to see you, sir.

Chairman COLE. May I say that we are very happy to provide a stage on which you two old friends can renew acquaintanceships.

Mr. Secretary, can you see any parallel with respect to the Federal aspects in connection with the public sponsorship approach versus the private sponsorship approach to the development of atomic power, any parallel between the Federal sponsorship of hydroelectric power and Federal sponsorship of atomic power, having in mind that the hydroelectric approach was predicated upon the national interest in conservation, in flood control, and the harnessing of waters that are collected from a variety of State jurisdictions, and upon transportation, water navigation? Do those provide parallels which can be applied to the atomic problem, where conservation of our natural resources is not involved, where navigation is not involved, where flood control is not involved?

Secretary MCKAY. Well, I think the parallel case, in my own opinion, is that in each instance there is room for private enterprise in municipalities, public utility districts, and so on, and the Federal Government, working hand in hand. Because, as I said before, the subject is so big, and it would require, I think, the combined efforts of everyone.

I feel the same way about hydro development. There should not be any roadblocks put in the way of anyone that has a part to play in the overall program.

I think this also applies somewhat to the synthetic-rubber program developed in World War II. The Government spent many millions of dollars in the war emergency, and the various rubber companies were allowed the benefit of that experimentation to better their merchandise to the public.

Chairman COLE. In response to a question from Senator Pastore, you indicated your feeling that any technological improvements which might result from joint Federal-private cooperation should become the property of the public.

Secretary MCKAY. Yes, sir; the same as though those improvements were discovered under Federal auspices exclusively.

Chairman COLE. I am wondering to what point you would carry that. Assume that private capital is ready to take a chance on this, but requires that it have the opportunity of using national laboratories in order to test out some particular concept or idea. Would you feel that simply the fact that the private entrepreneur had used Government laboratories to prove out or to test his device would be such as to give the Federal Government the right of full ownership of that device?

Secretary MCKAY. No; I think that the Federal Government should encourage the use of their laboratories. I don't know whether it would be possible for them to actually use them, but at least the results of their experiments in private enterprise would better enable them to deliver to the public the results of that experimentation. I think there should be cooperation between the Government and private enterprise.

Chairman COLE. Well, if there is to be a sharing of ownership in patents or devices that flow from Federal-private operations, should not the degree of that ownership be determined somewhat by the degree of Federal participation?

Secretary MCKAY. Oh, yes. The Federal Government's rights must be protected. But I don't believe that this should be in the form of a monopoly. I believe that this is for the good of all the people, and I don't think it should be on an exclusive basis to any group.

Chairman COLE. Well, as it is now, you realize it is a complete monopoly.

Secretary MCKAY. Yes; of the Federal Government.

Chairman COLE. And when you say you feel it should not be a monopoly, I assume you mean that it should be neither a Federal monopoly, in the power development aspect, nor a complete private monopoly as to any one industry or group of industries or cartel of industries.

Secretary MCKAY. That is right.

Chairman COLE. That the field should be broadened as wide as our national security requirements will permit in order to arouse interest and participation by private capital, by municipal capital, irrespective of where it may be?

Secretary MCKAY. Yes, sir. I agree with that philosophy.

Chairman COLE. That covers any questions I have in mind.

Mr. Holifield?

Representative HOLIFIELD. Mr. Secretary, I unfortunately was a little late in getting here and did not hear your opening statement, but I would like to explore this subject of patents. Have you read section 11, entitled "Patents and Inventions," of the Atomic Energy Act of 1946, as amended?

Secretary MCKAY. Is that this bill? Or the law?

Representative HOLIFIELD. No, this is the law.

Secretary MCKAY. No, I haven't.

Representative HOLIFIELD. Well, referring to page 23, paragraph lettered (c), "Nonmilitary utilization," this provides that if industries do obtain patents, and the patents are granted on a secret basis and on a basis of certain restrictions, the Government shall have the use of these patents, and so forth, and these people who obtain the patents shall be given reasonable compensation. Now, you will notice about halfway down the page it states:

The owner of the patent shall be entitled to a reasonable royalty fee for any use of an invention or discovery licensed by this subsection. Such royalty fee may be agreed upon by such owner and the licensee, or in the absence of such agreement shall be determined by the Commission.

Now, under the present setup, private industry can go ahead and continue during this interim period of, let us say, for example, 3 to 5 years, before we obtain an efficient, economically competitive reactor, assuming that will be done, and a great many people think it will be done within, say, from 3 to 10 years, and if they do come forward as a result of their interest and their investment in research, they are now protected by the basic act in that they can have patent rights under certain conditions and receive a reasonable payment for them. Now, as I understand it, your testimony is not to change that. You certainly would be in favor of that provision as it exists. But you would not want to give them a restrictive patent right. In other words, if they obtain patents, those patents shall be available to the rest of industry, if they are on a nonmilitary basis, on a reasonable basis, but they shall not have restrictive rights whereby they can deny the use of any patent procedure to the rest of the American economy. Is that, in effect, your position?

Secretary MCKAY. Yes, sir, that is my opinion. I believe that if we are going to get peacetime good out of this atomic energy development we are going to have to see that it is not limited to certain groups, and that it is not inclusive for any one group.

Representative HOLIFIELD. I think that is the intent of the act. Because the act plainly says that when the industrial application becomes practical it shall be made available under licenses of the Commission, so as to strengthen competition and to avoid restrictive procedures or monopoly procedures. That is one of the basic purposes of the act as it now exists. And certainly none of us have any objection to that.

Secretary MCKAY. No, none whatever.

Representative HOLIFIELD. Do you think that the production of atomic energy to its present state is comparable to the production of hydroelectric energy?

Secretary MCKAY. Well, I have no way of knowing, because I do not know the cost of the kilowatts.

Representative HOLIFIELD. I was speaking of the processes by which atomic development has been brought about. It has been brought about exclusively by Government investment. Hydroelectric power was not brought about exclusively by Government investment. In fact, most of the investment in hydroelectric power was done on a private basis. So we are faced with a different situation here than we are in the hydroelectric field. We cannot compare the origination or the development of this new source of energy to the electrical industry, because in the atomic instance it has been completely by Government funds, taxpayers' funds, and in the other instance it was

partly taxpayers' funds, along with a great deal of investment on the part of private industry and the using of private patents on motors and dynamos and turbines and all that sort of thing. So it is not, strictly speaking, a comparable situation.

Secretary MCKAY. No, that is correct. But, on the other hand, I think the Government has invested its money in the development of atomic energy, which apparently is going to be to the ultimate good of the civilian population. I would dislike to see the Government restrict it so that the people could not get the full benefit of it.

Representative HOLIFIELD. I think every member of the committee will agree with you on that.

That is all, Mr. Chairman.

Chairman COLE. Mr. Secretary, do you see anything in the supply of uranium, upon which any power program for industrial use must be predicated as far as we presently know, which would justify placing in the category of a natural resource, uranium ore in the same fashion that water in some areas is placed under Federal control, or forests are placed under Federal control? Or do you consider uranium in that respect as simply another ore, another metal, which should stand on its own the same as any other of our natural resources? In other words, do you feel that there is anything about the uranium ore existing in this country that requires that it be subject to Federal control, under the same arguments and philosophy that provide Federal control over our forests and some of our water resources?

Secretary MCKAY. I hardly know. Because my information on uranium and atomic energy is very limited. However, it seems to me that the Atomic Energy Commission would have control similar to what the Federal Power Commission has in the way of control over the granting of franchises for the building of dams for hydro. But it may be possible that uranium would come under that category later on, and I have no way of knowing.

Chairman COLE. Of course, there certainly should be control of uranium from the standpoint of our national security. Everybody agrees there should be that control. But do you see anything in the future of industrial nuclear power, so far as you now can see that picture, which would prompt you to urge that the Government control uranium from the standpoint of its being a natural resource?

Secretary MCKAY. Well, just as an offhand guess, I would think that the Atomic Energy Commission is now doing that very thing. I would dislike to see it taken away from them. I think it should remain there to be controlled.

Chairman COLE. Then is it correct that the intent of your testimony today is that the Department of the Interior, although it is mindful of the potential of industrial power from nuclear energy, feels that private enterprise should be encouraged to participate in the development of that field under provisions of law which will at all times protect the national-security interests and the public interests to the end that there should be no monopoly, either of Government or of private capital in the field?

Secretary MCKAY. That is correct.

Chairman COLE. And that the Department of the Interior for the time being at least is willing to rely upon the judgment of the Atomic Energy Commission to protect the Federal interest in this problem?

Secretary McKAY. Yes, sir. I think they are the best qualified of any Government agency to handle it at this time.

Chairman COLE. If there is nothing further, Mr. McKay, we thank you very much for taking the time to come down here with us.

Secretary McKAY. Thank you very much.

Chairman COLE. The next witness, who was to appear in behalf of the Department of Commerce, was Secretary Weeks. Mr. Weeks is unable to attend, and Mr. Williams, the Under Secretary of Commerce, is here as the representative of the Department.

Do you have a statement, Mr. Williams?

STATEMENT OF HON. WALTER WILLIAMS, UNDER SECRETARY OF COMMERCE

Mr. WILLIAMS. Mr. Chairman and members of the committee, I should like to say first that my associate, the Secretary of Commerce, Sinclair Weeks, expressed his keen regret that he could not be here, but matters coming up the latter part of last week which he could not control prevented him. Actually, however, I am not so sure but what it may be just as well, for the reason that he will be very glad to come back later on, and, inasmuch as our statement today is more or less a springboard, you might call it, for discussion, with the findings and our actions to come a little later on, I think perhaps his appearance later on may be more effective even than at the present time.

The Department of Commerce is vitally interested in the subject of application of atomic energy for industrial purposes. Atomic energy, within which term we include for present purposes source and fissionable materials, the major production facilities, and possibly to some extent the processes themselves, is in a real sense a national treasure of inestimable value. This treasure should be used from the start in the interest of all the people and on an equitable basis for the benefit of our entire economic community. It should be developed by private enterprise so far as practicable and feasible.

We strongly support the sound objective of promptly expanding the availability of atomic power to industry. The establishment of a close partnership between Government and business respecting this subject is indispensable both to our national security and to the continued development of our economy. The possibilities of atomic power in industry are vast, even though not clearly now predictable. Atomic energy will mean for American industry eventual expansion of productive capacity and reduction of production costs.

In 1900 our annual energy supply from mineral fuels and water-power was 7,893 trillion B. t. u. In 1950 it was 38,600 trillion B. t. u. This indicates the magnitude of our power and energy consumption even with conventional sources of energy production.

The introduction of atomic power in industry, which the testimony of the Atomic Energy Commission indicates may well become practical within a period of not more than 10 years, will result in an expansion of both power capacity and power utilization. The various atomic-power installations will doubtless take many forms, for example, the submarine, marine, or even airplane-motive unit on the one hand and the massive electric-generating plant on the other. The exploration and determination of practical uses in the economic field will be of greatest importance to the Nation during the next few years. We

are prepared to cooperate in such process to the fullest extent necessary to fulfill our responsibilities concerning business and commerce.

The implication of atomic-energy development on the economic structure of the Nation, including revenue-return aspects, definitely falls within the province and responsibility of the Commerce Department. Assuming the removal of present barriers to appropriate utilization of nuclear reactors and related materials and processes by private industry, there are five particular aspects of special concern to us as we now see the problem from the business point of view:

1. What measures can and should this Department presently undertake to assist the Atomic Energy Commission and other interested branches of the Government to explain and otherwise promote the sound utilization by industry of atomic power, marshaling the full resources of private initiative and private investment behind this development?

2. What will be the impact of commercial atomic-energy installations by industry on existing competitive business relationships?

3. What, if any, additional controls or stabilizing machinery, from an economic point of view, should be considered to avoid disruptive or unstabilizing effects during the transition from conventional power to atomic-power conditions?

4. What, if, any measures should be taken by the administrative agencies or the Congress, or both, to assure the equitable distribution of benefits to all classes, types, and areas of business?

5. What, if any, revenue or similar measures should be considered in this connection in application of sound economy within industry and of the budgetary principles of the administration?

We are glad to note the fine cooperative relationship existing between the Atomic Energy Commission and industry in working out problems of experimentation, development, and organization, in connection with production and related aspects of industrial use of atomic energy. This Department expects to be called upon to cooperate with industry in somewhat parallel manner, to the extent found appropriate by the administration and by Congress, in development of an aggressive attack on the type of economic problem we have mentioned. In our opinion it is essential that this kind of thinking and planning on a fully cooperative basis proceed contemporaneously with the scientific and technical work already so well advanced, in full protection of the public interest.

The time is ripe to marshal the full resources of private initiative and private investment behind practical industrial development of atomic power. Under the law as it has been written, great progress has been made. However, the experience of many seems to indicate that some legislative changes are now necessary to afford the full benefits of the private-enterprise system in securing American leadership in the civilian application of atomic power.

This Department has already set in motion an authoritative exploration of those aspects of this subject affecting business and commerce, over and above the economic provisions already contained in the law. Our exploration will, of course, be coordinated with those of other interested branches of Government as well as with business. It will be timed to accord with technical advancement toward full competitive use of atomic power in industry.

Any plan for the utilization of atomic power by industry should give special attention to the respective needs and interests of the different types and classes of business. At an early date we firmly intend to devise a plan or plans for the fullest possible utilization of atomic power by the different types and classes of business and we are continuously studying that matter. To the extent technically practicable, these benefits should be made available on a nondiscriminatory basis, to both large and small business, and to all geographical regions of our Nation as when needed. Careful study and planning from the economic point of view are in our opinion required to make effective the sound objective of expanded industrial use and full-scale peacetime development of atomic energy, so well stated in the policy provision of the Atomic Energy Act of 1946 as follows:

* * * it is declared to be the policy of the people of the United States that, subject at all times to the paramount objective of assuring the common defense and security, the development and utilization of atomic energy shall, so far as practicable, be directed toward improving the public welfare, increasing the standard of living, strengthening free competition in private enterprise, and promoting world peace.

This Department is prepared to do its full part in making this objective a reality, and believes the success of this whole venture a vital factor in America's future.

Chairman COLE. Thank you, Mr. Williams.

Are there any questions of Mr. Williams?

Senator PASTORE. No. All I wanted to say is that I think in very fair language you present the problem that really confronts us. And I await with eagerness and anxiety the presentation that you will make later on as to how this should be done. I think it is the \$64 question.

Mr. WILLIAMS. There may be more than these five questions we have enumerated, but at least they give some starting points from which to work.

Representative HOLIFIELD. Mr. Chairman?

Chairman COLE. Mr. Holifield.

Mr. HOLIFIELD. Mr. Williams, I think your statement on the face of it is a fair statement. There might be some points in it which need a little clarification. I notice in your objectives Nos. 2 and 3 on page 3, you assume as part of your duties the charge which is given to the Atomic Energy Commission. They are specifically charged by the act to do exactly what you have outlined in 2 and 3. And I assume that in accepting that responsibility, you are accepting it under the general interest of your Department and in full cooperation with their specified and directed legal obligations.

Mr. WILLIAMS. Oh, very definitely. I think I referred throughout to the need for cooperation not only with the Atomic Energy Commission but with other branches of the Government. We would certainly not expect to operate unilaterally.

Representative HOLIFIELD. In other words, your expression of your concern at "the impact of commercial atomic-energy installations by industry on existing competitive business relationships" refers to cooperation on your part and not to superseding the obligations of the AEC to make that same kind of study and to report to the President.

Mr. WILLIAMS. You have stated our feelings on that exactly.

Representative HOLIFIELD. At the bottom of the page, page 3, you say:

The time is ripe to marshal the full resources of private initiative and private investment behind practical industrial development of atomic power.

I think we can agree that at all times we want to use the full resources of the Nation for the benefit of the Nation. However, as to the timing and as to the price we might have to pay to put private industry into this program on their own, that might be a matter of some debate, as to the timing of it. In other words, if we have to put private industry into this program at this time by making concessions to them by which they can stake out, either through patent rights or excessive amortization or discriminatory participation, certain advantages, selfish advantages, to private groups, then it certainly would not be the time to do it, would it?

Mr. WILLIAMS. No. I think as much as anything else, the psychology of the situation is indicated by that statement. As everyone knows, because it is public information, it apparently will not be too long a time now before we have the realization of our atomic-powered submarine. Now, I suspect that once that becomes a reality, then psychologically, perhaps more than any single event in connection with the development of the peacetime use of atomic energy, we will certainly come to the realization that the atomic power age has arrived. And I think this emphasizes the fact that we are now right here on the threshold, where we want to marshal all of our forces to get the job done as fast as we can and as effectively as we can.

Representative HOLIFIELD. But in coordination with the Atomic Energy Act's objectives and the welfare of the Nation, as you say in the quoted paragraph on page 5.

Mr. WILLIAMS. That is correct.

Representative HOLIFIELD. Now, in the last paragraph on page 4, you say:

To the extent technically practicable, these benefits should be made available on a nondiscriminatory basis, to both large and small business, and to all geographical regions of our Nation as and when needed.

I think that is a very fine statement, and I would just ask you at this time: What do you mean—and this is for clarification only—by the phrase “to the extent technically practicable”? Does that have regard to the security problems, the availability of uranium ore?

Mr. WILLIAMS. Well, it would have, I think, to do with not only the production end of it, but also from the standpoint of distributing factors. I can imagine a good many factors perhaps that would not be practicable in, let us say, the desert areas of Nevada that would be practicable in Chicago. I had in mind among other things the different kinds of conditions which exist in different areas of our country. Maybe I could have used the words “to the extent practicable” and left out the word “technically” and get the broader term. But to the extent that the program and the development can be made practicable, then these benefits should be made available, and so on.

Representative HOLIFIELD. I think that is a fine statement, sir, of your intent in that paragraph.

That is all, Mr. Chairman.

Chairman COLE. Mr. Price?

Representative PRICE. Mr. Williams, your reference to the submarine reactor kind of leads me to detect a little school of thought that we do not have to do any further research on the power question because we are going to have the submarine reactor. Is there any such thought going on?

Mr. WILLIAMS. I don't mean to imply that, sir, no. I simply mentioned the fact that psychologically we will perhaps feel we have arrived. Now, of course, that may be the starting point, because I think it will give impetus to our development. In no sense do I mean that now we have arrived and there is nothing more to do. No; I think the testimony that has been given before this committee up to this point evidences the fact that not only have we made rapid progress, but we have tremendous strides yet to take before we reach the zenith. I suppose that will go on for decades and decades.

Representative PRICE. Do you believe that we acted wisely a short time ago when we gave indication that we were willing to kick out the window several of these reactor programs, CVR for instance?

Mr. WILLIAMS. Well, I don't know as to just what the point is you are raising. But certainly, in this whole development of the atomic energy as well as the atomic-power problems, it has been trial and error, and I suppose there have been discouragements, and there certainly have been lots of differences of opinion.

Representative PRICE. The reason I ask that question is because of your discussion of the atomic submarine reactor. I thought I detected that maybe there was a school of thought that that was all the distance we had to go.

Mr. WILLIAMS. I didn't mean to leave that impression at all.

Representative PRICE. It has been indicated over the last months that some people may think that way.

Mr. WILLIAMS. That certainly is not to be read into my remarks. And, furthermore, I should agree with you very heartily that we should dislike very much to think that the fact that we had developed a submarine powered by atomic energy meant that that was the end of the line. It still becomes very much the beginning of the line.

Representative PRICE. What sort of setup do you have in the Department of Commerce on atomic energy?

Mr. WILLIAMS. Well, we don't have any specially constituted body. We have a small unit there. We have been in the process of reconstituting what was the NPA and hatching something to be known as Business Services Administration; and in connection with that program there are relationships with all, you might say, of the various businesses in certainly the major industries of America. And we have a hard core of people down there who will be prepared to help hatch out a program along these lines and do a job of research. I suspect, just as your committee in these hearings is feeling its way along, we are feeling our way along.

Representative PRICE. Do you have a separate division down there?

Mr. WILLIAMS. Not in the way of a separate division, as such. We have a small unit, a group of men down there who are giving a larger proportion of their time to this particular problem.

Representative PRICE. But when you referred to these specific problems being made, who would be conducting those studies?

Mr. WILLIAMS. Well, coming back to what I said a moment ago, what we have at the moment down there is a starting point. As this

whole program continues, we shall hope and expect to strengthen by added personnel the study unit. At the present time there are just a few men down there.

Representative PRICE. But what sort of background would those men have? Would they have any background in the field of atomic energy?

Mr. WILLIAMS. I am afraid I can't give accurate information by way of answer to that question. I think there is one man down there who I know has had rather direct contact with the atomic energy group; but, just how far he and any of his associates are possessed of a background of technical and scientific knowledge, I am not prepared to answer.

Representative PRICE. The reason I ask that is that there has been reference to various studies going on, and I just wondered who was conducting them and how far advanced they were.

Mr. WILLIAMS. They are not too far advanced. Let me say that. They are just at the threshold of this whole business.

Representative HOLIFIELD. In your paragraph on page 4, where you say the benefits should be made available on a nondiscriminatory basis to both large and small business and to all geographical regions of our Nation as and when needed, you would include in that, I suppose, not only large and small businesses but States and municipalities in case they were interested in the acquisition of atomic-power-producing facilities?

Mr. WILLIAMS. I would think so. Of course, here again I think we are sort of at the threshold of trying to make decisions with respect to circumstances that have not yet arrived. But, so far as we can see the situation now, I would concur with your interpretation.

Representative PRICE. Mr. Williams, in your statement on page 2, you state:

We are prepared to cooperate in such process—
you are talking about the utilization—

to the fullest extent necessary to fulfill our responsibilities concerning business and commerce.

What additional tools would you need to carry on that cooperation?

Mr. WILLIAMS. I think the honest answer to that, Mr. Price, is that we don't know. I think we have to explore that out.

Representative PRICE. Then, actually, you are not prepared to cooperate. You are willing to cooperate.

Mr. WILLIAMS. I think maybe I would be willing to accept that correction; yes. It is an expression of intention and desire.

Representative PRICE. Because you don't have the facilities down there. You do not have a separate division to study the problems of atomic power.

Mr. WILLIAMS. Not as we are constituted presently, no.

Representative DURHAM. It seems to me that in your No. 2, relating to the impact of commercial atomic-energy installations by industry on existing competitive business relationships, you have what would be your major problem in the Department of Commerce. Because, after all, it is primarily concerned with the effect that this would have on business throughout the country.

Mr. WILLIAMS. I think one of our big problems is not to be found so much in being a group of atomic experts ourselves, through the

Department, but rather in trying to put together a competent staff capable of analyzing the disruptions that will be occasioned or will be threatened between and among the different types of energy. That is related, of course, to the technical development, but it is strictly on the economic side. So, of course, I agree with you. I think that is one of the major problems that we have got to wrestle with.

Representative DURHAM. When we talk about a pound of uranium containing $2\frac{1}{2}$ million times the energy contained in a pound of coal, it would bring that problem clearly to mind, would it not?

Mr. WILLIAMS. Or, as someone brought out in the hearings here, the fact that in the year 2000 we are expecting to be using the same amount of energy that was used from the birth of Christ to the year 1860. And there are bound to be many dislocations that we will have to wrestle with and study out answers to.

Representative DURHAM. Well, this is the point as I see it in this patent field of operations. I do not think we have reached anywhere near the end of what is going to exist in patents probably in this field. Because when we have only taken out about 6 percent of the energy, at the present time with all the patents that exist today, that is where we have got to engage in the development of reactors if we expect this thing to ever come to a point where it can be used commercially on a competitive basis. And I think that difference of 90 percent is going to see patent rights flow from somewhere, either the Government or private enterprise, which is going to be enormous, and that is bound to come.

Mr. WILLIAMS. And there are about 40,000 patents being issued every year through the Patent Office, and I suspect a lot of them will come in this field.

Representative HOLIFIELD. Mr. Williams, I suggest before you embark on any program in your Department down there, you study very closely sections 11 (a) and (b) on the utilization of atomic energy. And on the issuing of licenses under the act you will see clearly there the responsibilities of the AEC, and you will be better able to coordinate your own policies.

Mr. WILLIAMS. I have already read those sections, and I am familiar with that.

Chairman COLE. Mr. Williams, in making this study, do you anticipate any difficulty in arriving at a full consideration of the problems without having to go into highly sensitive information?

Mr. WILLIAMS. I couldn't possibly answer that question today, Mr. Cole. I just am not informed at all on that. I wouldn't have any way of knowing what we are going to run into.

Chairman COLE. Well, from the extent of the studies that your people have made so far, have any of them been cleared for sensitive information?

Mr. WILLIAMS. I can't answer that. I think most of the studies thus far have been along the lines of the economic rather than getting into the technical. I don't think we are embroiled in the technical field. It may very well be that the two will intermesh a little later on, but I don't think we have had that problem to deal with yet.

Chairman COLE. I direct your attention to No. 5 of the factors which you feel your Department should concentrate your study on. What did you have in mind when you suggested that it might be necessary to give consideration to special revenue measures?

Mr. WILLIAMS. Perhaps that question can be answered by saying it is something in the nature of a shotgun reply. But I can narrow it to a rifleshot perhaps by drawing an analogy between what this may be, could be, and the St. Lawrence seaway project.

Now, all of the years that that has been before the Congress and the various administrations, it has always been on a noneconomic return basis. Now for the first time it is before us on an economic return basis, a self-liquidating basis.

Now, this is not put in there with any notion that it is to suggest that this must be it. It is simply suggestive of a possibility, another one of the avenues to explore. That is all.

Chairman COLE. What kind of measures do you think might be applied?

Mr. WILLIAMS. Well, it is conceivably possible that some facet of this whole program might be leased, and if it were leased it might then be on a royalty or revenue basis. I suppose that at any one of the stages all the way down the line from the very inception, even from the mining stage on down, there might be possibly, as a result of careful studies, steps at any one of which you might consider it would be in order for the Government, if it is on the owning end of this, to make a charge to the State or city, as was pointed out a little while ago, or the private enterprise unit, as the case might be, for the use of that particular benefit. There is nothing spelled out there. I want that made plain. This is merely stating the problem and stating a potential field that might be studied.

Chairman COLE. Then you did not anticipate that you might be justified in establishing a special tax law which would provide revenue as revenue, for the Government; but rather that in the exercise of general laws there might be required appropriate adjustments?

Mr. WILLIAMS. Yes. That is the interpretation we place on it.

Chairman COLE. Not for the purpose of simply raising money for Government purposes?

Mr. WILLIAMS. No. That wasn't the thought. In fact, I suppose it could be just a little further elaboration of the present act of 1946, because at one stage there it says the Government may license or sell—I have forgotten just what the words are—with or without compensation, that is, "With or without charge." You see, that thought has already been registered. We are simply lifting that in a sense and putting it in here as one other field that might well be studied.

Chairman COLE. That might well be used to protect the public interest in this field?

Mr. WILLIAMS. And to provide revenue.

Chairman COLE. And not primarily as a source of revenue.

Mr. WILLIAMS. Well, not from the standpoint that you interpreted a little while ago. It could be a source of revenue in that the Government was deriving compensation for something it had to lease out.

Chairman COLE. I think you might have in mind something like the oil leases today on Government-owned lands.

Mr. WILLIAMS. That would be an example; yes. I think your project on the St. Lawrence seaway might come closer. But that was simply to point up something that might require examination.

Chairman COLE. You have set up five very penetrating and very pertinent points. Now, I am curious to know just how soon you can provide the answers to them.

Mr. WILLIAMS. I didn't bring my crystal ball along, and all I can say in answer to that, Mr. Chairman, is that I think all of those who are identified with the Commerce Department are anxious to do our share as well as we possibly can in helping to speed the day when American citizens can derive the maximum benefits from atomic power development. And so far as I am personally concerned, I am anxious that we give as much impetus as we can to the program in Commerce so that Commerce will do its full share of speeding the day.

Senator PASTORE. Coming back to what Mr. Price asked you, do you think you are adequately staffed to do that?

Mr. WILLIAMS. Definitely not today. And I do not know what the answer to that will be, other than that we have got to feel our way along and try to develop whatever staff seems to be justified by what we run into.

Senator PASTORE. Have any attempts been made to bring about that adequacy in personnel?

Mr. WILLIAMS. Not excepting in a very feeble way. I think one of the values, as a matter of fact, of this whole hearing is in the fact that it focuses up to the different departments and other branches of Government, those directly interested, the fact that here is another very important program to pay heed to.

Senator PASTORE. Of course, the only trouble there is that we are going to fall into a vacuum if all we do is point it up without doing anything about it.

Mr. WILLIAMS. I meant to convey the impression, Senator, that the very fact that it has been focused to the attention of the public and to our attention makes it stand out now as a program that has become a must item in our Department to get a job done.

Senator PASTORE. What is remarkable is that you do take the position, and rightfully so, in my opinion, that the Department of Commerce is going to be a very integral part of these studies and this development. And yet as far as I have been able to observe from what you have said, you are not adequately staffed to do that.

Mr. WILLIAMS. We are not at the present time.

Senator PASTORE. When do you expect to be so staffed?

Mr. WILLIAMS. It depends upon what Congress does, of course, with our budget. But I think we must learn to walk before we run, and I think I can only say we are barely started at the present time, and as we get along we will try to do what we can to get our organization going properly.

Senator PASTORE. As I said before, you have posed to us the \$64 question. And you must provide the answers.

Representative DURHAM. This is the first time, I believe, since 1946 that the Department of Commerce has been asked to comment on this question.

Mr. WILLIAMS. As far as I am concerned, this is the first time. I have not been here that long.

Chairman COLE. Even if you were adequately staffed with technical people, would you be able to provide more than a best guess as to the answers to these five questions, at the beginning of a period such as this?

Mr. WILLIAMS. Oh, I doubt it. Because I believe everybody is doing a "best guessing" job in whatever field they are in at the present moment.

Chairman COLE. And the answers to your five factors can be found only as experience unfolds and as this program develops, and whatever you might recommend now or at the conclusion of your initial studies should be expected to be modified as time and experience move along.

Mr. WILLIAMS. That is exactly right.

Chairman COLE. Do you feel, in order that we may have some target date in mind to anticipate the answers to your five questions, that you might be in a position to present a reasonably sound recommendation on those points some time early next year?

Mr. WILLIAMS. Well, we certainly could give a progress report. I don't suppose we could give any more than that then.

Chairman COLE. Can you indicate now as to whether it would be a helpful progress report?

Mr. WILLIAMS. Well, I happened to graduate in chemical engineering, and I have learned by that training that you cannot predict the outcome of a chemical experiment until you have reached the end of it. Perhaps as you get going on it, you can make some statements as to what the conclusion is going to be. But I think, applying that statement here, about all we can do is draw upon the very best information that we can get from Government agencies and from private agencies and then move along step by step getting our conclusions reached as fast as we can. And then, of course, we know that when we reach those conclusions, new experience is going to cause us to go forward beyond that stage. So I don't know how it would be possible, Mr. Chairman, at the moment, to say more than that we want to get the program set up beyond its initial stage, which characterizes it now. We want then to move forward and be prepared to give just as helpful a progress report as possible early next year, as you suggested.

Chairman COLE. What I am trying to learn is your present intention. Is it your intention to concentrate on a study of these problems as far as your Department is concerned, or are you going to rock along until the Congress may forcibly require you to do it, to make the studies?

Mr. WILLIAMS. Well, the question was asked a little while ago, or the comment was made, I believe, by Mr. Durham, that as far as he knew this was the first time since 1946 that the Department of Commerce has been brought before this committee. That would probably answer the question, then, as to what Commerce has been doing with respect to direct relationship with this on this program. Now we have made the start, and it is my very deep conviction personally that this is one of the most important things the Department of Commerce could sink its teeth into. Because the atomic age, and the atomic power age are certainly here, or practically here, and everyone of us knows that the implications, the effects, upon our economy, are going to be terrific. Then, of course, it just reposes itself as one of the major problems I think we should address ourselves to down there.

Chairman COLE. I am very glad to hear you express those sentiments, which indicate a determination to put your teeth into the problem and to chew it as rapidly as possible.

Representative DURHAM. I might add to that that it shows very clearly the wisdom of the selection of chemical engineers for this type of job.

Chairman COLE. Are you in a position to speak for the Department with respect to its endorsement of the power policy and description of legislative requirements made by the Atomic Energy Commission?

Mr. WILLIAMS. No, sir, I am not prepared to.

Chairman COLE. That power policy and the recommendations of a general nature were not submitted to the Department of Commerce for comment?

Mr. WILLIAMS. I think not. They haven't been brought to my attention.

I understand from the counsel that they have been submitted, but we have not had the opportunity yet to prepare replies.

Chairman COLE. I am not speaking of the proposed draft of legislation. I am speaking of the description of the legislative requirements which might be necessary to carry out the Commission's power policy.

Mr. WILLIAMS. We apparently have not been asked for specific comments on that.

Chairman COLE. Very well. If there are no further questions, Mr. Williams, you may be excused.

We thank you very, very much for coming down to be with us. And we entertain the hope, or at least I do, that when we call upon you again within the next 24 months or sooner, you will be in a position to give us some reasonably accurate answers to those very fine 5 goals you have set yourselves.

Thank you very much.

Mr. WILLIAMS. We will do the best we can. Thank you very much.

Chairman COLE. Our next witness is a representative of the Federal Power Commission, Mr. Dale Doty, who himself is a member of the Commission.

Mr. Doty, we are glad to see you here this afternoon. We hope that you can give us some encouragement as well as enlightenment on the problem that confronts us.

STATEMENT OF HON. DALE E. DOTY, MEMBER, ACCOMPANIED BY FRANCIS L. ADAMS, CHIEF, BUREAU OF POWER; AND HOWARD E. WAHRENBROCK, ASSISTANT GENERAL COUNSEL, BUREAU OF LAW, ALL OF THE FEDERAL POWER COMMISSION

Mr. DOTY. Thank you, Mr. Chairman.

I wish to state at the outset that any views that I may express on behalf of the Commission have not received the usual clearances that are required by the Bureau of the Budget. I am speaking for the Commission in my prepared statement. As to anything that I may be asked after my prepared statement, of course, I will just have to watch myself to be sure that I am expressing their viewpoint.

Mr. Chairman, I am Dale E. Doty, a member of the Federal Power Commission. In response to your letter of June 23, 1953, I have been requested by Chairman Kuykendall to give you a short statement on the views of the Commission on some of the problems incident to the definition of a Federal policy on industrial atomic power development.

I know you will appreciate that the Commission has not had time to undertake a comprehensive study of these problems. However, the Power Commission believes that it has information and experience

with respect to electric utilities and their regulation, the licensing of the development, transmission, and utilization of power from water-power sites, and the administration of such licensing requirements, which may be of value in considering a Federal policy on industrial atomic power development. In seeking to promote the development of electric energy from atomic energy by utilizing the initiative of private and other non-Federal enterprise there is a parallel in the basic ideas embodied in the Federal Water Power Act of 1920 (now pt. I of the Federal Power Act, 16 U. S. C. 791a U. S. C. et seq.) under which non-Federal development of the Nation's waterpower resources has successfully proceeded for a third of a century.

The approach adopted in that act to encourage the development and utilization of the Nation's water-power resources was to provide for the issuance of licenses for limited terms of not to exceed 50 years, and subject to conditions which would encourage private or other non-Federal development, and at the same time assure that the Nation as a whole should share in the benefits which could be derived from that great energy resource.

If the approach to the problem now before you is to be through the method of issuing licenses authorizing the production of electric energy from atomic power it is suggested that legislation should provide that the conditions of such licenses should not be governed solely by standards relating to the use of fissionable materials and the protection of those interests of national defense and security which are particularly associated with the development of atomic power for military purposes.

We believe, as was provided for in the issuance of licenses for hydroelectric development under the Federal Power Act, that provision should also be made in any such legislation for the consideration of private and public interests in the production, transmission, and distribution or utilization of electric power.

If on the other hand, it is decided that the consideration of such interests should be left to existing utility regulatory agencies operating as at present, any legislation with respect to the development of atomic power should be designed to facilitate and not hamper such regulation. Thus under both Federal and State statutes, electric utilities are required to report detailed information and data regarding their finances, facilities, and operations. Under section 311 of the Federal Power Act, for example, this Commission has the responsibility and duty to secure information—

* * * regarding the generation, transmission, distribution, and sale of electric energy, however produced, throughout the United States and its possessions, whether or not otherwise subject to the jurisdiction of the Commission, including the generation, transmission, distribution, and sale of electric energy by any agency, authority, or instrumentality of the United States, or any State or municipality or other political subdivision of a State.

Under this and other provisions of the act the Federal Power Commission collects financial, engineering, and operating information and data which are used by the financial community in marketing, and in investing in, electric utility securities by the industries planning developments dependent upon power supply; and by the Federal Government for national defense and many other purposes in addition to the regulation of utility rates and services.

If such information and data are to be of real utility for these purposes they must include information with respect to production of

electric energy from atomic power sources corresponding to that obtained with respect to production from coal, gas, oil, other fuels, and waterpower. Therefore we feel that in any such legislation under which the development or utilization of atomic power is licensed it should be made clear that the so-called atomic energy licensees which are engaged in the electric utility operations or which supply electric energy for that purpose shall not be exempt from regulation and reporting requirements under otherwise applicable State and Federal statutes. Consideration should also be given to the possibility of conflicts which may arise between the present requirements of such State and Federal regulatory statutes and the security requirements which might be imposed in the legislation authorizing the use of atomic power. In this regard we suggest that the Atomic Energy Commission should be authorized and directed to work out methods and procedure for eliminating such conflicts or accomplishing the essential objectives of the State and Federal regulatory statutes in a manner compatible with the accomplishment of the development of the use of atomic power.

In order to encourage capital investment for atomic power development it would seem to be necessary to issue licenses for terms covering a considerable number of years and correspondingly to enter into long-term contracts for the purchase of fissionable or byproduct material. Protection of the public interest may require limitation on the license term as in the case of licenses issued under the Federal Power Act. On the other hand, we do not believe that it is possible now, or will be possible at any time within the next few years, to fix prices or other terms or conditions which will be equitable over the entire period of a long-term license or contract. We, therefore, suggest that the license and contract conditions should be subject to periodic review and renegotiation, say at intervals of not more than 5 years.

Consideration should also be given to making provision that upon the termination of a license, if the licensee has in its possession structures or materials which can be used only under license, they may be taken over at the net cost to the licensee as provided for in the case of water power projects in section 14 of the Federal Power Act.

In the event it would be considered necessary in order to enforce the provisions of the license that the Government be authorized to take immediate possession of the nuclear reactor and processing facilities where a licensee fails to comply with the provisions of a license, consideration should be given to the problem of continued supply of the electric utility load dependent upon that source of energy. Inasmuch as any termination or severance of a power supply of a public utility may have a direct effect on service to the public it is suggested that provision be made that in the event Government repossession is invoked against a public utility, continuance of the power supply be made by the Government until alternate arrangements can be made. In other words, that the public not be penalized for violation of the license by a utility operator or licensee.

Mr. Chairman, I have with me today the head of our Bureau of Power, Mr. Francis Adams, and Mr. Wahrenbrock, our Assistant Chief Counsel of the Bureau of Law, who can answer any technical questions that I may not have at my fingertips.

Chairman COLE. Thank you very much, Mr. Doty for the very precise statement, in fact, so precise that I am not sure I understand it completely.

Are there any questions the members of the committee wish to ask?

Representative HOLIFIELD. Mr. Chairman, I looked down to see if Senator Pastore wanted to exercise the prerogative of a member of the other body to question first.

Senator PASTORE. I defer to you, sir.

Representative HOLIFIELD. Mr. Doty, I want to say that this presentation here, although only on 21½ sheets of paper, is probably one of the most provocative and most informative statements that has been presented to this committee.

You point out very thoroughly some of the problems which are involved, and in place of giving us a group of generalizations you point out specific points for the committee to consider.

Without commenting on the merits of your suggestions, you at least have given us some direct evidence on some of the problems, just some of the problems that this committee is faced with.

Now it is the opinion of the Federal Power Commission, I suppose, that this production of power, once it has been produced, must of necessity be integrated with existing power policies and power laws throughout the United States?

Mr. DOTY. That is correct, sir; we consider this another source of power like coal and oil and gas.

Representative HOLIFIELD. Regardless of its peculiar origination, it becomes power, and as such it comes under the many laws and many public policies which have already been developed?

Mr. DOTY. We feel that it should.

Representative HOLIFIELD. Let us go behind that point. I do not expect you to be technically qualified, possibly, on some of these questions, but it would be your opinion, would it not, that in the development of this power, so-called, for release at the bus bar, that the investment of the taxpayers of the United States should receive first consideration in seeing that the benefits are applied as widely as possible throughout the Nation?

Mr. DOTY. I would certainly agree with that, speaking for myself, and I believe I can speak for the Commission as a whole on that point.

Representative HOLIFIELD. You would have no objection, of course, to private industry participating in this as long as it did not result in any deletion of those benefits to the people or prohibition of those benefits?

Mr. DOTY. No, sir, I would not. Of course, the Federal Power Act was basically established as a way for private hydroelectric companies to use a Government resource. And under the Federal Power Act a public body, State, municipality, has a preference to secure a license for a particular site if it can show that its plans for the comprehensive development of that area are equal or better than those of the private bodies.

Representative HOLIFIELD. In other words, the city in a locality near the Bonneville Dam, for instance, has a preference in the acquisition of bus-bar power?

Mr. DOTY. I am speaking of construction, Congressman Holifield. Representative HOLIFIELD. Construction?

Mr. DOTY. Construction at a site.

Representative HOLIFIELD. At a site. The Federal Power Commission would endorse the construction at a site of a public body's application?

Mr. DOTY. Project, if it is equal in other respects to the plans presented by the private power company.

Representative HOLIFIELD. But in case no public body wishes to take advantage, it would be open to any private industry?

Mr. DOTY. Yes, or in the discretion of the Commission to submit the matter to Congress with its recommendation.

Representative HOLIFIELD. In setting up power rates for the public to pay, there would be no difference in the consideration of atomic-generated power over hydroelectric or steam-generated power, would there?

Mr. DOTY. No, there would not.

Representative HOLIFIELD. And do you think that all the policies and laws which now apply to our public-power policy as a Nation should apply to this new source of power when it is available?

Mr. DOTY. It is a question of how far the Congress wants to go in that particular respect. Some of the laws of Congress, as far as power is concerned, have preference provisions as far as cooperatives, municipalities, and public bodies are concerned.

Representative HOLIFIELD. That is a matter then for Congress to determine?

Mr. DOTY. It is a question of policy whether they want to incorporate into any legislation on this subject parts of the legislation involved in TVA Act and the Flood Control Act.

Representative HOLIFIELD. But those questions are involved in any change of the law whereby this development would be turned over to private industry?

Mr. DOTY. That is right, in our opinion anyhow.

Representative DURHAM. Your agency, of course, has not come into this field at the present time much except for the hope that in the future something will develop that will be useful. So you will not enter the picture until the power is produced; then you begin your regulatory outline as you have stated here.

Mr. DOTY. We have not been in this field to any great extent, Mr. Durham. We have done work at the request of the Atomic Energy Commission.

Representative DURHAM. You made no study of reactors or anything like that like you do of dam sites or other facilities for producing power?

Mr. DOTY. At the request of the Atomic Energy Commission we have made studies in various areas in the country to determine comparative costs of power.

Representative DURHAM. But not on the design of a reactor, you have not gotten into that picture at all?

Mr. DOTY. No, we have not gotten into that picture at all.

Representative HOLIFIELD. You speak of studies of costs of conventional power?

Mr. DOTY. Costs of conventional power in order to determine what the high-cost areas of the country are. We have a cooperative ar-

arrangement with the Atomic Energy Commission where we make studies at their request.

Representative DURHAM. In making that study now, did you go into the field of the need for a facility of this type, which, of course, can be placed without having to have water and having to have other facilities that do not exist in some of these areas? Did you go into that field as to the areas in the country that needed such facilities?

Mr. DOTY. I wonder if I might ask the Chief of our Bureau of Power if he could answer that question? He could answer it more correctly, Mr. Adams.

Mr. ADAMS. No, sir; we did not go into that question.

Representative DURHAM. Is it contemplated you are going to make any such studies?

Mr. ADAMS. We have, as Commissioner Doty stated, a cooperative arrangement with the Atomic Energy Commission which might possibly lead to such studies, but up to now we have not.

Representative DURHAM. As I look at your field of operation, it is one of the requirements to make such a type of study as to where it is needed in a particular area. Of course, it cannot apply to something like the Hoover Dam, but the transportation of coal to some parts and some areas of the country becomes very expensive. I wondered if you were looking at it from that standpoint.

Mr. DOTY. We have the engineers that could be helpful on such matters.

Representative DURHAM. You have not done it yet?

Mr. DOTY. No.

Representative PATTERSON. Mr. Doty, I notice at the bottom of page 2 you speak of venture capital. Are you also going to take into consideration the geographical location of the licenses in the issuing of these licenses? For instance, there might be one sector of the country where there would be more capital that could be readily used as investment than with respect to another section. How are you going to get around that, or are you just going to issue them strictly on the ability of the investor?

Mr. DOTY. We are not suggesting, Congressman Patterson, that we do this licensing. We feel that we can give the committee assistance from the experience we have had under the Waterpower Act. If the Congress would wish to give us any responsibility under that, that would be a different matter. But we feel that in the 30-year history of the Waterpower Act, and we think it is very similar, since atomic energy is a Government-owned resource, we can suggest matters for consideration which may be helpful.

Of course, in the waterpower field we get applications which are for particular locations. We try to determine what the effect of the full development of that waterpower site is going to be on the whole area, and to require that the plans that are submitted will give the greatest results in comprehensive development of the site. In other words, we would not permit a partial development of a particular electric site.

Representative PATTERSON. Of course, I had in mind your own statement here, these long-term contracts for the purchase of this fissionable matter. One section of the country could tie that up geographically, where some other section would be left entirely out.

Mr. DOTY. That is right; it could. I think it is one of the things that should be given consideration by whatever body issues licenses if it is decided to go on a licensing basis.

Representative PATTERSON. That is right.

Representative HOLIFIELD. Mr. Doty, the Atomic Energy Act requires the Commission to prepare a report to the President stating all the facts with respect to industrial use and impact upon the social, political, economic, and international conditions of our country, when and if these licenses are issued. It also provides supervision by the Congress for those licenses.

Now, in the preparation of that report—which incidentally has not been prepared—I suppose that your Federal Power Commission would probably have available more economic statistics, more quantitative electrical energy producing statistics per region than any other commission in the Government on the subject of power?

Mr. DOTY. That is right. Under section 311 of the Federal Power Act every electric utility is required by law to report to us on various phases of the electric industry.

Representative HOLIFIELD. If the Commission took upon itself the obligation of the act to make such a report, it would be almost necessary for them to come to you for the background of facts in relation to the regions of the United States so that they could make a proper analysis of the impact which cheap atomic power might have on existing investments, would it not?

Mr. DOTY. Yes, sir.

Representative DURHAM. What is the span, would you say, on the cost of the present production of power in the United States; that is, the lowest cost and the highest cost?

Mr. ADAMS. The energy cost from fuel electric plants, which would be comparable to energy production by a nuclear reactor, is the lowest in the Southwest, where natural gas is a relatively cheap fuel.

Representative DURHAM. What does that cost?

Mr. ADAMS. Ranging down to about 3 or 4 mills per kilowatt-hour.

Representative DURHAM. Then up to what? What is the highest?

Mr. ADAMS. The highest costs run up to about 15 mills, possibly higher in small communities.

Representative DURHAM. Do we have some that cost that in the United States—15 mills?

Mr. ADAMS. Yes, sir. These are costs of production that I am speaking of, not cost to the ultimate consumer.

Representative DURHAM. Not cost to the ultimate consumer. What is the span between the consumer costs, the lowest and the highest?

Mr. ADAMS. I do not have those figures. It would depend on the rate schedule to which we were referring, the type of service rendered. But I believe we can make the comparison of atomic power versus conventional sources better from the standpoint of the cost of production.

Representative DURHAM. Can you make such a comparison?

Mr. ADAMS. We have made studies of the cost from conventional sources, but we do not yet know what the cost would be from atomic energy.

Representative DURHAM. What did you base those figures on—information received from the Atomic Energy Commission?

Mr. ADAMS. The figures for conventional sources are based on information the Power Commission has.

Representative DURHAM. You do not have the other information?

Mr. ADAMS. We do not have the other. We have discussed with the Atomic Energy Commission the problem of what are the high-cost power areas and what would be the competition, so to speak, a nuclear reactor would have in terms of conventional costs today; but we do not know, and they are unable to state today, what the costs would be from a nuclear reactor.

Representative DURHAM. Of course, this whole thing is the question of costs when we get down to an atomic-energy-producing reactor. That is why I asked the question on the span between. You say your lowest cost is 3 mills and the highest cost is around 15 mills at the bus bar, not distributed?

Mr. ADAMS. That would be at the generating-plant bus bar; yes, sir.

Representative DURHAM. In other words, the distributing plant?

Mr. ADAMS. Yes, sir.

Representative DURHAM. That is quite a span there.

Mr. ADAMS. Yes, sir; that varies with location. Cost of fuel has a decided effect, the size of a generating plant, the location of the load—of course that affects the delivered costs—but the cost at the generating plant is greatly affected by plant location, fuel costs, size of the plant, labor costs, and so forth.

Representative DURHAM. Is there a pretty sizable percentage of your power that is costing 15 mills at the present time in the United States? Would you hazard a guess as to what percentage is costing that of the overall production of power?

Mr. ADAMS. That would be a very small percentage.

Representative DURHAM. A very small percentage?

Mr. ADAMS. Yes, sir.

Chairman COLE. Where would those areas be located?

Mr. ADAMS. Those areas would be largely in communities or areas that are remote from fuel supply, and transportation costs are high; for instance, northern Maine, the central part of the country, and areas like Nevada. Florida has some relatively high-cost areas, particularly central Florida where fuel oil is the principal source of heat. When you get away from the port areas and have the transportation costs inland, the interior areas of Florida are relatively high-cost areas.

Representative DURHAM. Do you have available the costs at the bus bar for power in some other parts of the world, foreign countries?

Mr. ADAMS. We can work up something from files we have on foreign countries.

Representative DURHAM. Can you supply that for the record?

Mr. ADAMS. Yes, sir.

Representative DURHAM. I think it would be very valuable to the committee in making our study.

Mr. ADAMS. Yes, sir.

Representative HOLIFIELD. With particular reference to European countries, please.

Mr. ADAMS. Yes, sir.

Representative DURHAM. Any countries you have, South America or wherever.

Representative VAN ZANDT. Could we have a memorandum for each member of the committee and also one for the record?

Mr. ADAMS. Yes, sir.

(The information referred to follows:)

FEDERAL POWER COMMISSION MEMORANDUM ON COST OF PRODUCING ELECTRIC POWER IN FOREIGN COUNTRIES

Pursuant to the committee's request during the Federal Power Commission testimony on June 29, 1953, a review has been made of the data in the Bureau of Power files on electric power in foreign countries to determine the extent to which information is available on the cost of producing electric power as compared to costs in the United States. The information in our foreign power files is fairly complete with respect to general plans of other nations to meet existing power shortages, but reliable data on power costs were found to be very limited.

In order to supplement the cost information obtained from the Commission's files, the subject was discussed with various other possible sources which were able to furnish some additional data. These sources included the Mutual Security Administration, World Bank, Export-Import Bank, manufacturers of electric power equipment, American engineering firms handling foreign power projects, the staffs of several embassies, and others.

Viewing the problem as a whole, in the light of the information available from the above sources, it must be stated that, with a few exceptions where detailed costs are available, a discussion of power costs in foreign countries can be presented in only general terms. It is believed, however, that the information presented in the following pages will be sufficient to give the committee some conception of the probable relationship between costs in the United States and those in other countries.

Most of the nations of the world are now engaged in extensive construction programs which will result, in many instances, in doubling or trebling their prewar generating capacities. It is observed from consultation with American engineers connected with some of these projects that the new equipment now being installed is considerably more efficient than similar equipment installed prior to World War II; hence less fuel is required to produce a kilowatt-hour and less operating labor is required per kilowatt of capacity. However, inflationary factors, which are responsible for rising construction, fuel, and operating labor costs, tend to hold the overall costs up. Reports of the operational organizations in many foreign countries contain statements relative to sharp increases in all elements of power costs (construction, operation, fuel, etc.). Most of these reports make specific mention of the necessity of increasing the rates for electric power in order to avoid operating at a loss.

It is extremely difficult to make any direct comparison between the cost of operation of a foreign business enterprise and a similar American enterprise, if for no other reason than the basic differences in financing methods and accounting procedures. Privately-owned utilities in the United States are operated under local, State, and national regulatory bodies that require uniform accounting practises and the reporting of detailed construction and operating cost data on a comparable basis. Most of the foreign data available to us pertain to publicly owned or quasi publicly owned undertakings, which results in a quite different financial structure from the American utility and directly affects the fixed-charge component of power-production costs.

I stated during the course of the hearing that the total cost of producing steam-electric power in the United States, including fixed charges on the capital investment, varied from about 3 mills to 15 mills or more. The average cost would be about 6 to 8 mills with a relatively small percentage of the total generated at the low cost of 3 mills per kilowatt-hour in the Southwest where the fuel, natural gas, has been relatively cheap. At the top of the cost range is found a still smaller percentage of the total power produced in very small and relatively inefficient plants at isolated locations usually distant from fuel supply sources.

During the year 1952, according to reports filed with this Commission, the class A and B privately owned electric utilities in the United States, operating 683 steam-electric generating plants with a total capacity of 53.5 million kilowatts, produced 267.9 billion kilowatt-hours. The actual production costs, operation, and maintenance, including fuel, amounted to 4.57 mills per kilowatt-hour

of which 3.38 mills was the fuel cost. The reported investment in these generating facilities was \$6.5 billion. Assuming an annual fixed charge rate of 11.7 percent¹ on the investment to cover return, depreciation, and taxes, the estimated annual fixed charges will be \$760 million or 2.84 mills per kilowatt-hour generated. Adding the production costs of 4.57 mills and the estimated fixed charges of 2.84 mills gives an estimated average total cost per kilowatt-hour of steam-electric power of 7.41 mills for 1952.

The corresponding kilowatt-hour unit costs for 27 major interconnected power pools generating over 60 percent of the above-mentioned total are as follows:

	<i>Mills</i>
Fuel.....	3.04
Operation and maintenance.....	1.01
Subtotal.....	4.05
Estimated fixed charges.....	2.69
Total estimated cost.....	6.74

The lowest overall total costs for 3 post-war plants utilizing the 3 principal fuels are as follows:

[Mills per kilowatt-hour]

	Coal	Oil	Gas
Fuel.....	1.80	3.77	1.15
Operation and maintenance.....	.46	.60	.25
Subtotal.....	2.26	4.37	1.40
Estimated fixed charge.....	1.63	1.94	1.12
Total estimated cost.....	3.89	6.31	2.52

The corresponding available data for European and other foreign nations are summarized in the following paragraphs.

Great Britain

The annual report of the British Electricity Authority for the year ending March 31, 1952, its 4th year of operation as a state or governmental undertaking, states that 55.8 billion kilowatt-hours (includes a negligible amount of diesel and hydro generation) were generated in its steam-electric plants for the English grid system at an average total cost of 7.72² mills per kilowatt-hour. Of this amount 5.25 mills represented fuel costs, .95 mills the operation and maintenance costs, and 1.56 mills the "other" generating costs which roughly approximates our "fixed charges." It is to be noted that the interest costs are not comparable with our estimated return costs and that for the year reported there is no tax liability for any of the English income taxes. (Federal income taxes are 50 percent of the United States tax item included in estimated fixed charges.)

Irish Free State

The Electric Supply Board of the Irish Free State, in the fiscal year ending March 31, 1950, generated 782 million kilowatt-hours in its steam-electric and hydroelectric plants, totaling 244 megawatts of installed capacity. Steam plants produced 60 percent of this power.

As is the case with many of the foreign nations there is no breakdown between steam and hydroproduction costs. The operating and maintenance costs, including the fuel for steam generation, were reported as 5.90 mills per kilowatt-hour. The unit fuel cost was given as 7.41 mills for steam generation only. We were unable to determine the fixed charges associated with the generating plant investment. Therefore, the 5.90 mills per kilowatt-hour is not a total cost comparable with the above-mentioned United States and British costs.

Belgium, France, Italy, and Spain

No production cost data are available at this time. Some data may be made available at a later date.

¹ Used by the Bureau of Power in power-value calculations. Based on average representative costs as follows: Cost of money, 5 1/4 percent; depreciation (sinking fund), 1.4 percent; taxes (State, local, and Federal), 4.5 percent; insurance, 0.3 percent.

² In this and following examples foreign currency has been converted to the United States dollar on average rates of exchange effective during the period covered.

About 90 percent of Italy's power is produced in their northern hydroelectric plants. New steam and hydroplants are now under construction to cope with a national power shortage. A report on the situation deals at some length with the high construction costs and the cost of money required for financing the construction. Fuel oil for Italy's steam plants is relatively high priced.

Norway and Sweden

Hydroelectric power predominates in both nations where power resources are highly developed. Complete data are not available. Recent reports from Norway indicate that hydroelectric power from two new hydroprojects will be produced and delivered to the Oslo grid system at total costs, including fixed charges, at about 2.1 and 4.2 mills, respectively. These costs are reported as indicative of high and low figures for new Norway hydropower from new plants. The costs of power at the older plants in northern and western Norway are generally lower.

There are no available data on Swedish power production costs.

Denmark

Primarily thermal power—no reported information.

Greece and Turkey

No production cost data. Power generating facilities are being increased in both nations. The estimated investment cost of a modern steam plant under construction in Greece is \$200 to \$225 per kilowatt for a plant of about 40,000-kilowatt capacity. Oil, which is the principal fuel, is reported as costing 55 cents per million B. t. u. in Greece. It is planned to burn lignite which may be available at a considerably lower cost as soon as new mines can be developed.

Union of South Africa

The Electricity Supply Commission, a state project consisting of eight undertakings (according to its 29th annual report covering 1951 operations), produced 7.3 billion kilowatt-hours in its plants, over 99 percent of which was steam generation. The production cost is given as 1.95 mills of which 1.25 mills represented fuel. Coal, in terms of American money, is still cheap in South Africa, being about \$1.25 per ton delivered at the plants. The fixed charges are not available. The Electricity Supply Commission recently borrowed \$30 million at 4 percent from the World Bank to extend its power generating and transmission facilities.

Latin and South American Nations

Modern oil and coal burning stations are being built in Brazil at \$200 to \$275 per kilowatt for medium-size plants. Such costs appear to be typical in these countries. Oil is the principal fuel although coal is available in some areas. The price of fuel oil at this time varies from 15 cents to \$1.06 per million B. t. u., the low price being applicable only in oil-producing areas.

No specific data are available on production costs. However, despite the low fuel costs for some plants the fixed charges on the large investment will probably keep total costs per kilowatt-hour on a relatively high level.

Cuba

No production cost data are available.

The Republic of the Philippines

A new 75,000 kilowatts oil-burning plant is under construction in Manila. Current estimates of the total cost of power, including fixed charges, indicate about 9 mills per kilowatt-hour. Fuel accounts for 6 mills or two-thirds of the total cost. No data are available on the older prewar plants.

Japan

An estimate of the cost of producing 8.4 billion kilowatt-hours in 1952 indicated a total cost of 20 mills per kilowatt-hour. This is a composite cost for hydro and steam power. Production costs including fuel for steam generation are estimated at 18.75 mills per kilowatt-hour and fixed charges at 1.25 mills. Production costs reflect the direct results of inflation. The fixed charges are based on investments made prior to inflation with no adjustments for inflationary factors.

India

No production cost data are available.

Hawaiian Islands

According to its annual report to this Commission for 1952, the Hawaiian Electric Co., Ltd., produced 703 million kilowatt-hours in its two oil-burning plants at a total production cost of 6.17 mills per kilowatt-hour. This is exclusive of fixed charges which on the basis of the estimated United States figure of 11.7 percent would be 4.47 mills giving an estimated total cost of 10.64 mills.

Canada

Hydroelectric power is predominant in Canada, although there is some steam capacity in operation and more under construction. No specific cost data are available. However, it appears that the cost of producing steam-electric power in the new plants will be reasonably close to the corresponding costs for similar new American plants located near the international boundary.

SUMMARY

The results of our studies and of discussions with consulting engineers and others who are well acquainted with the problems of planning, constructing, and operating electric power plants in various parts of the world may be summarized as follows:

(1) The relative cost of constructing electric generating stations, steam or hydro, is generally higher per kilowatt of capacity in Europe and other nations than in the United States.

(2) Annual fixed charges on the investment in power facilities vary widely throughout the world.

(3) Despite the wide range in fixed charges, they are not, in general, the controlling factor in the cost of steam power generation. Fuel cost is the major item in most countries that are dependent in whole or part on fuel-produced power.

(4) Except for a few outstanding examples, such as 15-cent oil in Mexico and \$1.25 coal in South Africa, fuel costs in foreign countries are generally higher than in the United States.

(5) Regardless of low wage scales, the total labor costs for operation of powerplants in foreign countries are at least as high as in the United States, and in many instances they are higher.

(6) Plant maintenance costs are usually higher in most of the foreign nations than in the United States.

Representative HOLIFIELD. Mr. Doty, I notice in your presentation, you noted on the first page that the Federal Power Act encourages development and utilization with issuance of licenses for terms of not to exceed 50 years.

And on your second page you say if we are to encourage investment of capital for the development of atomic power, it would be necessary to issue licenses for terms of considerable number of years, long-term contracts. You further specify that you think they should be subject to review and negotiation at intervals of 5 years.

Now, in order to issue long-term contracts such as you contemplate there, would it not be necessary for the Government to take quite a risk in negotiating contracts, say, for 30 or 40 or 50 years in a completely new industry where the cost factors are yet unknown and where inventive genius and development is rapidly progressing, and which might make today's contract, which might appear to be good today, null and void within a very short length of time. Is it because of that possibility and probability that you suggest review and negotiations be included in the contract every 5-year period?

Mr. Dory. That is right.

Representative HOLIFIELD. In other words, there would not be the background of knowledge of costs which you have in the hydroelectric or steam generating power industry, and therefore, as the Government would be embarking on a completely new field, it would be necessary for it to advance cautiously and protect the interests of the people by having renegotiation clauses and cancellation clauses and all that sort of thing in their contracts?

Mr. DOTY. Yes. The elements of cost in the hydroelectric projects are pretty well determined. We had 30 to 40 years of experience before the Federal Water Power Act was finally passed in 1920, where the issues were pretty thoroughly thrashed out in the Congress and in other forums; so they are understood.

Representative PATTERSON. You would never hope to estimate the price in comparison with waterpower. This is a business you have never gone into or know nothing about. It is a conjecture on your part.

Mr. DOTY. Yes.

Representative PATTERSON. How could you arrive at an estimation?

Mr. DOTY. For an atomic energy—

Representative PATTERSON. For atomic energy.

Mr. DOTY. That is why I suggest it be limited to 5 years so it can be reviewed in light of experience at that time, at the end of 5 years, to see if the costs that are being charged are reasonable.

I just had called to my attention that the Bonneville Act has a similar provision for a 5-year review.

Representative HOLIFIELD. Mr. Doty, you also bring up the point of continuation of the fuel supply to private industry. How could the Government guarantee a continuation of fuel supply in the light of the fact that this fuel happens to also be the core of many of our weapons, our new marvel weapons, and there might be at any time in the future a need for that material for weapons? It is quite different from water and coal and oil, which are in comparative abundance. The Government is faced also with that problem in the supplying of fuel to the civilian-type reactors.

Mr. DOTY. I think that would create a problem, but I do not think it is too difficult a one. Under the Federal Power Act, if a project is necessary for Government use, my understanding is it can be taken over by the Government and arrangements made to continue the operation of the facility, but under Government operation rather than private. You might have a cutting down of service, but the way is created under the Federal Water Power Act to have Government control and to have it work in the Government interest in time of emergency.

Representative HOLIFIELD. In other words, you would advocate a recapture clause similar to our sale of war inventory plants so that the Government could step in and take over not only the power, but, if necessary, curtail the operation of the plant and use the material?

Mr. DOTY. The Water Power Act has a provision in it where at the end of 50 years the President—the power is not in the Federal Power Commission, but with the President, the President can recapture a project.

Representative HOLIFIELD. At the end of 50 years?

Mr. DOTY. At the end of 50 years. It is also my understanding that during the term of a license permit that he can recapture it. It was

only done in one case, and that was the Grand River Dam project out in Oklahoma where there were difficulties during the last war in contractual arrangements, and the President took it over under the clause in our Water Power Act. It was run, I believe, by the Army during the war until the problems got straightened out.

Representative HOLIFIELD. Of course, the likelihood of taking this over because of the dual purpose of use of plutonium, both as a fuel and as a weapon, would be much greater, and therefore private industry would have to take that into consideration in making capital investment?

Mr. DOTY. That is correct, sir. The problem faced there, of course, is much greater than those we face under the Water Power Act, but I think that many of the techniques and principles that we have developed under the Water Power Act can be helpful.

Representative HOLIFIELD. I would like to ask you this question, and you can answer it as an individual, or if you feel that you are authorized to, from the standpoint of the Commission. In view of the uncertainties that are now apparent in determining costs and other uncertainties in regard to the dual use of fissionable material and the necessity for long-term contracts to effectuate private capital investment, would you think that the Government would be in position at this time to execute attractive or valid contracts, looked at from the standpoint of the profitable investment of private industry's funds?

Mr. DOTY. I certainly could not answer that on the part of the Commission, and I do not think I am particularly qualified to do it.

Representative HOLIFIELD. I will withhold the question.

Chairman COLE. Mr. Doty, I get the impression that the attitude of the Federal Power Commission on this subject is predicated on the assumption that nuclear power for industry is here, and do not recognize that it is not here. Now, of course, if it were true that nuclear power for industrial use is here, then everybody would agree that it becomes then a conventional fuel and, therefore, should be put on the same basis exactly as presently required of conventional fuel.

Mr. DOTY. I do not think that the Commission would take that position, Chairman Cole. We do not know any more about whether it is here from an industrial possibility standpoint than we get from just reading the reports of the Atomic Energy Commission which are public documents. But we do feel that is a question of such great importance we should start looking into the policy problems involved right now so that when it does come up, we will be better prepared. I certainly would not say that we do take the position that it is a practical thing now from an industrial standpoint.

Chairman COLE. But in your statement you have indicated that in the Commission's consideration of the granting of a license to an individual or group, it should have in mind other factors than the national security.

Mr. DOTY. Yes.

Chairman COLE. And by that I assumed you had in mind that the Federal Power Commission should have some voice in the ultimate decision.

Mr. DOTY. No, we do not care who has the voice. But we feel that when legislation is passed, if it is going to be on a licensing basis, in other words, if there is going to be extensive non-Federal interests

developing the power potential of the nuclear fission, that we should take into consideration how it is going to operate, how it is going to fit in with other electric rates, how it is going to fit into the comprehensive development of an area, to what extent is the advantages of the development going to get to the public, how are they going to get to the public.

Chairman COLE. You feel those are factors which the Atomic Energy Commission—

Mr. DORY. Any commission established by Congress to do it.

Chairman COLE. As it is now, and as it is contemplated, that Federal commission will be the Atomic Energy Commission. Then it is your feeling that the Atomic Energy Commission should weigh those factors which your Power Commission now weighs, should be a determining voice in reaching a decision ultimately named by the Atomic Energy Commission.

But it is a question of emphasis, is it not—or it appears from my viewpoint it is a question of emphasis, whether it is your feeling as the Federal Power Commission—that the Atomic Energy Commission should give the same degree of emphasis on those economic factors of cost of production, of saturation of existing electrical energy, and needs and so forth that you do.

Mr. DORY. That is right.

Chairman COLE. What I have in mind—it is conceivable that a proposal may be made to the Commission by some organization to obtain a license to build a reactor to generate power. Now it might happen that the location which that applicant desires is in an area already saturated with electric power, but for some economic or whatever reason they may want, this applicant is ready to embark upon the venture.

If there are other factors which the Commission might feel justified in accepting in a decision to grant the license, even though there are these contrary factors existing, do you not think the Commission would be justified in doing that?

Mr. DORY. I certainly do. It is a question of the Commission, whatever body is selected, to weigh the various values.

Chairman COLE. It is an important military factor. In fact, from the security standpoint, it might be an applicant has a new idea how to construct a reactor for electrical energy generation. Now, the place that is put, the rates that are existing in that area, might not be of any great consequence from our security standpoint, but it might be of very great importance for the experiment to have been made that we might learn more about new processes in order to adapt them in our own plant or our own production program.

You feel then, that the Commission in its decision to grant a license to any applicant, should take into consideration the economic factors which your Power Commission takes into consideration?

Mr. DORY. The economic- and the public-interest factor.

Chairman COLE. But they need not necessarily control?

Mr. DORY. I think it should be spelled out in the act. At least Congress should consider whether they are of sufficient importance to be spelled out in the act to give whatever Commission has the responsibility guideposts to follow.

Chairman COLE. Do you feel now that before the Commission were to grant a license to anybody to build an electric reactor it should con-

sult with, and obtain the consent of, the Federal Power Commission before that license is granted?

Mr. DOTY. No, I do not, unless it feels we could be helpful.

Chairman COLE. I could not hear you.

Mr. DOTY. No, I do not feel that they should.

Chairman COLE. Certainly, they should consult with the Federal Power Commission. I think we all can agree that the Atomic Energy Commission should consult the Federal Power Commission.

Mr. DOTY. That is right. We think consultation is desirable. We do have provisions in other acts where we consult with Interior and the Corps of Engineers, and they consult with us, on provisions that go into licenses, so there are already established precedents in other fields. We would like to help out if we possibly can, but it is their responsibility now and up to them to exercise their judgment.

Chairman COLE. And of course you can help them reach a sound decision. But you do not feel that the Power Commission should have a final veto in the ultimate decision?

Mr. DOTY. Not unless Congress should give it to us.

Representative DURHAM. Mr. Chairman, would you yield?

Chairman COLE. Yes.

Representative DURHAM. What would be the situation, of course, if you begin to distribute power under the present laws?

Mr. DOTY. If the atomic energy started?

Representative DURHAM. Yes, if we were producing power and had it available for distribution or began distributing it.

Mr. DOTY. I think we would run into a period of great confusion as to the cost of power if the atomic-energy program should develop to the extent that they can market power commercially in competition with other forms of energy.

Representative DURHAM. Would not your laws be applicable to the distribution of that power just like it is to the distribution of other power?

Mr. DOTY. It would cause a great deal of difficulty, Congressman, because we would have no way of knowing what the costs are. We would have no way of knowing, for example, if it goes into interstate commerce. We may have no way of setting the rates or the prices if all the security provisions under the atomic energy which have been discussed are established. We would have no way of getting back of the basic figures to determine costs.

Representative DURHAM. Then it would necessitate more information than you have at the present time to arrive at some conclusion as to what you would do?

Mr. DOTY. I feel, if it comes to that point, that the Congress is going to have to act to clarify the responsibility.

Representative HOLIFIELD. Mr. Chairman, on that point. Of course, if it goes to the point where power is transmitted across State lines, it very definitely comes under existing laws pertaining to transmission of electrical energy in interstate commerce; does it not?

Representative DURHAM. It does not make any difference where it comes from.

Representative HOLIFIELD. And the Atomic Energy Commission would be under the obligation of conforming with all of the laws on the subject unless it was specifically excluded from that compliance by amendments to the act?

Mr. DOTY. I assume that is correct, sir.

Representative HOLIFIELD. As far as the Government utilizing that energy within its own plants or intrastate, then that would be a subject matter which is either already provided for in the Atomic Energy Act, which permits the use by the Government of byproduct electric energy produced in atomic plant. That is already provided for in the act. If it sells it within the State, it would have to comply with State laws. If it sells in interstate it would have to comply with Federal laws. Is that not correct under existing law?

Mr. DOTY. I assume it is basically correct. I have not checked it myself, but I think there would be a lot of confusion as to getting the basic information.

Representative DURHAM. It does not make any difference where it comes from, fissionable material or coal or water or what, once it gets on the line.

Representative HOLIFIELD. I think the witness' point is that at the present time you have no way of computing costs.

Mr. DOTY. That is right.

Representative DURHAM. I understand that.

Representative HOLIFIELD. And it is only on the computation of costs that the retail sales price of kilowatt-hours is made.

Representative DURHAM. That is the problem. You have to have more knowledge to make your finding as to how it is to be integrated into this system on a cost basis.

Mr. DOTY. We would have to fix rates then, and the rates are fixed upon investment and other factors such as the cost of money.

Chairman COLE. Let me ask you, Mr. Doty, is it the present requirement of the law that a utility company obtain permission from the Federal Power Commission before it constructs a generating plant to create electricity which moves into an interstate grid?

Mr. DOTY. That is my understanding, Mr. Chairman, but I would like to check with Mr. Wahrenbrock to see if I am correct.

Chairman COLE. Or is the provision of the Federal power law simply that when a company does construct a generating plant and does sell electrical energy across the State line, that then the Federal Power Commission moves in and regulates the rates?

Mr. WAHRENBROCK. The latter is the situation. There is no requirement in the Federal Power Act for obtaining certificates of convenience and necessity in order to construct facilities for interstate commerce in electrical energy.

Mr. DOTY. I was wrong in that. I got confused with the Gas Act where they have to get our permission any time they put up compressor stations and the like.

Chairman COLE. That presents a different situation than what I had in mind then. Then under the present provisions of the law the Commission could grant a license to anybody that might want to build a reactor and generate electricity to move and distribute across State lines without the consent of anybody except the Atomic Energy Commission, but in doing so, the applicant would understand that having obtained permission from the Atomic Energy Commission to construct, when he did construct, when he did generate electricity and started to distribute across State lines, he then would be subject to normal provisions of law in the Federal Power Act. Is that correct?

Mr. Doty. That is correct.

Chairman COLE. If there are no further questions, Mr. Doty, thank you very much for coming down.

The next meeting of the committee on this subject will be Wednesday when we will hear the witnesses of the various study groups who were engaged by the Commission to study in this field.

The meeting is adjourned.

(Whereupon, at 4 p. m., Monday, June 29, 1953, the meeting was adjourned until 2 p. m., Wednesday, July 1, 1953.)

ATOMIC POWER DEVELOPMENT AND PRIVATE ENTERPRISE

WEDNESDAY, JULY 1, 1953

CONGRESS OF THE UNITED STATES,
JOINT COMMITTEE ON ATOMIC ENERGY,
Washington, D. C.

The joint committee met at 2 p. m., pursuant to recess, in room P-63, the Capitol, Senator Bourke B. Hickenlooper, vice chairman of the joint committee, presiding.

Present: Representative Cole (chairman), Senator Hickenlooper (vice chairman), presiding, Senators Bricker and Pastore; Representatives Van Zandt, Patterson, Jenkins, and Holifield.

Professional staff members present: Corbin C. Allardice, executive director; and Wayne P. Brobeck, Walter A. Hamilton, J. Kenneth Mansfield, and George Norris, Jr., of the professional staff of the joint committee.

Senator HICKENLOOPER. The committee will be in order.

The purpose of this meeting today is to hear testimony from representatives of some of the industrial groups which have been studying the prospects for atomic power development using private capital. The witnesses will be: Mr. Walker L. Cisler, president, Detroit Edison Co.; Mr. W. Tyrone Gillespie, representing Dr. Leland I. Doan, president of the Dow Chemical Co.; Mr. Edwin Putzell, secretary of the Monsanto Chemical Co.—and I do not know whether the Union Electric Co. is represented or not; I understand Mr. Putzell will speak for both—and Adm. Earle W. Mills, president of the Foster Wheeler Co.; Mr. Fred C. Kellogg, president of the Pioneer Services & Engineering Co.; and Mr. Willis Gale, chairman of the board of the Commonwealth Edison Co. of Chicago.

There is background information, which perhaps it is desirable to place in the record at this point.

The first industrial atomic power study groups were set up in January 1951 by the Atomic Energy Commission for the purpose of determining what possibilities exist for private enterprise to play an increased role in atomic power development. The original four teams were:

1. Monsanto Chemical Co.
Union Electric Co. of Missouri
2. Dow Chemical Co.
Detroit Edison Co.
3. Commonwealth Edison Co. of Chicago
Public Service Co. of Illinois
4. Bechtel Corp.
Pacific Gas & Electric Co.

In addition, it was understood that the large companies actively developing atomic power plants for the AEC were conducting internal studies of a like nature. The total number of original official studies was held down in order to minimize the drain on the time of the Commission laboratory personnel and facilities on which the study groups have had to rely for basic education and data.

Last October another study team was added: Foster Wheeler Co. and Pioneer Services & Engineering Co. At that same time, the AEC opened its study invitation to everyone. No other groups have sought an opportunity to conduct such studies.

Thus these five teams are the only groups who have devoted any considerable principal attention to the question of whether or not atomic power development by private industry could be encouraged to the overall benefit of the program.

Here is a letter from Dr. Charles Allen Thomas, president of Monsanto Chemical Co. of St. Louis, just received, addressed to Hon. W. Sterling Cole, Chairman of the Joint Committee on Atomic Energy, Congress of the United States, Washington 25, D. C.

DEAR MR. COLE: It is with regret that I find it is impossible for me to be present at the hearing on July 1, 1953. I am however preparing an unclassified statement for the record which I hope will be helpful to your committee, and I am asking Mr. E. J. Putzell, Jr., secretary of Monsanto Chemical Co., to be present and to read this statement to you.

Sincerely yours,

CHARLES ALLEN THOMAS.

The first two witnesses today will be from a team composed of the Detroit Edison Co. and the Dow Chemical Co. The first witness will be Mr. Walker L. Cisler, president of the Detroit Edison Co.

Is Mr. Cisler here?

Would you care to sit there, Mr. Cisler?

Are you Mr. Gillespie?

STATEMENTS OF WALKER L. CISLER, PRESIDENT, DETROIT EDISON CO., AND W. TYRONE GILLESPIE, REPRESENTING DR. LELAND I. DOAN, OF THE DOW CHEMICAL CO

MR. GILLESPIE. Yes, sir.

SENATOR HICKENLOOPER. Will you please be seated, Mr. Cisler? Do you have a prepared statement, or will you speak from notes?

MR. CISLER. Yes, I have a prepared statement, Senator Hickenlooper, which differs somewhat from an earlier printed statement which we brought with us, which we will distribute with the understanding that the official statement will be as I present it here at this time.

SENATOR HICKENLOOPER. Yes. That will be understood.

All right. You may proceed in any way that you like.

MR. CISLER. Members of the joint committee and gentlemen, we are privileged to be here today in response to the invitation of your chairman, to present our statement in connection with the development of atomic energy by industry for industrial and civilian needs. Appearing with me today is Mr. W. Tyrone Gillespie, representing Dr. Leland I. Doan, president of the Dow Chemical Co. And I would like also to introduce to you Mr. J. F. Fairman, vice president, Consolidated Edison of New York.

SENATOR HICKENLOOPER. We are glad to have you here, Mr. Fairman.

Mr. CISLER. Mr. Elmer Lindseth, president of the Cleveland Electric Illuminating Co.

Senator HICKENLOOPER. We are happy to have you with us, Mr. Lindseth.

Mr. CISLER. Mr. R. G. Rincliffe, president, Philadelphia Electric Co.

Senator HICKENLOOPER. Glad you could be with us, Mr. Rincliffe.

Mr. CISLER. Also Dr. John Grebe, director of nuclear research and development for the Dow Chemical Co.

Senator HICKENLOOPER. Glad to see you again.

Mr. CISLER. Prof. William J. Pierce, of the University of Michigan Law School, Alton P. Donnell, coordinator, the Dow-Edison project, and Mr. Arthur S. Griswold, assistant to the president, Detroit Edison Co.

Senator HICKENLOOPER. I now know what you mean when you say a team.

Mr. CISLER. Thank you, sir.

This statement advocating private competitive industry development of atomic energy for peacetime purposes is made by the Dow Chemical Co., of Midland, Mich., the Detroit Edison Co., of Detroit, Mich., and 25 other enterprises associated with us in undertaking the development of a high-temperature fast-breeder nuclear power reactor. We believe modifications of the Atomic Energy Act of 1946 are necessary to permit and encourage the participation of competitive industry using private funds in the development and application of atomic energy for peacetime uses. In our opinion, these modifications can be made without relaxing the security provisions of the act.

We believe atomic energy, as related to peacetime civilian and industrial applications, is a most important natural resource, which can greatly influence our civilian and industrial economy. We further believe, in keeping with the principles of free competitive enterprise upon which our economy is based, that the development of this resource for peacetime purposes is the responsibility of competitive industry. This has been traditional in the history of our country and has been the main factor in the development and growth of our industrial capacity and strength.

The influences expected on the peacetime economy can result from—

- (1) the vast new source of heat energy which is made possible by the nuclear fission process;
- (2) the manufacture of nuclear fuels, plutonium, and uranium 233, produced by transmutation from fertile materials;
- (3) the development of commercial and industrial uses for fission products; and
- (4) radioactive isotopes which can be produced by irradiation in the fission process.

Obviously no one knows precisely the time, the extent, or the form in which the anticipated results may appear in our economy. We are, however, reasonably confident that we can appreciably improve our standard of living. Radioactive isotopes are widely used now and new applications are being discovered almost daily. On the other hand, little effort has been directed to the development of commercial uses for fission products. There is now, however, a demonstrated potential in the heat energy liberated in the fission process and in the production of a new fuel. This potential should be studied and de-

veloped to the point where its use for industrial processes and the generation of electricity is commercially practical.

The Dow Chemical-Detroit Edison project, representing 18 electric power systems, 4 manufacturing industries, 1 chemical company, and 3 engineering and construction organizations, has undertaken this study of peacetime uses of nuclear energy with the excellent cooperation of the Atomic Energy Commission. We have been engaged in this endeavor since 1950, and our initial report to the Commission has been released to the public in declassified form. We are continuing our studies without interruption under an extension of the arrangement with AEC.

It is important to stress the reasons for our intense interest: (1) Heat energy is a major cost item in our businesses, and a more economic source of heat energy means greater economy in the production of products for general public use; and (2) these companies believe that this development can and should be carried forward by competitive enterprise, with its own resources, subject to reasonable governmental regulation for purposes of national security and safety.

To illustrate the extent of our interest, the 18 electric power systems are spread over much of the eastern part of the United States. Their kilowatt-hour output is approximately 32 percent of the total for our country, and their total investment is more than \$8 billion. They now have under way plans to install 7 million kilowatts of new generating capacity in the years 1953-56, and will invest more than \$700 million of private funds annually for this purpose. The power generated by this group in 1952, largely by fuel-burning equipment, totaled 112 billion kilowatt-hours. This would have required more than 60 million tons of coal, costing nearly \$500 million, if no other source of primary energy had been used.

The manufacturing companies are well-known in their respective fields. They are looking to the future, when new methods, new products, and new economies will contribute to our ever-increasing standard of living.

OUR OBJECTIVES

Our goal is the establishment of a competitive atomic energy industry in the United States. Although nuclear energy has unique properties and far-reaching implications, fundamentally it is a resource to supplement coal, gas, and oil. Its development is clearly a responsibility of competitive industry.

We believe private industry can fulfill this responsibility and that private capital will flow into the industry if the opportunity is afforded.

We recognize that the electric power systems are regulated industries. However, they have the right and the duty to study and develop new discoveries that promise to result in lower cost and improvement in their services. Research and development have always been considered legitimate expenses in their operations.

SHORT-TERM OBJECTIVES

Our present effort is primarily directed toward (1) the development of the preliminary design of a high-temperature fast-breeder reactor and associated plant for the generation of electric power on a competitive basis, and (2) a determination of whether such a reactor

promises the economic production of electric energy. It is clearly recognized in this project that the ultimate commercial value and use of reactor products, both fissionable materials and fission products, is an important consideration in determining whether a reactor can be or is commercially competitive.

The work is being supported by the associated companies, using their own facilities, experience, manpower, and funds. Certain research essential to the project but also of value to the entire atomic energy development requires facilities presently available only in the AEC national laboratories.

Because several types of power reactors may be developed, some comment about our choice of a breeder reactor is necessary. Although the potential heat resources of atomic materials are very great, the amount of natural fissionable material is comparatively small. If this material is to be used for the wide-scale commercial generation of electric power, the processes selected should avoid the rapid depletion of the world's supply of natural fissionable material. We simply cannot afford to continually use fissionable materials produced in such costly processes as at Oak Ridge and Hanford for the commercial generation of electricity.

Sound judgment certainly tells us that the breeding process, which adds to the world's supply of fissionable materials, is most desirable. After an initial charge of fissionable material, a breeder reactor will not only reproduce its own fuel by conversion of fertile material U-238 to plutonium, but it will result in the production of additional plutonium, which will supplement the supply of natural fissionable material.

The principle of breeding has recently been confirmed by the Commission, and this represents a most important step forward, which should be developed to the maximum possible extent. In effect, for the commercial generation of electric power, this confirmation of the theory of breeding should outmode all processes which contribute to the depletion of the world's supply of fissionable materials.

The reactor we propose will include an integrated process plant and fuel preparation system in order to make it completely independent of Government production facilities except for the initial charge.

The nature of the problems involved make impractical the assertion of a date when these objectives can be accomplished. Various technical aspects of the project are proceeding, but it may be a year or even more before conclusive results are obtained from some of the research now under way. Our belief, expressed to the Commission in December 1951, that the development of a commercially competitive breeder reactor does appear to be feasible, has been strengthened by the subsequent studies. It is entirely possible that we can be ready to undertake the detailed design and construction phases before the end of 1954. We hope to do just that.

LONG-TERM OBJECTIVES

To reach the goal of a competitive atomic-energy industry, the long-term objectives include the development of fissionable materials as a commercial source of heat energy and the utilization of atomic energy in the economy of our country to the maximum extent.

From our present knowledge, it appears that fissionable materials can supplement our conventional fuels as a source of heat energy, but that they will not supplant the use of these fuels. We are unable to predict in detail the manner in which fission products may enter into our peacetime economy, but both military and commercial uses now appear to be possible. The fissionable materials will increase the military potential and should be valuable as the initial charge for other similar reactors and as a premium fuel.

If the present work shows a breeder reactor can be commercially competitive, and the law permits, the group intends, with private funds, to design, construct, test, and operate a full-sized breeder reactor. If the tests prove that such a reactor is commercially practical, then the individual power systems and others undoubtedly will use similar installations to provide electric power to the areas and the industries which they serve.

It should be emphasized that from a practical commercial standpoint the use of atomic fuels for the generation of electric power can be justified only if the costs are as low or lower than the costs using conventional fuels, taking into proper account the value of reactor products. Certainly, we would not build a reactor unless it has this promise.

Your committee may wish to know the proposed means of financing the test installation in question. As yet, no definite financing plans have been made, and none can be developed until the law is modified. The electric-power companies alone presently engaged in the project have capital investments exceeding \$8 billion, annual gross sales exceeding \$2 billion, and annually are expending about \$700 million for expansion of their facilities. The capital investment and annual sales figures for the entire group would be substantially increased by the five associated manufacturing organizations. These companies constitute a very substantial national resource, and we believe that it will be possible to undertake privately the construction of the reactor and associated facilities. They possess the financial capacity, economic incentive, and organizational capability to carry out this project. We believe Congress should provide the opportunity to do so by appropriate legislation which will eliminate the legal roadblocks now confronting private industry.

NEED FOR AMENDING THE LAW NOW

If competitive private industry is to engage actively in the atomic-energy development and to risk its owners' funds, it is essential that rights of ownership be given to private industry so it may have the normal opportunity to recover investments and to benefit from its ingenuity. This is the economic system which makes it possible for business and industry to exist and to expand.

Fuel-burning electric-power generating stations ordinarily have a usual life well in excess of 30 years. Those investing private capital in a plant to use atomic fuels would need to know that they could have full control of the plant for its useful life. They would need to know that they could obtain the necessary atomic materials for fuel and could sell or dispose of fission products through the normal channels of commerce, subject to Government regulation in the interest of national security and safety. Those who might engage in other aspects

of the development, such as the commercial use of fission products and the manufacture of equipment peculiar to the utilization of atomic materials, all have similar problems.

The present Atomic Energy Act contains numerous prohibitions and restrictions with respect to the ownership and production of fissionable materials, source materials, and the right to purchase and sell these materials in normal commerce. A careful analysis of the act, prepared by Dean E. Blythe Stason, of the University of Michigan Law School, as an activity of the Phoenix memorial project, includes the following statement:

It is submitted that under the present statute, private capital is virtually precluded from embarking upon atomic-energy industrial enterprise and, particularly, such capital will not flow into the use of atomic energy for the commercial production of electric power.

This entire analysis entitled "Memorandum on Private Utility Ownership and Operation Under the Present Atomic Energy Act," by Dean Stason, was submitted at a previous hearing. A copy is attached, for the convenience of the committee, as attachment 2 at the end of my testimony.

To bring about conditions under which private competitive industry can be enabled to invest its own funds in the development, the Atomic Energy Act should be amended to permit private enterprise to do the following:

1. To build, own, and operate atomic-energy plants.
2. To acquire, own, and dispose of fissionable materials.
3. To acquire, own, and dispose of source materials.
4. To sell and distribute end products and byproducts produced in an atomic-energy facility.
5. To obtain licenses from the Atomic Energy Commission, subject only to the requirement that operations thereunder be conducted in compliance with conditions set forth in the license in accord with standards to be prescribed by the act.
6. To attain normal patent and trade-secret protection, subject only to full disclosure to the Commission for its own use and military purposes.

The national security and safety aspects of the atomic-energy situation are fully recognized in recommending the above modifications of the law.

There are many well-known reasons for carrying the atomic-energy development forward without undue delay. This can be done adequately and upon the broad front that is required only with the participation of competitive industry. It is important, therefore, that the law be modified in the near future.

Our project and our plans to undertake private financing of a reactor may be used as an example to illustrate this point. If we assume that our studies will be completed in 1954 and that we conclude that a trial installation should be built, then we should be in a position to proceed with the next steps, detailed design and construction, without delay. In order to proceed with these, we would need to know that the financing is complete and that money is available for the entire construction program.

Obviously, many problems must be met in undertaking such a venture, and a substantial amount of time, probably a year or more,

will be needed to complete the negotiations. If we are to meet such a schedule, law modifications in the near future are essential.

Of greater and more general importance, however, is the need to attract additional private participation and investment in research and development. This will come slowly at best, but will not begin until the way is cleared by law changes.

If we agree that competitive industry should participate more widely in the atomic-energy development, then there is no tenable reason for postponing the law modifications which will make that participation possible.

THE PATENT PROBLEM

Although we do not feel that it is necessary or desirable in this hearing to discuss specific details of changes in the law, we do believe the problem of patents deserves special attention at this time. As you know, section 11 of the Atomic Energy Act severely restricts normal patent rights in the atomic-energy field.

For private capital to be invested in research and development, the normal incentives of patent protection should exist. Otherwise, capital will be invested in other areas of scientific development.

Section 11 prohibits the issuance of a patent that is useful solely in the utilization of fissionable material or atomic energy for a military weapon. Undoubtedly this restriction is necessary and desirable. However, section 11 also restricts patent rights in respect to inventions or discoveries that are used in the production of fissionable material, although compensation awards may be made by the AEC. Also, the AEC is empowered to declare patents "affected with the public interest" if the invention or discovery utilizes or is essential in the utilization of fissionable material or atomic energy.

At the same time, we recognize the legitimate concerns of protection of Government-sponsored inventions and devices, patentable and unpatentable, and of protection of classified data. Any changes in the law must include the necessary safeguards.

We are not prepared to suggest specific statutory amendments of the patent provisions, but we are confident that the interests of the public can be protected and at the same time provide the necessary incentive for private industrial development of atomic energy.

SUMMARY

In summary, our proposal is consistent with governmental participation. This means, in brief, that governmental ownership and operation of its facilities, constructed at great cost, can continue exactly as at present. The Government can continue its own and independent development. Private industry only requests that Congress give it the right to own and operate its facilities, subject to regulation in the interest of national security, health, and safety.

Until now, the AEC has borne the cost of research, contributing to private programs, because the research also has added to the overall store of knowledge and information. If hereafter the AEC decides that a reasonable charge to industry is proper, then private industry can decide for itself whether to meet the charge or to provide its own similar facilities.

It should be remembered by all of us that we are dealing with but one form of natural resource, a source of heat energy just as is coal, gas, and oil. No one suggests that the research and development of the use of coal be nationalized, as does the Atomic Energy Act in the case of fissionable materials. We make no "grab" and we do not seek to appropriate something that is not paid for by private capital and that we do not develop from our own efforts.

That completes the formal presentation, Senator Hickenlooper.

Senator HICKENLOOPER. Thank you, Mr. Cisler. You have touched on, I think, the major phases involved in this question.

Are there any question by any members?

Mr. CISLER. May I say that there are attachments, for example, the names of those associated with the Dow-Edison project, a communication which we had received from Chairman Cole earlier, our reply by telegram, and, of course, the memorandum prepared by Dean Stason.

Senator HICKENLOOPER. Yes. They will be inserted in the record at this point.

(The material referred to follows:)

ENTERPRISES ASSOCIATED IN THE DOW CHEMICAL-DETROIT EDISON HIGH-TEMPERATURE FAST-BREEDER NUCLEAR-POWER PROJECT

Electric-power system

- Atlantic City Electric Co.
- The Cincinnati Gas & Electric Co.
- The Cleveland Electric Illuminating Co.
- Consolidated Edison Co. of New York, Inc.
- Consolidated Gas Electric Light & Power Co. of Baltimore
- Consumers Power Co.
- The Detroit Edison Co.
- General Public Utilities Corp.
- The Hartford Electric Light Co.
- New England Electric System
- Niagara Mohawk Power Corp.
- Philadelphia Electric Co.
- Potomac Electric Power Co.
- Public Service Electric & Gas Co. of New Jersey
- Rochester Gas & Electric Corp.
- The Southern Co.
- The Toledo Edison Co.
- Wisconsin Electric Power Co.

Summary statistics for 18 electric-power systems

Total investment, Dec. 31, 1952	-----billion	\$8.3
Total gross sales, year 1952	-----do	\$2.2
Total generating capacity, Dec. 31, 1952	-----million kilowatts	21.0
Total generation, year 1952	-----billion kilowatt-hours	112.9
Total scheduled capacity additions, 1953-56	-----million kilowatts	7.1
Average annual investment for new facilities, 1953-56	-----million	\$700.0

Chemical and manufacturing industries

- The Dow Chemical Co.
- Allis-Chalmers Manufacturing Co.
- The Babcock & Wilcox Co.
- Bendix Aviation Corp.
- Ford Motor Co.

*Summary statistics for 5 industries**Billion (approximate)*

Total investment, Dec. 31, 1952-----	\$1.4
Total gross sales, year 1952-----	4.6

Engineering and construction

Gibbs & Cox, Inc.
 United Engineers & Constructors, Inc.
 Vitro Corporation of America

ANN ARBOR, MICH., April 21, 1953.

MEMORANDUM ON PRIVATE UTILITY OWNERSHIP AND OPERATION UNDER THE PRESENT ATOMIC ENERGY ACT

Can a private utility utilizing atomic fuels be financed, owned, and operated under the present provisions of the Atomic Energy Act Section 7 of the act authorizes the Atomic Energy Commission to issue licenses under certain stated conditions, permitting private persons to manufacture, produce, or export equipment utilizing atomic energy, or to utilize atomic energy in industrial peacetime applications. Other sections of the act, principally sections 4, 5, and 11 also bear upon private utilization in an important manner. What is the effect of these provisions upon peacetime development of private operations in atomic energy?

It is submitted that, under the present statute, private capital is virtually precluded from embracing upon atomic-energy industrial enterprise, and, particularly, such capital will not flow into the use of atomic energy for the commercial production of electric power. The principal reasons for reaching this conclusion, all of which will be elaborated more fully later in this memorandum, are as follows:

(1) The act in section 7 absolutely prohibits the issuing of a license whenever the activity involves production of fissionable materials, thus precluding the breeder type of reactor.

(2) All licenses issued under section 7 are fully revocable at the discretion of the Atomic Energy Commission, with no guiding standards specified, thus creating an unstable foundation for large investments of private capital.

(3) Section 4 specifically makes unlawful both private ownership of facilities for the production of fissionable material and also private production of such material, thus preventing a private company from becoming the owner of its plant.

(4) Section 5 prohibits private ownership of fissionable materials, thus precluding ownership of an essential ingredient of atomic fuel supply.

(5) Section 5 also seriously restricts the right to purchase source materials, thus still further impairing access to the basic fuel supply.

(6) The act fails to make necessary provision for sale or discussion by private operators of byproduct, end-product, and waste materials, thus leaving in doubt a substantial element of value in private industrial cooperation.

Without amendment in the foregoing particulars, it is inevitable that large areas of private industrial utilization, including most of the electric-power industry and large segments of the chemical industry, simply will not enter the field. But these are by no means all of the impediments found within the present language of the Atomic Energy Act. Among other features needing reconsideration, at least three additional provisions constitute such serious handicaps that they will assuredly hamper industrial participation, namely:

(7) Section 7 imposes a specific requirement calling for general release of technical information and data concerning licensees' activities, thus precluding retention of normal trade secret information concerning techniques and processes developed within the plant at the expense of time, money, initiative, and ingenuity of personnel.

(8) Section 7 contains an ambiguous, unusual, and unnecessarily restrictive provision affecting the status of competitive enterprise in the atomic-energy field, thus leaving in doubt the possibility of effective collaboration between units of the electric power and the chemical industries.

(9) The patent provisions of section 11 constitute a radical departure from the normal American patent system, thus impairing to a considerable degree the normal American business incentives.

Notwithstanding the well-known fact that American industry will undertake reasonable risks in new and promising fields, it must be recognized that private

capital cannot and will not be invested in an enterprise, at least at favorable rates, unless certain favorable conditions exist, among which are reasonable security for the investment, reasonable certainty with respect to the conditions and restrictions under which the industry is to operate, and normal incentives expected and found in other areas of the economy.

An atomic electric powerplant, sufficiently large to merit serious consideration, will cost approximately \$50 million. At least \$30 million of this sum will be expended for the atomic reactor and its supplementary steam-producing apparatus. The remainder will be used for the conventional turbines, generators, and transmission equipment. It is a large sum of money.

A \$50-million office building would not be built upon property the title to which is in doubt as a result of conflicting public or private easements or other rights. Appropriate proceedings would be taken to remove the cloud from the title. Likewise, an electric-power plant will not be financed and built from private funds except upon a secure foundation, a foundation which assures title to the plant, reasonable access to fuels and other necessary supplies, and other conditions assuring reasonable security for the investment, equivalent to that found elsewhere in the economy.

For the reasons enumerated briefly above, these economic conditions simply cannot be met under the present language of the Atomic Energy Act, an act which was drafted to create a closely held Government monopoly at a time when such monopoly seemed essential to national security. The requisite conditions can, however, be furnished by the adoption of a few reasonable amendments to the act, making room for a more normal development of American industry and enterprise in this new field. Moreover, this can be done without in any way impairing national security. The Commission must and will retain full control over all military and other Federal programs and full regulatory power over private operations. The expansion of private industry alongside the huge Government program will strengthen the Nation.

The following analyses of the nine points above listed indicate more specifically the reasons why the language of the existing act does not provide an adequate statutory basis for the expenditure of private capital in the field. We now proceed to elaborate each of these nine items.

(1) Section 7 prohibits the issuing of a license whenever the activity involves production of fissionable materials.

A licensee under section 7 cannot be permitted to produce fissionable materials, for section 7 (a) states that "no license may permit any such activity (for example, private industrial utilization) if fissionable material is produced incident to such activity, except as provided in sections 3 and 4."

However, a "breeder" or even a "converter" reactor (the kind that in all probability will have to be used in the atomic electric plant) produces fissionable material. Indeed, it must do so, for unless such material is produced, economical private operation of the plant does not seem possible.

Examining the language of section 7 (a) more closely, one may ask whether or not the clause excepting operations under section 3 offers assistance. Section 3 authorizes the conduct of "research and development activities," which are duly defined in section 18 (e) to mean "theoretical analysis, exploration, and experimentation, and the extension of investigative findings and theories of a scientific or technical nature into practical application for experimental and demonstration purposes, including the experimental production and testing of models, devices, equipment, materials, and processes." But even under the most strained and favorable interpretation, "experimental and demonstration" plants could not be construed to include commercial or industrial operations. For the same reason, another sentence in section 7 (a), reading "nothing in this section shall be deemed to require a license for the conduct of research and development activities" does not help. Nor does the other exception in section 7 (a), that is, that related to operations under section 4, serve any better end, for section 4 (except, again, for research and development activities) permits production of fissionable material only in AEC-owned facilities. Finally, as will be noted in detail later, section 4 (b) confirms the prohibition in section 7 (a) precluding private production of fissionable materials by stating categorically that "it shall be unlawful for any persons * * * to produce fissionable material, except to the extent authorized by subsection (c)"—and, still again, the exception is of no avail.

Accordingly, as section 7 is now written a licensee under it cannot produce fissionable material, and, therefore, the only feasible atomic energy electric power plant, that is, the breeder or converter reactor, is completely precluded. Section 7 must be amended in this regard if a practicable electric powerplant is to be built.

(2) Licenses issued under section 7 are fully revocable at the discretion of the AEC.

Section 7 expressly provides that all licenses issued under it are fully revocable at any time at the discretion of the Commission, without any standards to guide its action in so doing. Licenses are in effect no more than mere day to day permits to continue operations. They are not franchises; they lack the essential quality of stability.

Looking at the specific language, section 7 (c) provides that "the Commission is authorized and directed to issue licenses on a nonexclusive basis and to supply to the extent available appropriate quantities of fissionable material * * *" and further that "each such license shall be issued for a specified period, shall be revocable at any time by the Commission, in accordance with such procedures as the Commission may establish, and may be renewed upon expiration of such period * * *." The specified period may be long or short in the discretion of the agency. At the end of the period the license may (or presumably may not) be renewed, again in the discretion of the agency. Section 9 (b) of the Federal Administrative Procedure Act (which section deals with license revocation in the Federal system generally) would prove helpful if standards were included in the Atomic Energy Act to provide express conditions upon which revocation of licenses might be effectuated, but no such standards are set forth in the present act.

This is, indeed, an unstable foundation on which to rest private enterprise. All of the pertinent facts must, of course, be clearly set forth in the prospectus filed with the Securities and Exchange Commission, including the facts showing character of the right to do business. Investors will be justifiably reluctant to participate. At best, interest rates will rise to speculative levels. Furthermore, State public utility commissions in many States may well refuse to approve security issues based upon so unstable a foundation, particularly if interest charges are substantially increased because of the speculative quality of the investment.

Finally (and parenthetically), attention must be called to the above-quoted provision of section 7 (c) to the effect that the license must be "on a non-exclusive basis." Note also the statement that the Commission shall "supply to the extent available appropriate quantities of fissionable material." Do these provisions mean that the Commission is obliged to issue licenses to all qualified applicants, regardless of whether or not an adequate supply of material is available to care for the needs of the entire number? If so, the results will be disastrous. If not, the language calls for clarification.

In view of the foregoing it seems clear that section 7 (c) should be rewritten in at least the following respects: (1) to set forth in plain terms the period for which licenses shall be issued, (2) to provide for renewals of such licenses unless there is proof of violation of the law or infringement of national security, (3) to spell out clearly the standards controlling the action of the Commission in ordering the revocation of a license, and (4) to clarify, or perhaps modify, the phrase "nonexclusive basis" to prevent an excessive number of licenses and a consequent undue dilution of the available supply of atomic fuels.

Without such amendments it seems inconceivable that private capital will participate.

(3) Section 4 specifically makes unlawful private ownership of facilities for the production of fissionable material, as well as private production of such material.

Turning now to section 4, we find that the present act proceeds on a theory of a complete Government monopoly of facilities for the production of fissionable materials. Section 4 (b) expressly makes unlawful private ownership of production facilities. Also it is made unlawful for any private person to produce fissionable materials unless it is done in facilities owned by the Government, or (in minor quantities) in research and development activities. The production of fissionable material is a complete and exclusive Government monopoly.

Looking at the statutory language in detail, section 4 (b) provides: "It shall be unlawful for any person to own any facilities for the production of fissionable material, or for any person to produce fissionable material except to the extent authorized by subsection (c)." Then subsection (c) provides: "The Commission shall be the exclusive owner of all facilities for the production of fissionable material * * *" (with certain exceptions that are not pertinent). Subsection (c) then authorizes the Commission to produce fissionable materials itself, or to provide by contract with private

companies for its production, but it is to be done only in Commission-owned facilities. As previously noted in item (1) above, to be economically feasible, private electric power development must depend upon a breeder or at least a converter operation, that is, the plant must produce fissionable material in order to supply itself with the requisite fuel. Accordingly, these provisions of section 4 constitute a serious obstacle.

Furthermore, it should be noted that section 4 (a) of the act interprets the word "produce" when used in relation to fissionable material to include "separation of fissionable material from other substances." However, the privately owned utility plant must be permitted in the normal course of its operations to separate fissionable material by chemical processes from the source materials with which the reactor is blanketed. If it cannot do so, probably an insuperable handicap is imposed.

Mention should also be made of section 4 (e) which authorizes the Commission to license a private person to acquire facilities for the production of fissionable material. Does this provision offer any assistance? It would seem not to do so, for the rather ambiguous authority to acquire facilities cannot, consistently with section 4 (b) making private ownership absolutely unlawful, be interpreted to authorize the ownership of a reactor, and it certainly does not authorize the operation of such facilities to produce fissionable material.

Finally, section 4(e) in its concluding sentence provides: "Nothing in this section shall be deemed to require a license * * * for the conduct of research or development activities in the United States of the type specified in section 3 * * *." However, as previously stated in discussing a similar point raised in connection with section 7 (a), reliance cannot and should not be placed upon the possibility of a broad and favorable interpretation of the phrase "research or development activities." A private public-utility plant for commercial purposes cannot be so classified. Such a plant cannot reasonably be construed to be merely an "experimental and demonstration" plant.

Accordingly section 4, as it is now written, makes unlawful the very type of operation which is necessary if the private electric-power industry is to make use of atomic fuels. The section must be amended to make lawful private ownership of facilities for the production of fissionable material, and also to authorize the private production of such material to the extent needed for economical powerplant operation, always subject, of course, to full powers of inspection and regulation by the Commission to protect national security and other public interests.

(4) Section 5 prohibits private ownership of fissionable material.

Fissionable material is an essential fuel for electric-power production. The act prohibits private ownership of such fuels and it even prohibits the borrowing of such fuels from the Government on any firm and continuing basis.

Looking at the statutory language, section 5 (a) (2) of the act provides that "All right, title, and interest * * * in or to any fissionable material * * * shall be deemed to be vested in the Commission." Then section 5 (a) (4) provides: "The Commission is authorized to distribute fissionable material owned by it * * * for use pursuant to a license issued under the authority of section 7. Such material shall be distributed in such quantities and on such terms that no applicant will be enabled to obtain an amount sufficient to construct a bomb or other military weapon." And continuing, section 5 (a) (4) provides: "The Commission shall not distribute any material to any applicant, and shall recall any distributed material from any applicant, who is not equipped to observe or who fails to observe such safety standards to protect health and to minimize danger from explosion or other hazard to life or property as may be established by the Commission, or who uses such material in violation of law or regulation of the Commission, or in a manner other than as disclosed in the application therefor." How do these provisions bear on a private utility operation?

To operate a public utility continuity of fuel supply is essential. Even assuming the utmost of current cooperation from the Commission, no private operation can rest securely on the hope that such cooperation will continue over the long period of time necessary to make reasonable amortization of the investment. How can continuity of fuel supply be assured? National security must, of course, be given predominating consideration, and, in the event of war or other emergency, the demand for weapons purposes may conceivably require the shutdown of private operations. But apart from such contingency it seems clear that statutory arrangements superior to those now available under section 5 must be made for assurance of fuel supply. It would be preferable if such

arrangements were in the form of ordinary private ownership of the requisite supply. However, in the alternative, it might be reasonably acceptable if provision were made for a firm loan of fissionable materials for a reasonable period of time, such materials to be subject to recall by the Government only upon proof of reasonable conditions stated in the statute and not left to Commission regulations.

Attention must also be called to the fact that section 5 (a) (4) prohibits a licensee from obtaining an amount of fissionable material sufficient to construct a bomb or other military weapon. The desire to protect national security is natural and desirable. Without knowledge of the necessary technology, it cannot be specifically stated at this time whether or not this limitation of amount imposes an absolute quantitative prohibition which will make the operation of a private powerplant of reasonable size an impossibility. It might also be argued that even a small amount of fissionable material, even though not enough for a bomb, is sufficient because of its poisonous quality to be classified as a "weapon." This interpretation would be even more restrictive. Therefore, the expressed limitation should certainly be reviewed in connection with amendatory legislation designed to authorize private operation of electric powerplants utilizing atomic fuels. If an amount of fissionable material in excess of the present limit is necessary to operate the plant, then the choice must be made between increasing the limit, always under appropriate safeguards, or not reaping the benefits of atomic electric power.

In view of the foregoing, it seems clear that the provisions of section 5 must be amended to provide more satisfactorily for supply of adequate quantities of fissionable fuels. It should be understood, of course, that any private ownership or possession on loan must be subject to full powers of inspection by the Atomic Energy Commission and to accurate and adequate accounting procedures. Moreover, the Commission must have full authority to take possession of such fissionable materials at any time it has reason to believe that they may be utilized for purposes detrimental to national security or other predominate public interests. Furthermore, in the event of military emergency such materials must of course be subject to condemnation upon the payment of just compensation. But with these precautions duly observed, amendment of section 5 regarding fissionable fuels is clearly necessary to provide essential continuity of adequate supply to the utility. Mere reliance upon a hoped for favorable exercise of the Commission's discretionary power will not suffice.

(5) Section 5 seriously restricts the right to purchase source materials.

"Source materials," a term which is defined to include natural uranium and thorium and their ores, are of importance equal to that of fissionable materials in the operation of a privately owned electric powerplant using atomic fuels. In a breeder type of operation such source materials actually constitute the bulk of the fuel supply. Section 5 severely limits the right of acquisition of these essential materials.

Referring to the statutory language, section 5 (b) (2) provides: "Unless authorized by a license issued by the Commission, no person may transfer or deliver, receive possession of, or title to, or export from the United States any source material after removal from its place of deposit in nature * * *." Section 5 (b) (3) provides further: "The Commission shall establish such standards for the issuance, refusal, or revocation of licenses as it may deem necessary to assure adequate source materials for production, research, or development activities pursuant to this act * * *."

These provisions confer very broad Commission power over the basic fuel supply of the atomic-energy utility plant. Open market operations comparable to the purchase of coal for a coal-burning plant are not permitted. The Commission's power is broad enough, for example, to permit the refusal of a license for purchase of natural uranium if the Commission deems it desirable to award the limited existing supply (over and above Government needs) to other private-enterprise utilization plants. The privately owned plant has no recourse to normal contractual arrangements for the purchase of fuel supply. Can private industry proceed on any such basis? Even assuming that the Atomic Energy Commission will currently utilize its discretionary power wisely, equitably, and favorably, a private utility built from private capital cannot properly make a like assumption for the long-range future—for the reasonable life of the plant. No industry can undertake an operation based upon such uncertainty in its basic fuel supply.

Accordingly, arrangements must be made either for open competitive market operations for source materials, subject, of course, to the United States claiming

priority for its weapons programs, and to Atomic Energy Commission regulations and orders to prevent misuse of the materials; or, if open-market operations in source materials are not feasible under current circumstances, authority should be given the Commission to make binding contractual agreements with private industry to permit licensees under section 7 to buy reasonable agreed quantities of source materials over specified periods of years, again subject to reasonable regulation by the Commission in the public interest.

(6) The Atomic Energy Act fails to make necessary provision for sale or disposition by private operations of byproduct, end product, or waste materials.

There is every reason to anticipate substantial commercial value in the utilization by the chemical and related industries of byproduct and waste-product materials, and, in addition, there may be value derived from sales of fissionable materials to the Government or to licensed private users.

Section 5 (c) (2) now authorizes the Commission to distribute byproduct materials, but no corresponding provision is included concerning the possibility of sale of byproducts or other materials by the owner of a private reactor. Although there is nothing specific in the act to prohibit such sales, nevertheless, in view of the fact that special provision was deemed necessary to authorize sale by the Commission, it is only proper to conclude that like provision will be required to authorize private sales. In addition, it is apparent that such sales should be made only to persons duly licensed by the Commission to receive and make use of them. Accordingly express provision should also be included for the licensing by the Commission of purchasers at private sales, for otherwise the agency would lack requisite authority.

Section 5 should, therefore, be amended to provide for private sale of byproducts, end products, and waste products, making appropriate provision for the licensing of purchasers by the Commission, and for compliance by them with Commission regulations concerning public health and safety. The absence of such authorization from the act at the present time leaves an element of uncertainty troublesome both to the byproduct industry and to the Commission.

(7) Section 7 imposes a specific requirement of general release of technical information and data concerning licensees' activities.

Licensees are obliged by a clause inserted in section 7 (c) to "agree to make available to the Commission such technical information and data concerning their activities pursuant to such licenses as the Commission may determine necessary to encourage similar activities by as many licensees as possible." This opens the door far wider than is customary in American industry; and precludes the retention of normal "trade secret" information concerning techniques and processes developed at the expense of time, money, initiative, and ingenuity of personnel.

In the development of industrial processes for the production of power and the utilization of byproducts and waste products, large and important quantities of technical information and data will undoubtedly be accumulated. Valuable new processes and techniques will be developed. Useful operational data will be assembled. The accumulation will include not only that which is collected in connection with the public-utility phases of the enterprise, but also it will involve the related chemical and other industrial uses. It will embrace not only patentable inventions and discoveries, but also nonpatentable techniques and processes created by the ingenuity and investment of the licensees. Much of the material will be newly discovered fundamental scientific knowledge, and, as to this, free and liberal dissemination is greatly to be desired, subject always to paramount considerations of national security.

However, it is patently unfair that the industry which develops successful technological processes should be required to submit all of it in its entirety and without exception to the public domain for use by others. Such practice is not required in other phases of the industrial economy. The free rider is not entitled to such assistance—a condition which will stifle the entrepreneur's initiative.

Accordingly, section 7 (c) should be amended to modify the present requirement of release of all "technical information and data," permitting in the private atomic-energy field the normal American practice of withholding technical information and trade secrets, the revealing of which would give competitors an unfair and unearned advantage. This is surely a reasonable incentive for reward of initiative and ingenuity within the industry.

(8) Section 7 contains an ambiguous, unusual, and unnecessarily restrictive provision affecting the status of competitive enterprise.

Section 7 (c) of the act now contains the statement: "Where activities under any license might serve to maintain or to foster the growth of monopoly, restraint of trade, unlawful competition, or *other trade position inimical to the entry of new, freely competitive enterprises in the field*, the Commission is authorized and directed to refuse to issue such license or to establish such conditions to prevent these results as the Commission, in consultation with the Attorney General, may determine." The italicized clause may easily be construed to handicap effective collaboration in the field between units of the electric power and chemical industries.

Of course, there is no question that practices declared unlawful by Congress should be prevented. Accordingly, monopoly, restraint of trade, and unlawful competition should be kept out of the atomic-energy industrial field. However, the phrase "other trade position inimical to the entry of new, freely competitive enterprises in the field" would seem to introduce a new concept of uncertain scope and meaning not encountered elsewhere in the statute books. What does it mean? Would the provision, for example, preclude the owner of an electric powerplant from disposing of reactor byproducts exclusively to a specific chemical company regardless of that company's active fiscal participation in the enterprise, or regardless of the fact that the byproduct supply is insufficient for all who seek them? Or must the byproducts be sold freely in the market to all who wish to buy them with equal treatment for all? If the latter is intended, it will be a deterrent to substantial financial participation by the chemical industry in the construction of power reactors, and good policy would dictate that the phrase should be eliminated leaving the matter to reliance upon the usual legal requirements. But if Congress really wishes to establish this as a new policy, a new standard of unfair competition for the atomic-energy industry, at least the phrase should be clarified so that its meaning may be clearly understood. As at present written the phrase is ambiguous and it should be clarified by amendment in order that there may be no question concerning its meaning.

(9) The patent provisions of section 11 constitute a radical departure from the normal American patent system.

The usual incentives of the American patent system are impaired, and, indeed, are largely eliminated under the present provisions of the act.

Section 11 deals with patents and it is comprehensive and complicated. Subsection 11 (a) (1) prohibits the issuance of a patent "for any invention or discovery which is useful solely in the production of fissionable material or in the utilization of fissionable material or atomic energy for a military weapon." Subsection 11 (a) (2) provides that, in the case of inventions or discoveries useful for purposes other than the production of fissionable material or weapons, patents may be granted in normal course, but, if such inventions are also used in the production of fissionable material or for weapons, no rights shall be conferred so far as the latter uses are concerned. Subsection 11 (b) states that no patent shall confer rights to the extent that the invention or discovery "is used in the conduct of research or development activities." Finally, subsection 11 (c) provides that the Commission may, under certain stated conditions, declare any patent that is issued in the atomic-energy field to be "affected with the public interest," and if such declaration is made, any licensee under section 7 of the act may use the patent, first paying the owner a reasonable royalty fee to be determined either by agreement, or, if no agreement can be reached, by the Commission.

A system of awards and just compensation payable by the United States in amounts to be determined by the Commission, together with the above-mentioned royalty fees, substitutes to a limited extent for the normal incentives of the American patent system. However, such awards, just compensation, and royalty fees fall far short of normal patent incentives. For example, no award is made to the extent an invention is used in connection with research or development activities. Again the doctrine of *res judicata* prevents an award, once made, being reopened to provide compensation for subsequently discovered uses of an invention for which the award has once been granted.

The foregoing restrictions and limitations upon the normal incentives of the American patent system materially reduce the encouragement which the patent system affords to inventive skill in other technical fields, and even more importantly they tend to promote nondisclosure of new discoveries with the consequent deterrent effect on scientific and technological development. Accordingly, it is highly desirable that section 11 be carefully reconsidered and revised to bring it more nearly into harmony with the patent system applicable elsewhere in the economy. Such revisions should, of course, take full account of the needs of national security, and, in addition, it must be made certain that no patents are

granted for inventions or discoveries derived from Government operations or operations financed by the Government.

CONCLUSION

The foregoing considerations clearly demonstrate the necessity of important changes in the Atomic Energy Act, especially in sections 4, 5, 7, and 11 if private industrial utilization is to proceed. It is true, that 2 or 3 of the aforementioned obstacles might possibly be minimized by favorable court interpretation of ambiguous language of the present act, but successful development of peacetime uses of atomic energy cannot and should not be expected to wait for or rest upon doubtful interpretation. The doubt and confusion that will constitute a serious impediment to prompt and effective industrial atomic development should be replaced by adequate revision of the statutory language with clear-cut phraseology, protecting national security at every step, but substituting legal certainty for ambiguity and permitting American enterprise to proceed in a reasonably normal manner with reasonable assurance of security, understanding, and encouragement. Such revision will prove of very great value to industrial expansion in the new atomic field, and thence to the Nation.

Certain alternative short-cut means of solving some of the above-mentioned problems have been suggested, but they will not prove to be an adequate substitute for clear-cut revision. It has been suggested for example, that section 7 alone might be amended to stabilize the license issued thereunder, and, by special provision, to authorize private ownership and operation of facilities within narrow limits. Such a solution would fall far short of achieving the benefits of more complete revision.

Again it has been suggested that a single special provision might be written into the law by amendment authorizing the Atomic Energy Commission to proceed by contract with one or more private organizations to authorize the financing, building, and operating of an atomic-energy powerplant and its related activities, leaving to the Commission the task of determining the terms and conditions of the contracts as to rights of ownership, access to materials, and other matters. Such a solution would delegate to the Commission plenary power to determine the scope and nature of future policy in this important area of private enterprise. It is a serious responsibility that should not be delegated but should be assumed by Congress, the constitutional repository of legislative policymaking power.

We conclude that a careful revision of the act, at least in the particulars above noted, is the only satisfactory way to assure for the Nation in this new and promising field the well-known benefits of American ingenuity, initiative, and enterprise.

Moreover, the foregoing conclusion, although not so specifically documented, has long been reached by some of the ablest and best informed persons in the field. For example:

"What is important is to first get the law changed. You cannot have any commercial power with the existing law, as it now exists, in my opinion."—Charles Allen Thomas, president, Monsanto Chemical Co., at the Chicago University Conference, December 2, 1952.

"I, therefore, propose that the basic provisions and fundamental assumptions of the Atomic Energy Act and its administration be thoroughly reexamined by the country. * * * I believe this reexamination will demonstrate that a thoroughgoing revision of the law is required. I urge that the revised law state flatly and without equivocation, as a fundamental policy of this country, that development of the industrial atom shall be in accord with the American system."—David E. Lilienthal, former Chairman of the Atomic Energy Commission, in *Collier's Weekly*, June 17, 1950.

"There will obviously come a time, as the state of the atomic-energy art advances, and as industry recognizes more opportunities for a free competitive participation—particularly in power—when the desires of industry can no longer be accommodated under the law's present provisions."—Gordon Dean, present Chairman of the Atomic Energy Commission, addressing Founder's Day, University of Michigan Law School, April 25, 1952.

The time has now arrived to take the next great step, and, by appropriate revision of the statute, to make use of American private industry along with the established Government industry to give the Nation the full benefit of atomic energy.

Respectfully submitted.

E. BLYTHE STASON,

Dean, School of Law, University of Michigan.

[Telegram]

WASHINGTON, D. C., May 4, 1953.

WALKER CISLER,

President, Detroit Edison Co., Detroit, Mich.:

Would greatly appreciate statement by you for joint committee use as to whether or not Detroit Edison proposes to build a reactor suitable for ship propulsion; if so whether this reactor proposal depends upon Government subsidy or Government purchase of byproducts; the number of years required to design and construct the reactor after satisfactory changes in the law are made; your ideas as to the personnel and facilities you would use; whether any such company proposal has support of Detroit Edison board of directors; and details as to how your present proposal, if any, for a ship reactor differs from the proposal for a stationary reactor you have already submitted to the Atomic Energy Commission. Thank you kindly for your cooperation.

W. STERLING COLE,

Chairman, Joint Committee on Atomic Energy.

[Telegram]

MAY 5, 1953.

HON. W. STERLING COLE.

Chairman, Joint Committee on Atomic Energy, Congress of the United States, Washington, D. C.:

The project in which the Dow Chemical Co. and the Detroit Edison Co. have been engaged in for some time past, and presently are continuing research and development work, relates to a high-temperature breeder reactor suitable for stationary land installation. Others are associated with us in this undertaking. We have not heretofore made any statements of its possible use for ship propulsion, and to the best of our knowledge it would not be appropriate for shipboard use. Our studies relate to a reactor which if successful will provide an economical method for utilizing atomic energy as a supplement to conventional fuels in the generation of electric power. This program previously submitted to the AEC has the approval of the board of directors of the Detroit Edison Co., and in a summary way may be stated as follows:

1. The Dow Chemical Co. and the Detroit Edison Co., together with others associated with us, are studying and developing the technical problems and design of a high-temperature breeder reactor which we believe would be best suited for the widespread generation of electric power or other heat-energy requirements.

2. This research and development has been and now is being carried out to the extent permitted under existing laws by the use of our funds and of those engaged with us in the effort. All of our work has been and is open to Commission inspection.

3. We have made much use of research performed by the Commission laboratories. We also are utilizing additional results as they become available from research at the Experimental Breeder Reactor, Material Testing Reactor, and other locations, performed as a part of the Commission activities not directly related to our project. In addition, certain specific research and development work needed to complete our studies requires facilities presently available only in the AEC National Laboratories such as Ames and MTR. Because a solution of the problems involved and the results of the research will be of interest to the entire atomic-energy development, it generally has been assumed that this work would be assisted by research facilities of the Commission. The results of any research and development carried on in the laboratories of AEC for us are of course available to the Commission and to others that may be entitled to them.

4. If our studies indicate that a high-temperature breeder reactor is commercially competitive, considering both heat energy and reactor products, and we are hopeful they will, we propose to design, construct, test, and operate such a reactor using private investment funds and without Government subsidies, plutonium-purchase contracts, or guaranties of any kind. Although our program must justify itself on this basis, we believe that if breeder reactors are a success this country eventually can be made independent of overseas sources of raw uranium. In addition, the military would have a further source of high-grade materials for defense purposes.

5. This design, construction, testing, and operating program is contingent upon modifications of the Atomic Energy Act which would make such action lawful and possible as in other normal industrial development.

6. A high-temperature breeder reactor would produce plutonium as a byproduct, which we consider to be a high-grade fuel. This material would be suitable for the initial inventory for other high-temperature breeder reactors, or possibly as the fuel for other types of reactors, as well as for military purposes.

7. We have said repeatedly that the development of atomic energy for civilian peacetime applications should be carried forward on the basis of competitive industry. We also have envisaged that the AEC at the same time should vigorously carry forward those matters related to national security. This function and purpose of the laboratories should be protected and encouraged. In addition, AEC through its National Laboratories, which alone have the necessary facilities, should carry forward important research and development work of distinct value to civilian atomic-energy development. This research and development would be a contribution to the economic advancement of the country and would be comparable to similar activities of the National Advisory Committee for Aeronautics, the Department of Agriculture, the Bureau of Mines, and others.

We understand this statement is for the use of the joint committee and not to be released for publication. You may be assured of our continued cooperation.

WALKER L. CISLER,
President, Detroit Edison Co.

MEMORANDUM TO THE ATOMIC ENERGY COMMISSION—GENERAL PRINCIPLES TO BE CONSIDERED IN THE REVISION OF THE ATOMIC ENERGY ACT OF 1946 TO FACILITATE THE CONSTRUCTION AND OPERATION OF AN ATOMIC ENERGY PLANT BY PRIVATE INDUSTRY

Submitted by companies associated with the Dow Chemical-Detroit Edison Breeder Reactor project

When the Atomic Energy Act of 1946 was enacted, relatively little was known about nonmilitary utilization of atomic energy and private industry was not heard. Military uses and the protection of the public against potential dangers of misuse were the only factors given serious consideration. Possible participation of this country in international agreements regulating atomic energy was under consideration, but attention was primarily directed toward military application and national security. The nonmilitary uses seemed many years removed. All of these factors dictated that the act establish an almost complete Government monopoly. The result was an innovation without comparable precedent in the United States.

As a result of the joint efforts over the last 2 years of the Atomic Energy Commission and industrial study groups, the companies associated in the Dow Chemical-Detroit Edison project are convinced that a new industry, utilizing atomic energy, is about to emerge. Traditional competitive free enterprise is ready and able to undertake the task. Private industry is prepared to promote this development both with trained personnel and also with large investment of private capital as soon as conditions are right. The time has come when consideration must be given to changes in the Atomic Energy Act to encourage substantial investment of private industrial resources.

The correctness of the original assumption that atomic energy would present a peculiar problem unsuited to development through the traditional competitive free-enterprise system is now without foundation in fact. It has become clear, particularly in the last year or so, that the development of atomic energy is essentially no different from other industrial activities, and that peacetime utilization can be carried out by competitive private enterprise.

The purpose of the Atomic Energy Commission would remain. The benefits of industry's research and development would always be available to it.

The question then becomes, How can this great potential inherent in our private industry be best utilized? The closer the approach is to American competitive free enterprise, while at the same time safeguarding the public health, safety, and national security, the more efficient will be the country's utilization of atomic-energy potentials. As the Atomic Energy Act is now written, private industry is virtually precluded. The forces of free competitive enterprise will more rapidly advance the art of utilizing atomic energy, not only for peaceful uses but also in the interest of our national security. We believe that the act can be so modified as to make it possible not only to preserve paramount national interests but actually to advance them.

The Atomic Energy Commission must be given the power to grant long-term licenses, in the nature of a certificate of public convenience and necessity, to justify the use and employment of private capital and development. Such

licenses will, of course, be subject to appropriate limitations necessary to protect the public health, safety, and national security.

Moreover it should be recognized that privately owned atomic-power facilities, to the extent that they are used in traditional public-utility operations, should be subject to the established regulatory authorities.

Private industry recognizes that national security must be the first consideration in the development of atomic energy and in considering any amendments of the Atomic Energy Act. Specifically, the companies associated in the Dow Chemical-Detroit Edison project recommend that subject to the foregoing the Atomic Energy Act be amended so as to permit the following:

1. *Private ownership of facilities for the production of fissionable material, which is now prohibited by section 4 of the act.*—No person or group of persons will invest large funds unless there is legislative assurance that the plant may be owned and operated for a very long time. Adequate financing can be obtained only if the law allows the normal incentives and security for private investment. This includes private ownership of plants and equipment.

2. *Private ownership of fissionable material, which is now prohibited by section 5 (a).*—Since fissionable material is basic in atomic-energy operations, private financing is as dependent upon private ownership of such material as upon private ownership of production facilities. Subject to limitations of supply, prior to military needs, national security, and to regulation in the public interest, there should be a free right to acquire and sell fissionable material among the licensees and the AEC.

3. *Private ownership of source materials, which is now prohibited by section 5 (b).*—The assumption of private financing of facilities is completely unrealistic without an assured source of raw materials.

4. *A right to sell the byproducts of private operations, which will require modification of section 5 (c).*—Since the sale of byproducts is essential to profitable private operation of atomic facilities, licensees must be free to sell them, subject to necessary health and safety regulations, and to national security.

5. *A right to a long-term license, which will require amendment of section 7.*—The investment of adequate capital cannot be expected unless the duration and the conditions under which operations will be allowed to continue are known. These should be specifically set forth in the license in accordance with standards prescribed in the act. Furthermore, licenses should be subject only to compliance with specifically stated conditions and standards.

6. *A right to normal patent and "industrial secret" protection, which will require amendment of sections 7 (c) and 11.*—Only under the incentives of competitive enterprise will the greatest advances in the art of producing and utilizing atomic energy and its byproducts be realized. Not only will private development be greater, but the military program will also benefit. Satisfactory procedures have long been established for control of inventions and discoveries having military significance. The system has protected the military and at the same time rewarded the inventor for his investment and ingenuity. Industry has accepted this pattern in the past. There is nothing in the nature of atomic energy requiring a different treatment except as may be required in the interest of national security. One of the most important features of our free-enterprise system is the development of new processes and methods. It seems inappropriate to take away this incentive by changing patent rights and requiring full disclosure to all competitors. Of course, full disclosure to the AEC on a confidential basis should be required to protect the public health and safety and to determine which have military significance.

The above changes are imperative if a free competitive atomic-energy industry is to be established. Such an industry will not only produce the full benefits of potential peacetime uses but will also provide the Nation with a broader and sounder base upon which to build in time of emergency. In addition to the foregoing it is also desirable that many other features of the present Atomic Energy Act be studied for amendment or repeal:

(1) The provisions of section 7 (c) which give the Commission responsibility in antitrust matters probably should be handled as other antitrust matters are handled, by the office of the Attorney General.

(2) The provisions of section 7 (d) which possibly interfere with the regulation of public-utility operations by presently constituted regulatory agencies probably should be left to those Government agencies.

The foregoing is submitted for the purpose of discussion. We believe an opportunity is hereby afforded to reconcile the fundamental purpose of the Atomic Energy Act, the protection of national security with the purpose and advantage of utilizing private industry's ability and facilities.

Mr. CISLER. We are very privileged to be here today, and we thank you very much for your courtesy.

Representative HOLIFIELD. Mr. Cisler, we are glad to have you before the committee again.

Mr. CISLER. Thank you.

Representative HOLIFIELD. Is your statement a statement on behalf of the whole group, or does it represent a statement of the utility portion of that group?

Mr. CISLER. It is a statement for the whole group, Congressman.

Representative HOLIFIELD. Now, as I understand, the utility companies are not particularly interested in patents, as such. They are interested chiefly in the power, the end product power.

Mr. CISLER. I think it is very necessary, Congressman Holifield, to realize that the heat energy is just a part of this development. As I endeavored to point out in the formal presentation, there are other aspects in the commercial value of the products and byproducts which have a very definite effect on the economic and competitive aspects of the generation of electric power.

Representative HOLIFIELD. But in the main, the utility group is interested in production of cheap power, rather than in patenting processes and patenting machineries?

Mr. CISLER. I can speak for my own company. We have had a research and development program for many years. We have encouraged invention by our employees. We have also carried forward certain research and development work as a corporate undertaking. I feel that patent matters are very definitely a part of this, because we are concerned with the development of equipment, and that equipment must come out of the teamwork which this group represents. I don't believe that it is possible to separate one part from another.

I think we have an unusual situation here, whereby the electric power industry, in order to carry forward this development, must be very interested in the development of the equipment itself. We have always been concerned with that, but we have largely looked to the manufacturers of equipment for much of the development work, and they in turn have been concerned with patent matters. I do not believe it is possible, in this particular project, to separate out the patent aspects. I would be glad for Mr. Gillespie, who is here with me, and who is much more versed in those aspects than I am, to speak, if he would care to.

Representative HOLIFIELD. Well, Mr. Cisler, I, of course, agree with you that the patent problem cannot be divorced from the change in the law. And I regret that you have not made the presentation to us which would state in clear terms the types of patents that you would like to have, the values that those patents would have to industry, upon what basis those patents could be given, due to the fact that we already have this great base of technical knowledge which it is necessary for you to go to the Government to get. Before you even start patenting anything, you must have access to this material, which in the last 5 years has cost the Government \$550 million, in the research and development of reactors alone, not in weapons or anything like that, but in the reactor phase alone. The Government has spent \$550 million in the reactor phase. Now industry comes in with a desire for a change in the law, which you have stated on several different occasions here, and yet in your statement you have avoided being explicit on the patent provision. And yet we have to be very explicit in writing legislation on that point.

MR. GILLESPIE. Mr. Holifield, may I answer your question, possibly more explicitly? We have discussed the subject of patents among the various members of the association, and it is our feeling that the patents on power development developed in the course of our project, provided that the act were amended, would be licensed to the United States Government for military purposes without charge.

Representative HOLIFIELD. The present act provides for that.

MR. GILLESPIE. The operation of the act, as expressed by the regulations require that in order to do work in atomic energy, you contract with the Commission, and in most instances when you contract you have an "A" type patent clause which takes all of the patent rights.

Representative HOLIFIELD. That is right; for military uses.

MR. GILLESPIE. For all uses.

Our policy would be that the Government, for military purposes, would be granted a license royalty-free. The associates in the group individually would also be granted a license royalty-free for anything developed by the group itself with its own money. To the rest of the world, the patents would be available for power development, but a royalty would be charged.

Representative HOLIFIELD. What type of a royalty? Would it be on a restricted basis?

MR. GILLESPIE. No. We would open it to all the world. The forward looking companies of America today feel very strongly, as I am sure our companies do, that the greatest profit to the company comes from a broad patent licensing basis, similar to the chlorophyll illustration that I gave you before in executive session. Let everyone come in at the lowest possible royalty rate. Then your broad base of patent licensing gives the income, rather than holding it to the restricted few and charging a high royalty rate.

Now, forward-looking companies feel that way. I would assume that, inasmuch as we have made a positive statement here that on power development we would license the patents to the world, we would charge a royalty rate that would be reasonable and right.

Representative HOLIFIELD. You would agree, then, to compulsory licensing to any group that came before you and offered to pay a fair and indiscriminate royalty?

MR. GILLESPIE. I wouldn't agree to the theory of compulsory licensing. I state that the position of our project is that we would license voluntarily in the field of power.

Representative HOLIFIELD. Well, if you would do it voluntarily, and that is your objective, we are writing legislation, you know, and your personal assurance to this committee is accepted at face value. But you may be dead tomorrow, and the law may live on. Now, you would object, then, to compulsory licensing so as to make any patent that you might have acquired available to all other private industry groups and all States and political divisions?

MR. GILLESPIE. We would object to the theory of compulsory licensing, yes. As far as we personally are concerned, we would give the same effect to our activities as though we had compulsory licensing. But you see, it is a voluntary thing, and that is different than compulsion.

Representative HOLIFIELD. Well, if you want complete widespread participation in the benefits of atomic energy, which you admit has a very, very strong base, which has been produced by Government expenditure, and if you want the widest possible competition, the

widest possible use, such as the chlorophyll example that you have just given to us, it would seem to me that you wouldn't object to a compulsory licensing provision.

Mr. GILLESPIE. I would feel very strongly that we shouldn't put a compulsory licensing clause in the Atomic Energy Act, for the reason that it should be made as near like the patent provisions of the general business of the world today as possible, and compulsory licensing is not a usual feature of patents.

Representative HOLIFIELD. Well, how do you propose to compensate the taxpayers of America for their investment to date in this development?

Mr. GILLESPIE. Mr. Holifield, we have compiled a group of questions which have been put from time to time by yourself and others. We have attempted to answer them in the best way that we could. We have them written here. And I would like to leave a copy of them with you, so that you might look over the answers that we have made to the sort of question which you now propose.

Representative HOLIFIELD. Well, it might be well to read into the record the answer that you have.

Mr. GILLESPIE. All right. I will ask you if this is the question that you put to me:

Will the public investment of \$12 billion be turned over to private enterprise for exploitation if the act is amended?

Representative HOLIFIELD. That is close to it. However, I realize that part of that 12 billion has been along the line of military development.

Mr. GILLESPIE. That is true.

Representative HOLIFIELD. And I certainly would not apply the \$12 billion in toto to the comparison of the investment that your private groups have put in.

Mr. GILLESPIE. Our answer to that is this:

Most of the 7 billion that has been spent for the Government atomic-energy program and the 5 billion it has declared it will spend in the near future has been for military production. We do not ask to take over the entire program; we do not want to make bombs. We, and we speak in this sense as a member of industry generally, ask only for permission to use certain knowledge of small dollar value which has not been fully exploited by Government. This knowledge will not be consumed; it will be put to use, like a breeder reactor, to generate more knowledge. This new knowledge, which we return to the Government, is the interest we pay for use of the old.

Because of our patent policy which we have heretofore announced, if we succeed, the Government and the Nation gain by our success. If we fail, the Government reaps the benefits of our sad experience without cost.

Senator HICKENLOOPER. I think we might have all those questions and answers put in the record at the end of this testimony, if that is all right.

(The material referred to will be found on p. 167.)

Mr. GILLESPIE. That would be very fine, sir.

Representative HOLIFIELD. Mr. Cisler, how much money is your company or your group prepared to put into this development?

Mr. CISLER. At our previous meeting, Congressman Holifield, we said that such a project might cost \$50 million or more. And Chairman Cole asked:

Do you make the unqualified statement that you have \$50 million ready to undertake this project if the law is changed?

My answer to that question was this:

When you ask me, do we have \$50 million directly in hand, I must answer that we do not. But we certainly do hope to have it when the time comes to carry out the project.

And may I say this same situation with respect to financing is true throughout all of the expansion of our facilities. This year alone our company has gone into the market and borrowed more than \$50 million to carry out the expansion of its facilities. Perhaps later this year and next year, of course, we will be doing more financing. We seek the funds as we need them to carry out the construction. And we would expect to proceed in a similar way in carrying out this proposed project.

Representative HOLIFIELD. Would you plan to build a single-use reactor or a dual purpose reactor producing plutonium as well as power?

Mr. CISLER. Oh, indeed a reactor producing plutonium as well as power, a fast high temperature breeder reactor, which is a producer of energy to be used for the generation of power as well as for the production of plutonium, which of course, is a military material and is also a very high grade fuel.

Representative HOLIFIELD. I assume that you would want contracts with the Government to purchase that plutonium?

Mr. CISLER. No; we do not seek any contracts for the purchase of the plutonium. And if I may take just a moment further, I would like to—

Representative HOLIFIELD. Well, you know, no one else would be allowed to buy it under present law, and certainly it could not be released in an uncontrolled fashion into the general market as other materials are, because of its bomb-making properties.

Mr. CISLER. That is true. Whatever use would be made of the plutonium produced would have to be in keeping with the law as it is written. But I do want to make it clear that we are not seeking any contract, any guarantee, for the purchase of plutonium on the part of the Government. What we produce must find its place in competition with the Government's own production of plutonium.

Representative HOLIFIELD. Well, now, assuming that your plutonium is not, from a cost standpoint, a fuel which is competitive with convention fuel, it would be very doubtful if it would have a very widespread sale outside of the Government.

Mr. CISLER. Well, it is possible that it could be used as a premium fuel for power generation in remote areas where fuel costs are high. We must keep in mind that the justification for a nuclear heat power reactor would be influenced greatly by the cost of the competitive fuel. Conditions will be different for all parts of the country. The competitive justification of atomic fuels certainly will not occur first in those areas where conventional fuel costs are lowest.

Representative HOLIFIELD. Well, in view of the fact that the Nation has large coal resources and oil resources available to it, do you think that now is the time for the Government to subsidize the production of atomic power by private industry?

Mr. CISLER. No; I do not.

Representative HOLIFIELD. You would not require any form of subsidization in the form of abnormal tax amortization or long-term Government financing at low interest rates or contracts for the purchase of plutonium at fixed prices?

Mr. CISLER. No.

Representative HOLIFIELD. You would depend upon the patent rights and its economic value to the market to sustain it?

Mr. CISLER. Yes. I think it is important, too, to remember that up to the present time the atomic-energy industry has really been a military industry, and it has been an industry that has consumed great quantities of power rather than produced power. We are endeavoring to make it produce power.

Representative HOLIFIELD. Assuming that the Congress were to grant private industry the privilege of producing plutonium for sale to the Government or to other facilities, how many firms should be allowed to have that privilege?

Mr. CISLER. I think as many as would care to engage.

Representative HOLIFIELD. As many as can raise the 80 to 125 million dollars to build a reactor?

Mr. CISLER. And they would do so on the economic justification.

Representative HOLIFIELD. Why is it necessary for you to own the reactor? When you want to take the power, when your chief interest is in the end product, could not the federally owned reactors deliver power to the private utilities company, so called, at the busbar—why could not that arrangement be satisfactory?

Mr. GILLESPIE. In the first place, the Government reactors presently in being are not competent for doing so.

Representative HOLIFIELD. Well, that is true. There is no reactor in existence at the present time. It is all in the planning stage.

Mr. GILLESPIE. And we propose to build that reactor. That is why that could not be done.

Representative HOLIFIELD. Wait a minute. The Government could build the new type of reactor just the same as private industry.

Mr. GILLESPIE. There is no question about it, but they have not done it.

Representative HOLIFIELD. Neither has private industry. So that is no argument.

Mr. GILLESPIE. We are asking the opportunity.

May I go back, Mr. Holifield, to your last question? You made the statement that in order to have the qualification to get into the atomic industry under this program, we should have to have a hundred million dollars. I think that we have got to think a little further than that. There would be a lot of small business. There would be a lot of inventors, men who are not now participating, that would be qualified. And I think that the AEC would license them to take patents, people who today can't patent their material, because they are not in the study groups and not in the places where they would have the access to it. This would open up a broad new field to people qualified under the regulation of the Atomic Energy Commission, from the public-health and national-security standpoints. So it would not mean by any means that you would have to have the qualification of a hundred million dollars to get into the business because of the fact that the law were changed.

Representative HOLIFIELD. Just a minute. At the present time, of course, any properly cleared person can have access to the laboratories of the Government, just the same as your group has been given access to this mass of information. Now, no backyard mechanic is going to go in, in this highly complicated technical field, and start making inventions which are new and novel, but they have to be qualified people trained along the line of chemistry and nuclear physics, as

you know, and those people can obtain clearance, and as a matter of fact, the majority of the people in the United States that are qualified, I believe are associated in one way or another with this program. I mean those that are highly qualified. There may be some others that may get into it later.

Mr. GILLESPIE. There are some people in universities, I believe, that are qualified that do not come in.

Representative HOLIFIELD. We have a very strong university program, as you know.

Mr. GILLESPIE. That is true.

Representative HOLIFIELD. I yield to my friend.

Representative PATTERSON. Just following your statement here, is it not true that the large corporations would have an advantage and might build patent-protected monopolies and freeze out these little fellows?

Mr. GILLESPIE. Oh, I think that would be very unlikely?

Representative PATTERSON. Why would it be unlikely?

Mr. GILLESPIE. If you will just pardon me one moment, I think we have answered that in one of these questions. We have discussed that, and I will give you the answer that we have developed on that.

Representative PATTERSON. Well, maybe you could tell me how the smaller companies would have an equal opportunity to, say, capitalize on this public-financed background there, of your own study groups.

Mr. GILLESPIE. The smaller companies?

Representative PATTERSON. Yes.

Mr. GILLESPIE. Well, the smaller companies are joining in our study group. We have electric companies that are smaller companies. They aren't large; they are very small companies. And where there may be a possibility that at the core of most of these study groups you will find a company which is more expert and has had more experience in the atomic-energy field, but each of these projects has gathered in new companies. For instance, our group is now 1 of 30 companies involved. Not all of them are associated. I think there are 3 or 4 of them that are hired, but there are 30 involved. And of all these 30 companies, only 7 of them had ever had any contracts or a chance at being on the inside of the atomic-energy program before. So we have 23 new companies associated in the program. And you have the scientists, the engineers of these companies creating a great reservoir of new people added to the atomic energy research program. It is a great reservoir that is being added, of large and small companies; some are very small companies.

Representative PATTERSON. What is the answer now to the question I just propounded?

Mr. GILLESPIE. The answer is on page 9. The question is:

Isn't private enterprise best served with more companies involved? The amendment of the act now would limit participation to relatively few large businesses on the "inside."

And we point out there that we have added 23 companies to the "inside" group, so to speak, and that included in these 23 companies are some very capable, brilliant men. And we have added \$10 billion of resources to the program.

Representative PATTERSON. Would these companies be dependent upon your organization?

Mr. GILLESPIE. In the inception, the training of the new people is dependent upon the organizations who have had contractual expe-

rience, but soon they fly upon their own. It doesn't take too long for them to catch up.

Representative VAN ZANDT. Is it not true that your group is actually spearheading the effort for the industry in general?

Mr. CISLER. I do not believe that we are spearheading for the industry in general. I do not think that is true. Those who are associated with us have done so because they wished to. There are others not now in the group who are desirous of joining the group. We have not asked the Atomic Energy Commission to include them, but we think it would be desirable to have them as members of the group.

Representative VAN ZANDT. In other words, you are independent, this group is, of the industry in general?

Mr. CISLER. Yes, we are entirely independent, and we do not speak for the industry. We speak for only those who are associated with us.

Representative VAN ZANDT. Suppose you were successful in the development of a fast reactor, and you actually constructed the plant. What would be necessary for another member of the industry to become part of your group? Would they have to buy in under rules established by you?

Mr. CISLER. I believe that that would come about largely through whatever royalties they might pay as a part of the purchase cost on equipment and the like which would be used. This would not be unusual, because in the history of the power industry equipment has been developed, and certainly the producers of that equipment have had definite rights, patent rights. Those holding the patents have licensed others to build similar equipment, and the proposed plans would be no different than that.

Representative PATTERSON. But in a situation like that, who would control the patent rights?

Mr. CISLER. In our project, the associated group.

Representative PATTERSON. It looks to me like the building of a monopoly.

Mr. CISLER. I don't believe so, Mr. Patterson. I believe that the necessary precautions should be taken to prevent that.

Senator HICKENLOOPER. If you do not mind, may I ask a question here that might illustrate this?

For instance, Westinghouse and General Electric probably operate very few powerplants delivering electricity to the people. But they build generators and things of that kind and sell them to the industry. Is it possible that such a development might come, where individual powerplants would not want to put any part of the money into research, but they might be perfectly willing to buy the designs and the plants, as they do generators that they now buy from the people who specialize in making them?

Mr. CISLER. And which also may have royalties or patents involved in them.

Senator HICKENLOOPER. Certainly. In other words, it is not necessarily envisioned that each company that wants to use an atomic furnace to create some heat for power will build its own, is it?

Mr. CISLER. That is true.

Senator HICKENLOOPER. Probably it is impossible for many that would use it to build their own plant.

Mr. CISLER. Traditionally the electric power systems, the operators, have bought their equipment from the manufacturers. Now we must be a part of the development of that equipment for future use.

Might I just say, Mr. Holifield, that this particular project involves a complete system. It is more than just the reactor. It includes the processing of the reactor products and the byproducts. It starts with the source material and carries right through to the end point.

Representative HOLIFIELD. You mean you are planning to do all of that?

Mr. CISLER. We are planning to do all of that as a part of this project. Our plans do not stop with the reactor.

Representative HOLIFIELD. I hope you are not planning to do that for \$50 million, or even a hundred million, or even \$500 million. Because the processing in the plants that process this material, to clean it up after it becomes contaminated, I assure you is expensive.

Mr. CISLER. I am aware of that. We believe that we can do it at less than the present cost.

Representative VAN ZANDT. Will the gentleman yield?

Will you tell us about how much the plant you have in mind will cost?

Mr. CISLER. We have used a figure of approximately \$50 million.

Representative VAN ZANDT. Where are you going to get the manpower?

Mr. CISLER. To build?

Representative VAN ZANDT. No, to operate.

Mr. CISLER. We would develop the manpower, train it, or seek it from other sources of experience.

For example, at the present time we have about 50 people working full time on this project. Those men are from the various organizations associated with us. They have had experience at Oak Ridge. They have had experience at Schenectady. They have had experience elsewhere. We have endeavored to mobilize this experience, this manpower resource, to make it useful in carrying forward this development. This procedure has been a very essential part of our project and has been made possible by the widespread participation. Mr. Rincliffe from Philadelphia has people with us; Mr. Lindseth from Cleveland; Mr. Fairman from New York. And so I could name all of those participating. The men from these companies are working in different locations, in the manufacturing plants, back in Detroit, Midland, New York, and elsewhere.

Representative VAN ZANDT. Another question, Mr. Chairman.

I notice that the total investment of your group represents about \$8 billion. Do you know of any other combination of companies within your industry that could form a similar group and probably come up with \$50 million for this purpose?

Mr. CISLER. I am not prepared to say, because I personally should not speak for any other part of the industry which is not associated with us.

Senator PASTORE. May I ask a question on that point at this juncture?

Could you invest all this money without the permission of your local activity administrator?

Mr. CISLER. We believe that the public service commissions should be kept fully informed of the development. As a part of the project, we at very early stages requested the Atomic Energy Commission to clear Mr. McCarthy, the chairman of the Michigan Public Service Commission, and he has been cleared. He was with us here when

we appeared before this committee a few weeks ago in executive session. The NARUC, which is the organization of utility commissioners throughout the United States, has appointed an atomic energy committee, and in the membership of that committee there is a member from Michigan, a member from Wisconsin, a member from California, I think one from Missouri, and they are going to be concerned with this development from a Commission standpoint. I believe that the Commission has had a request to clear those people so that they can be enforced. We believe that our Commission in Michigan should be kept informed, because we are expending funds. Whenever we are going into the market to attract funds into our enterprise, we do so with the full knowledge and approval of the Commission our expenditures on atomic energy should be on the same basis.

Senator PASTORE. Therefore, is it reasonable for me to assume that any investments made would be supervised from the standpoint of the public interest?

Mr. CISLER. I believe so.

Senator PASTORE. Here is another question I would like to ask you, Mr. Cisler. Your thesis that you have developed here today is predicated exclusively upon private funds being invested in this experiment, exclusive of any Federal appropriations?

Mr. CISLER. Yes, sir.

Senator PASTORE. Am I right in that assumption?

Mr. CISLER. Yes; with the exception of the work which is being done at the national laboratories. And there we have said that if the Atomic Energy Commission should decide that there should be a charge made for the work, then industry would have the alternative of meeting that expense or seeking other similar facilities to carry on the work.

Senator PASTORE. And if these changes which you have suggested are made in the law, do you see private industry building a reactor within a reasonable time?

Mr. CISLER. Yes; I do.

Senator PASTORE. Would you venture a guess on the number a year?

Mr. CISLER. We have said in this presentation that we would hope to have our preliminary research and development work accomplished by, say, the end of 1954, and that we could then proceed with the detailed engineering design and later construction. As you know, even the conventional powerplant today requires 3 to 4 years for its construction. Certainly it would require a longer period of time to carry out the design and construction of a nuclear reactor plant. Going with that nuclear reactor would be the same type of generating equipment which is used in the conventional plant, and which requires about 3 years for its manufacture and erection.

We would hope to accomplish this entire project in a period of 10 years or less.

Senator PASTORE. And one further question, Mr. Cisler. To merely get your opinion on the record on this question: Do you see nuclear energy or power being developed for civilian commercial use by Government alone?

Mr. CISLER. Being developed by Government alone?

Senator PASTORE. Do you see any prospects of that within the 10-year span that you are talking about?

Mr. CISLER. I think that it would be possible, of course, for Government to do it in that period of time. Whether Government should or should not do it I think is a matter for Government to decide.

We have said in our summary here that the opportunity that we are seeking does not in any sense preclude Government from doing whatever those in responsible charge may decide should be done.

Senator PASTORE. Do you think that private industry can do it better and faster?

Mr. CISLER. I do.

Representative VAN ZANDT. May I add, Mr. Chairman, cheaper?

Mr. CISLER. Yes; from the overall standpoint.

Senator HICKENLOOPER. Senator Bricker, do you have any questions?

Senator BRICKER. You mentioned a moment ago that this group banded together anticipating, of course, the development of power for public utility consumption as well as private consumption.

Mr. CISLER. Yes, Senator Bricker. For example, with us in Michigan, we are interconnected with the Public Lighting Commission of the city of Detroit. We exchange power with them. The Consumers Power Co of Michigan, interconnected with us, interchanges power with the city of Lansing, Mich., which has its own plant. The Ford Motor Co. has a large powerplant of its own. We interchange power with them. So that any economies that could be brought about by the use of atomic energy for power generation would benefit all of the users of power; because power is interchanged on an economic basis, and it ultimately reflects in lower costs to the user.

Senator BRICKER. You mentioned a moment ago that a committee has been appointed by the National Association of Utilities Commissioners for the purpose, I suppose, of just keeping in touch with the development throughout the country of the private utilization of this new source of energy. The Commissioners at the present time, of course, would not be interested in the program as such, except that it might deplete the resources of some public service company, to the extent where it would affect the character of the services that were rendered.

Mr. CISLER. Yes.

Senator BRICKER. That is the only place that their jurisdiction would attach. Would they "blue sky" your investments in this new operation?

Mr. CISLER. They would be concerned, for example, with the period of amortization and the reserves to be set up. The period of amortization might be shorter, or it might be longer. As we said, the conventional powerplant has a useful life in excess of 30 years. We are using equipment that has had 40 years of useful life. If there had to be a more rapid amortization, because replacements or improvements of nuclear reactors were necessary the public service commissions would be concerned.

Senator BRICKER. That is after you begin to render service, of course.

Mr. CISLER. Yes.

Senator BRICKER. At the present time, you are not thinking of developing this as a public utility.

Mr. CISLER. Well, of course, the power would be used in the public or industrial systems. The actual carrying out of the project might

be done as a separate undertaking, contracting for the sale of the power to the system in the area.

Senator BRICKER. Where do you anticipate building this reactor?

Mr. CISLER. We don't know, Senator Bricker. At the present time a very large exclusion area is required. We hope that the exclusion area requirement can be lessened greatly because the economic consideration will be influenced greatly by the amount of land required. Certainly we would have use for such an installation in Michigan. I am sure there are many other States where such an installation could be placed on an economic basis, provided, of course, that the disadvantages as to area requirements or distance do not make it an unsound economic venture.

May I say this: that we expressed what our associated group are doing in the way of expenditures and increasing the capability of their systems. The interconnected power systems of the United States, those which are privately or investor owned, those which are federally owned, and those which are nonfederal, such as Los Angeles, have under construction more than 40 million kilowatts of additional generating capability scheduled to come into service in the period 1953 through 1956. Of that 40 million kilowatts more than 36 million kilowatts is in the form of fuel-generated electricity. This shows that predominantly, the electric power of the future in this country is going to come from the use of fuels. That is borne out by the present President's Materials Policy Committee report. The fuel reserves of the country are far greater than the hydraulic reserves.

Senator BRICKER. This is hypothetical only, but if you are going to build this in Michigan, would you anticipate going to the Michigan Public Utilities Commission for authorization?

Mr. CISLER. Yes, certainly, as a public utility.

Senator BRICKER. My first question was: You are going to proceed on the theory that this is a public utility, and a public utility service will be rendered?

Mr. CISLER. Oh, yes. Very definitely. The Detroit Edison Co., speaking for the company, could not proceed on any other basis.

Senator PASTORE. As a matter of fact, if this experiment were a failure, that cost might have to be passed on to the consumer in that area; might it not?

Mr. CISLER. If it was a failure, it certainly would be a cost to the owners of the property, and there would be a cost certainly that would come out of the revenues, or the reserves that you have set up.

Senator PASTORE. It might affect the rate base?

Mr. CISLER. It might affect the rate base.

Senator BRICKER. It would not affect the rate base. It might affect the cost of service, if it were not used and useful. If it did not become used and useful, it would have nothing to do with the rate base, and then there would be the question of whether or not it was a legitimate expenditure for the purpose of rendering the present power service.

Mr. CISLER. Yes, sir.

Representative HOLIFIELD. Mr. Cisler, during the past 7 years, there has been a tremendous development in the atomic-energy field, as you well know. We have improved our reactors. As you know, we had trouble at Hanford with certain processes, problems which have now been solved. We have developed a great many special metals, zirconium, for instance; we brought the price down from several hundred

dollars a pound to a few dollars a pound. We have developed pumps, special machinery, and all that sort of thing, to do this job. And last and probably most important we have got the genesis of the breeder process pretty well established, although it will be, as Mr. Dean said, probably 5 years before we get the benefit of the breeder process.

Now, you are aware that that progress was made by private industry, using Government funds.

Mr. CISLER. Yes.

Representative HOLIFIELD. They made it under contract. So I am a little bit at a loss when you say that private industry can do something so much better than private industry has done in the past, when we have had the biggest and the best industrial companies in the Nation doing this job, and they have had an unlimited amount of funds, and they have not had to answer to stockholders, and they have not had to hesitate, and they have not had to raise funds to do this job. And they have been given the privilege of going down many avenues of research and development, which a private company could not afford to do.

It somewhat amazes me to hear you say that now, by the investment of a very few million dollars, private industry is going to bring about some miracles in the next 3 to 5 years.

Mr. CISLER. Mr. Holifield, I was speaking about this particular high-temperature fast breeder reactor project.

Representative HOLIFIELD. Well, now, let us speak about that. Was that not developed by Dr. Zinn and some of his colleagues? That was not developed by the group that you are affiliated with. In fact, your group, all of your men, got their training from these men in the Government-managed facilities. They went to these different private companies, like GE, at Hanford, and the Berkeley Laboratory, which is under contract, and they got the knowledge of these thirty-odd different types of reactors, and they have already been thought about and put down in writing, you might say, although not developed in detail. So you are not coming up with an original contribution in this high-temperature reactor.

Mr. CISLER. Much of the data has been known. In fact, some of the scientific information was known before even the Government carried on its military program.

Representative HOLIFIELD. Oh, I am sure that is true.

The early history of atomic energy is the history of what occurred in the private laboratories, in educational institutions in this country and overseas. The basic principles have been known. Certainly private industry has benefited. I hope that private industry has contributed also.

Representative HOLIFIELD. I think private industry deserves great credit for the development of atomic energy to date, even though they have done it with Government funds. I think in the operational field they have been the ones who have done it, and I am anxious to give them that credit.

Mr. CISLER. We have for several year been doing work in Michigan for Argonne to carry out certain research and test work for the Government.

Representative HOLIFIELD. I realize that.

Mr. CISLER. And the Government has used many others; ourselves in only a small way. Certainly we have benefited greatly.

I would believe that the carrying out of a specific project of this kind, a complete system, would draw on a great deal of the background of knowledge now had and knowledge which will be gained by research and development now under way.

We have had wonderful cooperation from the Atomic Energy Commission and its staff throughout.

Representative HOLIFIELD. I think this committee has pushed them, if "pushed" is the right word, out of the operational field, or prevented them rather, from getting into the operational field, as a Government operation, and has insisted that they act as a management group and contract for the actual operation to be in private industry. This was a protection against the growth of a great Government bureaucracy.

Mr. CISLER. I have felt personally very close to this, because I was a consultant for the Atomic Energy Commission in 1947, to assist in setting up the controls over the export of materials and equipment, and I felt it was a privilege to be able, as a citizen, to help the Commission and its organization in certainly a small way to advance forward atomic energy.

Representative HOLIFIELD. I am sure you have rendered valuable service, sir. I wouldn't want the line of questioning I am taking to indicate that I am antagonistic to private industry participating in this. I do say that I have some question as to the timing and type of participation. And I would like to ask you what you think about this.

Let us assume that out of the 30—and I use the figure "30" loosely—reactors that could be built, 10 of the most promising, or 5, were selected, and the Government went ahead, at the cost of approximately \$10 million, and built fairly large pilot types, large enough so that from an operational standpoint we would get many of the answers that we want in this period of interim development. At the end of that time, with an experimentation of, say, a hundred million dollars, we could develop the 10 most promising types of reactors, under the actual operation of private industry, just as we have proceeded in the past. Then, at the end of, say 3 to 5 years of experimentation along that line, it seems to me that private industry would be in a position to select from out of that 10 the 1 or 2 most promising types. And then they could go ahead with actual knowledge, in the investment of their stockholders' money, and from that time forward, the field would be open to everyone, without exclusive patent rights obtained in this interim period, or exclusive claims of any type of advantageous equity for these few groups that can participate—and they must be few because of the amount of money that is involved.

And it would seem to me that private industry would then be in a much safer position, with their own stockholders' money, and they would certainly be in a more knowledgeable position, after a 3- to 5-year experimentation period along this line. And you admit that you could not get a large reactor into operation for less than 6 or 10 years. And you might then find that in the meantime development has brought about processes which would make your reactor obsolete.

So it seems to me that you are entering into a period of extreme risk for capital investment right at this experimental stage. What would be wrong with that type of a program, may I ask?

Mr. CISLER. Well, I think that it would not accomplish results as quickly or as effectively as I believe they can be accomplished by permitting private industry now to use its resources of all kinds to carry forward this development. I believe that private industry ought now to put its shoulder to the wheel in carrying forward atomic-energy development. Private industry has great resources, in experience, in manpower, in financial resources. Certainly it has been the history of industry that once an opportunity and a development gave promise, it would move forward. We believe there is promise. We believe this is serious business for us, and that we ought to engage in it now as rapidly as we can; that we should carry forward the research and development work with the hope and the expectation that we could then move forward into the actual construction.

I think that there may be no one best type of reactor. We believe this type is the one which, to us, holds forth the greatest promise of being competitively and commercially successful.

Senator HICKENLOOPER. You mean there may be several types of color television?

Mr. CISLER. Yes.

Representative HOLIFIELD. Mr. Chairman, I am going to desist in my questioning, although I have a great many more questions, but I think there will be other witnesses that I can ask the other questions. But I would like to say this, that in case the newspaper reporters take the \$50 million figure you gave as a complete cost for building a practicable reactor and the processing and the generating equipment that would go along with it, and the chemical processing cost of the fissionable material, I would warn them that \$50 million would be, in my opinion, about between 10 and 20 percent of the cost involved, and not the total cost. I do not think you would want to let that \$50 million stand, would you, sir, as your estimate of that total process?

Mr. CISLER. We have used that figure, after very careful thought. We would hope that we can find ways and means of decreasing the capital expenditure, and that would be a necessary part of the accomplishment.

Representative HOLIFIELD. Well, I hope you can.

Mr. GILLESPIE. In connection with your last question, Mr. Holifield, we have gone through this same process of selection ourselves, very naturally, before we arrived at the idea that this was the type of reactor that should be developed as the type that we wanted to invest our stockholders' money in, and that is, of course, the reason we do it.

Mr. CISLER. We really seek the opportunity of moving forward.

Senator HICKENLOOPER. I understand your testimony, Mr. Cisler, along that line. You have not been in this business before. You are treading in a new field, and you would be pioneering in a field where you cannot exactly calculate costs at this moment. You would have to revise your estimates from time to time up or down or otherwise as the art developed along the lines that you expect to proceed. Is that correct?

Mr. CISLER. Yes.

Senator HICKENLOOPER. Thank you very much, Mr. Cisler. Do you have anything further?

Mr. CISLER. No, sir.

(The question and answer supplement referred to on p. 155 follows:)

QUESTIONS AND ANSWERS SUPPLEMENTING DOW-DETROIT EDISON STATEMENT
MADE TO JOINT COMMITTEE ON ATOMIC ENERGY JULY 1, 1953

1. WHY IS NUCLEAR POWER NOW NECESSARY?

There are five persuasive reasons.

A. To support the foreign policy of the United States.

Our status as a Nation will be affected by the place we take in world development of atomic energy. Every conceivable sort of atomic research must be carried forward to insure for this country a first place as a scientific Nation as well as a first Nation in military strength.

Also the trading advantage of power with small natural resource necessary to back it up is of inestimable value in trading with countries with small coal and oil resource and few transportation facilities.

B. To conserve national resources.

To us in the United States coal and oil are commonplace and plentiful, but under urgent military necessity even our vast supplies may dwindle, or be incapable of production as quickly as the situation may require. New uses for coal and oil may accelerate depletion, transportation bottlenecks may close powerplants, so that in consideration of these things a new source of power is most desirable.

C. To provide military strength.

The breeder reactor will give our country great military strength not presently possible without huge outlays of capital.

D. For specialized uses.

Because of the fact that relatively little material is used to fuel a nuclear reactor, great adaptability is achieved. It can be located at remote places otherwise removed from transportation facilities or natural resources. The technology learned can be utilized to operate vessels on land, sea, and air, and to perform functions for mankind not now dreamed of.

E. To be made economic.

If we are ever to know how to produce nuclear power cheaply, efficiently, and effectively, selective research must be started now to choose and develop the commercial approach.

2. WHY SHOULD PRIVATE INDUSTRY DEVELOP NUCLEAR POWER?

Private industry need not develop nuclear power alone, but the advantages of a team of the Government developing the military phases using the technology of private industry added to that technology already held by Government creates a great reservoir of strength which is greater than that of Government alone.

Private industry, to be competitive, will seek to practice economies which will accomplish the goal and inure to the benefit of Government. Private industry will attempt research which the Government dare not attempt because of the responsibility to not fail when using tax moneys. Military urgencies fluctuate with world situations. The urgency to produce the best the most cheaply, which is the essence of competition, is always present.

Lastly, the success of capitalism is based on freedom of industry to participate in business and not to reserve islands of business to monopoly, either Government or private.

Where the military is not concerned directly, there is no reason that atomic energy should differ from any other business in that regard.

3. UNDER THE PRESENT LAW, COULDN'T PRIVATE INDUSTRY AND PARTICULARLY OUR PROJECT PROCEED AS PLANNED EXCEPT UNDER GOVERNMENT CONTRACT?

This question goes to the basic philosophy of who is to do the business of the country—the Government or free enterprise. Every argument for free enterprise is an argument here. We are willing to do our patriotic duty and to give without price or contract the fruits of our research and know-how for the purpose

of meeting military requirements, but beyond that point, it is traditional that the fruits of an individual's effort belong to the individual. We would not contract to furnish anyone, even the Government, the data to build a new industry which will destroy us. The history, the concepts, nor the Constitution of the United States do not require it, nor does the history of the world ever disclose a country which has survived under the operation of national socialism.

4. ADMITTING THAT THERE WILL BE A PLACE FOR PRIVATE INDUSTRY, WHY NOT WAIT TILL SOMETHING MORE TANGIBLE EMERGES? WHY NOT WAIT TILL THE TIME OF PRACTICAL VALUE MENTIONED IN THE ACT?

We are in this program for two altruistic reasons. First, we feel that stringent peacetime development of power reactors has been neglected by the Government, not through any fault of anyone, but by the exigency of military necessity, and that our efforts will be instrumental in revival of nuclear power for the peacetime benefit of the American people. Second, the value of our work to the military, if successful, will be enormous. However, we are profitmaking organizations and it would be dishonest to our stockholders if we went about this work without obtaining the profits, if any are to be had, for them. Therefore, we can no longer invest our money or the time of our engineers and scientists without amendment of the act.

It is our firm belief that if we are proven right, the Nation's economy and military might, will be enhanced. If we are wrong, we, and not the country, will bear the loss.

The framers of the act foresaw that the act would not always be sufficient and the amendment would be necessary. To quote from section 1 of the act: "It is a field where unknown factors are involved. Therefore, any legislation will necessarily be subject to revision from time to time."

Amendment of the act should not be the cause of loss of momentum. Government and industry must move toward the goal of peacetime utilization of nuclear energy for power. Who arrives first at the goal, whether it is the Government, Dow-Detroit Edison, or some other project, is immaterial, the Nation is the gainer. The important thing is that every responsible approach is persistently developed. As Chairman Cole of this committee has so aptly pointed out, the development of peacetime uses of Atomic Energy is most important to our position in the world.

5. TO WHAT EXTENT DO YOU EXPECT GOVERNMENT PARTICIPATION IN YOUR PROJECT?

We do not expect any financial appropriation to the project.

There is work and effort of great importance being directed by the outstanding scientists of the AEC laboratories which is of great interest to all reactor projects. To duplicate these efforts would be a disastrous loss in time and a great waste of our national resources. We could duplicate this work if we could hire these good minds and if we were allowed to carry out this research, but it is so much more practical to put questions to the laboratories and let them be solved in the regular course of the work.

This is not a great contribution in the point of money and we ask no patent rights from this work and we offer the Government a full disclosure of our total know-how for military necessity as our payment therefor. Indeed, to date, everything we have accomplished has been given gratis to the Government, without any preservation of rights to ourselves. Any work which we can get done outside of the Government laboratories, we propose to do. We have already hired several commercial, scientific and engineering companies to do part of the work which we cannot do and it is only when these possibilities are exhausted, do we call on the Government. To put a value on this work done by the Government in dollars is very difficult, but we feel that before the first reactor is built, the value of our contribution will be substantially greater than that of the Government. If the Government is unwilling to make this contribution, some of our scientists are willing to go it alone.

6. WHAT WILL INDUSTRY DO TO CUT THE COST OF POWER THAT GOVERNMENT WOULD NOT DO?

Eternal vigilance is maintained by industry to cut a penny here and a quarter of a cent there in its normal production. The same vigilance would be exerted to cut the many corners necessary to make nuclear power possible economically.

Specific examples often quoted by our scientists are:

(1) Design for minimum cost for exclusion area.

- (2) Reduce the cost of fuel processing.
- (3) Use low-cost fuel with maximum breeding gain.
- (4) Design for optimum size without extensive prototypes.
- (5) Maintain low inventories.
- (6) Design for maximum self-regulation.

7. ISN'T PRIVATE ENTERPRISE BEST SERVED WITH MORE COMPANIES INVOLVED? THE AMENDMENT OF THE ACT NOW WOULD LIMIT PARTICIPATION TO RELATIVELY FEW LARGE BUSINESSES ON THE "INSIDE"?

We feel that the larger the segment of private industry working on this problem, the better. We have 30 companies involved in our project. Of this 30, only about 7 had ever done work for the AEC under contract; therefore, 23 companies are on the "inside" because of our project. All 23 are responsible, solvent, successful companies whose engineers and scientists are capable, brilliant men. This project, alone, has added to the scientific team working for our Nation many of these men, plus almost \$10 billion of resources. Amendment of the act now would give the AEC tremendous reservoir of resources not now present and give more companies an opportunity to get inside without great cost to the Government.

8. WOULD YOU EXPECT TO MAKE YOUR REAL PROFIT BY SALE OF PLUTONIUM TO THE GOVERNMENT?

We would want the privilege of selling plutonium to other industrial-power producers utilizing a cheaper, nonbreeder reactor. We would expect the Government to be a customer—not a contract customer, but a customer who goes upon the open market and finds that it can buy plutonium at a price lower than the Government cost.

9. WOULDN'T YOUR PROGRAM COMPETE WITH THE MILITARY FOR SUPPLY OF FUELS TO RUN YOUR PROJECT?

No; the fuels that we will use for both the first charge and makeup fuel are materials now unusable. This, naturally, has the effect of tremendous multiplication of the military material supply. This is one of the most cogent reasons for our project which makes it so immediately necessary for fruition.

10. SHOULD THE RIGHT TO ENTER INTO SUCH PROJECTS AS YOU PROPOSE BE OPEN TO EVERYBODY?

Yes. In this, as in other fields of Government where the national health and security is involved, it is a recognized province of Government to regulate for the national interest. This is a far different thing than Government monopoly. We would expect that fixed standards be set in the act so that the rules would not be changed in the middle of the game, but would possess the essential quality of stability. Without this quality of stability in the licenses, the private company cannot secure the capital, nor would it desire to do so, to carry on a project to produce nuclear power.

11. WHAT EFFECT WOULD AMENDMENT OF THE ACT HAVE ON INTERNATIONAL COMMITMENTS?

We cannot pretend to know what international commitments there may have been. It is reasonable to presume that our Government would not make international commitments which would deprive its citizens of the right to engage in a commercial enterprise except for military reasons. There are treaties on poison gas and on dumdum bullets, but they do not prevent the use of chlorine as a raw material for "wonder" drugs or dumdum bullets for deer hunters.

12. WHAT WOULD BE THE PATENT POLICY YOU WOULD EXPECT IN AMENDING THE ACT AND HOW WOULD YOU PROPOSE TO HANDLE YOUR PATENT ARRANGEMENTS?

It has often been said that the patent policy of the United States is largely responsible for the great industrial gains which have been made in this country.

In this important new field, we have handled the patent situation in the most socialistic manner we have heard of anywhere in the world. We have long operated under the program set up by the military where the inventor is the

owner of the patent, but it is held secret for security reasons. This is effective, established, and a program industry accepts. We fail to see why this patent policy should not apply to the science of nuclear energy.

If we are granted patents for development of power on this project, we have expressed the policy that we would license those patents to the United States Government for military purposes, and to all associates without charge. The patents would be available to all others for lawful purposes on payment of a reasonable royalty.

13. WHAT SECURITY REGULATION WOULD YOU EXPECT UNDER THE ACT?

Private industry has a reputation for not losing its industrial secrets. Several of the companies associated in our project year after year protect new developments under a shroud of security which has been uniformly successful. This is accomplished by instilling into each employee the responsibility for security. The same technique is applied to our project. In addition, we would expect to adhere rigidly to the letter and the spirit of governmental security. We have already spent large sums of money on indoctrination of those employed on the project in the form of lectures, studies, movies, manuals, pamphlets, investigations, and the inculcation in each employee of the awareness and the sense of security.

14. WHY CAN'T THE GOVERNMENT CARRY OUT THIS RESEARCH UNDER THE PRESENT ACT IN ITS OWN PLUTONIUM-PRODUCING FACILITIES AND SELL THE POWER OR AT LEAST UTILIZE THE POWER IN ITS OWN OPERATION?

It is a technical fact that by any approach now in use power could not be produced if the plant is to operate for the maximum production of plutonium. Therefore, it would be impossible for the Government to attempt to produce any power in its present facilities unless it is willing to sacrifice the value of much more plutonium than the value of the power to be produced.

15. WILL THE PUBLIC INVESTMENT OF \$12 BILLION BE TURNED OVER TO PRIVATE ENTERPRISE FOR EXPLOITATION IF THE ACT IS AMENDED?

Most of the \$7 billion that has been spent for the Government atomic-energy program and the \$5 billion it has declared it will spend in the near future has been for military production. We do not ask to take over the entire program; we do not want to make bombs. We—and we speak in this sense as a member of industry generally—ask only for permission to use certain knowledge of small dollar value which has not been fully exploited by Government. This knowledge will not be consumed; it will be put to use, like a breeder reactor, to generate more knowledge. This new knowledge which we return to the Government is the interest we pay for use of the old.

Because of our patent policy (which we have heretofore announced), if we succeed, the Government and the Nation gains by our success. If we fail, the Government reaps the benefits of our sad experience without cost.

16. ARE YOU PREPARED TO SAY THAT YOU WILL BUILD A REACTOR IF THE LAW IS AMENDED?

Unfortunately, we can only say that we cannot build a reactor if the law is not amended. The technical progress looks most promising. It is felt that unless legislation is forthcoming very soon the technical progress will be stopped, awaiting legislation allowing further progress. This question asks how far in the future is a real reactor a possibility. We can only say that there are orderly steps which must be followed. First, the solution of certain technical problems which are seemingly solvable, the proper legislation, the proper financing and then location and construction. The last of these steps should be in motion within the next 18 months.

17. DO YOU FEEL THAT ALL REACTOR DEVELOPMENT SHOULD BE TURNED OVER TO PRIVATE INDUSTRY?

No. In the field of submarine and naval-vessel propulsion, aircraft propulsion for the Air Force, and in many fields, the Government has a legitimate and certain interest.

In the field of commercial power, as an industry, we feel that we can contribute most and that, if we prove with our money it is practical and feasible, it should

be given to free enterprise—not to Dow-Detroit Edison alone but to all free enterprise.

18. IS THE DEMAND FOR INDUSTRIAL PARTICIPATION A BUDGET-CUTTING MANEUVER BACKED BY THE ADMINISTRATION?

Industrial participation will certainly cut the budget, but we emphatically deny that the idea was started by the Administration. Our project started December 1950 in the former Administration.

The use of a breeder reactor for electric power could effect untold savings of tax dollars for the production of plutonium. It will substitute an incentive program in the hands of American business which, if profitable, will pour tax money into the Treasury instead of consuming tax dollars.

As a business proposition, any time you can get rid of an expense of production, have the production for your own use till you are saturated and sell the excess at a profit, it is considered a sound deal. It is rare in business that you can eat your cake and have it, too. This is one of those rare chances.

Senator HICKENLOOPER. Next is the Monsanto and Union Electric Co. group, represented by Mr. Edwin Putzell. Mr. Putzell? Do you have a prepared statement, Mr. Putzell?

STATEMENT OF EDWIN J. PUTZELL, JR., SECRETARY, MONSANTO CHEMICAL CO., ST. LOUIS, MO.

Mr. PUTZELL. Yes; I have, Mr. Chairman, but, like Mr. Cisler, I would like to have my prepared statement amended by the additional statements which I will read into the record as I go along.

Senator HICKENLOOPER. You may proceed.

Mr. PUTZELL. Mr. Chairman and gentlemen, I am Edwin J. Putzell, Jr., secretary of Monsanto Chemical Co. You are kind enough to let me appear in the place of Charles Allen Thomas, president of Monsanto, who regrets exceedingly his inability to accept your invitation to be present today. This statement represents his views.

As we all know, more than 10 years have passed since the Nation proved that a controlled nuclear chain reaction is possible. We learned that we could release large amounts of atomic energy in the form of heat and radiation. But that knowledge was, of necessity, developed for and devoted to pressing national security problems. Information about a nuclear chain reaction gave us a military advantage which we had to—and did—exploit to the fullest. The war against Japan was brought to a prompt conclusion without additional loss of life, and then the Congress enacted legislation to control and protect this country's most valuable atomic-energy knowledge. As a result, we have the Atomic Energy Act of 1946, an admirable piece of pioneering legislation in a new and theretofore completely unknown field.

Since passage of the act, the United States has continued to invest heavily in atomic-energy development to the point where it is now estimated that total Government expenditures in the field have reached approximately \$10 billion. And we have accomplishments in the national security field which more than justify such an outlay of manpower and funds.

But despite our steady onward push in the development of the military aspects of atomic energy, the question inevitably arises as to whether we as a people are giving adequate consideration to the other side of atomic-energy development, that is, the so-called peacetime or nonmilitary uses of nuclear fission. For very understandable rea-

sons' our progress in this area has been slower and to date it can, with fairness, be said that we have only scratched the surface in exploring useful and peaceful ways of putting our vast fund of atomic-energy information to work for mankind.

We of Monsanto therefore respectfully urge that American private industry be permitted to participate in nuclear reactor development work at its own expense and in its own facilities. We make this recommendation because we look on the development of atomic power as but one peacetime application of atomic energy, and as perhaps the surest means of finding other new ways in which the heat and radiation produced in nuclear reactors may find a place in industry in order to benefit us all.

And at this point, let me assure you that all of our thinking and everything I have to say today assumes that security regulations required in the national interest and safety regulations for personnel and property would continue to be the primary responsibility of the Government, as is now required by the Atomic Energy Act. At the outset of its work in this field Monsanto realized that paramount security and safety requirements should remain where Congress has put them and where they now are. Our thinking about industrial participation in nuclear power development continues to have that in mind.

My purpose today is not to try to describe what all of the new peacetime applications of heat and radiation from nuclear fission will ultimately be, for that is beyond the power of anyone; but to suggest that as a Nation we should do whatever we can to commence finding and exploring the nonmilitary applications of atomic energy, while at the same time making sure that the paramount national security interests never suffer. Even though we cannot say what these applications will be, we feel sure they can be found. In the chemical industry, for example, we know that many chemical reactions are markedly affected by heat and radiation. We also know that the properties of materials can be substantially affected.

In a speech given almost 2 years ago, Chairman Dean, of the Atomic Energy Commission, said:

There is, as you know, another side to this picture, no less important than the military side, and, in the long run, perhaps very much more important, and this is what we might call the positive or peaceful side. When we undertook an atomic energy development program, we also acquired the responsibility—not only to ourselves, but to people everywhere—to do all we can, consistent with our defense and security, to realize the peaceful promise of the atom.

Thus, the real problem relates not just to the industrial development of atomic power, but to the whole question of what policy changes are needed to permit and to encourage the discovery of peaceful and constructive uses of atomic energy in the national interest.

At this time we have, I think, only two choices. The first would be to proceed as at present and to hope that somewhere within the framework of current policies the new applications of atomic energy will be found and the related know-how will develop. This would necessarily require the continuing expenditure by our Government of large sums of money to do the job.

The other possible method, and the one which we favor, is to permit American business, with practical problems to solve, to study and experiment with the question of whether a nuclear chain reaction would be of help in resolving any of its industrial problems. This,

of course, follows the pattern of industrial development through our country's history. Radar, television, and 3-dimensional motion pictures are recent examples of similar situations where scientists and engineers found ways to apply basic discoveries to the development of new industries.

Let me be more specific about how this would work. To find an application of atomic energy in some particular field, say, for example, in the manufacture of plastics, one would enable the engineers who are studying better ways to make plastics to know some of the details about how heat and radiation in a nuclear chain reaction are produced. The engineers must know, too, that if they think of a better way to make plastics, then it would be legally possible for them to build and to operate the necessary plant. In other words, they must know that they are not wasting their time in thinking about it. Then, if as a result of their work the new application of atomic energy makes it possible to produce plastics more cheaply, the competitive advantage should be protected at least long enough to permit the enterprise to get back the money it had spent on the research. By so doing, the research funds can be expended again and again to develop still other ideas and better products and processes further to raise our standard of living. This is the way that new technical knowledge develops in a given field, and it is what is needed in atomic energy.

In sum, we must find means which, while serving our larger national security, at the same time make available information on nuclear chain reactions so that scientists and engineers in American businesses can use it in furthering our industrial development. By permitting our system of free competitive enterprise to begin to operate in the nuclear reactor development field and to determine whether uses for constructive peacetime applications of atomic energy really exist, we will see a continued world leadership by this country in the peacetime as well as military applications of atomic energy.

It has been suggested that opening the nuclear energy field to private industry will constitute a giveaway of the approximately \$10 billion of information which has been developed at public expense. This we would question. In the first place, most of the moneys spent to date have gone for bricks and concrete and other items used in the construction of weapon-producing facilities. The cost of developing the Government's information about nuclear reactors is some small percentage, perhaps 3 or 4 percent of that figure, but even a small part of such a large amount is a lot of money and the point here is that the Government still has little information about nuclear reactors which has any present peacetime commercial or industrial value, so far as we know, without additional research and development and pilot plant work. And that we feel is true regardless of the amount of money that has been spent on reactor development.

To stimulate industrial thinking about nuclear reactors, we must start somewhere. With this in mind Dr. Thomas suggested some 3 years ago that private industry be permitted to have some of its own people, at its own expense, study nuclear reactors without interfering with military objectives. The suggestion was that in the production of plutonium for atomic weapons it might be possible to save the heat which is necessarily produced and to use this heat to generate

electricity instead of throwing it away. In such an operation private industry would get started in the production of industrial atomic power, thus taking a big step forward in the peacetime applications of atomic energy, and perhaps at the same time reduce the cost of plutonium to the American people. This approach involves, of course, the so-called "dual-purpose" reactor which produces plutonium for our national-security program and power for industrial or domestic use.

There may be some other avenue of approach to the prompt development of atomic power at private expense. If so, we have not as yet discovered it. Certainly each of the five industrial teams which have been studying the feasibility of developing atomic power and any other party interested in this field should be encouraged to tackle the problem with the hope of making economic atomic power a reality as soon as possible.

Let me emphasize: as soon as possible. For if the United States doesn't focus all of its resources, both governmental and industrial, on the prompt development of economic atomic power, any of several other nations may do so, and succeed with the attendant political, social, and economic implications. That is so because the large body of basic scientific knowledge applicable to nuclear reactors, in contrast with that concerning military applications of atomic energy, is unclassified and available to skilled nuclear scientists around the world.

This brings us to the broad recommendations which we should like to make to you. First, we believe that the Atomic Energy Act should be modified to permit private ownership of nuclear reactors under adequate governmental security and safety regulations. Second, patent policies in the atomic-energy field should be modified to permit the patenting, not of any information which exists today, but of new inventions in the nuclear-reactor field which we hope will develop. And finally, we recommend that the Atomic Energy Commission's sound policy of permitting reputable firms to examine reactor technology should be continued and expanded. Although this may not be a legislative matter, it is essential to the development of peacetime applications of atomic energy.

Representative HOLIFIELD. Would you prefer to finish your statement before you are questioned?

Mr. PUTZELL. If you don't mind, sir.

As to the first recommendation—private ownership of nuclear reactors—we feel that no one in industry can think very seriously about or risk his money on the development of new applications of nuclear reactors so long as he knows that it is illegal to own the plant even if he should discover a novel and unusual way of using its nuclear heat and radiation. In our view, the restriction against private ownership of nuclear reactors calls for serious reconsideration. It does not serve security purposes, for it does not protect the large body of unclassified information on reactors. It only prevents industry, with its scientific and technical personnel, from being able to develop and adapt reactor technology. And here again I do not refer to military applications of atomic energy, but solely to nuclear reactors.

Thus, the net effect of the restriction against reactor ownership is to hamper this country's development of reactors. For we are of the opinion that able American scientists having available some

uranium, perhaps slightly enriched, and only the large body of unclassified reactor information available today, but none of the classified material, can design and build workable nuclear reactors. The unavailability of classified information would slow down their progress, but it would not prevent them from succeeding. And if able American scientists can do it with unclassified reactor information, why can't equally skilled foreign scientists, unhampered by the Atomic Energy Act's restriction against private ownership, also do it?

Also, in connection with the point on private ownership of reactors, it is worth noting that past experience shows that companies choose to accept all the incidents of ownership, including the risk of loss, in order to be free to manage their businesses in the most effective and economical manner.

As to the second recommendation relating to the national patent policy in the atomic-energy field—we believe that the incentive which traditional patent rights would provide will help greatly to advance the technology. Admittedly, patents and inventions dealing solely with the utilization of atomic energy for military purposes should remain the exclusive property of the Government. However, to give maximum encouragement to industrial development of atomic-power reactors, there should be a modification in the present policy which forbids the granting of patents on any invention or discovery which is useful solely in the production or utilization of fissionable material. While it is understandable that such a rule be adopted during times when almost all inventions were obtained at Government expense, it seems that with the approaching possibility of major industrial progress in the field of atomic power, a review of such policy is in order.

For example, should not there be some right to the protection of its inventions granted to a company which has at its own expense and effort done substantial research and development work in order to find a new and different application of atomic reactors as a direct tool and aid for use in the chemical-manufacturing industry?

As you know, research in the atomic-energy field is expensive, and patentable inventions are not easy to come by. Together with the Union Electric Co. of Missouri, we have spent a little less than a half million dollars of our funds studying the feasibility of atomic power, and have no patentable ideas. Nor, may I say, did we undertake the study for the purpose of securing patents. However, the only way in which industry can hope to get back such moneys is from the sale of products resulting from the research effort. To do this requires that one must protect at least for a while the competitive advantage that has been gained. For if a competitor is assured of being able to use the same results without any research and development effort on his part, it will inevitably affect the willingness of the company making the invention to invest more of its funds for further research. To put it another way, if research results are available to competitors without effort on their part, then each is likely to wait for the other to spend research dollars and overall progress in the field will slow down.

As to our final recommendation—the continued examination of reactor technology by reputable firms—we believe this will enlarge the reservoir of technically trained people available to support our atomic energy program in its peacetime and national defense aspects. The handling of any classified information by such firms should of course

accord with the Government's standards of security. Thus, the security of that technology which has military value can be maintained while at the same time permitting the development of the new industrial technology which we need.

In conclusion, let me say that what we need is more study and development on nuclear reactors rather than less, and private enterprise provides the framework. By allowing industry to work on the use of nuclear heat and radiation to solve its problems, the element of competition is immediately introduced into the nuclear reactor field with the inevitable reduction in costs. As we train more people in this new business, we also broaden the technical base for even further developments in atomic energy. The construction of more nuclear reactors by private industry could make for a greater dispersal of such facilities, which might be of great importance in the event of war. And finally, we can expect the development of new industries through the possible discovery of new materials and products as well as different and cheaper methods of producing existing ones. This, of course, would bring with it increased employment and greater prosperity. This is the American way, and it is the way of making sure that the people of this country will benefit most from their present large investment in atomic energy.

We can hope that the United States will continue to lead the way in constantly improving man's standards of living. In peacetime uses of atomic energy—some foreseen, many not yet contemplated—we have a great tool for contributing materially to our economic and social development. The most expeditious means that we can see for hastening the advent of such peacetime uses is by encouraging the industrial development of nuclear reactors. By tradition and experience, peacetime applications of science and engineering in all fields are in this country a function and responsibility of private industry. We in Monsanto believe that now is the time for the Congress to amend the Atomic Energy Act with legislation which will enable and encourage private industry, under Government security and safety regulations, to develop economic atomic power and other peacetime uses of atomic energy in its own plants, at its own expense and under our competitive system.

Senator HICKENLOOPER. Thank you very much, Mr. Putzell. Chairman Cole has returned now, and I shall happily turn the responsibilities over to him.

Chairman COLE. I am sure the Vice Chairman has been performing creditably, and I suggest he continue.

Mr. PUTZELL. Senator Hickenlooper, Mr. J. Wesley McAfee, the president of the Union Electric Co., of Missouri, was also unfortunately unable to attend, and I believe he wrote a letter to the chairman of the committee asking that I be permitted to read his statement into the record. I will, or will file it with you, sir, as you desire.

Chairman COLE. I wonder if it would not be better for you to expose yourself to questions from the committee with respect to your own statement, before you inject the thoughts of Mr. McAfee.

Mr. PUTZELL. Certainly.

Chairman COLE. Are you in position to subject yourself to cross-questioning on Mr. McAfee's statement?

Mr. PUTZELL. No, sir, I am not. I am speaking for Monsanto alone so far as the questions go, and I just read the statement of Monsanto. Mr. McAfee's statement is a separate document.

Chairman COLE. Are there any questions that the members of the committee desire to ask Mr. Putzell?

Senator HICKENLOOPER. Just 1 or 2 questions, along the line of the feasibility of competitive economic power from this source.

Are you convinced that it is feasible, that is, at a competitive rate?

Mr. PUTZELL. Are you talking now about a dual purpose reactor, sir, or the general field?

Senator HICKENLOOPER. I am talking about the investment of private capital in the field of producing power with atomic energy fission as its source, whether it is dual purpose or otherwise. Does your company from its studies believe that it is feasible? You may not have the methods yet at hand, but are you convinced of its feasibility?

Mr. PUTZELL. Yes, sir, we are. In fact, we so reported to the Atomic Energy Commission quite some time ago.

Senator HICKENLOOPER. And based on your studies and your judgment, if the law is adequately revised to permit it, you are willing to risk a lot of your own money, and your associates are willing to risk it?

Mr. PUTZELL. Senator, we wouldn't make such representations before committees if we didn't feel convinced that the matter had merit and was one we should stand behind when the time came to get into it.

Senator HICKENLOOPER. I am glad to hear you say that. Because the purpose of my question went to this point: Is this an experimental venture, in which from your standpoint companies might get into it a little bit and say, "Well, it is a little too burdensome, and we will drop it"? Or would you intend to go at it vigorously and with a real determination to develop an economically sound operation?

Mr. PUTZELL. Senator Hickenlooper, Monsanto has been in this business since 1942 in one war or another. We have run for the Government the Oak Ridge laboratories. We are now running an installation for the Atomic Energy Commission. Some of our best technical manpower has devoted lots and lots of time to this business. And if we were not convinced that the peacetime applications of atomic energy have a future, and that the chemical industry has a position in the development of the peacetime uses, not just power but all, whatever they may be, I assure you again, sir, that we would not continue over 10 years to push and put our own money into it.

Senator HICKENLOOPER. Let me assure you that there is no question in my mind about the stability and ability of Monsanto. I am asking you these questions for the purpose of the record.

Mr. PUTZELL. Surely.

Senator HICKENLOOPER. I need no reassurance of your determination and the art which you could bring to this field. I am well aware of that.

Thank you. That is all.

Chairman COLE. Mr. Holifield?

Representative HOLIFIELD. Of course, the building of a civilian power reactor would be an experimental venture. There is no such thing in existence at this time.

Mr. PUTZELL. Well, sir, our approach to this thing would be in keeping with the way the chemical industry always approaches new products, new ideas, and I can suggest to you the nylon situation, the kriliium soil-conditioner situation, just about any new development in the chemical field. And this is the way it goes, Mr. Holifield. After they get an idea of a new product and a new process and they take it through the laboratories, they don't jump into full-scale production. They do what they call pilot-planting. That is, they build the model. They test out the theories, get the kinks out as best they can, on a pilot-plant basis, and from that they go into the full scale.

And so we would treat this just like we do any other new idea in the chemical industry. We would want to pilot-plant it, to get out a lot of kinks, and to get many answers which we don't now have in this field of reactor development.

Representative HOLIFIELD. In other words, it would be necessary for you to proceed by a prototype or pilot-plant method?

Mr. PUTZELL. I am not sure what you mean by "prototype."

Representative HOLIFIELD. Let us call it the pilot-plant method. That would not involve the amount of money that would be necessary to build a full-scale civilian reactor of a type that would produce, say, 150,000 kilowatt-hours.

Mr. PUTZELL. Of course, we don't go this far in without having some reason for feeling that we can succeed. And therefore when we come before you and make proposals, it not only envisages that reactor development ought to go through the pilot-plant stage, if you take the route we suggest as being the quickest, but also into the full-scale plant.

Representative HOLIFIELD. If it proves feasible; if it proves economically feasible. But it has not been proven to be economically feasible yet.

Mr. PUTZELL. But we have reason to believe that it will be.

Representative HOLIFIELD. You have reason to believe that it will be, and I hope so, too.

Now, in your statement, on page 10, you brought out the point of the examination of reactor technology. What did you refer to there? A continued examination of the Government reactors? Or did you mean the reactors which some of your competitors might be building?

Mr. PUTZELL. We were referring to that work which can only, under the present law, be done in the Commission facilities, sir.

Representative HOLIFIELD. In the Commission facilities. But you would not open up your own reactor techniques to the Government except on an exclusive military basis?

Mr. PUTZELL. I am not quite sure—You mean assuming, now, we have a power plant in operation?

Representative HOLIFIELD. Assuming that you are building a reactor. That would, of course, be your own investment, and you would be entitled to keep that secret from your competitors and also from the Government, as far as industrial application is concerned, but not from the standpoint of any military use?

Mr. PUTZELL. That is right, sir. Nor from the health and security angles.

Representative HOLIFIELD. So your thought in the continued examination of reactors is that you should be allowed to continue to coop-

erate and absorb the developments in Government reactors in Government laboratories, as they are developing.

Mr. PUTZELL. Such as they may be, sir. We envisage a partnership here, in a sense. We look on this as trying to get it into its more traditional channels in American life—getting industry to put in some of its own skills, its own experience, and its own money, to take some of the risk of loss, and to go forward in this field hand in hand with the Government.

Representative HOLIFIELD. How much money is the Monsanto Co. prepared to put up for this type of an experiment?

Mr. PUTZELL. I can't answer that today, Mr. Holifield. But, as I said to Senator Hickenlooper a moment ago, sir—or, rather, I didn't tell him this; an analogy has just come to my mind. A couple of years ago, we decided we wanted to make a new product for us, which is called a acrylonitrile, a long name, but it is a simple little chemical when you come out at the end of the manufacture. We didn't have the know-how. We knew it would cost many millions of dollars. So we went to Germany and to other places here and abroad and decided that it was worth the risk to do something which hadn't been done before commercially in this country. We didn't then have the money. But having made the decision that the risk was a reasonable one and one that we in the chemical industry could and should take, we went forward. And the money we got, we provided. We raised last year about a hundred million dollars of new funds for the expansion of our business. And, of course, as you know, the chemical business has a reputation for raising money and developing, growing, with that new money.

Representative HOLIFIELD. Your participation, I believe, both you and Dr. Thomas have repeatedly said, is contingent upon the sale of plutonium to the Government.

Mr. PUTZELL. Our point, sir, is that we think that now is the time to get into the peacetime applications of atomic energy, including power. The quickest way that we have been able to find is a dual-purpose reactor, which involves the plutonium sale as well as the power production.

Now, if there are others who have other ways, we certainly believe that in keeping with the theory of competition they ought to be given every encouragement, and they may well have a better way than we.

Representative HOLIFIELD. Now, if you plan to produce a reactor large enough to produce plutonium in any quantity and power in any quantity, you would naturally expect to spend in the neighborhood of, as Mr. Cisler says, \$50 million, and as Mr. Dean says, \$83 million, and as some others say, \$125 million. So we will not pin you to a specific amount. But you would envisage an investment of that type?

Mr. PUTZELL. Yes, sir; we would envisage a substantial investment.

Representative HOLIFIELD. And in a case like that, of course, would you want to apply to that plant the regular rate of amortization, say a 30-year rate of amortization, to that plant, that equipment, that experiment; or would you want it on the basis of a certificate of military necessity, which would allow you to write it off in 5 years?

Mr. PUTZELL. Mr. Holifield, you have put your finger on one of the unanswered questions in this thing, on the technical side. That is, What is the reasonably expected life of a thing like this? We don't know.

Representative HOLIFIELD. That is right. Neither does this committee know. In order to write the legislation, we have got to guess at it. And neither does the AEC know.

Mr. PUTZELL. Well, the period of amortization would, to a large measure, depend upon the expected reasonable life of such a plant. Now, if we have as a goal here, as one of our national goals, getting into the peacetime applications of atomic energy promptly, before somebody else does, or maybe as quickly, then we may have to go the route of a certificate of necessity, which has been done with many other established products, as you know, on a national basis, during the last war and at the present time.

Representative HOLIFIELD. I am not criticizing your planned method. I am just trying to find out what your planning is.

Mr. PUTZELL. It depends upon just what the policy is, in our view, as to whether or not promptness is important in this thing.

Representative HOLIFIELD. And you would expect the Government to, of course, furnish you with the plutonium slugs for your reactor, I suppose?

Mr. PUTZELL. Yes, sir.

Representative HOLIFIELD. In case the Government, for military uses, found it necessary to cancel the furnishing of those fuel elements, would you require cancellation damages, in case you invest 50 or 100 million dollars in this plant?

Mr. PUTZELL. Well, again, that is the kind of thing that is going to have to be worked out just as we do when we build a huge plant for the Government in some other field; this plutonium being a matter of armament, a national-defense item.

Representative HOLIFIELD. I might say we are at the present time making a contract with the Ohio utility group, in which cancellation equities run up into many, many millions of dollars, and they are putting in a plant, and of course the Government says, "We are going to use your energy, and if we do not use it, we will pay you." So I am merely asking the question along the line of what is now being done.

Mr. PUTZELL. Yes, sir. I read the legislation that enables that particular contract to be executed. I believe it wouldn't have been legal, or the length of time involved wouldn't have been authorized, under prior law.

Representative HOLIFIELD. You would want a guaranty of raw material from the Government, of course, in such a plant?

Mr. PUTZELL. Yes, sir. That would be the only source we know of.

Representative HOLIFIELD. Would you want a fixed price over a period of years for the plutonium? Would you want a contract with the Government to take the plutonium off your hands at a fixed price?

Mr. PUTZELL. I can only say "probably." Because here again, experience in operating plants may well indicate some economies, some shortcuts, that may be in the interest of the overall organization. But it certainly would be clear that if, on the basis of a contract with the Government, and a change in the law, and these other things we have been talking about, Monsanto went out and raised many millions of dollars to build such a plant, there ought to be some fair degree of assuredness in the relationship with the Government, so that if the Government did cancel its contract shortly after the thing was set up, those who invested their money in it would not be just sitting there without anything.

Representative HOLIFIELD. Of course, I agree with you on that point. I say that if you go into an industry which has the element of risk, that this has in it at this particular time, I think you would be perfectly within your right to request that type of a contract. The problem this committee has to solve is whether now is the right time, or whether we should wait possibly 3 to 5 years when the development of reactor technology has advanced to the point where we know a little more about it, and where the risk of a long-time contract at a price for plutonium which might be different 5 years from this time.

Mr. PUTZELL. I understand that is one of the problems. I would like to say that this suggestion we made as one of the quick ways of getting into this whole field is based on the assumption that there is a decision made by the Government that it needs plutonium in the national interest. If that need does not exist as a matter of national policy, then this suggestion we made is without foundation.

Representative HOLIFIELD. Of course, the need does exist, but we do not know how long it will exist nor how much plutonium we will need, and we do not know what new process will double, triple, or quadruple the supply we have on hand. So in that area we are at sea also.

One final question. I suppose that you would require the same type of normal patents as now are given to private industry?

Mr. PUTZELL. Sir, we have not worked out any final answer on that any more than I take it other have.

Representative HOLIFIELD. Of course, that is the key to the whole legislation or one of the keys, at least, and something this committee has to consider.

Mr. PUTZELL. Yes, sir. I would like to make one general observation if I may. One cannot get patents on just coming across a rule of nature. Naturally, the law of gravity is not patentable. It has to be an invention, and it has to be novel. While I am the first to admit as my second point and recommendation had to do with, the need for an alteration of the patent policies in the Atomic Energy Act, I do think it is very easy to look on all ideas in this field as being subject to patent or as having value from the patent angle when in fact that is not and will not be so.

Representative HOLIFIELD. That is all, Chairman Cole.

Senator PASTORE. Mr. Putzell, directing your attention to page 9 of your written statement, I would like to ask a question or two on a point that you raise because I do think you make considerable sense. You say that the only way in which we can hope to get back such moneys, that is the money that you put into these ideas, is from the sale of products resulting from the research effort. To do this one must protect at least for a while a competitive advantage which was gained. We must admit that the whole field of atomic energy is more or less a monopoly on the part of Government. You make the point that private industry must share in this. Who will share in the beginning is a rather selective group and not by choice, but by capabilities, and they will be large concerns.

The question has been often asked, how do you give this monopoly that belongs to all the people to all private industry on an equal basis.

Mr. PUTZELL. Senator, I go back to many other developments, and I hope I may not be wrong in doing so. Let us take radar as an example. I would doubt that all the people in the sense that every-

body who has a machine shop or laboratory has an opportunity to use the radar know-how that was developed at Government expense. It certainly follows, it seems to me, that if any company can meet the normal requirements of the Government in terms of finance, in terms of management responsibility, in terms of security, in terms of those minimum essentials which the Government requires when it contracts for the building of an airplane or tank or for anything else that it needs for its military arm, then that company ought to be able to participate in this field on a fair basis with all others.

Senator PASTORE. But you are willing to admit now that that would be a rather select group, of course.

Mr. PUTZELL. As Mr. Cisler said a moment ago, I am not so sure, because lots and lots of little people get into it. In the manufacture of an airplane, I would imagine that there were an awful lot of small manufacturers who make plastic parts, who make small bulbs, who make maybe the paint that goes in it, who make all sorts of supplies and components which go into the airplane made by a large airplane company.

Senator PASTORE. Do you not think because of the very nature of the problem we are talking about, taking into account the fact that this is a governmental monopoly—and I think the people of this country would like to have it shared with private enterprise, if it is to be developed for the benefit of all in peacetime—we should keep these patent rights down to a minimum period as against the normal period of 17 years now for patent rights?

Mr. PUTZELL. That may be a way, sir. I had not thought of that. It may well be a way of doing it. Of course, that is the very idea of the patent system in America, a protection for a period of years. Maybe as you are suggesting the period of years normally granted is too long in this case. I cannot help but feel that as atomic energy on its nonmilitary side settles into its natural place in our economy, which it inevitably is going to do, that it is not going to be much different from some other things which in their day were just as new and maybe held just as many unknowns. Therefore, I wonder if the period of time is the answer? Maybe it is the basic principle of protection for any period. I just do not know.

Senator PASTORE. Of course, I can see your point of view, especially from the position where you sit. But you have to admit that the ordinary, average citizen feels that this is something that belongs to everyone. Billions and billions of dollars have been invested in this field of experiment. Now it is going to be passed on to private industry. When we say private industry, we use that as the general term to embrace everyone in our free enterprise pattern. As a matter of fact, that is not going to happen. There are going to be a number of select firms that are going to go into this, and reap all the benefits of it. That is something that belongs to all of the people of the country. How do you share the bounty of this great energy with all the people of the country? Necessarily, they are going to use these products but they will have to buy them, but you are going to make the profits on them. Now, how are we going to do this? I realize it is quite a speculation and it is a hard question.

Mr. PUTZELL. I have thought about it, Senator, because I remember it has been raised before. It seems to me that a lot of the other processes of government are going to be brought to bear. For ex-

ample, the antitrust laws, maybe they should be adjusted in this case, and maybe not, but the doctrines of the antitrust principles that we stand for in this country are going to be one of the policing forces. The tax laws are another policing force. There is talk of profits and rightfully so. But the tax laws succeed in taking a good bit of that away these days, so people benefit through that way.

There are all sorts of other means of policing by governmental regulations and statute which inevitably come in although they may not be direct or quite as clear as the patent point.

Senator PASTORE. Am I fair in assuming that all you want is this patent right for so long a period as will guarantee to give you a fair return on your original investment?

Mr. PUTZELL. That is one-half of it. I think the other half is much broader, and applies to society. As I understand, the basic reason for the patent law is to encourage new ideas, and to promote inventions in the common good. It seems to me that principle has application here, too. As I mentioned before, if a company knows that it can sit back or if anybody knows he can sit back, and as a result of someone else's effort without any cost to himself get the benefit, he is not likely to use too much of his own talents in that direction.

Senator PASTORE. I know. But this idea has all come into being through the expenditure of taxpayers' money. You are not actually starting from scratch. You are not starting in the dark completely. There has been a tremendous amount of progress made in this field. Now we are diverting it from a war effort to a peacetime pursuit. That is the only novel tieup to this point. In the development of this you have to admit that you have a tremendous head start at the taxpayers' investment.

Now, how do you share this tremendous start? I mean in dollars and cents now, and not with any platitudes and speeches.

Mr. PUTZELL. All I can say is that it ought to be open to everybody on an equal basis who can meet the Government's requirements.

Senator PASTORE. And you do not think we ought to seriously consider cutting down the period of protection on the patent rights?

Mr. PUTZELL. Take the field of radar, which is now used for private purposes, and developed originally at Government expenses, the difference may be in magnitude of dollars, but the principle is the same. The public developed the idea with the taxpayers' money, and they did not cut down the period of years for the patents involved in the radar development.

Senator PASTORE. All I can say is that it is wonderful to be Monsanto at this time, because Monsanto is one of the companies that can take advantage of this setup. But anyone running a little factory will have to wait until you discover something, and then he will have to pay royalties for the usage of it.

Mr. PUTZELL. No, sir, I do not think we operate our business that way, Senator.

Senator PASTORE. All patent rights are operated that way. That is the privilege of your patent rights, to exclude all others as long as that patent right continues.

Mr. PUTZELL. On kryptonium, which we happened to discover, and we have use patents, not composition of matter patents, which is quite a different thing, we have licensed 68 companies in the United States alone. We have a policy of pretty broadly licensing. We happen to

believe in the chemical industry that competition is good for us, even if there is a patent involved.

Our history has borne that out. I do not think our idea here is to get and sit upon a monopoly. Far from it. We are much more interested in using the virtues of atomic energy, the heat and radiation, for industrial applications away beyond the power end alone to make other products.

Senator PASTORE. I do not imply for a moment there is any ulterior motive in your position.

Representative HOLIFIELD. Will the Senator yield on that patent point for one question?

Senator PASTORE. Yes, I yield.

Representative HOLIFIELD. Would your company be in favor of compulsory patenting even if you were allowed a fair and reasonable royalty on your ideas? In other words, you would subject yourselves to the obligation of allowing any group of American industry or any municipality or State upon application to participate in such developments as you might make, based on this tremendous tax expenditure?

Mr. PUTZELL. We do not subscribe to the principle of compulsory licensing any more than has been subscribed to.

Representative HOLIFIELD. Then the answer is "No," and you would want to restrict the patent to those that you would care to license.

Mr. PUTZELL. Yes, sir, we would want to license as broadly as we could.

Senator PASTORE. I just want to conclude by saying this, that I am for this idea of having private industry participate in this, and I believe it is in conformity with our whole concept of our system of free enterprise. The thing that is bothering me is how do you pass these benefits on to all the people, and I think that is the big problem that we have to decide.

I can see also where you should be given certain patent rights as a protection for the money that you invest in research. But I was wondering, too, inasmuch as this is the big field and only the big companies can get in at the start, how do we protect the benefits to the smaller companies?

Senator BRICKER. Chairman Cole, along that line, I notice a reference to the fact that Thomas A. Edison set up the electric-light system in the 1880's in the Grand Central Station in New York. He had a patent on electricity for a long time and great value came to him, but immeasurably greater value has come to all the people in the country as a result of his discovery, and the protection of this patent during the early years of development. So I think we should look at the long pull, rather than deciding all the questions at the beginning.

Senator PASTORE. Yes, but the United States Government did not own electricity at that time. We do have the atomic-bomb secret as a monopoly.

Mr. PUTZELL. I am not talking about the atomic-bomb secret. I am talking about the unclassified nuclear-reactor information which is available around the world, not just to those who work for the Atomic Energy Commission, either on the staff or under contracts with them. As I said here, we believe that anybody who is a qualified scientist here or somewhere else, given some plutonium or some uranium, and the unclassified material available today, can build reactors. It is going to take him time, but he will do it.

I commend an article in *Look* that is on the newsstands today, by Mr. Dean, in which he comments on the other countries in the world which are now working on atomic power—not the bomb.

Chairman COLE. I am curious to have you explain to me what appears to be conflicting viewpoints. You say as a matter of policy your company believes in not exercising the exclusiveness of a patent right, and that as a matter of policy you spread it around to as many people as you can. Then on the other hand, you take the position in opposition of being required to do by law the very thing which you think as a matter of policy you should do, and which you are doing. It seems inconsistent.

Mr. PUTZELL. You are referring to compulsory licensing, Mr. Cole?

Chairman COLE. Yes.

Mr. PUTZELL. We feel again that standards have to be maintained, that there are lots of people who want to get things and exploit them. We have seen it happen in our business where we have given licenses to people, so-called fly-by-night operators, who were in to get money quick and get out without regard to the impact made on the public or the industry. Under a compulsory licensing system, we would have to give any so-called fly-by-night operator the same license as anyone else.

Chairman COLE. The difference is that in your company policy you retain the right of determining who shall use it.

Mr. PUTZELL. Yes, sir.

Chairman COLE. Whereas with compulsory licensing you surrender that right.

Mr. PUTZELL. Yes, sir.

Chairman COLE. Then you would not object to being required to share it with others if in that requirement you were permitted to select or to exclude persons from the use of it under appropriate standards.

Mr. PUTZELL. We think that is the way it has been and we would like to see the same policies continued in this field as in other fields of patent licenses.

Chairman COLE. What do you mean, that is the way it has been?

Mr. PUTZELL. Under present patent licensing a person has the right to decide whether a person should get a license.

Chairman COLE. I am talking about a new system in which the inventor would be required by law to share it with anybody who might want it upon condition that that applicant be somebody who is qualified to use the idea.

Mr. PUTZELL. By whose standards?

Chairman COLE. By standards that may be either set up in the act that imposes the requirement, or by standards that may be established by the Atomic Energy Commission.

Mr. PUTZELL. No, sir: I do not think so. That goes against the thing that we believe is the way it ought to be.

Chairman COLE. Then on the question of plant amortization, although I did not hear your entire statement, I have assumed that your position is that your associates believe the time has come for private capital to go into production of atomic-energy power on the basis of plant amortization; is that not correct?

Mr. PUTZELL. I am not sure I understand you correctly. As I said to Mr. Holifield, one of the unanswered questions is what the amortization should be.

Chairman COLE. The question of whether or not you are ready to go into it is determined on a matter of dollars and cents based on your own calculations.

Mr. PUTZELL. Yes.

Chairman COLE. Did the question of plant amortization come into your calculation?

Mr. PUTZELL. Certainly.

Chairman COLE. What did you use as a basis of calculation?

Mr. PUTZELL. We assumed a rapid amortization because we did not know how long we could amortize.

Chairman COLE. What basis of amortization did you assume?

Mr. PUTZELL. One can take almost any period.

Chairman COLE. I am talking about your calculations.

Mr. PUTZELL. Yes, sir. We have drawn up many sets of figures, and we came out with a different cost for the end products, depending on the number of years of amortization involved. If one decided that he had to have the power and plutonium in a hurry, regardless of cost, you could amortize in 1 year, and you would get a high price. If you wanted to drag it on for a period of years, you would accordingly reduce the cost. In our proposals which we have made on the dual-purpose reactor, we have talked in terms of 5 or 10 years' amortization.

Chairman COLE. What do you estimate to be the normal life of a plant?

Mr. PUTZELL. We do not know, sir. That is one of the things we wanted to find out when we experimented with the pilot plant.

Chairman COLE. You must have had consultations with the Commission and their reactor people as to their estimates of the life of a reactor.

Mr. PUTZELL. If so, I just do not know. I am not in that end of it.

Chairman COLE. My recollection is that they have estimated it to be roughly 30 years, which is pretty much the normal life of a conventional powerplant.

Mr. PUTZELL. A nuclear reactor with 30 years' life? I did not know that.

Chairman COLE. The estimate of a 30-year life of a reactor is approximately the life of any industrial plant for amortization purposes at least. At any rate, in your calculations you have based your estimates of success or of your willingness to enter into the venture upon an amortization period of 5 or 10 years?

Mr. PUTZELL. Yes, sir.

Chairman COLE. Now, on the question of cancellation which Mr. Holifield brought out, whether you would expect to be awarded damages by the Government in case the Government cancels your supply of fuel, it seems to me not unreasonable that any private industry would expect to be awarded damages since the venture is completely dependent upon the availability of fuel, and the only source of that fuel is the Government. If the Government for its own purposes finds that that fuel cannot continue to be made available to you because of some other public interest, there is no reason in my mind why you as a venturer in this field should be required to suffer damages. I can see why you would expect a measure of fair damages imposed upon the Government in its failure suddenly and unexpectedly to supply you the fuel.

On the question Mr. Holifield raised with respect to whether you would expect the Government to buy your byproduct of fissionable material, I cannot find any complaint with such a position. Of course, we expect the Government to take your byproduct if the Government says you cannot sell it to anybody else. There is no other market for it. If it was a loaf of bread or suit of clothing or something of a normal type in our economy, then we would not expect the Government to provide a market. But, because of the very peculiar nature of the byproduct, I think it is not unreasonable to expect that, and especially when we must bear in mind, I think, at all times, that this byproduct is like making gold. All the Government would be doing is taking gold off your hands at a price that is fair. The Government takes the plutonium byproduct and puts it in a vault, and it does not dissipate. To that extent the fact that the Government might provide a market for your byproduct should not be considered as a subsidy in the normal sense of a subsidy, because the Government would be getting something tangible in return—a quid pro quo.

Mr. PUTZELL. We certainly do not look on it as a subsidy.

Representative HOLIFIELD. Chairman Cole, if you will yield on that point, I do not want to be put in the light of objecting to something that is reasonable, unless the cost of plutonium is known and the price paid for plutonium is known, we do not know whether it is a subsidy or not. If you amortize your plant over a period of 5 years, and if you are guaranteed against cancellation, then you are putting in no-risk capital into it, because your risk capital is either returned to you through rapid amortization or through damages on cancellation.

Mr. PUTZELL. No.

Representative HOLIFIELD. Yes. If you operate 5 years and you get a 20-percent-a-year amortization, you get all of your money back out of the price of your operation. If it runs 3 years and you get a cancellation bonus at the end of 3 years equivalent to the other 2 years of your capital plant investment, you are getting a complete return on your risk capital. I believe that is a fair statement, is it not? If it is not, I would like to have it pointed out.

Mr. PUTZELL. Just one thought rushes to my mind, sir. Suppose a tornado hit that plant after it had been built and in operation a year. There is no provision for the Government to pay us off if the plant is destroyed.

Representative HOLIFIELD. I assume you would carry some fire and tornado insurance as a part of normal business caution.

Mr. PUTZELL. The point is that the group of companies that carry the risk have lost just like they do in every other plant in industry. There is absolutely no difference.

Representative HOLIFIELD. It all depends on the purchase price that is paid for the plutonium. If the purchase price paid for plutonium is enough so you can amortize your plant out of it, and if the cancellation bonus is enough so that you can protect your plant investment for the contract period, then it is not an ordinary risk. It is an abnormal risk. It is a Government-protected risk.

Senator BRICKER. May I come back, Mr. Chairman, to the patent appeals? Of course, nobody knows what you are going to patent tomorrow. But what field do you anticipate there will be a need for more patents or more research and more creative development where-in you would want protection?

MR. PUTZELL. Frankly, Senator Bricker, we do not see any now.

SENATOR BRICKER. That is what I was thinking about. I was wondering where you would start, and where the need is. There is a great deal of work already done in this field both by private companies and by the Government. You would start with what you have.

MR. PUTZELL. Yes, sir; just like any other new idea.

SENATOR BRICKER. And hope there might be opportunities for development and creative results.

MR. PUTZELL. Exactly. That is how we justify the expenditure of people's money in new ventures in the chemical industry.

SENATOR PASTORE. Do you think that this patent element that we are talking about is being overemphasized at these hearings?

MR. PUTZELL. I have not been to any other hearing, Senator.

SENATOR PASTORE. Every time you appear you talk about patents more than anything else.

MR. PUTZELL. Yes, sir. As I said a little earlier, I think it is very easy to draw up in one's mind a connotation in this business that every nuclear idea is patentable. It is sort of synonymous. It is not so any more than in any other field where there are natural laws involved. I would like to emphasize that, because, after all, all of us are benefiting by the discovery of basic natural laws in atomic energy, some by Americans and some not. Those are not patentable ideas in the traditional sense of patentable products. The law of relativity, for example, I cannot imagine it is as being patentable. Because Einstein had the idea, I do not believe he was able to get a patent on it.

SENATOR PASTORE. Yet, you do not see Monsanto investing too much money in this field unless they do get patent concessions.

MR. PUTZELL. I am not willing to say that is so. We cannot be sure that we will get patents. One of the incentives to go forward is the opportunity to get them if you get a patentable idea.

SENATOR PASTORE. I think I can understand that.

CHAIRMAN COLE. Are there any further questions of Mr. Putzell? If not, thank you.

MR. PUTZELL. Thank you.

CHAIRMAN COLE. Since Mr. Putzell said he is not prepared to discuss Mr. McAfee's statement, I wonder if we could not omit having it read for the record. I wonder if it would not be agreeable to Mr. Putzell as representative of Mr. McAfee to have his statement appear at the end of this discussion in the record. Copies of Mr. McAfee's statement have been distributed to the press or will be so it will be available to them.

With that understanding, that is the way it will be handled.

STATEMENT OF J. W. McAFEE, PRESIDENT, UNION ELECTRIC SYSTEM, THE NORTH AMERICAN CO., AND ELECTRIC ENERGY, INC., PRESENTED BY EDWIN PUTZELL

MR. PUTZELL. I am speaking for Mr. J. W. McAfee who is in the electric utility business and serves as president of the companies in the Union Electric System, the North American Co., and the Electric Energy, Inc.

Almost 2 years ago, Union Electric Co. joined with Monsanto Chemical Co. in a contract with the Atomic Energy Commission, the purpose of which was to study the feasibility of producing electricity

from nuclear sources. The contract was for 1 year and was subsequently extended for an additional year. The two companies have made cash expenditures in carrying out this work, which total just under a half million dollars.

The sole business interest of the companies with which I am connected is the development of a cheaper means of producing electricity. We have a subsidiary interest in the atomic energy program, which is directed to keeping ourselves informed as to developments so that in our future planning, we can take into account any possibilities that may be in prospect.

In making the studies mentioned above, and in our contacts with the AEC and with others interested in this subject, we have gathered and analyzed a substantial amount of material. Our interpretation of the results of these activities has led us to two basic conclusions.

(A) On the basis of what is now known in the field, there are several types of reactors which will produce large quantities of heat energy, and that it is feasible to design equipment which will gather the heat into boilers of more or less conventional design and produce steam which will drive turbogenerators.

(B) We are unable to find any type of presently developed reactor which, if used solely for the production of electricity, would result in costs as low as those obtained from the most modern equipment now being used by industry.

We are not discouraged in our efforts by these conclusions for we see the possibility of great future developments. Our rather optimistic view is not based solely on hope. There are known problems which are now being studied and worked on and which, if fully solved, will produce substantial gains toward a more economical result. To specifically mention items involved in these problems would probably lead into the classified field.

Of equal or greater importance in the lowering of costs is the tedious process by which great discoveries have in the past and will, no doubt, in the future be slowly improved in their practical application until they come to have enormous value to our economy.

It is my personal belief that nuclear power will only be made competitive by building and operating some full-scale plants. This field of science offers such broad horizons that if we wait for the best possible reaction, we will never build a plant.

Most of our progress in complicated industrial processes has come through observing and studying equipment in actual operation by men who have been given strong incentives for improvement and who are under the pressure of either producing an economical result or losing their position. The electric utility industry is generally thought of as a young one. Although developments in it have been comparatively rapid, nevertheless if you look back over its history and compare it with the progress that has been made in the atomic field, I think you will be much encouraged.

Mr. Thomas Edison built the first central station system in New York in the eighties. In developing the system, he was in possession of a great amount of basic scientific knowledge which had been developed through the centuries since an early Greek philosopher recognized electricity as a form of energy. It was Mr. Edison's inventiveness and ingenuity, however, which brought about the devices to put this scientific knowledge to practical application. In the next

20 years, a number of plants were built, many improvements made, but even so, if we compare the results obtained costwise with the most modern plant of today, we see the startlingly large gains that have been made in a half century. A kilowatt-hour of electricity can now be produced with about one-tenth the amount of fuel which was required 50 years ago. In addition, we have labor-saving devices, automatic controls, better transmission and distribution systems, all of which make for better service at considerably less cost.

If the construction and operation of a full-scale plant is essential to progress toward atomic power, and if the unit cost of production in the first such plant is to be, say, twice what it is in a modern present-day plant, how is the economic gap to be closed so as to permit financing of the atomic plant on a sound basis? There are two possibilities which, in varying degrees, would fit the undertaking into the fabric of business organization.

(a) If sufficient value could be ascribed to the byproducts of the reactor, the project could be made self-sustaining. I am thinking of both tangible and intangible byproducts. The principal tangible resulting products are obviously fissionable materials. I use the term "intangible byproducts" to refer to results which may have substantial value to the Government. Examples in this category are: (1) design of a reactor for power purposes but with features which would permit it, in times of emergency, to be quickly converted into a weapons-material producer; (2) developments which would be of value as ultimate equipment for battleships. Or even the design and construction of a prototype which might be acceptable for such purpose.

(b) By a direct Government subsidy. This method is far less desirable and would greatly lessen the incentive and responsibilities of those who undertake the development, and would thereby minimize the forces which have been so successful in bringing about industrial progress in this country. The method can, however, be justified, and I believe it would be in the interest of the country to follow it rather than to abandon the possibility of going forward with atomic power. The justification comes largely from the fact that the electric utility industry is restricted to a fair return on its investment so that any decrease in cost is of direct advantage to the industry's customers.

Developments in the nuclear field have gone far enough to make a revision of legislation presently desirable and, if we are to retain leadership, I believe it will not be long until such revision is imperative. Everyone must, in the present state of world affairs, accord a first priority to the weapons and defense field and the concomitant consideration of security. Within this limitation, I am confident that the best national policy will be one which encourages wide participation in the atomic program and affords sufficient incentives to attract capital and talent to its application to civilian uses.

The mention of incentives leads unavoidably to the controversial subject of patents. Our companies have little direct interest in this subject. The nature of our business, and particularly the relation of our expenditures to the price charged for our service, under regulation, forecloses the possibility of our putting large sums of money into speculative ventures or of our having prospects of making profits of sufficient size to warrant our engaging in hazardous undertakings.

The sums which we spend for research must be related to reasonable prospects of gain to our own customers. Nevertheless, we do know that research and other activities by producers of equipment we use and by those engaged in kindred activities are the source to which we must look for better tools with which to produce cheaper power. A policy which affords them sufficient incentive to go ahead energetically is indirectly of value to us and our customers.

Most of the discussion I have heard on the patent problems has included the question raised by the fact that most of the basic discoveries up to now have resulted from work done with Government money. It may be that this question has been overdone.

No one would, I think, dispute the necessity of making ample provision to preserve to the Government full rights to all discoveries which have thus far come about. However, in thinking of work to be done in the future and possibly patents to be granted for resulting discoveries, I can see little difference in this field as compared to any of the other divisions of science. In every field, there is an enormous amount of money and time spent in accumulating and recording basic knowledge. Mere familiarity with this basic work does not entitle anyone to a valid patent. It is only if one can take the knowledge accumulated from the past and, by his ingenuity, develop something wholly novel, that he obtains a right to it.

As I understand it, our general patent policy was adopted because it was believed that it would provide an incentive to discoveries which would be of value to the people. I think the policy has been a good one and has contributed much to the welfare of our country. The same principle seems to me to be applicable to the subject we are discussing. Again using Mr. Edison as an example—we afforded him access to the results of the great number of experiments and studies of electricity that had been made in centuries past. Then we made available to him a national policy under which, if his industry and inventiveness were sufficient, he could obtain valuable patent rights. All must agree that our course was a wise one.

There is also, I think, apprehension in the minds of some that the holders of patents in the nuclear field might use them in an antisocial way. But again, if there is any difference as compared with other scientific endeavors, it is only one of degree. If there is need of limitations for the protection of the public, I suggest that it should be arranged so as to detract as little as possible from the incentive feature.

Basic data on nuclear fission has, no doubt, been more expensive to the Government than have its efforts in other fields of science, but that fact alone offers no logical basis for differentiation.

Chairman COLE. We thank you very much for coming back, Mr. Putzell. Thank you.

Admiral Mills and Mr. Kellogg, singly or jointly, are the next witnesses.

Admiral, at the time the joint committee heard you a week or 10 days back, you had scarcely more than figuratively touched your toe in the cold water of an analysis of this new venture, and you were not sure just what the temperature would be, and therefore were not in a position to give us much advice. I do not assume you have progressed

much farther in the intervening 2 weeks, so we will not expect too much from you, but we still will hope.

**STATEMENT OF VICE ADM. EARLE W. MILLS, USN (RETIRED),
PRESIDENT OF FOSTER WHEELER CORP., ACCOMPANIED BY
FRED C. KELLOGG, PRESIDENT OF PIONEER SERVICE & ENGI-
NEERING CO.**

Admiral MILLS. Thank you, Mr. Cole. I know that a lot of ground has been plowed here this afternoon by representatives of teams who have been in business much longer than we have, but with your consideration, sir, I would like to submit a joint statement in behalf of the Foster Wheeler-Pioneer Service group regarding their participation in the nuclear-power studies of the Atomic Energy Commission.

Our study group, the fifth to participate in the Atomic Energy Commission's reactor-development program, is comprised of Foster Wheeler Corp. and Pioneer Service & Engineering Co. as the principal contractors. Foster Wheeler Corp. manufactures heat exchanges, condensers, cooling towers, marine and stationary steam-generating equipment; and it also designs and constructs refinery and chemical-plant equipment. Pioneer Service & Engineering Co. is a consultant firm providing engineering design, financial, and administrative services to electric utilities and other users of power. Pioneer is being aided in this project by six of its electric-utility clients: The California-Oregon Power Co., Louisville Gas & Electric Co., Northern States Power Co., Oklahoma Gas & Electric Co., San Diego Gas & Electric Co., and Wisconsin Public Service Corp.

The specific objectives of our study contract are:

- (a) To determine the engineering practicability of designing, constructing, and operating a power-producing reactor.
- (b) To examine the economic and technical aspects of building this reactor in the next few years.
- (c) To determine the research and development work needed before such a reactor project can be undertaken.
- (d) To offer recommendations in a report to the Atomic Energy Commission concerning such a reactor project and industry's role in undertaking and carrying it out.

To complete our team consisting of members of the staffs of the two principal contractors, a nuclear physicist, Dr. R. F. Humphreys, from Armour Research Foundation, has been added to the working staff, and Dr. T. H. Pigford, professor of nuclear engineering at Massachusetts Institute of Technology, has been retained as consultant. The most recent addition to our team is a metallurgist, Mr. Roy W. Emerson, of the Pittsburgh Piping and Equipment Co.

The basic team was formed in October of 1952 and originated as an outgrowth of the desire on the part of the companies concerned to examine the possibilities of adapting nuclear energy for the production of electric power by industry. Unclassified evidence at that time indicated that much of the basic work had progressed to a point where development experience could add substantially to advancement of the art.

The major effort of this team, composed of electric utility engineers, and power and process equipment manufacturers, is being directed toward the development of a nuclear powerplant that em-

phasizes the "power only" design and is not dependent upon the market for weapons material. The term "power only" in this case is defined as that design which has power as its primary purpose although fissionable and other materials may be produced in the process, which can either be utilized as a fuel or processed for sale to other users.

To arrive at the basic criteria of an overall design which might provide the best characteristics for "power only" application, the study group has been engaged in examining and correlating the technical and economic data in the field of nuclear power. In doing this we have been faced with determining methods of analyzing proposed designs and comparing them under similar economic conditions which might exist in a peacetime power industry. Such analysis requires investigation of related fields as well as the physical characteristics of the plant as other ramifications become evident. Some of these are hazard evaluation, possibility of byproduct utilization, available supplies and markets, and economic influences.

Although the summarization of this data has not been entirely completed, it is evident that no existing reactor in our opinion can fit into the economic "power only" picture without further development work and, in most cases, complete redesign of many components. The research and experimental reactors which are in operation have provided much of the basic information for new design. However, more experience is needed to prove how this basic information can be used to produce reactors of the type and size which can fit into the power generating field.

The Atomic Energy Commission has carried out basic research and development, and has designed and built reactors for military and other purposes. Accordingly, industry is dependent on the Government for the foundations, and will continue to be so for much of the expansion of this basic work in the immediate future. However, industry can and should experiment with new ways of utilizing this work, and building on it, to attain the characteristics necessary for a nuclear powerplant to operate competitively.

The interest of the Foster Wheeler-Pioneer Service team stems, not only from general progress and some previous participation in phases of the nuclear-energy development, but also from a definite feeling that a new power source for industry can become available sooner with the benefit of widespread business participation on a nonmilitary basis. Only by such broad participation with the resulting increased scope of development attack can we be certain that the utilization of atomic energy will be speeded toward improving the public welfare, increasing standards of living, and strengthening free competition.

We believe that the problems of atomic-power applications can be worked out most economically in terms of manpower, time, and cost, if many more scientists and engineers can be brought in contact with such problems through increased industry participation outside of Government agencies, but in cooperation therewith.

The Atomic Energy Act of 1946 is a most useful document, but changes and modifications are needed to encourage private business to strive for solutions much more forcibly, and on a broader front, if we are to speed up the day when this new power is really useful to our citizens.

We concur in the statement of policy on nuclear-power development already submitted here by the Atomic Energy Commission. We are convinced that the greater freedom there envisioned will be the key to wider and more intensive interest and activity in the progress of the new source of energy for the production of power.

We wish to acknowledge our understanding and appreciation of the situation as expressed recently by one of the members of the Atomic Energy Commission, Dr. Henry D. Smyth, in a talk at Case Institute, when he said—

that reasons for change in the present methods of operation are "compelling," even though difficult because the technology of nuclear-power production is inextricably mixed with the technology of producing the materials from which atomic bombs are made.

The "compelling" reasons for change were given as—

(1) The long-range weakness of any monopoly because of the lack of continuing, competitive stimulus; (2) the inherent difficulty of running a large industry directly under Government supervision; and (3) the increasing interest in uranium as a potential source of commercial power.

We also wish to point out that many benefits have accrued to the Navy over the years in the fields of design and construction for both combatant and auxiliary types of ships by reason of including the commercial engineering and industrial facilities in such developments. Some of these benefits would undoubtedly have come in time, but the advantages in accelerating these gains not only made for faster progress but tended to keep the Government's designers and engineers on their mettle by the stimulus of competition and the freshness of different viewpoints. The participation of industry broadened the fields tremendously and such participation in nuclear-power developments will bring many similar advantages as time goes on. Competition is the soul of progress and every Government activity has benefited from such influences.

The Foster Wheeler-Pioneer Service study group is just completing an interim report, the basic purpose of which is to aid the participants in the selection of avenues worthy of most intensive study during the remaining period of the contract. Upon the conclusion of the contract period a formal report will be submitted to the Atomic Energy Commission containing our conclusions and recommendations in accordance with basic objectives.

Many of the conclusions in our interim report are at this time to be regarded as indicative rather than conclusive. Among the reasons for this are:

1. The avowed initial purpose of narrowing the field before proceeding to a study in intimate detail.
2. The unavailability of certain cost data essential to development of a true economic status.

However, on the basis of our interim report, the following statements may be made at this time:

1. While we do not refute the place of dual-purpose reactors in special situations, we believe the specific field of nuclear power will in the ultimate be best served by concentration on reactors designed on the "power only" premise, to operate and compete in the conditions under which private electric utilities must operate in a peacetime economy.

2. Present-day conventional fuel costs in the continental United States place a heavy burden on the nuclear powerplant in its effort to compete with conventional steam powerplants. Fuel cost in many foreign countries creates a brighter prospect for nuclear plants. Despite this factor we feel that it would be contrary to American tradition to neglect to look to the future both with respect to our historical aggressiveness in pursuing new developments and the fact that conventional fuels may one day be less plentiful and more costly.

3. Present day, large thermal production reactors cannot be converted to economical power producers.

4. Certain thermal reactors based on broad modifications of material production units appear to be competitive if fuel may be subjected to long-term irradiation.

The philosophy of our group has been that the path followed should have the prospects of attaining a goal of producing power at a cost less than power by conventional means. A path which would lead to the production of power at the same cost as a conventional plant would be an insufficient incentive for investment in nuclear powerplants.

5. Reactors which we believe to be worthy of more detailed study are fast breeders, and fluid-fuel thermal reactors, as typified by the aqueous homogeneous reactor and the fluidized solids reactor.

Of these designs the fluid systems seem at this time to warrant major consideration by our group since:

1. They contain the desirable possibilities of (a) Low capital investment; (b) reasonable selling price of power; (c) increasing power output without marked increase in total capital investment, and (d) decreasing fuel operating cost.

2. The Foster Wheeler Corp. has had much experience with fluidized solids systems.

3. Many of the mechanical-design problems can be tested without using nuclear fuel.

Accordingly, recommendations are under consideration to gradually enlarge the group and to begin design evaluation of the promising systems. The group would map out the research and development program needed on the above basis. During this phase some essential experiments should be carried out.

I wish to add at this point that at a meeting yesterday we have decided to proceed in accordance with the statement set forth just above.

I now pass to the question of suggestions for revisions of the Atomic Energy Act of 1946.

We believe that, in order to encourage the investment of private capital for the development of industrial utilization of nuclear energy, changes in the Atomic Energy Act of 1946 should be based on the following principles:

I. OWNERSHIP OF NUCLEAR FACILITIES

Private ownership of fissionable materials and facilities for producing fissionable materials and nuclear power by appropriately licensed firms only, should be legalized with authority in the Atomic Energy Commission to formulate minimum standards of competence and responsibility to be met by firms seeking to be licensed to own and operate nuclear material or nuclear-energy production facilities; with appropriate safeguards regulating the export of nuclear materials or

equipment capable of producing fissionable materials; and to grant licenses to qualified firms if consistent with national security and antitrust laws; and to formulate and enforce uniform accountability and security standards to be adhered to by licensed firms in the acquisition, production, disposal, and loss-control of fissionable materials.

1. Licensing should not be required by firms engaged only in the development, design, manufacture, or construction of equipment or facilities for the production or use of fissionable materials, but firms utilizing such equipment or facilities for the actual production or use of fissionable materials should be licensed.

2. Sale of fissionable materials by the Atomic Energy Commission, if feasible without impairing national security, to licensed firms and sales or acquisitions of fissionable material by and between licensed firms, should be legalized subject to accountability and security regulations in effect.

3. Sale or acquisition of source materials (unrefined ores) should not require licensing except for export.

4. Licenses once granted should be revocable only for cause, i. e., violation of the terms of the license.

II. SAFETY

The Atomic Energy Commission and private industry, until such time as private industry can assume full responsibility, should share responsibility for establishing and enforcing appropriate codes and standards for the safe construction and operation of industrial nuclear facilities insofar as hazards peculiar to atomic energy affect the public in the vicinity of nuclear activities, particularly across State borders.

Private industry should immediately assume full responsibility for establishing and controlling safety procedures within the confines of individual industrial nuclear facilities and eventually for the formulation of appropriate construction codes by voluntary cooperative standards and code-writing bodies, including representatives of the various States, operating in a manner similar to the boiler and pressure vessel code committee of the American Society of Mechanical Engineers in cooperation with duly authorized inspection and enforcement agencies.

III. RESEARCH AND DEVELOPMENT

1. The Atomic Energy Commission should continue its program of basic research and development in the nuclear materials and nuclear energy fields, encourage and assist private industry in its own self-financed research and development projects in these fields by making available to appropriately qualified persons or organizations the results of its work subject to the national security requirements.

2. The Atomic Energy Commission, in turn, should have the right of access to the results of research and development work carried out by private industry and to utilize the results in the national interest.

IV. PATENTS

1. Private ownership of patents should be legalized on inventions of processes or equipment for the production of fissionable materials

of all grades, including weapons grades, or for the utilization of fissionable materials except in atomic or thermo-nuclear weapons; except that the Government shall have the right—

(a) To acquire and own all patents on inventions of processes or equipment solely applicable to the utilization of fissionable materials in atomic or thermo-nuclear weapons.

(b) To acquire nonexclusive, irrevocable, royalty-free licenses to all patents on inventions of processes or equipment adaptable to the production or utilization of fissionable materials for military uses.

(2) Appropriately qualified organizations should be granted free use of all patents on inventions of processes or equipment for the production or utilization of fissionable materials in scientific investigations and in research or development projects.

CONCLUSION

Considerable development work is required to bring to fruition competitive nuclear power. As a first step, certainly, and probably for some time to come, nuclear powerplants will supplement conventional installations. However, we feel the field offers sufficient promise to warrant the application of the collective talents of all those engaged in the field. We earnestly believe that the time has arrived when steps to permit a wider, fuller participation by industry are well advised. Given the opportunity within the bounds of national security, it is our belief that the inventive genius and practical engineering "know-how," resident in private industry and waiting to be of service, will hasten the day when nuclear power will realize its vast potential for peaceful service.

I would like to add at this point, gentlemen, that we subscribe to nearly everything that has been said previously in this hearing this afternoon, and where we have varied from those considerations, we have so indicated in this short memorandum.

I would like to say in response to some of the questions that have been previously asked that I certainly agree with Senator Bricker's summarization a few moments ago that the big benefit that will accrue to the people of this country by reason of commercial or private industry's entering into this field is in making available to all of the people at an earlier date the good that can be realized from competitive nuclear power, and probably even at a much cheaper rate.

Chairman COLE. Mr. Kellogg, do you care to add anything to what Admiral Mills has given?

Mr. KELLOGG. I think not, Mr. Cole. This is a joint statement, and we concur fully in what has been said.

Chairman COLE. It is a fine statement. It shows that you have given a great deal of thought to it. I compliment you for making concrete suggestions with respect to legislation which you have expressed in a general way you feel would be necessary to accomplish the goal which all of us seek to achieve. I think you have done a fine job.

Admiral MILLS. Thank you, sir.

Chairman COLE. Are there any questions? Mr. Holifield.

Representative HOLIFIELD. I want to add my commendation to the type of statement you have made, sir. It shows you have given the problem a great deal of thought, and you have made some very con-

structive and thoughtful suggestions in your statement. There are a few places in it that I might differ with you in a minor degree, but on the whole I think your statement is going to be of help to the committee.

Admiral MILLS. Thank you.

Representative VAN ZANDT. I want to add my commendations and at the same time tell the Admiral I am glad to see him again. It takes us back to our years of associations in the Navy.

Admiral MILLS. Thank you.

Representative VAN ZANDT. On page 3 you say :

We wish to point out that many benefits have accrued to the Navy over the years in the fields of design and construction for both combatant and auxiliary types of ships by reason of including the commercial engineering and industrial facilities in such developments.

When you read this portion of your statement, I got to thinking about the diesel engine.

Admiral MILLS. Yes, sir.

Representative VAN ZANDT. You are familiar with its history, I am sure.

Admiral MILLS. Yes, sir.

Representative VAN ZANDT. Could you tell us how the diesel was handled? I think the Navy Department and the Bureau of Mines took it over, did they not?

Admiral MILLS. The problem we were faced with, Mr. Van Zandt, as you are probably quite familiar, was the necessity of getting a fast running, light-weight diesel engine which we did not have in the United States at that time.

Chairman COLE. When was that time?

Admiral MILLS. That started in the early 1930's, Mr. Cole. Of course, we had what we considered to be for that time a reasonably satisfactory diesel engine but we were handicapped by the amount of power we could take out of it. The only way we could improve the operational ability of the submarine was to get a higher speed diesel and to get one that we could take more power out of for less weight.

We surveyed the field in Germany. We also surveyed the field in the United States. We chose, with the help of that information which we got from Germany, to make a domestic development of the diesel engine, and we interested four of the leading diesel engine manufacturers in this country and gave additional information to a number of others who might be interested in developing this field, and we came out with a fast-running, light-weight diesel engine which not only enabled us to realize the ultimate from our submarines from the development that had taken place up to that time, but it also served, like most other developments, a purpose which we did not realize at the time—the basis for the dieselization of the railroads today. I say that because it was the light-weight, fast-running diesel engine which made it possible for the railroads to realize the gains they have made in utilizing that engine in locomotives.

Representative VAN ZANDT. You can add also the trucks on the highways.

Admiral MILLS. Yes, sir. Anything that can utilize a light-weight source of power has benefited from that investigation and development.

Representative VAN ZANDT. How did you acquire the information from the Germans? Was it from the German Government or German industry?

Admiral MILLS. We got it primarily from the contacts through the German Government, but basically from German industry through the German Government. Of course, all we got really out of the German development was what the gentleman from Monsanto referred to awhile ago as the idea, and the real development of our diesel engine took place in the United States. I give full credit to the commercial and industrial facilities and engineering talents that were put to work for the excellent results we have received in that field.

Representative VAN ZANDT. Was it the Navy alone or did the Bureau of Mines join the Navy?

Admiral MILLS. The Bureau of Mines joined the Navy in the original contact.

Representative VAN ZANDT. Have you any idea how much money the American taxpayers put into the effort?

Admiral MILLS. Mr. Van Zandt, that is a dangerous answer to try to give you off the cuff, but I would say somewhere in the neighborhood of \$12 million.

Representative VAN ZANDT. What method did the Government employ in making available the information to the public?

Admiral MILLS. We made this information widely available to industry, and after we had made it available to industry we set up projects for them to develop prototype engines for test to determine whether or not we were reaching the goal we were interested in.

Representative VAN ZANDT. Ever since these hearings began, I have had in mind the effort of the Navy and the Bureau of Mines to develop the diesel engine, and I have tried to parallel this atomic development.

Admiral MILLS. There is one other development that is parallel, which I think is indicative of the benefit that can be realized by widespread use of the talents in industry, not only from the standpoint of increasing the breadth of attack and the freshness of the viewpoints, as I emphasized awhile ago, but to bring also to memory that we have not always had our own turbine and gear development in this country at the point we were able to utilize during the last war. It has not been many years ago that we were almost dependent upon licenses from abroad, particularly the English, for the production of turbines used in our combatant and auxiliary ships. Having decided that was not a good position to be in, we enlisted the aid of industry to solve the problem, and I think the outgrowth of that development through the help of industry has resulted in the United States Navy having the finest motive power of any navy in the world today. I say that without any fear of contradiction. We have developed what I call out of that development "an American turbine" as opposed to our dependence in prior years upon a foreign development for powering our ships.

Representative VAN ZANDT. Therefore, Admiral, what we are trying to do with atomic energy from the standpoint of making it available to industry is not new in the affairs of our Government.

Admiral MILLS. In my viewpoint, it is very desirable. That is the only reason I brought in this question of the gains that had been

realized by other Government agencies who are certainly interested in the technical field to a maximum extent.

Representative VAN ZANDT. That is all, Mr. Chairman.

Representative HOLIFIELD. Mr. Chairman, I am tempted to remark that I favor the Government proceeding and setting up a prototype project, and having private industry work them out just as in the diesel. That happens to be my position.

Chairman COLE. As Chief of the Bureau of Ships, Admiral, while you are here, tell us what the practice of the Navy was and as far as you know still is with respect to new ideas that are discovered in Government yards. Here we have a situation where the Government is in the business of building ships in navy yards.

Admiral MILLS. That is right.

Chairman COLE. Right across the bay or adjacent there might be a commercial enterprise doing the same thing. How do you handle patentable ideas?

Admiral MILLS. The situation is not a great deal different, Mr. Chairman, from what is proposed in these patent suggestions. Even in our navy yards we permit an engineer who develops a patentable idea to patent that idea, but the Government has free use of that idea if it was developed on Government time, and is the result of working on a Government project. But he is allowed to accrue to himself those applications which may be commercial. So that a man can get a very valuable patent, but the Government has free right to the use of any of its applications in the Government service; it does not prohibit him from getting benefits from commercial applications.

We have tried to emphasize that point by asking all personnel in Government service to list their patentable ideas, and the Government gives them assistance in obtaining these patents. We found that system works very well.

Coming back to this question of patents, it has been discussed here rather completely. I think it has been made adequately clear that industry does not expect to benefit from information in a patentable sense that has already been developed by the Atomic Energy Commission and by its predecessor, the Manhattan district, under, I think, a situation that has been remarkably successful. But the point I do want to emphasize is that we are in danger of limiting our attack on the development of new ideas if we restrict it to a Government activity solely, and we are also failing to take advantage, as I tried to point out briefly in my paper, of a lot of talent and a lot of different viewpoints that industry is anxious to put on this project. What we are interested in from the patent clauses are the new ideas that may be developed in the future. We feel that there should be some protection on that basis along the same lines as the Government recognizes in individual and company rights with respect to ideas developed in other fields.

Now, with respect to handling patentable ideas from corporations engaged in the building of ships, as they are developed, as I said awhile ago, in exactly parallel principle in building and working on a Government contract, the Government has the right to use the patents in its own special uses. But for any commercial exploitation, if you please, they are allowed to benefit where it does not involve a Government contract or restricted use.

Chairman COLE. Then the practice in the navy yards with respect to the patentable ideas is that a patentable idea that has been conceived by an employee of the Federal Government who works on Government time, who uses Government laboratories, and through that opportunity conceives a new idea, the Government has the right to use that idea without cost, but that individual, even though public funds helped him accomplish the idea, may license it under royalty to anyone he wishes?

Admiral MILLS. For commercial application. That is the only way that you can stimulate the development of new ideas.

In other words, the hope that the individual can benefit thereby, as well as the corporation.

Representative HOLIFIELD. The Navy uses that for any purpose it wants to use it.

Admiral MILLS. In Government service.

Representative HOLIFIELD. Not only in a military way?

Admiral MILLS. That is correct, sir.

Representative HOLIFIELD. It so happens that would be different from your presentation here, because your presentation says only where this fissionable material would be used in a military way. The Government has other uses for fissionable material than a military use.

Admiral MILLS. I think you misunderstood my statement about the other application. If it is a commercial use, the Government does not try to interfere with the individual.

Representative HOLIFIELD. I know it does not interfere with the individual. But under the present act, if the Government as a by-product produces energy in any of these atomic-energy plants, it can use that energy rather than to go out and buy the energy from TVA or from the Ohio Electric group. The present act provides that the Government can use that power. It even provides that it can sell that power to other Government agencies if it wants to. That is the way the present act is.

Now, if a company comes in and utilizes the laboratories and facilities of the Government and by utilizing that background of technical knowledge and the facilities which they say are necessary to go ahead and proceed in a cooperative way on this material, you have no objection to the Government utilizing that?

Admiral MILLS. I would say only for military purposes, Mr. Holifield.

Representative HOLIFIELD. But you would not say they could use it in their own atomic-energy plant to cut down the electric bill so we cut down the cost of the weapons?

Admiral MILLS. If that electric plant is being used for commercial purposes, I would say no, sir.

Representative HOLIFIELD. I do not follow your reasoning there. We are taking TVA power, which is produced by the Government at this time at cost into the Oak Ridge plant. We are utilizing that power at cost. We are also taking commercial power and utilizing it in that plant at the rates agreed upon with the commercial companies. So there is a mingling there of government-produced power and private power.

Admiral MILLS. I see. It occurs at a lot of other places, too.

Representative HOLIFIELD. Yes, that is true. You are in effect saying that notwithstanding the fact that an individual is working in the Government's laboratories and utilizing the Government's facilities, and if he develops a reactor which the Government can use to produce its own power to cut down its purchased power in that plant, that the Government, because it is a commercial and not military item, it cannot use it?

Admiral MILLS. If you do that, I think you are removing a lot of incentive for developing new and patentable ideas.

Representative HOLIFIELD. I cannot follow you there because the Government has not removed the incentive for developing patentable ideas according to your own testimony in its Navy procedure. As I understand it, the Government can use anything that is patented both for shooting a gun or mowing a lawn, regardless of whether it is for military use, or what you would ordinarily call common use.

Admiral MILLS. The illustration I gave you, Mr. Holifield, I was applying to the shipbuilding industry. We have not attempted to encroach on individual patents for application to anything except the shipbuilding industry on Government contracts.

Representative HOLIFIELD. Let me question you there. The Government builds ships and private companies build ships.

Admiral MILLS. That is right.

Representative HOLIFIELD. Let us assume that men working on a Government construction ship job originate a patentable idea. Would the Government foreclose its own use of that patentable idea?

Admiral MILLS. The Government has a right to use that in a shipbuilding application, whether it is being built by a private firm or a Government yard.

Representative HOLIFIELD. That was my understanding.

Admiral MILLS. But it does not attempt to exercise the free use of that patent for commercial purposes.

Representative HOLIFIELD. No, it does not.

Admiral MILLS. There has been a good deal of complaint against that provision, Mr. Holifield, and that is one of the points of issue here at the present time—where are you going to draw your line against commercial application itself and against strictly governmental military applications, and I thought were were trying to draw a line here.

Chairman COLE. Where do you draw the line in the shipbuilding industry?

Admiral MILLS. We draw the line at whether it is a Government contract for use by the Government in ships which it is either building or having built.

Chairman COLE. Suppose you were to build in a shipyard a vessel to carry people. In fact, I had in mind something comparable to the U. S. S. *America* or U. S. S. *West Point*. The troop ship is nothing more than another commercial ship.

Admiral MILLS. You mean if she is being built in a Government shipyard?

Chairman COLE. Yes, for Navy use. You would not expect to pay that inventor for his royalty?

Admiral MILLS. No, sir.

Chairman COLE. Even though it has a semblance of commercial application?

Admiral MILLS. What you are really saying is that if the Government solely built a transport which is used for the carrying of passengers really under military supervision, we would expect to use that patent if it was developed on Government time. But there is the difference that you want to remember. It should be apparent that is developed with Government facilities on Government time.

Representative VAN ZANDT. With Government money.

Admiral MILLS. Yes, sir. I think the distinction that I am trying to bring out here against the application that I was discussing with Mr. Holifield is that we are talking about patents in the nuclear energy field, which are developed by commercial firms with their money. In addition to those ideas which have been developed or would have been considered patentable up to the time this law is changed.

Chairman COLE. What is the practice with respect to patents that are conceived in private shipyards which you want to use to adapt to a Navy ship? Does the Government pay the inventor for the use of the patent?

Admiral MILLS. We have paid royalties on a number of patents, sir.

Chairman COLE. That is the general practice. Are there any cases that you know of where the Government has the right to use a patent without paying a royalty except those patents that may have been the result of its own employees or its own laboratories?

Admiral MILLS. I do not know of any case.

Representative HOLIFIELD. What is the application of that principle to the ships built for the Maritime Commission, do you happen to know?

Admiral MILLS. No, sir, I do not. I would not want to express an opinion on it. I happen to know about the Navy's procedure, but I would be guessing on the other.

Representative VAN ZANDT. Admiral, are you acquainted with the activities of the National Advisory Committee for Aeronautics?

Admiral MILLS. To some extent, sir.

Representative VAN ZANDT. How do they handle the development of aircraft when it comes to the patents?

Admiral MILLS. My understanding is that they try to do it on the same basis as I outlined for ships.

Representative VAN ZANDT. In other words, the aircraft industry today enjoys many benefits from the research conducted by the National Advisory Committee for Aeronautics?

Admiral MILLS. I do not think there is any question about that, sir.

Chairman COLE. You mean that the aircraft personnel have the right to use Government aircraft laboratories, and if as a result of that use they conceive a new idea, that the private company or individual obtains a patent on which the Government has no claim whatever?

Admiral MILLS. If it is developed by the firm itself with its own money, yes, sir.

Chairman COLE. But in a Government laboratory?

Admiral MILLS. That is correct, sir.

Representative VAN ZANDT. Admiral, let us take one of the large aircraft companies, say Boeing. Do they not have the right to send, we will say to the NACA test plant at Moffatt Field, a plane—maybe

a prototype—for testing purposes, and the test is actually conducted there?

Admiral MILLS. Particularly if the Government has an interest in that test. But that is a question of convenience, usually, of facilities, Mr. Van Zandt.

Chairman COLE. Admiral, do you care to comment on the provision of law providing for secrecy orders against any patent of vital interest to our security?

Admiral MILLS. Not beyond the point except that I think I made clear in my statement, sir. We feel if it has a direct application to military uses, the Government should have the right to utilize those patents if they have been developed as a result of information which has been made available by the Government.

Chairman COLE. My understanding of the effect of the secrecy order provision relating to the patents is that the Government has the right to grant a patent to the inventor but to deny him the use of it, even though the Government itself does not use it.

Admiral MILLS. I think that is a result of security, sir.

Chairman COLE. It prevents him from using it. But even under that secrecy order, where the Government does exercise that right, the Government is obliged to pay that inventor for the Government's use or nonuse.

Admiral MILLS. That would strike me as being fair, sir.

Chairman COLE. What I was trying to seek is whether you thought the same philosophy prevailing with respect to secrecy orders on patents affecting our national security should also apply to the nuclear field.

Admiral MILLS. If you have a definite military application, the Government certainly should be the one to indicate whether or not they want to put that under secrecy.

Chairman COLE. They might not have any particular use for it themselves.

Admiral MILLS. But they want to deny it for other purposes, that is correct, sir.

Chairman COLE. In that case even though they have no use for it themselves, simply on the basis of denial to another, they are required to pay the inventor.

Admiral MILLS. Yes, sir. I think that is fair.

Representative HOLIFIELD. I think that is one of our difficulties, that is, trying to divorce these processes and improvements, that is, the military from the civilian application, because the same reactor that makes plutonium for power makes plutonium for the bomb. That is one of the difficult problems that the committee faces, that is, the field where if we make a lot of this technology widely known, it would in effect give to an enemy advance technology in the production of bomb material.

I do not know how we are going to resolve that. I am anxious to resolve it.

Admiral MILLS. As a suggestion I would draw the line as between commercial application, military application, and a third category, those applications which you wish to deny for security reasons.

Chairman COLE. Just one other question, Admiral. Do you feel it is necessary at this stage of the game for a private company to have the right of ownership of the fissionable material, or is it sufficient

for our purposes simply that he should have the right to use it under license with the ownership of the material remaining with the Government?

Admiral MILLS. You probably could accomplish the same results by either method. But I believe that you would get along faster and make more progress if you changed the law to permit, under proper national safeguards, of course, the ownership. I say that because I believe you have a better interest from the standpoint of the commercial approach by industry to these problems if they realize that they have something that they are responsible for and which is their property, sir.

Chairman COLE. I have in mind particularly the problem of policing, whichever method is used—whether by way of leasing the material or by way of granting the outright ownership—either way involves a great amount of accounting processes and security surveillances and I wonder if it would not simplify those aspects of the problem if we were not concerned with the question of ownership.

Admiral MILLS. I do not believe so, Mr. Cole. I rather believe that there might be a benefit that would accrue from the other side of the picture, and that is that you can set up such standards of security and accountability as you desire, and you can make industry responsible for carrying out and policing them. I think we have indicated, certainly my experience with industry when I was on the other side of the fence in Government service, and my own experience with it now, I do not think there are any security regulations imposed by any proper agency, such as the Atomic Energy Commission, that cannot be properly administered by industry. It is being demonstrated every day, sir.

Chairman COLE. I know, but when you were in the naval harness you were not concerned with things so minute as a kilogram.

Admiral MILLS. On the other hand, I think that the very nature of this product that we are talking about lends itself to a pretty strict accountability.

Chairman COLE. Very well. Thank you very much, Admiral, and Mr. Kellogg. You have been very helpful.

Admiral MILLS. Thank you.

Chairman COLE. Our final witness is Mr. Gale, chairman of Commonwealth Edison Co.

STATEMENT OF WILLIS GALE, CHAIRMAN, COMMONWEALTH EDISON CO., ACCOMPANIED BY MURRAY JOSLIN, VICE PRESIDENT, COMMONWEALTH EDISON CO.

Chairman COLE. Let me apologize for keeping you waiting so long. Realizing what the hour is, since you are the last witness, I think we can conclude with you.

Mr. GALE. I would like to say that I have with me Mr. Murray Joslin, who is a vice president of Commonwealth Edison, and who has been closely associated with our study project from its beginning.

The CHAIRMAN. We are glad to see Mr. Joslin back with you again. We welcome you both, Mr. Gale. I assume you have a statement.

Mr. GALE. I have, sir.

The CHAIRMAN. You may proceed.

MR. GALE. May I, first of all, thank this committee and the Atomic Energy Commission for including Commonwealth Edison Co. and its recently merged subsidiary, Public Service Co. of Northern Illinois, as one of the four private industry teams originally assigned to investigate the feasibility of nuclear electric power. Our participation in this program has been a real challenge.

To it we have brought enthusiasm and hard work. From it we have gained knowledge which is its own reward for the time, effort, and expense we have put into our studies. I appreciate the opportunity to discuss with you today some of the results of those studies.

Chairman COLE. You do not mind the interruption. Can you indicate for the record the expense which has occurred to your group in making these studies?

MR. GALE. Actual outlay out of pocket is on the order of \$150,000, possibly another \$50,000 if every cent involved were charged to the project.

Chairman COLE. In order that the record may show what the other companies have paid, it is my recollection that one group has invested as much as \$500,000 in these studies, and another group something of the order of \$250,000. I speak of that only to indicate the willingness of your groups to incur this expenditure partially out of a sense of public responsibility. The expense of your studies or the other groups has not been shared by the Government in any sense. The money has been spent by you in making the study out of your own pocket, and the only thought of reward in addition to the satisfaction or gratification of knowledge you have learned is that some day you, as well as other private capital, in the country, can benefit from the results of the study.

MR. GALE. That is correct, sir.

Commonwealth Edison is an Illinois public utility serving approximately 1,725,000 electric customers in Chicago and across the northern part of the State. We operate our business on the theory that if we do a good job our customers will permit us to continue to perform this service and, at the same time, compensate our security holders fairly for the use of their money. Accordingly, we have an important interest in the possible development of atomic energy since it may some day be a low-cost source of power.

We are regulated by the Illinois Commerce Commission. Therefore, we are permitted to earn only a limited return. If we should obtain a cheaper source of power, the saving would be passed on to our customers. If we did not do this voluntarily, the commission would rightfully make us do it. Nothing would please us, or our commission, more than if the cost of generating electricity were cut in half—even though the saving would all accrue to our customers.

Conversely, as a regulated public utility, we are in no position to lose money on a venture into the uncertain field of atomic power. Any such loss would be borne by our stockholders who would have nothing to gain financially if the venture were a success. We cannot, therefore, speculate in big figures on such a venture.

Despite this valid limitation, we have made a thorough study of the engineering and economic possibilities of atomic power. We have been fortunate in having the tremendously valuable help of the Argonne National Laboratory. The proximity of our two groups in

the Chicago area made this working relationship an inherently good one.

Our study resulted in the completion of three preliminary designs of reactor powerplants. All three are practical, we think, from an engineering and operating standpoint. But I will discuss only the two which appear to have the best economic promise.

One, using natural uranium fuel with heavy water as coolant and moderator, would have a net electric power output of 211,500 kilowatts. The other, using slightly enriched uranium fuel with ordinary water as coolant and moderator, would have a net electric power output of 246,000 kilowatts. These, of course, are units of a very substantial size.

Our original assignment from the Atomic Energy Commission was to develop designs of plants which would produce both plutonium and electric power. The designs we submitted will do so.

In addition, we studied how plants of our design would operate with relatively long burnup of the uranium fuel to make power at the lowest possible cost. The byproduct would not be weapons-grade plutonium, but rather a possible fuel for other reactors.

Neither the heavy water nor the ordinary water design, operating with long fuel burnup, would today produce power at a price competitive with coal, taking into account both investment and fuel costs. But these designs do have good potentialities in this direction.

Based on today's level of a utility company's fixed charges, an 80-percent capacity factor, a 30-year life, and our educated guess as to the cost of the atomic ingredients, we estimate that our heavy-water design would produce power on a long burnup basis at a cost of about 1 cent a kilowatt-hour.

On the same assumptions, we estimate that the ordinary water design would produce power for something in excess of 1 cent a kilowatt-hour.

Thus we believe that our designs are not too far from economic feasibility.

It is my understanding that the committee is concerned, among other things, with the future direction of the atomic-power program. We of Commonwealth Edison are not experts in such matters. However, based on the knowledge and experience we have gained from our 2-year study, we do have some very general ideas.

Our first recommendation is that an atomic-power plant be built in the not too distant future. We are convinced that the present technology warrants this conclusion. We repeat the statement of Dr. W. H. Zinn of Argonne National Laboratory that we will know what it takes to make an economically competitive nuclear-power plant only after we have gained experience in operating the first reactor which is designed and constructed specifically as a central station powerplant.

As a matter of fact, it is entirely possible that more than one plant ought to be built. The potentialities of atomic power, in our opinion, are so important, that serious consideration should be given to starting down more than one road. We take it for granted, of course, that the dictates of national defense will be given first consideration.

Our second recommendation is that this plant, or plants, be for the primary purpose of producing power. The problem, as we see it, is

essentially one of economics. If the plant must achieve other objectives, economic results are likely to be obscured. Perhaps an atomic powerplant should be built for some other primary purpose. Such a plant would, no doubt, contribute to our store of technical knowledge. But, from the point of view of economics, the primary purpose should be to produce power.

Our third recommendation is that the plant be full scale and not a pilot version. While we agree that technical knowledge would be gained from a pilot plant, we doubt that it would make a worthwhile contribution to the solution of the economic problem. There are capable people who would disagree with this recommendation. They may be right.

Our fourth recommendation is that the first plant be built under some sort of partnership arrangement between the Government and private industry.

We believe that it would be a serious mistake if the entire atomic-power program were to be turned over to private industry at this time. For example, how could private industry spend \$100 million more or less on a powerplant without any real knowledge as to the cost of fuel?

We would regard it as an equal, if not greater mistake, were private industry to be shut out of the program entirely. We are confident that atomic power at competitive cost will be a reality much sooner if private companies participate.

Our fifth recommendation is that careful consideration be given to various types of partnership arrangements.

One type is the much-discussed proposal that the Government participate by making a long-term agreement for the purchase of plutonium at a fixed price. We would not favor this type of plan because, as I have indicated, we would not contemplate the production of weapons-grade plutonium except when needed for defense.

We have discussed with the Commission staff in a preliminary way another type of partnership plan. I am not sure that the board of directors of Commonwealth Edison would like it, to say nothing of the Commission or your committee. In fact, I am not even sure that I like it. However, it is illustrative of another possibility. I will summarize the plan for that reason.

The company would put up that part of the cost of the plant which would be equal to the value of its recoverable investment should the Government later decide to terminate the arrangement. This might be on the order of 20 percent of the total plant cost. The Government would put up the balance. To meet the requirements of the Atomic Energy Act, the Government would hold title to the reactor and its fuel. The plant would be connected with the utility's transmission system, and the utility would receive the power produced. The entire operation would be carried out under a long-term contract. Under it, the utility would pay for the electricity received on the basis of the cost of producing the same electricity in a modern, conventional station. If the nuclear-power cost were more, the Government would stand the excess. Perhaps I should qualify this by saying that the utility would receive an appropriate credit because of its capital investment.

Such an arrangement would protect the private utility against abnormal financial risks. We also believe that it would be fair to the Government.

There are other ways by which the Government and private companies could join in the financing of the first atomic powerplant. One objection to our plan is its complexity. Other plans may have the advantage of greater simplicity.

These are our specific recommendations. May I list some of the advantages of getting started soon on the building of one or more full-scale atomic plants for the primary purpose of producing electric power:

1. To do so should establish our Nation's leadership in the nuclear-power field. We are already the acknowledged leader in the field of atomic weapons.

2. It would hasten the day when nuclear power becomes competitive with power from other fuels.

3. Knowledge would be gained which comes only from actual experience with a full-scale operating plant.

4. A standby facility would be provided for producing weapons-grade plutonium in the event of a national emergency.

5. A facility would be provided for the production of fuel-grade plutonium for other reactors.

6. The program would contribute to the advancement of reactor technology in general, including atomic ship propulsion.

May I again urge that this program proceed on a partnership basis between the Government and private industry. In this connection, I would again remind you that, insofar as our particular industry is concerned, any benefits from atomic power would accrue only to our customers. I hope that you have noted I have not said that Commonwealth Edison Co. should be authorized to build a plant. It is more important to decide that one or more plants be built than it is to determine which particular company or companies should build them.

Whatever future course may finally be charted for the development of atomic power, Commonwealth Edison is greatly appreciative of the small part it has been permitted to play thus far. We hope that we may be allowed the opportunity of continued participation.

The CHAIRMAN. That is a very fine statement, Mr. Gale; the kind we expected to come from you as a hardheaded, realistic businessman. Are there any questions?

Representative HOLIFIELD. I just want to say, Mr. Gale, that I think that is a very good statement. I think it is completely in line with the public interest, and with the objectives of the Atomic Energy Act. I might discuss with you a little bit the advisability of proceeding with a full-scale type reactor as against testing out 3 or 4 pilot plants at this time. There might be some doubt in my mind. But if I was assured by competent physicists of the type of Dr. Zinn, that we know enough about these theoretical plants that have never yet been built to proceed on full scale, I might withdraw my reservation on that point.

I have a great deal of respect for Dr. Zinn and for some of his colleagues in the reactor field. If they would feel that the time has come to proceed with a full-scale plant, I would consider carefully any reservation I would have on experimenting with more than one type of prototype plant.

MR. GALE. We feel, in the case of the thermal reactor that the technology has advanced to the point where it is practical to proceed

to design and build a full-scale plant. We feel that the problem is working out the bugs from the point of view of economics. We think that you just have to work with that until you get to the answer.

Representative HOLIFIELD. At the end of that time, let us assume we would proceed on a partnership basis and build this full-scale prototype plant. We would no doubt find certain bugs which we would gradually eliminate, and obtain cost figures which we do not have now. At the end of that time would you be willing to allow all the industry in the United States to have the benefit of that experiment and then let them proceed from there on the basis of the race belonging to the swiftest in regard to additional improvements?

Mr. GALE. I am reluctant to speak of the patent side of this. I think industrial companies as distinguished from utility companies have the real interest in the patent situation. I do not think that patents have played a very great part in the development of the private utility industry. Our company like Detroit Edison, does a considerable amount of research every year. I never have heard of a dollar of royalty that our company has obtained. I do not mean that we are running an eleemosynary institution, but we just do not operate that way.

Therefore, I think that it is not fair for a utility man to undertake to speak for industrial companies in the patent area.

Representative HOLIFIELD. That is a fair statement. Thank you.

Chairman COLE. Mr. Van Zandt.

Representative VAN ZANDT. No questions, Mr. Chairman.

Representative HOLIFIELD. Could I be recognized at this time to make a very short statement and request?

Chairman COLE. Yes. Thank you very much, Mr. Gale and Mr. Joslin.

Mr. GALE. Thank you.

Chairman COLE. Mr. Holifield.

Representative HOLIFIELD. As you know, I have made some critical remarks about the Atomic Energy Commission's proposed new policy and legislation on atomic power. In the Congressional Record of June 22, 1953, at pages 7251 to 7253 I made a rather detailed analysis of the Commission's policy statement. Mr. Gordon Dean, the retiring Chairman of the Atomic Energy Commission, presented this policy statement to the committee in the hearing of June 24, 1953.

I want to say, Mr. Chairman, that I appreciate your placing in the Congressional Record of June 30, 1953, a further statement by Mr. Dean commenting on my analysis and amplifying the views of the Commission. Mr. Dean emphasizes that the proposed new policy on atomic power is not a "give-away" program. I know the Congress and the country will be glad to have this assurance, but I note that Mr. Dean omits any reference whatever to the Commission's requested authority to make commitments for long-term purchases of plutonium by private producers. This is the heart of the subsidy issue. This contains a give-away possibility that Mr. Dean does not discuss. I trust that the industrial witnesses will throw light on the matter of Government commitments to buy plutonium as a device for promoting private development of atomic power.

I am glad to note Mr. Dean's assurance that the Commission does not propose to give away any Government-owned facilities in the atomic-energy program. This clarification is important, because the

terms of the draft legislation prepared by the Commission would permit Government disposal of atomic facilities.

Finally, I want to call attention to this significant paragraph in Mr. Dean's letter which says in effect that whatever private enterprise does in the atomic energy field, the Government intends to continue its own program, whether it be power development or anything else. The paragraph reads as follows:

In summary, all the power policy does is permit groups other than the Commission to come into the power-development program with their own talent and their own money. What they do will be in addition to what the Government has done, is doing, and will do. Under the policy they cannot encroach 1 inch upon the Government's own program, and they can have only what they buy and pay for. And when I say, "they" I do not mean simply private concerns, I mean also other agencies of the Federal Government, State governments, and local governments.

In view of the fact that Mr. Dean, in his public testimony, before the committee and in his subsequent communication to you, has referred to my analysis of the Commission's policy on atomic power, I believe it would be appropriate, Mr. Chairman, to include in the printed record of these hearings, in connection with Mr. Dean's testimony, my analysis of the Commission's policy and Mr. Dean's statement in rebuttal of same which was given to you dated June 29, 1953.

I make the request that those two articles be included in the record following Mr. Dean's testimony.

Chairman COLE. Without objection that will be done.

I wonder whether Mr. Dean should have an opportunity to respond to the statement you make today?

Representative HOLIFIELD. I think I am in accord with most of his statement, and if there is any variance, or if he wishes to take up the one matter I call attention to there, he may do so.

Chairman COLE. With that understanding, in case that is brought to Mr. Dean's attention and he may desire to respond to your statement today, his response may be put in the record where we will include Mr. Dean's letter of the day before yesterday to me and Mr. Holifield's statement of today.

(The information referred to follows:)

Chairman Gordon Dean, of the Atomic Energy Commission, recently announced in a speech before the Edison Electric Institute, a trade association of private utilities, that an atomic breeder reactor had been successfully demonstrated. Members of the Joint Committee on Atomic Energy have known of this development since October 1952. While the announcement was hailed as a forward step in civilian power production from atomic energy, the journey toward that goal is still long and arduous.

Application of the breeder principle to practical use is extremely complicated and will require several years of further development. The breeder reactor, when finally perfected, will help solve the problem of hard-to-get, expensive source materials for atomic fission. By producing more atomic fuel than is burned, the breeding process ultimately will lessen our dependence on limited uranium ores, now largely imported, as the basic source of fissionable materials. However, the complex engineering and mechanical problems of converting heat energy, released by atomic fission, into economically usable electric power, still remain. And the crucial issues of public policy posed by industrial applications of atomic power likewise remain.

On June 1 I presented to the House a detailed analysis of atomic energy developments in relation to proposals for atomic power production by private industry. I urge the Members to read these remarks carefully, if they have not already done so. They will find that the possibilities of atomic power have been greatly exaggerated for self-serving ends.

Today I direct attention to policy statements on atomic power formulated by the Atomic Energy Commission. These have been mentioned frequently in recent newspaper accounts. They merit careful examination.

The Atomic Energy Commission has prepared for the consideration of other Government agencies and the Joint Congressional Committee on Atomic Energy certain policy statements and a draft of proposed new legislation in the atomic-energy field. These documents consist of, first, Preface to Statement of Policy on Nuclear Development; second, Statement of Policy on Nuclear Power Development; third, Description of Proposed Legislation; and, fourth, draft of an act to encourage the early development of the peacetime uses of atomic energy. Following are a summary and analysis of the above-listed policy statements. The proposed legislation will be analyzed in subsequent remarks.

PREFATORY STATEMENT SUMMARIZED

The preface to statement of policy contains five points:

First. Atomic power is technically feasible and there is widespread confidence as to its ultimate commercial practicability.

Second. Nuclear power, in the present state of technology, could not compete with conventional sources such as coal, oil, and hydropower; however, nuclear research to date has emphasized military needs, and if the specific aim of producing economic power is adopted, there is considerable optimism that it can be attained in a few years.

Third. The Commission judges it is time to announce a positive policy designed to recognize the development of economic nuclear power as a national objective; an important element of this policy is to promote and encourage free competition and private investment in development work, with the Government accepting certain responsibilities for furthering technical progress to provide a necessary basis for such development.

Fourth. Concluding that atomic power has not yet been developed to the point of economic use and that a report under section 7 (b) of the Atomic Energy Act is not timely, the Commission believes it imperative to create a favorable atmosphere to hasten that day. The United States should continue leadership in peacetime applications of atomic energy and not wait until circumstances force practical realization on a short-time scale.

(NOTE.—Section 7 (b) of the Atomic Energy Act requires the Commission to report to the President and the Congress when the industrial uses of atomic energy are practical, such report to estimate the social, political, economic, and international effects of such use and to give the Commission's recommendations for necessary or desirable supplemental legislation.)

Fifth. To this end, the Commission has endorsed a statement of policy as a basis of discussion with the executive agencies and the Congress.

POLICY STATEMENT SUMMARIZED

The Statement of Policy on Nuclear Power Development contains six points:

First. The Commission believes the attainment of economically competitive nuclear power to be a goal of national importance; this goal seems achievable in the foreseeable future if the Nation continues to support a strong development effort. To let leadership in nuclear power development slip out of American hands would be a major setback.

Second. Accordingly, the Commission recognizes its responsibility to continue research and development in atomic energy and to promote construction of experimental reactors advancing the power reactor art and leading to the design of economic units.

Third. The Commission also is convinced that progress toward nuclear power can be further advanced through participation of qualified outside groups in the development program.

Fourth. Recognizing the need for reasonable incentives to encourage wider participation, the Commission proposes seven moves: (a) Interim legislation to permit ownership and operation of nuclear power facilities by groups other than the Commission; (b) interim legislation to permit lease or sale of fissionable material under adequate security safeguards; (c) interim legislation permitting owners of reactors to use and transfer fissionable and byproduct materials not purchased by the Commission, subject to regulation in the interest of security and public safety; (d) such research and development work in Commission laboratories on specific power projects deemed warranted in the national interest; (e) more liberal patent rights as may seem appropriate to the Commission and

consistent with existing law; (f) consideration of a progressively adjusted code for safety and exclusion area requirements; (g) progressively liberalized information policy in the power reactor field.

Fifth. The objective of this policy is to further the development of nuclear plants which are economically independent of Government commitments to purchase weapons-grade plutonium.

Sixth. The next few years are viewed as a development period looking toward the realization of practical nuclear power; therefore it is concluded that the time is not yet at hand for the report called for in section 7 (b) of the Atomic Energy Act.

COMMENTS ON AEC POLICY STATEMENTS

These policy statements prepared by the Atomic Energy Commission to explain why new legislation is being proposed are disarming. Taken at face value they seem moderate and eminently reasonable. Agencies or individuals not well acquainted with the Atomic Energy Act and Commission policies would be inclined to give them ready acceptance.

Careful perusal of the policy statements justifies the conclusion that they are lacking in candor. The highly controversial nature of the proposed legislative changes and the extremely difficult problems these would pose in practical operation are not even suggested. The outsider gets no inkling that a drastic redirection of national policy in atomic energy is implicit in the proposals.

The Commission speaks disarmingly of wider participation in nuclear-power development, but it does not come right out and say that it proposes to let private companies own fissionable materials and facilities for production of such materials, privileges now reserved by law to the Government. Fissionable materials are elements that go into the making of atomic weapons. Thus the proposed legislation would have the effect of putting private enterprise into the atom-bomb business.

The policy statements nowhere touch upon the exact relationship of fissionable material for weapons and fissionable material for atomic power. The Commission knows full well that nuclear reactors designed solely for the production of atomic power are too costly to be built now and for many years to come. In other words, atomic power cannot pay its own way. All proposals to date made by private utility or industrial companies for the development of atomic power offer only one avenue of feasibility—dual-purpose reactors producing plutonium for atomic weapons and byproduct power from the energy released in the fission process. These private companies want the law changed so that they can produce the plutonium in their own facilities, sell it profitably to the Government at set prices in a guaranteed market, and use this assured source of income to bring atomic power within economic reach.

Without explaining that private enterprise is demanding a Government-supported plutonium market as the condition for atomic-power development, the policy statement glibly avers that the Commission's objective is to make nuclear-power plants economically independent of Government commitments to purchase such plutonium. Here is a fine touch of dissimulation. The Commission is proposing changes in the law to make possible that which it disavows.

AEC HAS DISJOINTED POSITION

There is something remarkably disjointed in its position when the Commission asserts on the one hand that the time has come for declaring a positive policy on atomic power development and on the other hand that the time has not yet arrived for practical application of atomic energy in industrial fields. Why the sudden rush to formulate a new policy and to propose far-reaching changes in the legislation when economically feasible atomic power is still a fancy and not a fact? The blunt truth is that the Atomic Energy Commission is capitulating to the overzealous demands of industrial and utility spokesmen who seek special concessions to private industry in atomic affairs.

The Congress, anticipating that atomic energy ultimately would have practical value in industrial and other fields, specifically laid down a course of action to be taken by the Atomic Energy Commission when that time arrived. According to section 7 (b) of the Atomic Energy Act of 1946, the Commission, whenever it believes that any industrial, commercial, or other nonmilitary use of fissionable material or atomic energy has been sufficiently developed to be of practical value, shall prepare a report to the President and the Congress stating all the facts with respect to such use, estimating the social, political, economic,

and international effects and making recommendations for necessary or desirable supplemental legislation. This same section provides that before the Commission can issue any license for manufacture, production, export, or use of atomic energy equipment or materials, a report must be submitted to the Congress 90 days in advance.

AEC SIDESTEPS CONGRESSIONAL INTENT

The congressional intent in section 7 (b) of the Atomic Energy Act is plain. Legislative changes would be considered when the practical value of atomic energy had been demonstrated and its economic and social effects more clearly indicated. The Commission sees fit to sidestep the procedures prescribed in this section by proposing far-reaching legislative changes far in advance of practical application. Furthermore the proposed new legislation would repeal the requirement that Congress be permitted to review the granting of licenses for industrial uses of atomic energy.

No one will disagree with the assertion that nuclear-power development should be vigorously pushed and that the United States should maintain its leadership in this field. In announcing this laudable objective, however, the Commission artfully ties it to changes in the law sought by certain segments of private industry. The erroneous impression is given that the present law is holding back this development; that United States leadership will be lost unless legislative changes are made to give more incentives to private entry into the field of atomic power.

The fact of the matter is that the atomic energy legislation now on the statute books is fully adequate to promote industrial participation in atomic power development. Private firms can and do perform nuclear reactor research, design, and construction for the Government under contract, thereby acquiring valuable experience and know-how in atomic technology. They can undertake certain atomic activities on their own, if licensed by the Commission. They are not required to have a license from the Commission to carry on private research or development relating to the manufacture of atomic equipment or the utilization of fissionable material.

As the law now stands, private firms cannot own fissionable material or the facilities—with certain exceptions—in which such material is produced. The Congress decided from the very start of the atomic program that the awful destructive power of the atom made exclusive Government ownership and control of bomb-making materials and facilities a necessity. No private individual or organization could be allowed to possess this means of mass destruction. National defense and security are still the paramount consideration in atomic energy development. Why, then, should this program be thrown off the track? Why should atomic progress be interrupted by tossing a monkey wrench of drastic amendment into the legislative machinery?

The Atomic Energy Commission has been criticized by some for not giving proper attention to the industrial possibilities of atomic energy. Whether this criticism is sound, whether the priority necessarily given to military-defense requirements left no alternative, can be debated at another time. I emphasize here the fact that the atomic energy legislation under which the Commission operates, sets up no roadblocks to atomic power development. No provision of the law bars the Commission from proceeding with reactor research, design, and construction, by contract, with private firms or through its own facilities, looking to the development of atomic power for industrial uses.

Indeed, the Commission has contracted with a score of private firms on various phases of reactor development. The lessons learned in this experimental work will have great value and direct application in developing reactors for atomic powers. When the atomic-powered submarine becomes a reality in a few years, our scientists and engineers will know considerably more about the technology of atomic powerplants. Experiments on atomic-powered aircraft carriers and airplanes, if not halted by shortsighted budget cuts, likewise will contribute to progress in the atomic power field.

In sum, continued advance in reactor technology is not dependent on changes in the basic legislation but in full and vigorous use of the opportunities created by that legislation. Legislative wisdom consists in ready response to public problems that press for solution, not in veering from the proven course to chart the unknown future. When atomic power comes to the point of proving its practical use, there will be time enough to decide what new legislation is needed.

AEC DETOURS FROM PUBLIC ISSUES

In yielding to the clamor for legislative amendments at this time, the Atomic Energy Commission not only sidesteps the procedures prescribed in the Atomic Energy Act to govern consideration of the industrial uses of atomic energy; more important, it takes a detour from crucial issues of public policy in atomic power. If certain segments of private industry can preempt this field before the issues will have been carefully debated and resolved, then the public interest will suffer and the Atomic Energy Commission will have done a disservice to the country. Of course the Congress will be the final arbiter of the need for new legislation; nevertheless it has delegated to the Commission a continuing responsibility to guide atomic-energy development for the national welfare and to recommend legislative changes whenever necessary to more effectively carry out the objectives of the Atomic Energy Act. The Commission cannot evade its responsibility by dumping on the congressional table a hasty concoction of legislative ingredients served up to satisfy some of its clientele in private industry.

What are some of these issues of public policy from which the Atomic Energy Commission detours? We start with the fundamental fact that the \$12 billion invested to date in the atomic program came entirely from the Public Treasury. Private industry along with all other groups and elements comprising the American public is entitled to a return from that investment. A cardinal principle of public investment is that the benefits must be distributed widely throughout the economy. What policies shall be formulated to guarantee an equitable distribution of the benefits of atomic power? The Commission has nothing to offer, except to open the door early in the game to private industry.

When the Federal Government undertook to make large investments in multi-purpose projects for navigation, flood control, land reclamation and hydroelectric power, the Congress wrote into various laws the principle of wide distribution of benefits. The people of the United States did not propose that there Government build great power dams, for example, merely to benefit the managers and stockholders of private utilities. They were interested in reducing the costs of electricity to consumers, in bringing power to farms and homes in rural areas, in creating incentives for new power-using industries to spring up and expand job opportunities. In the TVA Act, in the Bonneville Act, in the Flood Control Act of 1944 and in other basic statutes the Congress formulated policies for the wide distribution of hydroelectric power.

Atomic energy development, also financed by the public, has no such guidelines. In future years, when atomic power becomes a reality and private industry a factor in atomic power generation and distribution, legislative safeguards to protect the public interest will be necessary. Private utilities, which never looked kindly on the development of public power resources, doubtless would prefer to foreclose that future by getting control of atomic power still unborn. In any event, the Atomic Energy Commission completely ignores the public interest considerations in atomic power policy. It blithely asks private industry, which would mean in practical effect a few big corporations, to do the job.

The Government now owns huge and costly facilities to produce plutonium for the atomic bomb stockpile. Under existing law the Government could proceed to develop atomic power in conjunction with plutonium production. By using such power to operate atomic installations or selling it to industrial users, the Government could lower the heavy costs of atomic weapons and lessen the tremendous drain of energy that atomic operations make on the economy.

Consider now the anomalous position which the Atomic Energy Commission takes in atomic power development. Instead of moving toward the production of atomic power in Government-owned plutonium plants, it proposes to let private companies take over the manufacture of plutonium, to be bought back by the Government, in order that these private companies might exploit the atomic power possibilities. Here is a case of the tail wagging the dog, and to attain this peculiar end the Commission proposes to turn the animal completely around.

The Commission speaks modestly of "interim legislation," as if the legislative changes it proposes are immediately necessary pending a comprehensive consideration of permanent legislation. More properly, these proposals could be dubbed "softening up" legislation. By permitting private ownership, use and transfer of fissionable materials and the facilities for producing them, the Commission's proposals would give selected private firms a strategic hold on atomic energy development. Then subsequent legislation loosening the patent provisions of the present law would follow as a matter of course.

I can only conclude that the Atomic Energy Commission has shown a startling lack of perspective in its legislative proposals for atomic power development. These proposals range so far ahead of the prospects for atomic power that we must seek their motivation in sources other than the desire to meet problems of pressing importance.

UNITED STATES ATOMIC ENERGY COMMISSION,
Washington, D. C., June 29, 1953.

HON. W. STERLING COLE,
*Chairman, Joint Committee on Atomic Energy,
Congress of the United States.*

DEAR MR. COLE: Thank you very much for your letter of June 25, providing me with the opportunity to prepare a statement of my views on the matters covered in the statement of Mr. Holifield in his speech to the House on June 22.

I believe that most of the matters covered by Mr. Holifield were touched upon during my testimony before the committee on June 24; however, upon looking over the record I find one point that was not mentioned. This had to do with the general charge that the Atomic Energy Commission in its statement on atomic power policy had recommended what could essentially be described as a giveaway program.

I do not consider that charge to be a valid one, and I have prepared the enclosed statement in response to it. I would appreciate your seeing that it is printed in the Congressional Record, as you offered to do.

Sincerely,

GORDON DEAN, *Chairman.*

STATEMENT BY MR. GORDON DEAN, JUNE 29, 1953

The AEC is not recommending any giveaway program. Let's see why by answering a series of questions.

1. Does the AEC recommendation give away any natural resources?

No, the Government owns no uranium mines and no uranium-producing areas. These are all privately owned and operated. The Government buys all the uranium it needs from private producers and from producers in foreign countries. Under the proposed program the Government would continue to buy what it needs and continue to control the use of all other uranium.

2. Does it give away any Government-owned facilities?

No. Under the proposed program the Government would continue to own all of the facilities that it now owns or that it may build with public money.

3. Does it give away any information to which the Government has an exclusive right?

No. The Government does not have and should not have an exclusive right to any information except that which is held for national security purposes. The Government does not have and should not have any trade secrets. This is the way the Government has operated in the past and operates now. People who conduct unclassified research in the atomic energy program, both in Government-owned laboratories and outside are required to publish the results of their work for the public good. This is also true of the National Science Foundation, National Institutes of Health, Office of Naval Research, National Advisory Committee for Aeronautics, and all other Government agencies.

If the Government can put into the public domain the information it has developed on atomic power without damage to the national security, it will be doing only what it should be required to do and has done all along.

4. Does it give away any fissionable materials?

No. There is provision for the sale or lease of fissionable material to groups other than the Commission, but this will be done at a fair price and it will be material which can be diverted from the weapons production line without damage to the national security.

5. Does it give away any patent rights?

No. The policy in its present form is very general in regard to patents. In its list of proposed steps all it says about patents is this: "More liberal patent rights than are presently granted to outside groups as may seem appropriate to the Commission and consistent with existing law." The Commission all along has interpreted the patent provisions of the existing law very rigidly. Present policy can be relaxed to a certain extent without any change in the law. As of now the Commission has not proposed any change in the patent provisions of

the law. This does not mean, however, that it might not do so later on. The question is now under careful study.

In this regard, I think there are two objectives:

1. I don't think anyone should be allowed to come into the atomic-power picture with the investment of a dollar or two and walk off with patents worth hundreds of millions of dollars, and

2. I think people who come into the power program and make a real contribution based on a liberal investment of talent and money involving a real risk, should be entitled to some patent rights denied to others.

This all boils down to a question of fair play and commonsense. I think it is obvious that we cannot expect private concerns to come in and spend millions of dollars without getting some returns, and I think it is obvious that private concerns as well as the Government must be in this power program.

There is one thing to remember. No matter what is finally decided upon in regard to patent policy, the Government's right to use any patents developed in this field by anyone will be preserved. No Government patent rights will be given away.

In summary, all the power policy does is permit groups other than the Commission to come into the power-development program with their own talent and their own money. What they do will be in addition to what the Government has done, is doing, and will do. Under the policy they cannot encroach one inch upon the Government's own program, and they can have only what they buy and pay for. And when I say "they" I do not mean simply private concerns. I mean, also, other agencies of the Federal Government, State governments, and local governments.

This is not in any sense a giveaway. If anything it is a getaway program—a getaway from a Government monopoly and from the present policy impasse in the field of atomic power.

The CHAIRMAN. The next meeting on this subject will be next Monday, when we will hear Dr. Zinn. I could not help but think at the time you were speaking, Mr. Holifield, of the confidence you have in the doctor's judgment and recommendation, that we will hear that next Monday. Dr. Zinn is the director of the Argonne Laboratory.

We will hear Dr. Weinberg of Oak Ridge, Dr. Starr of North American Aviation, and others.

The meeting will now adjourn.

(Thereupon at 5:55 p. m., Wednesday, July 1, 1953, a recess was taken until Monday, July 6, 1953, at 2 p. m.).



ATOMIC POWER DEVELOPMENT AND PRIVATE ENTERPRISE

MONDAY, JULY 6, 1953

CONGRESS OF THE UNITED STATES,
JOINT COMMITTEE ON ATOMIC ENERGY,
Washington, D. C.

The joint committee met at 2: 15 p. m., pursuant to recess, in room 318 of the Senate Office Building, Representative James E. Van Zandt, presiding.

Present: Senators Millikin and Johnson (of Colorado); Representatives Van Zandt, Jenkins, Holifield, and Price.

Professional staff members present: Corbin C. Allardice, executive director; and Walter A. Hamilton, J. Kenneth Mansfield, and George Norris, Jr., of the professional staff of the joint committee.

Representative VAN ZANDT. The hearing will come to order.

First I want to express my regrets at being a little late, and since the Senator from Iowa has been delayed, we will proceed, until he arrives, by having a staff member, Mr. Hamilton, read a statement at this time.

Mr. HAMILTON. In the hearing last Wednesday representatives of the industrial study teams indicated that the various financing schemes designed to insure economic atomic power are still in a speculative stage. The discussions of ownership, patents, and regulations all were predicated on the assumption that designing atomic powerplants is already a straight forward proposition, but views on the validity of that assumption were expressed in varying form.

We have with us today 5 of the most experienced reactor designers in the country; 5 men who have had to do many times over exactly what the industrialists have approached as a straight forward scientific and engineering job. Our witnesses today are in a unique position to describe to us the sort of problems that are apt to be encountered, to testify as to the reliability of cost and time estimates made at this stage of the reactor art, and to give us their best advice on where we stand technically today.

Drs. Weinberg and Zinn head up two of our national laboratories. They and their associates have many jobs besides reactor design to work out. But these teams have really designed and built major reactors.

Dr. Zinn's team is perhaps most familiar to us for his experimental breeder reactor, which has recently been heralded as a success, the forerunner of the only known means of ultimately permitting us to burn all the uranium and thorium instead of only a fraction of 1 percent.

Dr. Weinberg's team is perhaps most noted for his materials testing reactor now operating at the Idaho Testing Station. This \$18 million plant is in certain respects the most advanced full-scale reactor in the

world today. The Oak Ridge team is also responsible for development of homogeneous reactor systems which hold real promise of permitting an integrated continuous reactor and fuel processing system.

Both Oak Ridge and Argonne are wholly owned by the AEC. They are actually operated by contractors—Union Carbide at Oak Ridge and the University of Chicago at Argonne. Neither laboratory does any privately financed work and both have unique experimental facilities acquired at very large cost to the taxpayers.

The North American Aviation Co. atomic laboratory has been wholly financed by the AE, but it is located on company property and is a fully integrated division of the company. Dr. Chauncey Starr, its director, is an outstanding reactor designer formerly at Oak Ridge. His work has been directed largely at units which would operate at much higher temperatures than existing reactors, hence these designs hold high promise of producing economic power. Dr. Starr's sodium graphite reactor is the machine recently publicized through an advertisement offering to build an atomic pilot plant for \$10 million using the federally financed design.

The chairman of North American, General Kindleberger, or the president, Mr. Atwood, will testify at a later date on the company's hopes regarding the atomic-equipment industry. Dr. Starr is being asked to testify as a laboratory director familiar with problems encountered in design and development of atomic reactors.

Dr. Cohen and Mr. Menke are the scientific and organizational genius and drive behind two unique privately financed ventures. Both of their companies are actively designing and advising others in the design of nuclear reactors and reactor components. Some of the industrial study teams turned to their companies for assistance in doing the designs which subsequently came to be known as the proposal of a specific industrial study group. To whatever extent there is a private atomic power business today these companies are in it. Their future lies largely in what eventually comes out of our deliberation here in this and the next sessions of Congress. Their experiences so far might help us understand better some of the things which may need attention either in the act itself or in its administration.

We have, then, 5 witness—2 from the Government-monopoly side, 1 from Government and private company partnership, and 2 from private industry.

Our first witness is Dr. Zinn, if he will take the stand. Dr. Zinn is the Director of the Argonne National Laboratory.

Representative VAN ZANDT. Doctor Zinn, we are highly honored by your presence. Will you please proceed with your statement?

STATEMENT OF WALTER H. ZINN, DIRECTOR, ARGONNE NATIONAL LABORATORY

DR. ZINN. Two years ago the Atomic Energy Commission invited various industrial companies to review the feasibility of generating electric power while producing plutonium with nuclear reactors. This coincided with proposals for the design of reactor plants capable of producing electric power, which were made to the Commission by various individuals who, as contractor personnel, were engaged

in reactor development. I was one of those individuals. Since that time reports have been rendered by the industry teams, a number of reactors have actually generated electricity, and many of us have participated in public and secret debate on the subject. All this has strengthened my conviction that nuclear powerplants are feasible, and I am very happy to have the opportunity to present to this committee some of the facts, as I see them, that support my conviction.

I understand that it is wholly unnecessary to present justification to this committee for the proposition that the United States should extend its preeminence in atomic matters to the area of industrial-power production. The questions under review are: By what methods, when, and by whom?

Nature has supplied only one fissionable fuel, namely, U-235. It occurs in nature highly diluted by U-238. Uranium, much enriched in U-235, is engineeringwise the most convenient fuel to use in a power reactor. The submarine propulsion plants, the STR and the SIR, are reactors which use such enriched uranium. Unfortunately, this apparently most convenient path to the realization of industrial-power reactors is blocked by two facts. First, a power industry based on the outright consumption of U-235 would have only a brief life, for the supply of uranium on present projection is inadequate. Second, the cost of this type of nuclear fuel is several times the cost of coal in a conventional generating station. To be competitive, a nuclear-fueled powerplant in which the fuel costs more than coal would have to have a capital cost smaller than the coal-burning equipment of a conventional plant. This seems so unlikely that we can accept the thesis that, to be successful, a nuclear plant must operate on a fuel economy which is less costly than coal.

Both of these difficulties can be circumvented if the reactor is made to generate within itself additional fissionable material and if this material, in turn, is used as fuel. This requires that the feed material be a combination of U-235 and U-238. Thorium can be substituted for U-238 and in the further steps of this regenerative process, the man-made fissionable materials, plutonium and U-233, become fuels.

A specific example is a thermal converter reactor fuel with natural uranium which is burned until 1 percent of the available energy from fission of all the uranium has been extracted. The fuel cost now becomes about 1 mill per kilowatt-hour, which is an acceptable improvement over the fuel cost for a coal-burning plant. The usage of uranium is still poor, but it is better by a factor of at least 5 than the usage in reactors which consume U-235 outright. Reactors operating in this way differ from the plutonium-production reactors only in the long residence time of the fuel in the reactor. This method of operation is often referred to as "long burnup." In brief, instead of removing the plutonium for weapons stockpile, it is left in the reactor to be burned for power. There are various technical reasons why this method of long burnup cannot be extended indefinitely but is limited to small percentages.

In the event that it is possible to design the reactor in such a way that the amount of plutonium generated, for instance, is only very slightly less than the U-235 burned or if it is actually more than the U-235 burned, it is possible by including chemical purification steps in the cycle, to consume a large fraction of the more abundant isotope U-238. This is a breeder reactor. Any concern about the adequacy

of uranium supply is removed once such operation is achieved. The fuel cost, however, has been increased by the addition of the cost of chemical-purification steps.

The successful realization of a breeder cycle is a highly desirable long-term goal. It is more difficult economically because, in addition to the necessity of achieving a first cost for the fuel which is acceptable, the recurring chemical purification must also be brought to an acceptable cost.

The reactors which have been proposed for industrial power can be classified as either being converter reactors with long burnup or breeders with very economical fuel processing.

As far as I know, the following reactors are considered to be the most likely candidates for successful power production.

1. Helium gas-cooled, graphite-moderated, using as fuel natural or slightly enriched uranium. The helium is pressurized in order to obtain passable heat removal. Long burnup operation is contemplated. No insurmountable engineering problems are envisaged, and the development of such a reactor would be straightforward. Because of large size and the relatively poor heat removal, it does not appear possible to generate electricity with such a machine at a cost less than several times the cost from coal-fired plants. For us, this is a too large margin, but it is interesting to note that it is acceptable to the British.

2. Sodium-cooled, graphite-moderated using as fuel partially enriched uranium. Long burnup operation is contemplated. This has the advantage of high temperature and, therefore, can have a high thermal efficiency. The use of partially enriched uranium is costwise a small disadvantage. It also requires specialized hardware for the highly radioactive sodium-cooling system; and, since no large-scale sodium system has been operated, estimates of capital cost must be given a considerable margin of error.

3. Light water-cooled and moderated using partially enriched uranium and long burnup. The water must be pressurized in order to obtain a moderate thermal efficiency. The use of partially enriched uranium is a slight cost disadvantage.

4. Heavy water-cooled and heavy water-moderated using natural uranium and long burnup. A disadvantage is the high cost of heavy water. The water must be pressurized in order to obtain a moderate thermal efficiency.

5. Aqueous, homogeneous, breeder reactor using enriched fuel. The advantage here is simplicity of the reactor core, a high consumption rate of the fuel, and a chemical-processing cycle which is an integral part of the reactor operation. The fluid is pressurized and the reactor structure requires materials of construction difficult to obtain. Homogeneous-fueled reactors can have superior performance in nearly all aspects of reactor technology, but problems remain and just when full success will come is not predictable.

6. Fast neutron-breeder reactors, sodium-cooled and using plutonium as fuel. The attraction here is high temperature of operation and high thermal efficiency and the possibility of the production of fissionable material in excess of that required to operate the reactor. It has the disadvantage of requiring a cheaper and simpler chemical processing cycle than any now in existence, and the engineering problems of obtaining rapid fuel turnover are truly formidable. Here,

again, success in solving the remaining problems can yield a reactor plant of superior performance but when such full success can be achieved is not predictable.

The very sketchy explanatory remarks which are attached above to each reactor type indicate that a choice of the best method cannot be divorced from the question "When?" In the event that there is a decision to proceed forthwith with a determined effort to make a nuclear-fueled powerplant which is as closely competitive as present technology permits, the choice of reactor type in my opinion must be one of the converter units.

If no such decision is to be made now, and if the necessary research and development is provided, it is entirely possible that the first competitive nuclear plant will be one of the breeder types.

I believe, however, that if this country wishes to obtain leadership in this field a decision to proceed with a fairly large-scale powerplant now is required. Testimony has been given this committee that some of the converter types are estimated to be able to produce power at 10 mills per kilowatt-hour. These estimates are made by extrapolating information from other reactor construction where the reactor had quite another purpose. It is extraordinarily difficult to make cost estimates for a device for which there has been no previous experience. About the only way real knowledge on costs can be obtained is to build reactors whose sole purpose is to make power. It cannot be guaranteed that the first power reactor will produce electricity at an actual competitive price. It could come close enough so that the experience gained in the design and construction and operation of the first plant would make possible further plants which would be commercially feasible in every sense.

Dual-purpose reactors, although technically feasible, may give misleading indications of the cost situation when the market for military plutonium is no longer available. For plutonium production, fuel preparation, handling, and storage provisions of a certain scale are required, for the long burn-up reactors, these are on a more modest scale; however, the fuel for the long burn-up reactor must meet demands which are not present in the plutonium production unit. Inevitably, the two products, plutonium and power, affect the design in different ways, and it would be a difficult task indeed to properly distribute the costs to the products.

Similarly, a power reactor which is designed to propel a ship such as an aircraft carrier cannot be expected to come close to being economically satisfactory for central-station power. For instance, the basic designs regarding the form of the fuel may largely determine the power cost. For a naval vessel, absolute reliability is a necessity; for a powerplant a different degree of reliability is acceptable. The added expense required to provide performance to naval specifications is entirely justified, but it may nevertheless be an expense which the central-station power reactor just cannot tolerate. These are examples of the undesirability of combining several objectives in a single reactor design. To get nuclear power competitive with coal will take thorough examination of each design feature and a ruthless elimination of any which inflates the cost.

In attempting to discover if now is the correct time to make a determined effort to build a power reactor, the question of the need for a pilot plant becomes paramount. It is my opinion that for the gas-

cooled reactor and the two water-cooled reactors listed above, a pilot plant would not be required. I am positive that for the breeder reactor types, a pilot plant of a large enough scale to resolve the principal engineering difficulties is very much to be desired. The case of the sodium-cooled, graphite-moderated reactor is not so clear, but cost figures on the hardware for a pilot plant would be very helpful.

In proposing that a full-scale power-only reactor should be initiated now, it is necessary to specify what is meant by full scale. Every analysis shows that as the electrical generating capacity of the plant goes up, the unit costs go down. For coal-burning plants, the way in which the unit cost varies with the size of the plant is well known. It is not known at all for reactor plants. A reactor plant of, let us say, 10,000 kilowatts electrical capacity, of any design, could not be competitive with a coal or diesel plant of similar size and it would not be very helpful in determining whether or not a large plant would be competitive. It could resolve many or all of the engineering doubts about the system.

An analysis of the situation indicates that in order to be on sure ground on the economic question, the minimum size of a power reactor should be in the range of 75,000 to 100,000 kilowatts of electricity. The most economical plant will be larger than this, but the extrapolation from this size to a larger plant would be on fairly sure footing. It follows that the investment required for the reactor generating plant would be very substantial. It is worth noting, however, that the reactor and its associated steam generating equipment account for only about 40 percent of the cost of the whole plant. The remainder is the conventional turbine and electrical plant.

The following four reasons are offered as justification for omitting a pilot plant for the pressurized-water reactors:

1. The Hanford and Savannah River water-cooled reactors were designed and constructed without pilot plant. Further, in terms of heat release, the suggested power reactor does not require a major extrapolation from the experience in the production reactors.

2. The technology which has been developed for the submarine thermal reactor, which is cooled by pressurized water, is entirely applicable to the central-station power reactor.

3. Such a converter reactor will make a minimum demand on the fissionable material supplies of the country; in one case natural uranium is required and in the other partially enriched uranium, neither of which should seriously affect the stockpile situation of the Commission.

4. Much research and development is under way at the present time on radiation damage, all of which is applicable to the problem of obtaining long burnup.

Since there is no sizable extrapolation in size and since the technology of using pressurized water already exists and since the fuel element development required is a matter of degree of performance rather than of new invention, a pilot plant would serve no real purpose. Everything that a pilot plant could reveal already is being tested in other reactors.

There is no great choice between using heavy water with natural uranium or light water with partially enriched uranium; in either case, the Government must be willing to make available materials whose production it controls. For the reasons that certain of the

engineering features of the heavy water reactor are considerably simplified, my preference is the heavy water, natural uranium design. Most of the engineering work which has been done in connection with the design of the Savannah River reactors would be directly applicable.

Water-cooled power reactors require pressuring a system which is substantially larger than the pressurized submarine thermal reactor system. I am told by competent authorities that this will not present any major difficulties.

It has been argued that the pressurized water reactor is handicapped by too low an operating temperature and therefore its thermal efficiency is poor. The first power reactor cannot be expected to be ideal, for instance, it may not be a real breeder either. The fact that the thermal efficiency is in the 20-percent range rather than in the 30-percent range would be important if this resulted in a demand for uranium which couldn't be met. The fact is that the 20 tons of uranium which would be required per year could be furnished to quite a few plants without embarrassment.

The objection also has been raised that nuclear plants will not have the 20- to 30-year life which conventional powerplant amortization postulates. The evidence is to the contrary, for instance, the original Hanford reactors are operating in good shape after 9 years. Long life is a matter of detailed design, and it is quite practical to make all parts which could wear out replaceable, as has been done in some reactor designs.

To proceed with the design and construction of a full-scale plant now does not mean that there will be no question about the complete technical and economic success. Every new step in this field has had some element of uncertainty about it. American industrial progress has not been achieved by avoiding every risk, but rather is characterized by a willingness to face difficulties and overcome them.

A generating cost of 10 mills per kilowatt-hour and an assumed selling price of 7 mills per kilowatt-hour requires a yearly subsidy of \$2 million to \$3 million. The experience gained in operating such a plant could easily be worth this sum of money. Further, it would be possible to convert such a reactor to a plutonium production unit with certain additions for fuel handling on the shorter burn-up cycle. I am not suggesting that it would be a dual-purpose reactor; it is just a reminder that a converter can be operated as a plutonium producer, when desired.

The subsidy indicated would not seem to be an excessive price to pay in order to get a new business started. Once established as a practical and useful operation, it will bring about its own improvement.

In making cost estimates for the long burn-up reactor, no credit has been taken for the fact that the fuel when discharged contains a very large amount of plutonium of nonweapons grade. It is conceivable that this material could be chemically recovered at a price which would make it attractive as fuel for another reactor; in particular, it would be suitable for use in the fast breeder type of reactor. The fast breeder-type reactor could afford to pay no more for this plutonium than the value of the energy it contains, namely, about \$15 per gram. If the chemical recovery could be done for substantially

less than this figure, there would be a byproduct bonus for the power reactor.

There has been some debate as to whether or not power-only reactors should be developed by private utility companies or by the Government. I submit that the facts make the Government a partner in whatever development does take place. These facts are:

1. The Government can never relinquish its control of fissionable material no matter where the actual ownership is lodged.

2. It is extremely unlikely that any reactor complex could be constructed without making use of many patents which are now held by the Government.

3. It is unlikely in the near future that any reactor design will be developed to the point of construction without making use of facilities now owned by the Government. For instance, most of the facilities for metallurgical development of fuel elements are Commission-owned and all of the facilities for high level radioactive chemical processing are Commission-owned.

It is difficult, therefore, to see how any private group could acquire a monopoly in any part of this field. Certainly, the Government would license the use of fissionable material, license the use of its patents, and make available its specialized facilities to any company which had a legitimate claim.

Conversely, I do not believe the Commission should attempt to go it alone in achieving economic nuclear-fueled central-station power. I believe the Commission and its contractors have a good record in using reactors to further our military position. Many times, however, cost has been sacrificed for speed or for a guaranteed performance by a certain date. What is needed now is experience in getting results in an area where cost is paramount. This experience the private utility companies have. The application of this experience to the reactor problem, I am convinced, would be the single greatest factor in getting a competitive cost, a greater factor for instance than selection of reactor type.

I respectfully recommend that in the national interest:

1. A policy looking to the early operation of a nuclear powerplant be established.

2. That this policy call for a rapid detailed design of the most promising reactor types capable of being in full operation within 5 years from now.

3. That this policy contemplate that the USAEC will develop the most effective combinations of power company management and its own experience, skills, and facilities for the management of the nuclear powerplant projects.

4. That this policy contemplate a public subsidy within limits to the power produced, if on examination the detailed designs show it to be necessary.

5. That this policy contemplate that the USAEC will foster or give its active support within whatever financial limits are provided to the development of reactor types of ultimate superior performance, but which may not be able to meet the 5-year time scale.

Representative VAN ZANDT. Thank you, Dr. Zinn.

Are there any questions from my colleagues?

Representative PRICE. Doctor, you make five recommendations at the end of your very fine statement. I wonder if, in the course of your

duties in charge of the Argonne Laboratory, you have ever made any definite recommendations to the Commission itself on the question of the development of industrial power.

Dr. ZINN. I have made no recommendations of the management scheme that should be used. There are various reports from our organization which talk about the technical problems involved.

Representative PRICE. The statement read to the committee by our committee staff member a few minutes ago summed up and stated in one of the paragraphs that one of the purposes of your presentation here this afternoon was to give us your best advice as to where we technically stand today. I wonder if you could just give that to us briefly, where we stand and how much further we have to go before we reach the stage of economic development of industrial power.

Dr. ZINN. Congressman Price, I would answer your question in this way. If we do not demand that our reactor type, the kind of reactor, be the very best we can imagine, but we are satisfied with somewhat lower goals of performance, then I believe the thermal converter type of reactor can make industrial power fairly close to the cost of power from coal. To do this will require very strict management of the capital expenditures in building this powerplant.

I believe that our lack of experience in building reactors under those circumstances is the thing that is handicapping us most. The reactors we have built up to now have always been for some other specialized purpose, and I am afraid under those circumstances the best attention has not been placed in getting the best reactor for the least money.

Representative PRICE. I was interested in the early part of your statement where you indicated that if we want to arrive at the goal of industrial power, we would have to develop a reactor just for that purpose. And if you are talking about an aircraft reactor, then you have to go that route. If you are talking about a ship reactor, you have to take a different route for that. You have to take each reactor as a separate identity. Is that what I gather from some of the early remarks you make in your statement?

Dr. ZINN. Yes; I believe that especially where it is the economic goal that you have to meet, as you add secondary purposes to a reactor, I believe you inflate the cost of the reactor. I can see, for instance, if you were making a plutonium and power-producing reactor, since the plutonium is the valuable product, so to speak, you might very well do things to increase the plutonium production, which would make it difficult to get economic power, if the plutonium market vanished, for instance.

Representative PRICE. And I think I also gather from your statement, that you feel it will be a long time before the Government can divorce itself from industrial power development. In other words, it may be some time before industry can go it alone in this field. Do you feel that way?

Dr. ZINN. There are two points which are past history, and the Government cannot get free of them. One is that it must control the use of fissionable materials. I need not mention the circumstances. But the control must stay in the hands of the Government. And secondly, the work of the past 10 years has put in the hands of the Government many valuable patents in this field. It cannot give those

up. The patents are there. And I doubt very much whether it is possible at least in the near future to develop a reactor without making use of some of that information. In time, of course, that second point would vanish. Private people would get their own inventions in sufficient number not to have to use any that are now owned by the Government.

Representative VAN ZANDT. Are there any other questions?

Representative HOLIFIELD. Dr. Zinn, I regret very much that I was not here to hear your statement. I was unavoidably detained. You are one witness of whom I did want to ask a number of questions, but in view of the fact that I have not had a chance to hear your statement, I find myself at a disadvantage at this time, so I will have to desist.

Representative VAN ZANDT. Mr. Jenkins?

Representative JENKINS. I would like to ask a question of Dr. Zinn. I am a new member of the committee, and I am not as familiar with what has gone on in times gone by as the other members. But please let me ask you, What is your background?

Dr. ZINN. I am a physicist who got into the atomic energy business very early, about 1939, and I have been continuously in it since that time; and also, since about 1940, I have been working on the problem of nuclear reactors, first at Columbia University, then at the University of Chicago, and since 1946 as Director of the Argonne National Laboratory.

Representative JENKINS. This laboratory, as I understand, is a Government laboratory?

Dr. ZINN. It is. It is Government-owned.

Representative JENKINS. And you are here to give your views with reference to the advisability of the Government turning over the production of atomic energy to private industry?

Dr. ZINN. Congressman Jenkins, I would not quite put it that way. I believe very much that if we are to have industrial power, this in its use must be handled by the private utility companies. They are the people who now supply power to the bulk of the Nation. They are the people who have shown real interest in getting into this field.

I do not believe that we should wait until they are fully capable of going at this by themselves. As I indicate in the last pages of my statement, I believe that it will require some sort of a combination between Government effort and private effort to get this thing going.

Representative JENKINS. I think that we all agree that the power-producing interests have done a good job over the years in developing electric power. And those who have appeared before the committee here have, I think, made a very favorable impression. Since you are a Government man and have been with the Government all these years, what, frankly, would you think would be the reasons why, if there are any, the Government should not encourage private power to get into this business?

Dr. ZINN. I believe the Government should encourage private power to get into this business, and I believe the Government should encourage them to get into it now. And the way to do this is to make some of the talents, the skills, the facilities, which are now owned or under contract to the Government, available in one way or another to these private companies to get along with the job.

Representative JENKINS. Do you not think, however, that because of the application, the production of atomic power has from a military aspect, it would still be well for the Government to hold some control over this production?

Dr. ZINN. I believe that the Government will have to have control over the use of fissionable material and over the safety and management conditions of the fissionable material. I do not believe the Government can ever surrender that right. Neither do I think it will.

Representative JENKINS. Then if that is the case, there is a place, then, for the Government in this great program, and there is also a place for the private industry.

Dr. ZINN. I testified a moment ago, I believe, to the fact that I feel right now the Government has to be in on it in several counts. I also believe it should make use of the skill, as you mentioned, that the utility companies have shown in getting costs down in their utility businesses; that it should use that skill also in this business, which will get the costs down also.

Representative JENKINS. Of course, those who have developed electric power have realized from the beginning that electricity was a commodity, if that is the proper term, that could be used, that it was usable, could be manufactured, and would be in great demand. Now, as yet, atomic energy has not quite reached that place where we can visualize that it will be used as we use electricity, in nearly everything. But at the same time, it will never come to that place unless we give it a chance, will it?

Dr. ZINN. It is my opinion that we must make a start, and so long as we say we need more research and development, and it takes more money before we can make a start, we will just be waiting. It is my opinion that now is the time. It is certain that 10 years from now we will know more about this business and could make a better reactor. But should we keep on waiting? Or should we make a start now?

Representative JENKINS. That is all, Mr. Chairman.

Representative PRICE. Dr. Zinn, I happened to have the pleasure of visiting with you at Arco in Idaho, about the time your breeder was reaching the critical phase, and within the last few weeks we have heard some report about that project, I wonder if you could give us some idea of the effect that particular reactor will have in the development of industrial power?

Dr. ZINN. As you know, Congressman, that particular type of reactor is one which was chosen by one of the main utility companies as perhaps its first choice for an eventual power reactor, and chosen by another one for perhaps its second choice. So outsiders who have looked at that type of reactor see possibilities. They may not see fully all of the difficulties which some of us see who have worked with it for a number of years.

I do not put that type of reactor in the category of something that we could proceed with now without pilot plant and get a suitable result. I believe we need a pilot plant, and we need considerably more research and development. It is in that category of reactor where we find superior performance. It would burn essentially uranium 238. It operates at fairly high temperature because it uses sodium as a coolant. Therefore you get efficient production of power. It does require things like very good chemical processing, which we don't

have, and some other engineering points which are rather difficult.

So I do not put it in the class of something that we could bring to success if we started out, on full scale now. Ultimately I have hopes, and I am confident this will be done.

Representative PRICE. Now there is another question I wanted to ask you because of some contact I have had with you in the past. You will remember I served as chairman of the subcommittee on the location of the Argonne Laboratory out in DuPage County. When that project was announced, there was quite a furore on the part of the populace against the location of an atomic energy plant out there. So I can foresee in the future when they start building atomic power-plants there may be some fear on the part of the people as to safety in the area. Could the safety standards here be lowered to such an extent that they would permit the economic location of plants near populous areas, say, near the city of Chicago?

Dr. ZINN. I believe this is a very good question, and my answer is that for some reactor types which have been envisaged, this seems to be not a remote possibility. For others, I believe we need much more work and development.

On this problem of reactor location, we do need more research and development than we have had in the past. There is some of it going on now, and I am hopeful that there will be still more in the Commission facilities.

One of the suggestions that has been made, of course, is that if we are trying to make a first power reactor to see what kind of a thing it is, the location problem can be solved by putting it on one of the Commission-owned establishments. But we all realize that the location problem cannot be solved in the long run by buying up a lot of real estate to locate the reactor on. This is a major problem in deciding how industrial powerplants shall be used, and I do not have a pat answer to the question.

Representative PRICE. Another question I would like to ask: In your statement, you seem to defer the construction of a pilot plant in connection with the industrial power program. I think that the majority of the industry people we have had before us, feel that the way you are going to arrive at this goal quickest, fastest, is by the construction of a central plant. And they point out, in the history of the electrical industry, the power industry, that progress was rapid after they built the first plant. Do you feel that if we had a pilot plant, if we built that central plant, we could arrive at the goal much faster?

Dr. ZINN. My opinion of whether or not a pilot plant is needed depends upon the type of reactor. If you choose a type which makes use almost completely of technology which is already being used in Commission plants, then I do not see the necessity for a pilot plant. We need the full-scale plant in order to find out if we are in the ball park economically. Small plants will not get in the ball park, economically.

For other types of reactors, I am quite willing to say that we need pilot plants. We are not ready to go into full scale.

Now, if you talk about a pilot plant, it takes on the order of 3 or 4 years to get a pilot plant going and another year or 2 to get some experience. So you must be talking about 5 or 6 years before you would begin on the plant which could give you an indication of whether this thing is economically feasible or useful.

Representative PRICE. You feel we are at least 5 or 6 years away from the building of a central plant?

Dr. ZINN. If we go through the pilot-plant stage. There is a type of reactor, just in my opinion, where you can skip the pilot plant, and you can get a full-scale plant in 5 or 6 years.

Representative HOLIFIELD. About what would that type of a plant cost, Doctor Zinn?

Dr. ZINN. Are you inquiring, Congressman Holifield, about a pilot plant?

Representative HOLIFIELD. A full-scale plant that would produce about 200,000 kilowatt hours.

Dr. ZINN. That would be a very major full-scale plant, and I believe one could not imagine this to be built for less than \$300 or perhaps \$350 per installed kilowatt. And that you could only do by being very careful in the management of the construction of such a plant.

Representative HOLIFIELD. That would be—

Dr. ZINN. That would be in the range of \$60 to \$85 million.

Representative HOLIFIELD. You also testified in your report that there would be no certainty that that type of a plant would be competitive with conventional fuel; that there would be a gamble in making that type of a plant.

Dr. ZINN. There certainly would be a gamble. There is no question about it.

Representative HOLIFIELD. Well, now, do you believe that industry is ready to take that type of a gamble, a \$60- to \$85-million gamble, without Government subsidy?

Dr. ZINN. I haven't seen anything that is concrete and positive that indicates that industry is ready.

Representative HOLIFIELD. What did you say?

Dr. ZINN. I have not seen evidence that industry is willing to take a gamble of that size.

Representative HOLIFIELD. Without subsidy.

Dr. ZINN. No, sir.

Representative HOLIFIELD. In the latter part of your statement, on page 7, item 2, you say:

That this policy call for a rapid detailed design of the most promising reactor types capable of being in full operation within 5 years from now.

Could I ask you how many reactor types you think are extraordinarily promising from a power production standpoint out of the 30-some-odd I understand are in existence?

Dr. ZINN. If we put this limitation of within 5 years from now on, then I do not permit really very much time for research and development.

Representative HOLIFIELD. That is true.

Dr. ZINN. Because you take most of that time for construction and for engineering, so the development work would be squeezed to a rather short time, let us say 1 year.

With that condition, I believe the light water cooled and pressurized machine, the heavy water cooled and pressurized machine, the sodium graphite machine, and perhaps a version of the aqueous homogeneous reactor, perhaps just might meet this specification.

Representative HOLIFIELD. In other words, you are telling us now that there are in your opinion at least three different types that are

worthy of consideration in regard to research and development for a full scale plant?

Dr. ZINN. I believe 3 or 4.

Representative HOLIFIELD. Three or four?

Dr. ZINN. Yes, 2 water cooled, 1 sodium cooled, and perhaps 1 aqueous homogeneous.

Representative HOLIFIELD. If we explored, then, fully, the field, it would mean 4 times \$85 million to build 4 plants of the promising type in order that we might have comparatively full knowledge on that subject?

Dr. ZINN. I don't believe you spend all of that money just to develop the detailed designs. I am assuming that when detailed designs have been made, either one or two or none would show themselves to be quite a good gamble, and we would go ahead with those. Or perhaps all four.

Representative HOLIFIELD. In other words, it would not be necessary to build the four?

Dr. ZINN. No; that is not what I have in mind. I have in mind that we go ahead and design them in detail. This costs money, I know. And that the decision to build will be based on the estimate from the detailed design of where the thing stands economically.

You see, none of the designs that have been made so far can really be called detailed designs.

Representative HOLIFIELD. That is right.

Dr. ZINN. Every one of them, by the way, has some piece of research and development that has not been done, but I believe could be done in about a year.

Representative HOLIFIELD. Then, as a matter of fact, no one of these industrial groups has come forward with a detailed design complete.

Dr. ZINN. No, I think it would have been expecting altogether too much of them in the time they have had, to ask them to come out with a detailed design.

Representative PRICE. Dr. Zinn, what about the North American project? What about that suggested reactor for the development of electric power?

Dr. ZINN. I believe Dr. Starr is here and can speak on it much better than I can.

I believe the small-scale reactor, the pilot reactor, which they have suggested, is fairly well detailed, and perhaps could be built straight-off. It is not a full-scale reactor, and it will not, I believe, tell you what power would cost from a full-scale reactor. It would prove out some of the engineering features. It would leave some of the nuclear characteristics of the reactor open. When I say "engineering features," I mean that. There is also the nuclear performance, which cannot always be gotten on a small machine.

Representative PRICE. While we are at this point, could you explain to us why the new reactors at Savannah River, which you of course helped to design, will not produce electric power?

Dr. ZINN. The principal reason why they will not produce electrical power is that if those reactors were made to produce electrical power they would produce less plutonium in a certain time. It is plutonium the Government wants.

Representative HOLIFIELD. On that point, the Atomic Energy Commission has had as its main objective the production of plutonium and not the production of power. Is that not true?

Dr. ZINN. In every case that a reactor has been designed for the production of materials, the matter of producing power at the same time I believe has been reviewed. The answer always comes out the same way. If you want to get the most material at a particular time, don't bother with the power.

Representative HOLIFIELD. So then we would not be just in criticizing the Commission because it has not developed civilian-type power reactors.

Representative PRICE. I would not want it to appear that I was criticizing.

Representative HOLIFIELD. I was not inferring that my colleague was so criticizing. I wanted to bring that out for the record. Because there has been some information that the Atomic Energy Commission has had this field now for 7 or 8 years and they have not produced any civilian type power reactors, and therefore we should let private industry get in and do the job, because they, the Commission, have not done a good job. And the question I was directing to you was this: In view of that criticism, the Atomic Energy Commission has been working toward the objective of plutonium production and not civilian power under the direction of the committee and the Congress; is that not true.

Dr. ZINN. That is completely true.

Representative HOLIFIELD. And we have never encouraged them to depart from that primary objective of the act, which is the security of our country, the production of weapon material. We have never encouraged them, I say, to depart from that up until this present hearing, in which we are exploring the possibility of now going into that field.

Representative PRICE. I think that is an accurate statement.

Representative HOLIFIELD. I wanted to ask you also: You speak of the patents, on page 6, that the Government does have many patents that are now in their hands, and that it would be unlikely that any type of a reactor complex could be built without utilizing the knowledge and the patents which are now in the hands of the Government. Is that your considered opinion?

Dr. ZINN. It is unlikely that it could be built in the near future without that utilization.

Representative HOLIFIELD. Have any of these study groups come forward with a new or unique idea which was not derived from the Government laboratories, in the way of producing a reactor?

Dr. ZINN. Well, there are small new ideas, but no major one that I know of.

Representative HOLIFIELD. And none that would justify, in your opinion, a patent which would provide a monopolistic advantage?

Dr. ZINN. No; no one has a patent which would do that. I think it unlikely that such a patent is going to show up in the near future.

Representative HOLIFIELD. Then, if any of these private enterprises put too much dependence upon patents, they are leaning on a very weak reed, are they not?

Dr. ZINN. Well, in the short range they are. In the long range they are not. In the long range, if this becomes a business—and I would like to interpolate here this statement—we are not talking about a business in which anybody can make any money at the present time, it seems. When this becomes a business, in the long range, certainly patents will become important. But what we are talking about here is to get a business started. And to me it has been just a little bit disconcerting to see arguments about patents when there is not any way to use these patents, to use them for what they are usually used, to make some money. In the long range the answer is “Yes; patents will be important.”

Representative HOLIFIELD. But at the present time, in this present state of development, you would not consider it necessary to change the patent law?

Dr. ZINN. I must confess I am not very familiar with the patent law. It does not affect me very much. Every patent I get goes to the Government.

Representative HOLIFIELD. The present construction of a reactor would necessitate the utilization of patents and metallurgical processes which are now the sole property of the Government, would it not?

Dr. ZINN. I believe so.

Representative HOLIFIELD. You have said in another part of your statement, I believe, that it should be a cooperative effort. And if that cooperative effort is carried out, you would not be in favor of the Government making concessions at this time which would allow any of these companies to obtain an area of special and discriminate advantage over the rest of American industry, would you?

Dr. ZINN. I do not think it can be done. I do not think any company can get in such a position. The Government can always make available to other people exactly what it would make available to a particular company, namely, fissionable material, heavy water, a license to use the fissionable material, a license to use various patents. I do not see how anyone can acquire a monopoly for quite a long time in this business and that long time means that other people would have a chance to get in competition and get their own monopoly, if you like; in other words, no monopoly.

Representative HOLIFIELD. Of course, if the Government goes into a 30-year contract with any group, such as, for instance, was suggested by the Monsanto group, that long-term contracts be entered into in which the price of plutonium would be set, then the Government would be bound, it seems to me. If they went into a type of contract to bind themselves to pay so much a gram for plutonium over a period of 30 years—some of the companies claim that they need that type of contract in order to justify a big investment, and some of them are asking that the Government go into a contract with them like that.

Dr. ZINN. I believe that selling plutonium to the Government is not the way to get into the power industry. That is the way to get into the plutonium business. So, I do not think such a contract is a good thing.

I don't know that our need for plutonium will run over 30 years. I am sure that our needs for power will go way beyond that.

Representative PRICE. Is it fair to say, then, that you are not a proponent of the dual-purpose reactor?

Dr. ZINN. I never have been, sir.

Representative HOLIFIELD. There is one point I would like to ask you about on the safety standards. Do you think they could be lowered safely to permit these plants to go into economic locations; and if you do, why have they not been lowered for Government plants?

Dr. ZINN. Let me say that I believe they can be lowered for certain reactor types.

Representative HOLIFIELD. But not the types now in use?

Dr. ZINN. No, I would not say that is so. The reason they have not been lowered at the present time is that usually the site has been selected and acquired for an unknown type of reactor to be constructed thereon. This always has been necessitated by speed. The Hanford site, I know, was selected before the Hanford plant was designed. I know the Savannah River site was selected before the reactor had been designed very far.

In order to be sure that the location is entirely adequate, obviously generous standards have been used.

Representative JENKINS. I should like to ask one question.

Dr. ZINN, are you familiar with the territory down around Portsmouth, Ohio, and the atomic energy plant to be built there?

Dr. ZINN. No, sir, I have never been to that area.

Representative JENKINS. The Government has been surveying and building there for about a year. I do not know how much money has been spent there, but they are proceeding very vigorously. There are two private powerplants being constructed in the Ohio Valley which are under contract to provide power for the big atomic plant. These powerplants are in the process of completion now.

I wonder if, in your judgment, the development of this power would take such a course that in some phase of atomic energy production there might be an atomic plant built near where the powerplant is now being built. Do you think the development of atomic energy would be such that some plant could be located near those electric plants? Electricity has to be the basis, I understand, of production of atomic energy.

Dr. ZINN. Yes. I understand the question is: Could not a nuclear plant be built to furnish some of the electricity which is used in the diffusion plant, the isotope separation plant?

It certainly could. Unfortunately, the location of the diffusion plant was made on the presumption that the area is the cheapest power area in the country. So if you go into that area to put up your nuclear plant, you are going up against the toughest competition you have. The competition from coal is already very tough. I believe power is being generated there perhaps at $2\frac{1}{2}$ to 3 mills per kilowatt-hour, whereas generally over the country the cost for a new plant is perhaps 7 or 8 mills per kilowatt-hour.

Representative PRICE. I might say, Dr. Zinn, the answer given to a lot of us who were trying to get a plant located somewhere else was that it was going into the Ohio Valley because of cheap power.

Dr. ZINN. It is the toughest place in the world to go with a new nuclear powerplant.

Representative JENKINS. I understand that you mean it is tough from the standpoint that it is the most advantageous place in the country to produce electric power. It is not the toughest place. It is just the best place in the world. It has been considered that that terri-

tory is the best territory in the country from the standpoint of the production of power.

What I am trying to do is to find out, in addition to this big atomic-energy plant located over at Portsmouth, which is about halfway between these two big electric plants, since it is such a fine place and has such fine people living there and is so progressive. We can reach out and expand a little and do more than has been planned now.

Dr. ZINN. It is very difficult to compete with such a fine place.

Representative JENKINS. I am glad you appreciate that we are what we are.

Representative VAN ZANDT. Doctor, as Director of the AEC at the Argonne National Laboratory, what part did you play in assisting these five industrial study groups?

Dr. ZINN. I believe we had meetings with each one. We have seen more of the Detroit group and the Commonwealth Edison group than the others. The Commonwealth Edison group particularly is near us, and we have seen them very often, and some of their people have been in the laboratory almost weekly, and daily perhaps. I would like to point out that of the types of reactors which the industrial groups chose to work on in their designs, several of them are designs which we have worked on also. So our contact with them has been fairly close.

If I may, I would like to make a comment in that connection. I think the best thing that has happened to the atomic-energy business in the last 2 years is the appearance of this rather large group of competent engineers from the utility companies and some chemical companies who are newly interested in this field, and they have impressed me very much as being earnest people, capable people, and fully desirous of advancing this business for the national interest, not just in their own company's interest.

Representative VAN ZANDT. Did you assist them in establishing the cost estimates that they are now using, of about \$60 million for this type of plant?

Dr. ZINN. Congressman Van Zandt, I will say that I have seen many difficult problems in science over the years, but none as knotty as the business of guessing costs. All of us have been making cost estimates and, frankly, I do not believe those cost estimates are really very good.

What happens is that the laboratory scientist makes an estimate of what some part will cost and puts it in the report. The industry man, not being in a position to know more about it than the laboratory scientist, copies that over in his report. Then we copy something from the industry report, and I am afraid these cost estimates sort of go round and round and come out with about the same answers all the time.

The real fact is that we must get some experience in building economical reactors before we know where we are. The submarine reactors had another purpose. They wanted to drive a submarine. Plutonium reactors make plutonium, and lots of things were sacrificed to get lots of production of a certain kind.

We have not yet tried to build one reactor of any size with the cost down. I would be delighted to have such an opportunity.

Representative VAN ZANDT. Doctor, have you made such a recommendation to the Commission?

Dr. ZINN. Informally, yes, I have many times said, "We have done the submarine job, and we have worked on the Savannah River reactors. We would like very much to take a crack at something that tries to make power at a reasonable cost."

Representative VAN ZANDT. Are you at liberty to tell us why they turned down your recommendation?

Dr. ZINN. It is not so much why. When there is not any money, there is no use talking about it.

Representative VAN ZANDT. This figure of \$85 million that you use—does it include any money for chemical-processing facilities?

Dr. ZINN. No, it does not. It does, however, include the electrical plant, and I would like to make the point that some, say, \$50 million of that would be the turbine, generator, and transformer station, the sort of thing you find at any power station, and only some \$30 million of that would be the reactor and the boiler that goes with the reactor. The rest of it is just conventional steam plant and generating equipment.

It gives an inflated notion of what the reactor costs. Even for a very large plant like that, the reactor itself, not talking of the boiler, would be only a \$10 million or \$15 million item. But it takes all of the rest, of course, to make it work, to be useful.

Representative VAN ZANDT. Doctor, is it not true that the success of the AEC in utilizing atomic power for submarines is truly a contribution to the development of atomic power for civilian use?

Dr. ZINN. I don't want to comment on where those projects are. I would say that we fully expect now that in the near future the submarine plants will be producing power. They are designed for that. Power from them looks just like any power. Unfortunately, it will cost too much to have use for ordinary purposes.

Representative VAN ZANDT. Nevertheless, we have made some progress already in the field.

Dr. ZINN. Technically, we are making power right now in perhaps three places. So there isn't any question that, technically, it can be done. That is not at issue.

What is at issue is: Can you make it at a price that anybody wants to pay?

Representative JENKINS. I have just one other question, while we are talking about this wonderful Ohio Valley. You were talking about chemicals. Allied Chemical has down there some very large plants right in my own section between these electric plants and this big atomic-energy plant. I suppose they have from \$300 to \$500 million invested there. Dow Chemical is now making a survey, and I think it will be but a short time until they will make the announcement that they are coming in there with a big chemical plant.

I make that observation only to show that since the Government has located down there with this big plant and the two big power-plants, we would welcome you to come in there. If it is a matter of locating somewhere else where you cannot get along, we will take care of you in pretty good shape down there.

Dr. ZINN. We are very happy to have the invitation.

Representative PRICE. To get back to that submarine reactor again, I take it that you feel that it is a very unsatisfactory route to go to attain industrial power.

Dr. ZINN. It is a wonderful way to drive a submarine under water and, let us say, at a good speed.

Representative PRICE. I am asking you that for an obvious reason. There has been some school of thought recently that we could abandon some of the other projects and just go along with the submarine reactor, and we would have the answer to everything.

Dr. ZINN. The submarine reactors that exist now, the Argonne-Westinghouse one, and the General Electric one at West Milton, both use enriched uranium as fuel without any regeneration. In my opening paragraphs I indicated that I thought that was not the way you could get economical power, because your fuel cost to start with must be more than the cost of coal. If you are going to expect the capital cost of the plant to be more than that of the coal plant, you haven't got a chance. You have to use a different way of fueling the reactor, not the one that has been chosen for the submarine reactors. If you use the regenerative way that I have been talking about, you get something that is too big, that does not fit in the submarine.

Representative PRICE. In other words, it would not be a good policy to follow the submarine-reactor routes to industrial power?

Dr. ZINN. I do not believe so.

Representative PRICE. In the second paragraph you say the United States should extend its preeminence in atomic matters to the area of industrial-power production. Do you think we hold preeminence in that field at the present time?

Dr. ZINN. We haven't got it, so I don't see how we can be holding anything.

Representative PRICE. Are you familiar with the British program?

Dr. ZINN. I know what the British program is as it has been publicly stated. They are constructing or beginning to construct a gas-cooled graphite-moderated reactor which would make power, on our figures, 2 or 3 times the cost of what our coal power is. That is all right in England where their power from coal costs a lot more than ours already, but it would be dismissed here as not having much chance of being competitive.

They have some other reactor plans in the mill, one of them being a breeder reactor which they are not getting ready to build at the present moment. They are just planing on it.

Representative PRICE. As I understand the British situation, during these years since the atomic age came into being, we in this country have been compelled to devote about 90 percent of our attention to military use. We have necessarily neglected civilian uses and peacetime uses. As I remember the British situation, there was a long period of time when they did nothing except experiment for civilian needs and peacetime use.

Is there any reason you can give why they would be so far behind us in the development of industrial power?

Dr. ZINN. I do not believe they are far behind us.

Representative PRICE. That is what I want to know. I would like to know how we stand comparatively.

Dr. ZINN. I believe they have a plant in construction, in the early phases of construction, for power only, or mainly for power. This plant they started quite a few years ago in design. I expect in 3 or 4 years it will be operating.

I do not think it would be quite correct to say that they didn't do things on the military scale because, after all, they have detonated one bomb.

Representative PRICE. There was a little push given to it in recent years, but there was a long period when they did not concentrate on military as we did. Is that not true?

Dr. ZINN. I don't know. I am not in a position so that I would know.

I will say the incentive they have to develop industrial power is a great deal larger than ours.

Representative PRICE. That is the reason I am asking you the question, because I feel that they have been giving much attention to the development of industrial power. I wondered what you knew about their program and the degree of success that they have had.

Dr. ZINN. If you discuss this matter with the British or with the Belgians and others in Europe, you find a very great interest and great determination to get nuclear power, because they feel they are power hungry. We don't have that feeling in this country.

Representative HOLIFIELD. Dr. Zinn, on page 5 you make the following statement:

The first power reactor cannot be expected to be ideal. For instance, it may not be a real breeder, either.

Can you explain to us what you mean by that?

Dr. ZINN. If it were a real breeder, it would mean that you would assign to it once a charge of fuel, and then it would keep regenerating new fuel so that as it went along over the years, you wouldn't have to take new uranium. It would be living essentially on its original supply for quite a while.

That is a very poor statement, perhaps, but that is what I meant. A nonbreeder or a converter reactor would require that you put into it about 20 tons of uranium per year, the one I have been talking about here. If you had a great number of powerplants, 20 tons a year might be a serious matter. But it certainly wouldn't be a serious matter for quite a few plants.

Representative HOLIFIELD. Would security allow you to say at this time whether there is a real breeder in existence?

Dr. ZINN. A real breeder as a powerplant, no. There is a small experimental machine running in Idaho which experimentally operates as a breeder.

Representative HOLIFIELD. Is it operating to the point of efficiency that you have described, that it does not need rejuvenation of feed material?

Dr. ZINN. That is correct.

Representative HOLIFIELD. So you have every reason to believe that at the present time a full-scale breeder reactor could be constructed that would live on its own fuel?

Dr. ZINN. Not at the present time. We would need a pilot plant first, and there are some very knotty and difficult development problems involved in getting this up to full scale.

The experimental machine is just that. It is on a small scale. To get it up to big scale, we have a tough job.

Representative HOLIFIELD. So it would be a mistake on the part of the public if they thought at this time that this breeder reactor had

been brought to the point of completion and that it was not still in the experimental stage?

Dr. ZINN. That certainly would be a mistake.

Representative HOLIFIELD. Since this announcement that the breeder had functioned, there has been a tendency on the part of the public, I think, to believe that we had arrived at that goal, and I think it would be well that the public be apprised that we have not reached that goal yet.

Dr. ZINN. I think the public should know that to go from a theoretical idea to a full plant, a useful operational plant, many steps are needed. Some of these are extensions of the theoretical idea; some of them are purely engineering and scale-up steps. We have just accomplished several of these steps, the first, early steps. There are still many big ones left.

Representative HOLIFIELD. I suppose it would cost a great deal of money to do this.

Dr. ZINN. Unfortunately, research and development in this field costs money.

Representative HOLIFIELD. It costs many millions of dollars?

Dr. ZINN. Yes, sir.

Representative VAN ZANDT. Do you estimate it will take 5 years to accomplish what you have in mind?

Dr. ZINN. I believe to develop and get going a successful pilot plant would take 5 years.

Representative HOLIFIELD. Then there would be additional years to build a prototype?

Dr. ZINN. I would say pilot or prototype plant. My idea of a pilot or prototype plant is, scaling it up from there is heavy engineering but not a great deal of development. It should be straightforward.

Representative VAN ZANDT. Thank you, Dr. Zinn, for your presentation.

Our next witness is Dr. Alvin M. Weinberg, Research Director of the AEC Oak Ridge Laboratory.

Doctor, we welcome you here today, another one of the pioneers in this field.

You have a prepared statement. Just go right ahead.

STATEMENT OF DR. ALVIN M. WEINBERG, RESEARCH DIRECTOR, OAK RIDGE NATIONAL LABORATORY, OPERATED BY CARBIDE & CARBON CHEMICALS CO. FOR THE ATOMIC ENERGY COMMISSION

Dr. WEINBERG. After Dr. Zinn's very articulate and very complete statement, I imagine that none of the rest of us will really have very much to add.

Most of the following remarks on nuclear power development are technical rather than administrative; for any nontechnical utterances, I claim much less validity than for technical ones.

Before discussing ways of making our nuclear enterprise a bona fide industrial undertaking, I shall try to summarize the technical situation.

In brief, there are two deeply essential and distinct aspects of nuclear fuel as a source of power which the technology is trying to ex-

exploit and which underlie its potential usefulness. On the one hand, nuclear fuel is compact; one large truckload of U-235 could power New York City for a year. This compactness is, of course, the feature which is exploited to the nuclear submarine. On the other hand, nuclear fuel is potentially very cheap; 1 pound of ordinary uranium, at a cost of \$10 per pound, has the same energy content as \$10,000 worth of coal, but how to take practical advantage of this is the difficult question.

I do not include in the essential aspects of nuclear fuel the fact that a nuclear fire is independent of oxygen, because I believe this has less bearing on the ultimate industrial utilization of nuclear power than do the other two. Nor shall I say anything, either, about the possibility of very high temperature heat from nuclear reactors which may be of considerable ultimate use to the chemical industry, but which I think is now only a remote possibility, or about the well-known fact that chain reactors can be used to produce nuclear fuel. I will be concerned mainly with the question of nuclear fuel as a power source.

Much of the discussion on industrial utilization of nuclear power has failed to appreciate this duality, the compactness on the one hand and the potential cheapness on the other. The technical problems which are involved in exploiting the compactness of nuclear fuel are in significant measure not the same as those which arise in exploiting its cheapness.

Most power reactor development work so far, being concerned with military mobile reactors, has involved exploiting compactness. Thus, while we have all but demonstrated in the submarine reactors that nuclear fuel is practical as a compact fuel, we have not yet demonstrated that it is an inexpensive fuel. Yet the belief that nuclear energy has strong industrial implications is based mainly on the assumption that the fuel can be utilized for cheap power rather than for compact power. The notion that development work has progressed to a point where we can say with absolute certainty that nuclear fuel is inexpensive is unwarranted, in my opinion. All we can say is that nuclear power is compact; we hope that with the expenditure of a development effort at least as great as that which has already gone into the demonstration of compactness, we can develop a nuclear system which is cheap.

Corresponding to this technical duality there are two questions to be asked in considering the industrial exploitation of nuclear power. First and certainly most immediate is: Is it possible to find a reasonable industrial framework into which to fit the demonstrated compactness of nuclear power systems? And second and less immediate: How best can we arrive at a comparable demonstration of the cheapness of nuclear fuel? Without this demonstration, I think it is idle to speak of large-scale economic utilization of nuclear power in central electric generating stations.

With respect to compactness, the situation is relatively simple. Our military mobile reactor projects on which better than \$100 million has been spent have proved, or should very shortly have proved, that a powerplant which is not tied to extensive fuel-transportation facilities is feasible. It appears to me that it makes sense for private heavy-equipment manufacturers to supply such reactor systems to the Navy under much the same arrangements as Newport News Ship-

building & Drydock Co. now supplies ships, or Westinghouse now supplies turbines, to the Navy. In much of the discussion of industrial participation in nuclear-power development, little attention is paid to the fact that the manufacture of reactor systems for the Navy is already essentially no more and no less a private enterprise than is the manufacture of gas turbines for the Air Force.

Applications of compactness to other than ship propulsion have been suggested. Several surveys have shown the existence of a market for relatively expensive nuclear power—say at 3 cents per kilowatt-hour—in remote places where conventional fuel sources are unavailable. Such “power packages” can be used at airbases such as Thule or in countries such as Peru, which have less coal than we. In any case, the manufacture and sale of such power packages could develop into a perfectly normal small industrial enterprise and one which, because of Government-subsidized development of the nuclear submarine, can be entered without the necessity for further great Government subsidy. The problem of allocation of fissionable material is not a serious one as long as the user is one of the armed services; should the user be civilian, more difficulties would be encountered, although I think, even under the present act, licensing of the material can be done on much the same basis as fissionable material has been lent to North Carolina State College for the research reactor.

Thus, in the development of compact power reactors, an eminently reasonable course has been charted, namely, the Government, by contract with equipment manufacturers, has done the development work required to demonstrate their feasibility, including actual operation of Government-owned experimental plants. From then on, the equipment manufacturers presumably will supply these devices in a manner not essentially different from the way in which this is done for many other items of heavy equipment. Since the development was done at Government expense, the designs are available to all who wish to enter the field, subject to restrictions of the same general type that surround any military-equipment enterprise. As I have said, I see no essential difference between this situation and the one which exists in the aircraft- or ordnance-manufacturing businesses.

Turning to the other major attribute of nuclear fuel—its cheapness—I suggest that the pattern which has proved so reasonable in the exploitation of compactness ought to be used in the exploitation of cheapness; i. e., in the development of large-scale central nuclear-power systems. For the Government is interested not only in compact power in its airplanes and ships; it is also vitally interested in cheap power partly because the Government—in the huge atomic-energy-diffusion plants, for example—is by far the country's largest single power user, but much more importantly because our potential in military nuclear explosives and, ultimately, in general economic strength, would be greatly increased if we had a large-scale economic central nuclear-power industry. Thus an urgent case can be made for the Government's assuming responsibility to develop inexpensive nuclear power—paying for and shepherding the development to the point where practical and cheap powerplants are working. These demonstration plants can, by virtue of their existence, serve as working models for the equipment manufacturers and for the utilities and the chemical manufacturers who use large amounts of power in their normal businesses.

From the technical standpoint, development of central station, cheap nuclear power is probably at least as difficult as the development of compact nuclear power. Some of the difficulties are legislative—e. g., the need for very stringent security and fissionable-material accountability, both of which add considerably to the cost of doing nuclear business; or the need for extreme care in the choice of location of nuclear-power plants because of safety requirements. Most of the difficulties, however, are technical. They are concerned with making the reactor system simple and, therefore, inexpensive, as well as reliable; and they are concerned with figuring out how to burn a large fraction of the fuel, or at least to regenerate chemically the unused part of the fuel in so expeditious a manner that advantage can be taken of the potential cheapness of the nuclear fuel.

As for simplicity of the reactor system, not much is known about what can be done, mainly because until now military urgency has made it imprudent to gamble by cutting corners. Thus, the estimates that capital costs for a nuclear-power system can be brought down to \$250 per kilowatt, compared with \$150 for conventional systems, are still speculative. Nor is the appropriate amortization rate at all clear, since we have had too little time to know, rather than to guess how long the materials of a reactor will hold together in the exacting environment of radiation and heat and corrosion encountered in a power reactor.

I might add this is one of the few points on which I differ, although rather slightly, with my illustrious colleague, Dr. Zinn, who in his statement points out that some—and I think he meant me—have pointed out that it is very risky to go into the nuclear-power business because the amortization rate is so difficult to assess. His answer is that it is possible to design these nuclear gadgets so you can replace them if they wear out.

In rejoinder to that, I can simply say that if you have to replace your reactor once every year, of course, the amortization rate would be so high you would be out of business, even though the installation as a whole is still going.

Much the same lack of knowledge pervades the matter of cutting the nuclear-fuel cost, either by breeding and managing to keep chemical reprocessing costs low or by burning ordinary uranium long enough really to take advantage of the low initial cost of uranium.

Yet, it is my belief—and in this I share the belief of Dr. Zinn—that the outlook is very hopeful on two accounts. First, while demonstrating compact nuclear-power plants in no sense is equivalent to demonstrating cheap nuclear-power plants, there are certainly many lessons already learned in the one which are applicable to the other. In addition, the plutonium producers have at least taught us a good deal about many of the problems which we must solve to achieve economical nuclear power, although not by any means all the problems.

Second, major progress is being made in all the laboratories in answering just those essential questions—cheap chemical processing, breeding, and high burnup—on whose favorable answers success of the large-scale central nuclear-power technology depends.

I believe that a development effort at least as large as that which has gone into the development of compact nuclear power must go into the development of inexpensive nuclear power if we are to achieve success—that is, if we are to achieve a price for nuclear power which

is competitive with coal power in perhaps not the cheapest coal-power areas but in the average coal-power areas.

For the reasons which I have already stated, I believe the Government has at least as great a stake and interest in the development of cheap power as in the development of compact power, and, therefore, the Government should be ready to pay the bill for this development. Those private industries which are also interested in cheap nuclear power—the chemical companies, the equipment manufacturers, and the utilities—should be given access to Government developments in cheap nuclear power just as ship and engine companies have been given access to data on compact nuclear-power plants. Should any private group wish to go it alone, I think the Government should give it encouragement and support, but I believe it would be a serious mistake for the Government to consider any such private effort—almost certain to be on much less than the \$100 million scale which I estimate to be the order of the required development bill—in any sense a substitute for the Government's own effort to demonstrate the feasibility of cheap central station nuclear power. Once the feasibility has been demonstrated, I believe there is plenty of time for cheap nuclear power to be put, along with airplanes or electronics or compact nuclear-power plants, into the ever-increasing group of industrial activities which derived their initial impetus from the Government and then proceeded to develop on traditional private industrial lines.

Representative VAN ZANDT. Thank you, Dr. Weinberg.

Your figure is \$100 million?

Dr. WEINBERG. I think my figure includes at least a part of the chemical plant. You see, Dr. Zinn and I really do agree, in spite of the fact we did not compare notes before the hearing.

Representative VAN ZANDT. Doctor, what part did you play in the five study groups?

Dr. WEINBERG. Essentially the same as the Argonne National Laboratory. The Oak Ridge National Laboratory had visits by each of the five study groups. It so happened that on the whole, the study groups were somewhat less interested in what we had to show them than what Dr. Zinn had to show them, perhaps because much of what the study groups have looked at has been concerned with the somewhat short-range possibilities of nuclear power; whereas much of what we do down at Oak Ridge is concerned with the long range. Each of the groups has visited Oak Ridge. We have had meetings with them.

Representative VAN ZANDT. Are you familiar with their recommendations to this committee?

Dr. WEINBERG. I am not familiar in detail with what transpired at the hearings at which they were represented. I have heard second-hand reports of what they have said.

I think my attitude in general is summarized, really, in the sentence where I say:

Those private industries which are interested in cheap nuclear power should be given access to Government developments in cheap nuclear power just as ship and engine companies have access. Should any private group wish to go it alone, I think the Government should give it encouragement and support, but I believe it would be a very serious mistake for the Government to consider any such private efforts to be a substitute for what the Government itself will have to do if we are in fact to achieve cheap nuclear power.

Representative VAN ZANDT. I take it from that, then, you are in favor of a subsidy ?

Dr. WEINBERG. I would prefer not to say just the terms on which the Government should give this support. Speaking rather as an individual—and, of course, Dr. Zinn and I are in the slightly anomalous position of working for private industry on the one hand and for the Government on the other, so I suppose I should take this opportunity to say that I am speaking not as an agent of the Commission or the Carbide & Carbon Chemicals Co., but just as Alvin M. Weinberg—I should say in this connection that my own belief is that the Government support would better take the form of direct support of the research and development, and in fact the building, rather than some rather artificial and devious subsidy.

It seems to me that we have achieved good success—with the aid of our good friend, Captain Rickover, in a situation where the Government said, "We want a nuclear submarine and we are going to pay for it."

I believe the Government has an equal interest and necessity for establishing cheap nuclear power, and we should therefore be willing to pursue that project on much the same lines.

Representative VAN ZANDT. Any other questions?

Representative PRICE. Doctor, have you made any other recommendations to your Commission along that line?

Dr. WEINBERG. I have talked informally with the Commission about possibilities along this line. As you understand, on the whole, we try to present the technical situation as best we can, and try not to say very much about what management possibilities might exist.

I might say, incidentally—and this is somewhat connected with what I have just been mentioning—that in connection with Representative Jenkins' suggestion that the Atomic Energy Commission might build atomic-energy plants to take over some of the power burden at K-25, the Oak Ridge gas-diffusion plants, or at Portsmouth or at Paducah, this strikes me as being an eminently sensible proposition. I am not sure that all of you are aware of the fact that down in Oak Ridge the Commission itself operates a 255,000-kilowatt, ordinary steam powerplant. This powerplant, for one reason or another—it was built during the war—is not really as efficient nor does it produce as cheap electricity as do the hydroinstallations or the more modern steam plants in that region.

Representative VAN ZANDT. What type of fuel is it using now?

Dr. WEINBERG. Right now, I think it uses gas. It started on coal.

It has seemed to many of us that just as the Commission has responsibility for developing various techniques which reduce the unit cost in the production of U-235 by making improvements on compressors or on the flow of gas, so it seems to me that the Commission really has a vital interest in investigating for its own use the possibility of developing very cheap power. If it can in fact develop very cheap power, since very cheap power is the most important raw material in the production of U-235, it seems to me that on this ground alone the Commission might be justified in going ahead to powering one of its diffusion plants with atomic power.

Representative PRICE. I take it you did not agree with the Commission when it yielded and gave up its industrial-reactor program.

Of course, Congress itself put it back in, but you did not agree with the position that the Commission took then; did you?

Dr. WEINBERG. I fear, Mr. Price, that my opinion wasn't asked on the matter. Again, I repeat, I speak for myself. I think it has not been quite sufficiently clear, that we really want cheap nuclear power quite divorced from any question of military production of plutonium or the propulsion of military ships.

Representative PRICE. In other words, you have to go the direct route to do it?

Dr. WEINBERG. If we want cheap nuclear power, we should say we need cheap nuclear power and we should go after it. We should not have to stand on our heads, so to speak, to prove that we want it.

Representative PRICE. Not take it as a byproduct of some other experiment?

Dr. WEINBERG. I don't think we will get it if we view it as a byproduct.

Representative HOLIFIELD. Dr. Weinberg, I am glad to see you make this statement so clearly here in regard to the Government's position, what the Government's position should be with regard to its responsibility to produce cheap power.

I want to ask you this question: Do you not believe that if the Government went ahead on the scale that you suggest here, and with the objective of producing cheap power, we would obtain that goal much quicker than we would by putting it in the hands of individual enterprisers who furnish their own money?

Dr. WEINBERG. I believe this is probably the case. Let me repeat, however, that I see an entirely or almost entirely bona fide aspect of the nuclear industry which can right now be taken over by private industry, namely, the small-scale power package. Development of large-scale central cheap nuclear power is very expensive. It is not quite clear to me that private industry is really in a position to make a complete go of this much more ambitious development.

Representative HOLIFIELD. If we did go ahead and produce this cheap power with the Government's funds and then make it available, we would get the so-called bugs out of the reactor and get it to the point of economic function. Then if we turned it over to private industry, it would be, in my opinion, and I suppose in yours, a quicker way to reach that goal.

Dr. WEINBERG. It seems that way. More than that, as I pointed out here, it seems to me that this path has ample precedent in many other large-scale technologies which have been invented and shepherded through to completion or at least through feasibility by the Government, and which then became the basis for a large-scale private technology.

It is a well-known fact, of course, that the electronics industry was practically nothing until after World War I. The same can almost be said of the automobile industry.

Representative HOLIFIELD. I think you made a very fine statement.

Representative JENKINS. I think the gentleman made a very fine statement, Mr. Chairman.

Representative VAN ZANDT. Doctor, can you tell us how many years will be necessary to develop the type of plants you have in mind?

Dr. WEINBERG. I agree with Dr. Zinn that when one speaks of central nuclear-power stations, one speaks of many different possi-

bilities. The longer one waits and the more one is willing to spend on the development, presumably the more significant and more far-reaching will be the implications of the development.

If we set our sights on what we can do within 5 to 7 years—and I would judge this to mean power in the range of 9 to 10 mills per kilowatt-hour—then, as Dr. Zinn said, we probably would be obliged to stick with systems which are as close as possible to either the compact or the plutonium-power system; and, as I say, it will take us from 5 to 7 years to get something which is useful but not as enormously useful as one would ultimately hope. If we set our sights on the ultimate, namely, power at 5 mills per kilowatt-hour—that is power which will be competitive with the best that can be done or that we can extrapolate with our conventional fuels, then it is my belief that it will take between 10 to 15 years, and about \$100 million to have a full-scale working plant.

Representative VAN ZANDT. What type of plant do you have in mind?

Dr. WEINBERG. Speaking of the type of plant, I should point out again to you the fact that probably has become apparent in these hearings: that each of the technical witnesses, such as Dr. Zinn, Mr. Menke, and I—each has his own pet that he loves better than any other. This is natural in technology of this sort, especially one in which one does not have real economic experience to determine which pet is better than the other. I myself am a homogeneous reactor man; I think we can ultimately make 5-mill per kilowatt-hour power with a system of this sort, and that it will be a breeder in short, that it will be the ultimate method.

But I by no means say that Dr. Zinn, who, by the way, is a fast reactor man—that his way won't turn out to be just as good.

Representative VAN ZANDT. Just one more question. Can we depend on atomic power for gaseous diffusion plants?

Dr. WEINBERG. One of the reasons that I suggest the possibility of the Atomic Energy Commission's building atomic powerplants for its gaseous diffusion plants is that at least at the beginning, during the time when one cannot depend on the atomic power as a reliable power source, one will have the enormous backup in ordinary power that is now available. The diffusion plants will ultimately use something like 10 percent of all the power that is generated in this country. Down in Oak Ridge we have a powerplant. The total power use down in Oak Ridge, which is a town of 30,000, is, I believe, considerably larger than the total that is used in the city of Detroit. This means that, let us say, if we back 2 million kilowatts of conventional electricity with 100,000 kilowatts of atomic electricity, even if that 100,000 kilowatts of atomic electricity proves to be, shall we say, cantankerous, one is not in a very embarrassing spot. It is on this account, among others, that I personally, and many of the people I have talked to, have felt that in spite of the fact that the power cost is low in Oak Ridge or the Ohio River Valley, there are great advantages in pursuing this possibility.

Representative HOLIFIELD. May I say that the Atomic Energy Act specifically provides for such an eventuality by providing that if electrical energy is developed as a byproduct of these plants, the Atomic Energy Commission can use that power. It is written into the act, and was foreseen by its originators.

Representative VAN ZANDT. Any further questions?

Thank you, Doctor. You have made a great contribution to the efforts of the committee.

For the benefit of the record, I would like to show that we invited Dr. Zinn and Dr. Weinberg here as individuals, and their statements have not been cleared by the Atomic Energy Commission. Their statements represent their own personal views.

The next witness is Dr. Chauncey Starr, Director of the AEC Atomic Power Division of the North American Aviation Co.

Dr. Starr, we welcome you.

Representative HOLIFIELD. Dr. Starr, as a Californian, I would like to welcome you. I have to get even with this fellow Jenkins on his Ohio Valley position.

Representative JENKINS. You cannot make atomic energy out of climate.

Representative VAN ZANDT. It is not unusual, Dr. Starr, for another Californian to welcome you. You may proceed with your statement.

STATEMENT OF DR. CHAUNCEY STARR, DIRECTOR, ATOMIC ENERGY RESEARCH DEPARTMENT, NORTH AMERICAN AVIATION, INC.

Dr. STARR. The major incentive to develop industrial atomic power is the long-range national need to provide an energy resource which can supplement conventional hydrocarbon fuels—coal, oil, and gas—when our reserves of these fuels are depleted or become uneconomic to recover. Atomic power should be making a material contribution to our national power supply within the next 25 years. In the near future, however, there may be a modest market for small atomic powerplants for special purpose or high-cost locations.

Although it is difficult to estimate the availability of our conventional hydrocarbon fuels in relation to future energy requirements of the country, it appears that the steady increase in these requirements will begin to deplete our economically recoverable fuel resources in perhaps 25 to 50 years. This situation will be reflected in an increasing cost of all forms of energy from the conventional fuels and an increased cost of electrical power. As this increasing cost of hydrocarbon fuels develops, the economic incentive for the development of other energy sources—such as atomic power—will become more and more evident. In fact, at such a future time it will be essential to the Nation's welfare that atomic energy undertake a significant portion of the power production in this country.

The availability of atomic power will be a major factor in keeping the cost of power to the consumer down to present levels. Thus the continued growth of the electrical power capacity of the country would be possible, and with it a steady increase in our industrial potential and standard of living. This, of course, is sufficiently important to our national welfare to justify a well-planned development program toward this objective at this time.

Atomic power does not now offer cheap electricity. Only a fraction of the income from the sale of electrical power by private utilities represents the cost of fuel, roughly one-fifth. The cost of the atomic fuel that will be consumed to make power is indeed very small. However, based upon present engineering knowledge, the extra costs asso-

ciated with nuclear reactors and their operation is more than likely to balance any saving in fuel consumed. For these reasons, the cost of power to the consumer will not be significantly reduced from present costs by the immediate advent of atomic power.

Many estimates have been made concerning the cost of electricity from atomic powerplants that could be built today. These estimates contain a very large uncertainty, due to the lack of engineering and operational information on the various components that go into such plants. It appears likely that an atomic energy plant today would probably produce power twice as costly as that from conventional plants. This cost differential could disappear very rapidly if a background of technological development and operating experience could be accumulated prior to the construction of any large-size plants.

The engineering development of atomic powerplants is in its infancy. There does not exist today any operating nuclear reactor that could really be considered a pilot plant for an economic power producer. There are several small-scale experimental reactors investigating bold and radical technical approaches, which as yet are far removed from full scale plant engineering.

There are several technical approaches to industrial atomic power plants which have received serious consideration by various AEC agencies. These include both fast and thermal breeders; that is, devices that utilize our uranium and thorium resources efficiently, various types of engineering configurations, and various types of coolants for removing the heat from the nuclear reactor. In particular, major emphasis has been given to both high pressure water coolant systems and liquid metal coolant systems.

The basic problems in developing any atomic powerplant are the improvement of the power output and thermal efficiency of these systems and the reduction of capital and operating costs, so as to decrease the cost per kilowatt-hour of electrical energy produced. The principal elements of capital cost include the reactor, the coolant system, the heat exchangers and boilers, turbines and generators, site, and the fissionable fuel inventory. Operating costs include fuel reprocessing, reactor operation and maintenance, and maintenance of the turbines and generators. Many of the costs associated with the nuclear reactor are much higher today than would be expected in the future due to the conservatism associated with the present lack of operational experience.

North American Aviation, under contract with the AEC, has examined in detail several of these proposed systems and has recommended to the Commission a development approach utilizing a liquid metal coolant, which we believe offers an exceptionally good opportunity, and perhaps the best, for achieving economical electrical power. For example, in the liquid metal coolant system proposed, power costs which might be conservatively estimated today to be in the range of 1 to 1.2 cents per kilowatt-hour might be reduced to 6 to 7 cents per kilowatt-hour by increasing the useful electrical power output from a given-sized reactor through a foreseeable process of development. An increase of about 150° F. in the liquid metal coolant temperature associated with an increase in the amount of coolant pumped through the plant can easily accomplish this.

Such an increase in temperature results in not only an increase in power output from a given plant, but also in a considerable in-

crease in its thermal efficiency. However, this increase in temperature could not today be taken as a reliable engineering operating condition without an exploratory experimental program as to the consequences of the increased temperature on materials, reactor equipment, and especially on the fuel elements.

This type of liquid metal-cooled thermal reactor not only provides a good possibility for producing competitive power from uranium fuel but also would permit operation as a self-sustaining thorium breeder. A thorium breeder manufactures the fissionable isotope uranium 233 as a product in quantities equal to or greater than that consumed in its own operation, so that after an equilibrium condition has been established, only thorium metal need be supplied to keep the system going. Such a thorium breeder system initially would require the use of uranium fuels in addition to the thorium but after several years would be able to operate on thorium alone, without any connection with the uranium complex associated with our present atomic weapons industry. An atomic power industry utilizing thorium breeders would be completely independent of the Government-owned processing plants presently in use as part of our atomic weapons manufacture, and in addition would utilize a raw material, thorium, which is unused at the present time.

It is our belief that a reactor program which would provide pilot-plant experience would require approximately 5 years and have a total cost of about \$10 million, including the cost of development. Following such a program it would then be proper to consider the construction of a full-scale plant which could reasonably be expected to compete with the cost of power from conventional plants at that time. To construct and place in operation such a full-scale plant would require probably another 5 years.

With this program, an operating full-scale plant, to serve as a proving ground for competitive atomic power, would be available to the Nation in about 10 years from now. When such a plant is economically successful, it is clear that further expansion of the electrical power industry would probably include an increasing number of atomic powerplants and these would have a justifiable place in the Nation's economy.

Proposals have been made that large central station atomic powerplants be built with today's engineering knowledge, and with some form of Government support to bear the technological risks. From a technical standpoint, such large scale plants are not the most expeditious path to economic power.

First, in order to insure their performance and protect the large investment involved—\$50 to \$100 million for a central-station-size plant—they will be designed with such conservatism as to entail much higher costs than might have been required if a pilot plant development had preceded them.

Second, engineering development and experimentation cannot be conducted effectively on full-scale production plants, both because of cost and because of interference with a production commitment.

Third, due to the cost of central station size plants, it is unlikely that any number would be built, even with Government support, until they become economically justified.

Thus, few of the many competing technical schemes for economic atomic power are likely to be tried on large-size plants.

What then is the proper course for the Nation to take?

First, the program should be in the hands of those in industry and government whose primary concern is atomic power plant development and manufacture, with, of course, the over-the-shoulder participation of the eventual operators.

Second, as the real market for central station-size atomic power plants is several years away, and their development is a national asset, Government support of a technical program leading toward their economic performance would be justified. Such support could be gradually removed as a real industry develops.

Third, the emphasis should be on small-scale pilot plants. Several of these should be built now in order to investigate the most promising technical approaches. At a probable rough cost of \$10 million, or less, each, a half dozen or more could be built for the cost of one central station size plant.

If dependable pilot-plant size units could be developed, there might be a small but real market for such plants in special purpose or high cost locations. The atomic power industry, as yet unborn, might be brought forth in this manner. When the technological development of atomic power plants results in economically competitive power from such plants, a sound basis for industrial atomic power will have been established.

Representative VAN ZANDT. Thank you, Dr. Starr.

How large is your laboratory in terms of people and dollars?

Dr. STARR. We have about 300 individuals, which includes engineers and technicians. Of these 300, roughly 150 are professional people. Of these 150, about 50 are Ph. D. level men.

Representative VAN ZANDT. What is the mission of your laboratory?

Dr. STARR. We have been a prime contractor of the Atomic Energy Commission for about 5 years now, working directly for the Division of Reactor Development. We have worked on various types of reactor problems, materials, reactor design, nuclear experimentation associated with reactors.

Representative VAN ZANDT. Is there any private money in this effort?

Dr. STARR. Yes. Our company has provided the facilities and installations required for this work. The experimental equipment and the payroll have been provided by the Government, by the Atomic Energy Commission.

Representative VAN ZANDT. Any questions?

Representative PRICE. Doctor, you have a very interesting statement. You have had considerable experience in the atomic energy program, have you not? Were you not originally at Oak Ridge?

Dr. STARR. Yes.

Representative PRICE. How much experience have you had?

Dr. STARR. I have been with the atomic energy program since 1942, originally with the Berkeley project, and then at the Clinton laboratories (now the Oak Ridge national laboratory) until the end of 1946.

Representative PRICE. I have been interested for some time in the offer of North American Aviation to build a power reactor for anyone who wanted one built. I think you even carried a full-page ad in the Wall Street Journal. I have been curious to know the background of that, how that transpired, how you could do that. Were you not a contractor for the AEC?

Dr. STARR. Yes; we were and still are a contractor for the AEC.

Representative PRICE. Did the development of this reactor result from that contract?

Dr. STARR. Yes; it did.

Representative PRICE. I am at a loss to understand how North American can offer that, then, as a private project to industry.

Dr. STARR. It was presumed at the time that this ad was published that anyone from private industry who would offer to supply funds for this type of work would make arrangements with the Atomic Energy Commission for the supply of fissionable material and for permission to build the plant.

Representative PRICE. Was this reactor, after you experimented on it for some time, eventually approved by the AEC?

Dr. STARR. I don't believe I understand the question.

Representative PRICE. Was it an approved project and did the AEC finally accept this as being a type of reactor that would lead to the development of industrial power?

Dr. STARR. The Division of Reactor Development reviewed this reactor design and it was approved by the Commission as a specific reactor project for the development of industrial power.

Representative PRICE. Somewhere along the line, I recall an objection to this design. Where did that come in?

Dr. STARR. I am aware of no rejection of this design. I believe there were some financial difficulties of a budgetary nature.

Representative PRICE. It seems to me that the National Security Council, or someone along the line, passed an adverse opinion on it.

Dr. STARR. I believe on the budgetary aspects of this, rather than on the technical aspect.

Representative PRICE. If a private industry accepted your offer, if they saw this ad in the Wall Street Journal and entered into a contract with you for the sum of \$10 million to build this reactor, what would they have?

Dr. STARR. They would have an experimental pilot plant on which the development, such as I have indicated here, could be carried through.

Representative PRICE. It seems to me there is a great difference of opinion among the scientists as to the feasibility of the pilot plant.

Dr. STARR. I believe this difference of opinion arises from the difference of objectives. One has to distinguish between an objective of demonstrating power today for reasons other than economic reasons, and finding what I call in my prepared statement the most expeditious path for technical development. If one wishes to demonstrate power today on full scale, then the question of economics becomes a secondary thing. You build a plant such as Dr. Zinn, for example, has recommended for such a purpose. The Government shares the cost or supports it in such a way as to make it economical to operate it, whether it be by the Government or a private utility.

The objective which I have outlined is a purely technical one, and that is how fast can the country develop, in the minimum amount of time and minimum amount of total cost, competitive economic power. It is my belief, and I think the belief of many people in the field, that the best way to do this is not by building full-scale plants, of which, as I indicated, the Nation might not be able to afford more than 1 or 2

or a few, but by putting this money into development of what I call pilot-plant-size machines.

Representative PRICE. The thing that puzzles me about the North American situation is this: The AEC entered into an experimental contract with North American. For what purpose?

Dr. STARR. To develop—

Representative PRICE. For whom?

Dr. STARR. For the Government.

Representative PRICE. On what basis, then, can North American advertise that it was available to anyone if they would put up \$10 million?

Dr. STARR. I believe our advertisement indicated it would have to be with the collaboration of the AEC.

Representative PRICE. I am just talking about this, seeking information. I was surprised when I saw the ad and wondered what it was all about. Did the AEC pass on the advertisement before it was run?

Dr. STARR. No. This was a responsibility of ours. They were aware of it, however.

I might point out that the position of our company is perhaps a little different from those of the previous two witnesses. We intend to become an equipment manufacturer in this field. We are happy to build this equipment for the Government or for private enterprise.

Representative PRICE. The point I am getting at, Doctor, is this: You ran this ad inviting industry to come in and you stated in the ad that you operated under contract with the AEC. To me, if I were in private industry, that would give me the idea that AEC said, "This is it. This is the pilot plant. This is the route to go."

Dr. STARR. That would be your interpretation of the ad.

Representative PRICE. I am just thinking out loud. That is my interpretation. I do not really know. I thought it was an unusual course.

Dr. STARR. The particular purpose of this course of action was to solicit private funds to assist in the development of this plant. It was our understanding from the statements made by the Commission and its representatives publicly that if such private funds were available, some means would be worked out for cooperating with such private funds for getting these plants built. The advertisement was run in that spirit: namely, to solicit private funds to assist in the development of this field.

We anticipated no difficulty with the AEC if such private funds became available, in working out suitable arrangements. I would not now anticipate such difficulties.

Representative VAN ZANDT. Have you had many responses to that ad?

Dr. STARR. We have had responses, but none of a nature which would indicate that private funds were available at this time to develop this field.

Representative VAN ZANDT. In any amount?

Dr. STARR. In any amount.

Representative PRICE. That would have been my next question, but that is all right.

Representative HOLIFIELD. It is still a good question.

Representative VAN ZANDT. Dr. Starr, could you give us an exact figure of the amount of private funds you had in mind as necessary?

Dr. STARR. We asked for \$10 million. We got no takers, no offers. We got many people interested. Throughout the country there was response from chambers of commerce who were interested in the development of their areas. I think this was under some misapprehension that what atomic energy was going to bring them today was cheap power. We made the point specifically clear that what we were advertising and asking for was financial support for a development program.

Representative PRICE. If you had any takers, who could have built it legally?

Dr. STARR. Legally, if the Commission had granted permission to use the technical information which the Commission had available, it is our interpretation of the act that anyone could have built it. This is an experimental plant, not a production plant. The allocation of fissionable material would have to have been done by the Commission with license.

Representative PRICE. Did the Commission indicate it was ready to allocate fissionable material?

Dr. STARR. We felt perhaps this was a little bit like the chicken and the egg problem. We felt that if such private funds were available, a proposal would be made to the Commission, and in view of the Commission's public statements, we anticipated no difficulty in making arrangements. The Commission has indicated frequently that it was interested in having private cooperation in this field.

Representative VAN ZANDT. Dr. Starr, my congressional district in Pennsylvania has many bituminous coal mines. I would like to know whether the chambers of commerce in my congressional district made inquiry?

Dr. STARR. None that I am aware of.

Representative PRICE. One more question. If this pilot plant had succeeded, what then would be the cost of a full-scale model?

Dr. STARR. This question of the cost of a full-scale model is very uncertain, and I do not believe any of the cost estimates for full-scale machines are valid within roughly a factor of 50 to 100 percent. There is a very wide area of uncertainty.

One of our great reasons for feeling this way is that you have to make certain assumptions in estimating the cost of a full-scale plant and its operation. Some of these include, for example, the cost of the hardware that goes into the nuclear reactor. Some of it includes the cost of operation. One of the big operating costs is the face of the maintenance. There isn't large-scale experience on the maintenance of this type of plant. Very small changes in this can make a very large difference in the final cost of power.

It is our hope that out of the development program, which involves the pilot-plant operation, many of these questions would have been resolved by experience.

I can give you certain special examples which illustrate some of the problems. For example, if any part of the complex in the nuclear reactor becomes contaminated through failure of the equipment, the replacement of it is a rather expensive maintenance procedure and might involve long-term shutdowns. The effect of these shutdowns on the cost of the power, the manpower required, the special train-

ing of the crews—these are things which are still undetermined, and these are also things which are the subject of development.

This is true of every one of the industries that has been faced with this problem. You can build something which will work the first time, but if you want to make it replaceable or maintenancewise, you might change the design.

This you get through experience. As I pointed out in my prepared text, the other things you learn are how to improve the operating conditions. The purpose of a development program is very specific. We foresee exactly what it is we want to do, developmentwise. We know what the possibilities or probabilities are, but these are uncertain yet. We want to find out what can be done in the way of improving performance characteristics, what can be done in the way of decreasing construction costs.

Representative PRICE. Doctor, did you make any recommendation to the AEC that it build such a pilot plant?

Dr. STARR. Yes; we did. We recommended this specific pilot plant to the AEC. I believe it was favorably received. As I indicated before, I believe there were budgetary problems involved. We still hope this pilot plant, or some modification of it, will be approved by the Commission.

Representative PRICE. How much does the AEC have invested in this experiment at the present time?

Dr. STARR. There is roughly on the order of magnitude of \$10 million or so invested in our operation and the background of development. All of this has gone into building up this type of experiment.

Representative HOLIFIELD. Dr. Starr, I am very favorably impressed with the method by which you propose to enter this field of research and development. It makes sense to me to make 5 or 6 of these pilot-plant models of different types, selecting the best from the many designs of reactors.

In view of the fact that there is no immediate shortage of power or immediate urgency to develop power, it seems to me that the program that you have offered here makes sense; that we can make haste by going slowly, as far as the full-scale reactors are concerned.

Maybe it is my Scotch blood in me that makes me a little bit cautious, but from my knowledge of the lack of actual experience in these large-scale plants and the lack of actually having any of these plants in existence, it seems sensible to me that you take 5 or 6 of these models that have been decided upon, possibly by a convention of physicists, as being the most productive type and the ones that have the most potentiality, and then let the Government pay for a pilot-plant type of experimental reactor and operate them for a few years. Then it seems to me that private industry would be much better informed and more able to come in with a plan of proper type of amortization and the proper type of development.

I want to compliment you on your presentation, not because you come from California and are close to my district, but because I believe that it makes sense. I have been hoping someone would come forward with a plan like that.

That is all, Mr. Chairman.

Dr. STARR. I might say, Congressman, that I believe that it is very necessary to understand why the various technical groups propose or pick as their winning horse in this race, different designs. Very rare-

ly is it because of the performance of these machines today. It is always based upon the result of a development program which they see laid out before them. They see that there are certain technical hurdles which, if they overcome them, can end in economic power.

Our particular approach is the result of many years of study, and we believe this particular horse that we are trying to bet on is the one which is going to have the best payoff in the long run.

Nevertheless, there are other technical people who might have other ones. It is always on the result of a development picture, and without that technical development picture none of these things would be achieved.

Representative HOLIFIELD. Let me ask you, has the AEC similar research and development such as yours? Are there other groups doing approximately the same type of work on reactors?

Dr. STARR. Other than the National Laboratories, I am not aware of any. I think we are in a peculiar position in this respect. There are, of course, the General Electric Co. and the Westinghouse Co., who are building for the military service.

Representative HOLIFIELD. But they are building a special type.

Dr. STARR. Yes.

Representative HOLIFIELD. In your research and development, have you tested or considered many different types of reactors before you came to this particular type?

Dr. STARR. We have considered many types.

Representative HOLIFIELD. How many types have you considered seriously?

Dr. STARR. We have considered actually a very large number. There are variations, I might point out, to every one of the major types. We have considered several dozen of these. They fall into certain classes.

We have also considered these in terms of a time scale. Those in the very far distant future have so many unknowns about them that there is a long program of development prior to even the pilot-plant stage. There are those where we feel they can be built today, but even with development they are not necessarily going to improve very much.

We have considered, we believe, most of the major types that have been recommended by the various groups working for the Commission and the various industrial groups. We have made our own economic analyses of these. We have looked at these in terms of a time scale.

Out of these we have picked this one as being (1) within a reasonable time scale and (2) having the greatest development potential.

Representative HOLIFIELD. Is this a dual-purpose type of reactor, or single purpose?

Dr. STARR. Single purpose. We believe, with our other AEC laboratories on this, that the way to get industrial economic power is to build plants for it, and not multipurpose plants. It is very difficult, if not impossible, to achieve multiple objectives with one plant.

Representative HOLIFIELD. With economy?

Dr. STARR. With economy.

Representative HOLIFIELD. Did any of these study groups call on your plant and discuss this matter with you?

Dr. STARR. All the industrial study groups have had representatives

out at our plant, and have gone over this information freely, and many of them have considered it very seriously.

I might point out here again that the objectives have to be looked at somewhat differently. They are well aware of our developments, and also of our analyses and our points of view. Some of these industrial groups have taken the attitude that even though other plants might be obsolete eventually, because of this 5-year development period which we honestly feel our plant requires, they would prefer to have something which could be built today, even though it were uneconomical today.

Representative HOLIFIELD. Why should they want something built today without regard to its economic value?

Dr. STARR. Because their objective is to get full-scale experience today. Most of these proposals have involved Government support of one sort or another, so as to make the assimilation of these plants and their net worth an acceptable thing. This might be a perfectly permissible objective and perfectly satisfactory if the Nation wants it, if you want full-scale plants built now, if you want demonstrated power.

Representative HOLIFIELD. If you are willing to pay for it with Government subsidy and with patent privileges on gadgetry and processes, it would be all right to go ahead.

Dr. STARR. I think if you want to put this field on a basis that is not Government-supported, what is going to have to be demonstrated is the competitive advantage of power from nuclear plants. Until such demonstration takes place, I believe Government support of one sort or another is going to be required.

If the Government wants full-scale plants built, it is going to have to support this.

My own feeling is simply that the Government should pay for the manufacture of knowledge, but should not subsidize the manufacture of power. We feel, as I indicated in my statement, that Government support in the manufacture of knowledge is a justified thing.

Representative JENKINS. I have been very much interested in your statement. You have confused me. As I said before, I am the youngest member of this committee, and I am not familiar with a lot of things you talk about.

I get the impression from your testimony, it implies to me, at least, that you look upon this manufacture of atomic energy as a big, gigantic thing which can be done by hardly anybody but the Government, and that when it is done it will be done on a big scale in large centers and distributed.

Do I gather correctly from your statement that your theory is that eventually, if it is carried out, we will have innumerable places manufacturing atomic energy.

Dr. STARR. Yes, Congressman. My feeling is that the field will grow of its own economic forces simply by what is going to happen in this country as time goes on. The cost of power from conventional fuels is going to go up. This has been pretty well agreed upon, I believe, by many people in the utility business. When this occurs and there are simultaneously economic nuclear plants, there is not going to be any lack of private capital to expand the power business on nuclear plants.

I don't believe there is any necessity for the Government—unless there are other reasons for doing this—I do not believe there is any necessity for the Government's artificially stimulating this power business. It will come of its own accord. What the Government can do and should do is to stimulate the development of these plants to the point where one can demonstrate to private utilities that these plants will produce economic power.

Representative JENKINS. Let us develop that a little further. Now, for instance, with the development of electricity there are not very many powerplants in the country, comparatively speaking. I suppose in the State of Ohio there probably are 300 or 500 places where they make electricity, not more than that.

So far, in the production of electricity apparently it never has seemed advisable for the little fellow to try to get into that game, because it is an expensive one.

I judge from your remarks that in the production of atomic energy, it is going to be more easily done and more cheaply done and consequently there will be more people engaged in it than there are in the production of electricity now.

Dr. STARR. Atomic energy is a very young field, and in my opinion it is going to be many years before it will be a big one, in industrial atomic power at least. In those years, I believe there will be ample opportunity for the aggressive organizations of the country to grow to the size necessary to participate in it.

We are very much in the state of what the automobile industry must have been in 1900. We are talking about experimental units. We hardly have a business yet. I think there is ample time for us to grow.

How many there will be in the field, I don't know. I think in this country, competition of this sort is good.

Representative JENKINS. I am not an expert on this at all, but it appears to me that we make electricity out of nothing; but when we come to make atomic power, we have to have something to make it out of.

Dr. STARR. We are going to have to have the raw materials. There is no question about that. I think here again, when the situation develops that there is a legitimate market or a genuine market economically for atomic powerplants, the question of the raw material availability will have been decided one way or another.

Representative JENKINS. That is all, Mr. Chairman.

Representative PRICE. What is your best recollection of the consideration which the National Security Council gave to the North American reactor?

Dr. STARR. We have no direct access to the deliberations of the National Security Council. I feel that either the Council or the Atomic Energy Commission could speak more authoritatively on that.

Representative PRICE. Do you feel this reactor would promote the construction of experimental reactors which appear to contribute substantially to the power-reactor art and constitute a useful contribution to the design of economic units?

Dr. STARR. The answer to that is "Yes."

Representative PRICE. I understand that is the grounds on which they rejected your reactor.

Dr. STARR. I am not in a position to say. I believe the grounds were other than that.

Representative PRICE. You feel, through all your study and experiment and work on this project, that this reactor would fulfill that requirement?

Dr. STARR. Yes.

Representative VAN ZANDT. Thank you, Dr. Starr.

Our next witness is Dr. Karl Cohen, vice president, Walter Kidde Nuclear Laboratories, Inc.

You are welcome here, Doctor. Please proceed with your statement.

STATEMENT OF KARL COHEN, VICE PRESIDENT, WALTER KIDDE NUCLEAR LABORATORIES, INC.

Dr. COHEN. I am vice president and a director of Walter Kidde Nuclear Laboratories, Inc., which was founded 15 months ago for the purpose of participating in the development of commercial nuclear power. I have been active in atomic energy matters during my entire professional career. I began working full-time in 1940 on what later became the Manhattan project, in the field of isotope separation. For the past 9 years I have been concerned principally with the industrial applications of nuclear power.

My scientific colleagues and I, who have been working together for about 5 years, and the Walter Kidde interests—they are probably best known to you as leading manufacturers of fire extinguishers and pneumatic aircraft equipment, and as a construction firm established for over 50 years—founded this new company because we were profoundly convinced that atomic energy can be made a commercial source of power, that there is a definite need for supplemental power sources in the United States as throughout the world, and the conviction that Congress would insist on the development of atomic power within the framework of the economic system which has made this the most powerful country in the world. We are presently engaged in research and development work, under contract from the AEC and other Government agencies, on various applications of atomic energy; principally the design of nuclear reactors.

As businesses go in atomic energy, we are a small business. The net worth of the Kidde industries with which we are associated is about \$10 million. The capital investment so far in the Walter Kidde Nuclear Laboratories has been \$300,000. The view of things from our vantage point is considerably different from that of the completely subsidized national laboratories, from that of the larger Atomic Energy contractors, or from that of the public utilities. It may even be a surprise to you, in an industry which has been afflicted since its very beginning with giantism, that we feel that there is a place, and indeed an indispensable place, for businesses in the atomic-energy field which at least start small.

There are three main reasons why we believe that new businesses, which will inevitably start small, have a significant role in the development of useful atomic power. The first consideration is that reactors which will make economic power will not, in fact cannot, be exorbitantly expensive. Even the most elementary economic studies show that atomic power will be uneconomic for large stationary plants if the reactors and associated auxiliary equipment cost more than about

\$200 per kilowatt of developed electrical power: the economically interesting range will be about \$100 per kilowatt.

I might interpose here, parenthetically, to make sure the basis for our figures coincides with those which have been presented before, that the figures just given refer only to the reactor and its auxiliary equipment. They do not include the estimates of the electrical generating equipment which have been in the figures which the other witnesses gave.

Representative HOLIFIELD. Or the chemical processing?

Dr. COHEN. Or the chemical processing. Or, for that matter, the fuel.

Representative HOLIFIELD. Yes.

Dr. COHEN. This means that the goal for a reactor which would furnish the energy for a 200,000-kilowatt powerplant, which is typical of best current practice, is \$20 million. That is the goal. One might expect that most progress would be made in the early stages of development of nuclear power by reactors producing smaller blocks of power; that is, units of less than 50,000 kilowatts, and consequently costing less than \$5 million. We are thus talking of sums of money for construction of reactors which could be raised by modest enterprises.

A question of no less importance than the cost of the reactor is the cost of the necessary development work, and of the research facilities within which the development work would be done. As the other witnesses have told you, the cost of the development work depends very strongly on whether we are satisfied to produce our first powerplants by relatively minor advances to present technology, or whether we set ourselves goals which cannot be reached without years of development. There is a current conception that we should try now to develop reactors to solve the world's power problem in the year 2,000. We therefore appear to be led, through consideration of the total power resources of the world, to consider the development of breeder reactors of an advanced type based on a technology which is yet to be developed.

However, in our view this is not the problem facing us at all. We are not now considering how to sustain a stationary power industry on uranium, but how to start one. There is no need for the nuclear power industry to solve its long-range supply problems until the industry begins to make some dent in the uranium supplies. An analogous situation would be to insist on the development of a successful coal hydrogenation process before using one drop of oil.

We believe on the contrary that we should establish a civilian nuclear power industry on the basis of a technology not too far different from what we now possess. We might require for this purpose an expenditure of \$2 million for development; this is again a sum of money which can be thought of without having recourse to the Federal Treasury.

We envisage the development of an atomic power industry by a series of advances to limited objectives. The first objective is to establish a small localized industry on a sound economic basis, without seeking to furnish all the electric power in the United States, or to solve the uranium supply problem for 100 years. Such an atomic power industry would have the incentive and the ability to lower its costs which National Laboratories could not be expected to have. As a

result of progressively lower costs there would be an extension of the area of application. Pressure on the nuclear fuel supplies would be created by this expansion and would be reflected in higher fuel prices. Higher prices would require greater fuel utilization. The problem of breeding would then be presented to the nuclear power industry by normal economic forces, as the problem becomes real, and as the industry achieves the economic stature to solve it.

To sum up this first point, a reasonable present goal should be to produce reactors which would cost less than \$5 million and would require less than \$2 million to develop. Neither of these objectives requires giant enterprises and both are apt to be accomplished more quickly by the competitive efforts of small enterprises.

A second reason why we believe that the development of commercial atomic power should be done by a multiplicity of businesses, large and small, rather than by a few large groups, is that there is an enormous diversity of possible reactor types. Reactors can be made out of a bewildering variety of materials. A reactor can use natural uranium, pure U-235, plutonium, U-233 which is made from thorium, or any mixture of these elements as fuel. The fuel may be a metal, oxide, salt, or alloy, may be fabricated in the form of pills, plates, powders, prisms, rods, or threads, or may be liquid. The reactor may contain graphite, or water, or heavy water, or beryllium, or a number of other compounds as moderators to slow down the neutrons; or it can be built without moderators at all. It will, in addition, contain jackets and structures made of any isotope of nearly 100 elements.

The heat can be removed with air, water, oil, liquid metals, or anything else imaginable. The core can be homogeneous or heterogeneous; it can be surrounded by a reflector, by a breeding blanket, by both or by neither; the variety of each of these adjuncts is as great as that of the core. The reactor core can be spherical, cylindrical, flat, divided, or shaped like a pair of water wings; and it can be as small as a football or as large as a six-room house. A reactor can be built like a fine watch and shielded with rare materials, or it can have no structure at all and be shielded with water or tamped earth. In addition, it may operate hot or cold, and at low or high pressures.

There is no programmatic way to determine which of this tremendous variety of reactors is best for any power application, since the missing ingredient which makes all the difference between a remote possibility and a practical solution is invention; and invention cannot be scheduled. We believe the solution for this problem is to match the diversity of reactor types with a diversity of independent reactor design teams.

To show the advantage of diversity in reactor designs, let me cite an example from our own experience. When the Westinghouse Corp. and the Navy were making a survey of reactor types to determine which would be the most suitable for the CVR—the powerplant for an aircraft carrier—the reactor type which they selected turned out to be one which had been advocated and developed over a period of 4 years, not by one of the national laboratories, but by our small group.

I do not bring this forward for the purpose of praising our own achievements, but rather to show that the number of reactor types is so great, and the intricacy of reactor design and reactor economics is such, that no one group can determine by orderly procedures, or by administrative decision, which is the most economical reactor. Many

designs must be made, many discarded, and many tried if we wish to progress to commercial atomic power. This is the way American industry has always progressed.

On this same ground of the diversity of reactor types, we are dubious of the benefits of a noneconomically motivated demonstration plant for atomic power, to be financed or underwritten by the Federal Government or some nonprofit foundation. A natural hazard of a demonstration plant is that the results are subject to different economic interpretations by different groups. A recent example is the Bureau of Mines' Demonstration Plant at Louisiana, Mo., for the production of gasoline by hydrogenation of coal. From the same data, the Bureau of Mines, Ebasco Services, Inc., and the National Petroleum Council deduced respectively 11, 28, and 41 cents a gallon as the price of synthetic gasoline. If we add to this confusion that one reactor type is apt to be very unrepresentative of another type, we see that the principal value of a nuclear-power demonstration plant will be psychological.

To recapitulate, our second point is that the diversity of reactor types calls for more reactor design teams; and we believe that independence of concept and originality of approach are best nurtured by independent organizations.

A third reason that we believe new businesses have an important function in the development of commercial atomic power is that their interest in atomic power is central and not collateral. In other words, success or failure to achieve competitive power makes a difference to a firm specializing in atomic energy. The most efficient way of developing new products or processes is the free-enterprise system, and free enterprise is based on incentive. New businesses have this incentive; and, consequently, they are the ones who can be expected to, and will, take calculated risks.

I have followed the testimony published recently by your committee under the title "Atomic Power and Private Enterprise," and I note the disappointment which members of this committee and the public seem to have experienced over the reluctance of public utilities or the large AEC contractors to volunteer important capital outlays for power reactors or power-reactor development. I appreciate the feeling in Congress that reopening atomic energy to private enterprise would not contribute to the public interest unless there were real prospects for private investment in atomic facilities. None of us would propose to reap private profits from public investments.

How can we stimulate the investment of private capital? The return on investment of a public-utility company is so regulated by law that it would be the same whether electricity were generated by fission of uranium or by burning peat moss. The utilities, as Mr. Joslin of Commonwealth Edison Co., Chicago, has pointed out, have no venture capital in the usual sense since they cannot derive additional profits to counterbalance additional risks. Is it reasonable to expect the public utilities to risk money in reactor development?

It is likewise understandable that established companies, which have heavy responsibilities to stockholders for continuing development of their existing lines of business, do not wish to divert their resources to less familiar fields. Most of the companies which are large AEC contractors expect minimal direct advantages from the development of atomic power. The main advantages would seem to

be indirect, as, for example, through an expansion of the general power-consumption rate. How can we reasonably expect them to take much risk to develop nuclear power when the main advantages to them would be only collateral, and when they can maintain a preferred position in the field by completely subsidized research?

But new businesses founded on atomic energy have the all-important economic motivation, and one can expect them to spearhead the movement of private funds into the development of atomic power. There are many instances in economic history where the effect of a small company starting the movement of capital had results which were out of proportion to the means employed. One may find recent examples in the development of radio and television. The automobile industry is another illustration. Thus, our third point is that the investment of private capital in atomic energy will be associated with the development of new businesses even more than through the expansion of already established enterprises.

It is at this point that we find ourselves disagreeing with the Atomic Energy Commission's program for the development of commercial atomic power. That is, as we understand it from published reports. The policy of the Atomic Energy Commission, based on its desire to take maximum advantage of existing industrial strength and managerial ability, and also on its desire to simplify its own administrative function, has been to concentrate the responsibility for its major programs on a few large contractors. As a result, the atomic-energy industry, although one of the largest dollarwise in the country, has not seen the development of new enterprises of any appreciable size.

I believe that this is unique in American history, for each of our principal industries, such as aircraft, automobile, oil, steel, aluminum, radio, rubber, chemicals, and so forth, has seen the rise of new companies specializing in their field. It would be, to say the least, unprecedented that civilian atomic power should be developed in its entirety as a byproduct of already established enterprises.

Yet, if Congress entrusts the prime responsibility for developing commercial atomic power to the AEC, it is inevitable that the Commission should follow its usual pattern of reliance on established companies, even though in this case urgent military necessity no longer justifies it. To make the matter a little more graphic, if it were 1903 and the AEC had to select firms to produce automobiles, it would choose 1 or 2 railroads and a carriage-manufacturing company, but it would never even consider Henry Ford.

We therefore feel that if Congress postpones granting a charter to private initiative new businesses will not be able to fulfill their traditional role as points of attraction for new capital, and the result will be relative stagnation.

I want to emphasize that I am not raising here the fundamentallyphony issue of large versus small business, but rather the more important distinction between new businesses, regardless of size, which concentrate on atomic energy, and established firms to whom atomic energy is a side issue. The question is whether progress can be made solely by the extension of established large businesses or whether it does not require the birth of new ones.

I believe that if one looks a little deeper it will be perceived that the Commission could not choose any different policy. What stand-

ards can a Federal agency use in choosing a contractor other than his past accomplishments? The obstacle is not the Commission; it is the Atomic Energy Act, which requires a Federal agency to develop a new industry. The Commission is doing as well as it can within the framework of the law.

To sum up, there are three reasons why we believe new businesses should pay a major part in the development of civilian atomic power. The first is that reactors are within the capability of small businesses. The second is that new businesses will bring diversity of technical approach. The third is that the American pattern for industrial development is the formation of new businesses, which provide venture capital. We therefore recommend a revision of the McMahon Act to encourage the growth of new businesses.

The McMahon Act affectively shuts out all private initiative, and within its limitations industrial participation consists of having selected industrial laboratories work out pieces of a master development plan established by the Commission. We believe that the clauses of the McMahon Act which restrict individual initiative are not necessary to fulfill the fundamental purposes of the act, and they are not consonant with the American way of doing things. We feel that commercial atomic power will always be 5 years away unless a way is found to bring in private enterprise on its own initiative.

We recommend that the act be amended with the following principles in mind:

- (1) The legitimate government and military objectives of the Atomic Energy Commission should be retained;
- (2) Broad participation of industry on its own initiative should be permitted; and
- (3) Changes should involve the least possible dislocation of the present atomic-energy program.

We believe these aims are not contradictory; the necessary controls on materials and knowledge can be enforced without Government monopoly or Government ownership. The specific changes that we suggest are written up in detail in the appendix to this statement, which I shall not read. However, I would like to summarize the suggested changes.

We propose to add a section, which logically should fit between the present sections 6 and 7, entitled "Civilian Applications of Atomic Energy." This section would authorize, under license by the Commission, the private ownership of reactors, processing facilities and fissionable materials for nonmilitary purposes. The section also defines standards and conditions for such licensing, so that basic policy is set by Congress and not by the Commission.

We likewise propose that section 7 (which is entitled "Utilization of Atomic Energy" be amended to conform with the new section. In particular section 7 (b), which requires a report to the President by the Commission on the social, political, economic, and international effects" on nonmilitary use of atomic energy, should be deleted. There is ample evidence from the studies which have been made that there will be no untoward dislocation of the American economy by the development of atomic power, and the clause as it now stands is a constant threat of excommunication to a civilian power industry.

Another way of looking at it is this: If this committee, as a result of its hearings, reports out legislation encouraging the development of

commercial atomic power, you will by this act have answered affirmatively all the questions which are left open by section 7 (b).

We also propose that section 11 on patents and inventions be amended to permit more nearly normal patent rights in the field of nonmilitary utilization of atomic energy. As a matter of procedure, we feel that it is desirable to permit patents to be filed on both military and nonmilitary uses. The Commission would be authorized to requisition or condemn any inventions in the fields of production of fissionable materials and weapons, and to acquire by purchase any patent in a nonmilitary field. Holders of all patents would be required to tender to the Commission a free license under such invention for all governmental purposes, and compulsory licensing of patents of broad application is provided for.

I think you will agree with me that it is desirable to have private capital invested in atomic facilities rather than that they should be a perpetual burden on the taxpayer. However, it is not realistic to expect private investment unless the investor has some protection against the Government giving the fruits of his venture, free of charge, to a competitor. We believe that to accomplish this aim it is necessary to revise the patent clauses.

Traditionally, patents are the means by which small companies can flourish in the shadow of their larger competitors. They are a stimulant to diversity. In the field of atomic energy, the patent problem seems to be clouded with the question of the title to the vast amount of research which has been done in Government laboratories or in totally subsidized laboratories. I do not see why this problem cannot be met very simply by observing that all this material is in the public domain, and no one can obtain patent rights.

Before concluding this testimony, I would like to anticipate a question and clarify a matter which was left hanging earlier. I stated then that it was desirable to open the field of commercial atomic power by the use of reactors based on present technology. I am sure that you will inquire whether such reactors would find economic use and hence support a civilian atomic energy industry. We believe that power can be produced by such reactors, in blocks of less than 50,000 kilowatts, at a price less than 1.5 cents per kilowatt-hour. We do not think that it takes much ingenuity to find places where there is a demand for power at this price, and we have good reason to expect that we will be able to finance such reactors without having recourse to newspaper advertising.

Representative VAN ZANDT. We will make a part of the record, Doctor, the remainder of your statement which includes a copy of the proposed bill.

(The material referred to follows:)

A. PROPOSED BILL

A BILL To amend the Act entitled "Atomic Energy Act of 1946," approved August 1, 1946

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. That a new section 6½ be added to such Act as follows:

"CIVILIAN APPLICATIONS OF ATOMIC ENERGY

"SEC. 6½. (a) AUTHORITY.—The Commission is authorized and directed to license any responsible person applying for such license to engage in research and development work in the uses of fissionable or radioactive materials for non-

military purposes and to produce, lease, and sell apparatus or devices for the employment of such materials for nonmilitary purposes, and to erect suitable plants to produce power from atomic energy and to use or sell such power, subject to State or Federal regulation of such sale.

(b) Licenses under this section shall be issued upon application. Such application shall set forth—

“(1) The nature of the operation or operations for which license is sought ;

“(2) The financial ability of the applicant to conduct such operation or operations ;

“(3) The kind and quantity of fissionable material to be used and the proposed source of supply thereof, whether such proposed source is the Commission or otherwise ;

“(4) The amount or rate of production, if any, of other fissionable materials in the operation and the proposed disposition of such materials, whether they are to be consumed in the operation, delivered to the Commission or otherwise.

“The application shall also contain :

“(5) The promise required by section 10 (5) (B) of this Act.

“(c) For the purposes of this section, security clearance may be granted under the regulations established by the Commission for the issuance of clearance, upon payment of a fee which shall be fixed from time to time by the Commission in amount sufficient to cover the cost of investigation and certification.

“(d) The Commission shall not deny a license to an applicant otherwise qualified, on the ground that the proposed operation may be useful for military as well as civilian purposes unless the military applications are of sufficient importance to warrant the continuation of the project under direct control of the Commission, in which case the Commission shall, in denying the license, tender to the applicant a contract to proceed with the project as a contractor of the Commission under the usual terms and conditions.

“(e) The Commission shall either grant or deny a license under this section within 90 days after the filing of the application therefor or the clearance of the applicant, whichever is later. (If the applicant is a corporation, the date of clearance of the president or chief operating officer shall be the date on which the 90-day period shall commence.)

“(f) If the Commission shall deny a license to an applicant under this section, it shall furnish the applicant prior to the termination of said 90-day period, with a copy of its findings of fact and its reasons for denying the license. The applicant may then apply to the United States District Court for the District of Columbia for a review of the Commission's decision and the court shall upon the basis of the evidence submitted to the Commission and any new evidence which may be admitted at the trial before it, either affirm the Commission's decision or order the issuance of the license applied for.

“(g) Any license granted under this section shall be without limitation as to time and shall be terminated only (1) Because of the completion or voluntary discontinuance of the project for which it was issued, or (2) For the wilful violation of applicable security provisions by the licensee. If the licensee is a corporation, the license shall not be terminated, but appropriate steps shall be taken against any individual or individuals responsible for the violation of security provisions.

“(h) No application for license under this section shall be granted for any operation outside the United States except upon the specific authorization of the President. Any application for such operation must, if the Commission finds it otherwise acceptable, be submitted to the President with the Commission's findings and recommendation within 120 days of the filing of the application, and the license shall be granted or denied forthwith, upon receipt of the President's decision and in accordance therewith.”

SEC. 2. That the following other amendments should be made to the Atomic Energy Act :

Section 4 (c) (1), line 6, insert “and 6½” after “section 3.” At end of (1) add “except when such production is by a licensee under section 6½.”

Section 4 (c) (3) line 3, insert “or under section 6½” after “(1) above.”

Section 5 (a) (2) line 3, add at end of line “except such as may be owned by licensees under section 6½.” Next to last line, insert “except licensees under section 6½” after “no person.”

Section 5 (a) (3), add “This section shall not apply to licensees under section 6½.”

Section 5 (a) (4), line 8, insert "section 6½" after "of" at beginning of line. Line 9, insert "other than a licensee under section 6½." Line 12, strike out "and" and insert (,) after "research" and add "and industrial" at end of line.

Section 5 (b) (5), second from last line, insert "or products of fission" after "materials."

Section 7 (a), 2d line, insert "or section 6½" after "6 (a)."

Section 7 (b), delete.

Section 7 (c), 16th line, add "except that licensees under section 6½ shall not be required to divulge any information which they deem to be patentable" after "as possible." Insert "except such as are issued under section 6½" after "license." Twenty-first line, insert after "growth of" and before "monopoly," the word "illegal." Twenty-second line, after "other" insert "unlawful." Twenty-ninth line, before "No license" insert "Except as provided in section 6½."

Section 7 (d), 2d line, after "material" insert "by the Commission."

SEC. 3. That paragraphs (1) and (2) of subsection (a) and the entire subsection (b) of section 11 of the act entitled "Atomic Energy Act of 1946" are repealed, and paragraph (3) of such subsection (a) is renumbered as paragraph (1) and subsections (c), (d), and (e) are renumbered as (b), (c), and (d), respectively.

SEC. 4. Subsection (d) of section 11 of such act is amended by striking from the first sentence the words ", or to take, requisition or condemn, and make just compensation for," and at the end of such first sentence to insert before the period the following: "; and to take, requisition, or condemn, and to make just compensation for, (1) any invention or discovery which is useful in the production of fissionable material or in the utilization of fissionable material or atomic energy for a military weapon or, (2) any patent or patent application covering any such invention or discovery."

SEC. 5. Subparagraph (B) of paragraph (2) of subsection (e) of section 11 of such act is amended by striking therefrom "subsections (a), (b), or" and inserting in lieu thereof "subsection (c)."

SEC. 6. Subparagraph (C) of paragraph (2) of subsection (e) of section 11 of such act is amended by striking the words "who is not entitled to compensation therefor under subsection (a) and who has complied with subsection (a) (3) above" and inserting in lieu thereof the words "or which utilizes or is essential in the utilization of fissionable material or atomic energy, who shall tender to the Commission a free license under such invention or discovery for all Governmental purposes,"

SEC. 7. Subparagraph (B) of paragraph (3) of subsection (e) of section 11 of such act is amended by striking therefrom "(a), (b), or (d)" following the word "subsection" and inserting in lieu thereof "(c)."

SEC. 8. Paragraph 4 of subsection (e) of section 11 of such act is amended by changing "Court of Appeals" in the first sentence to read "United States District Court"; by inserting in the third sentence, after the phrase "certified to it" the words "and upon any further evidence offered by any party"; by inserting in the fourth sentence, after the word "conclusive" and before the period, the words "except as affected by additional evidence presented to the Court"; by striking from the last sentence the words "final, subject, however, to review by the Supreme Court of the United States upon writ of certiorari on petition therefor under section 240 of the Judicial Code (U. S. C., title 28, sec. 347)" and inserting in lieu thereof the words "subject to review in accordance with Title 28, United States Code (1948 ed.) sections 1291, 1292, and 1294, upon appeal."

SEC. 9. Such act is further amended by adding a new section 22 as follows:

"SEC. 22. (a) Any patent heretofore revoked in whole or part under former sections 11 (a) (1), 11 (a) (2), or 11 (b) of this Act is hereby reinstated, effective as of August 1, 1946.

"(b) Any patent application on which a patent was denied by the U. S. Patent Office under former sections 11 (a) (1), 11 (a) (2), or 11 (b) of this Act is hereby reinstated and shall be deemed to have been continuously pending since its original filing date.

"(c) No application for patent on any invention or discovery for which a patent was previously barred under former sections 11 (a) (1), 11 (a) (2), or 11 (b) of this Act shall be denied solely because of Title 35, U. S. Code, sections 102 (b) or 102 (d), where such application is filed within one year from the date of enactment of the present section 7 of this Act."

B. PRESENT SECTION 11 AS CHANGED BY THE PROPOSED BILL

PATENTS AND INVENTIONS

SEC. 11. (a) PRODUCTION AND MILITARY UTILIZATION.

(1) Any person who has made or hereafter makes any invention or discovery useful in the production of fissionable material or in the utilization of fissionable material or atomic energy for a military weapon shall file with the Commission a report containing a complete description thereof, unless such invention or discovery is described in an application for a patent filed in the Patent Office by such person within the time required for the filing of such report. The report covering any such invention or discovery shall be filed on or before whichever of the following is the latest: (A) The sixtieth day after the date of enactment of this Act; (B) the sixtieth day after the completion of such invention or discovery; or (C) the sixtieth day after such person first discovers or first has reason to believe that such invention or discovery is useful in such production or utilization.

(b) NONMILITARY UTILIZATION.

(1) It shall be the duty of the Commission to declare any patent to be affected with the public interest if (A) the invention or discovery covered by the patent utilizes or is essential in the utilization of fissionable material or atomic energy; and (B) the licensing of such invention or discovery under this subsection is necessary to effectuate the policies and purposes of this Act.

(2) Whenever any patent has been declared, pursuant to paragraph (1) to be affected with the public interest—

(A) The Commission is hereby licensed to use the invention or discovery covered by such patent in performing any of its powers under this Act; and

(B) Any person to whom a license has been issued under section 7 is hereby licensed to use the invention or discovery covered by such patent to the extent such invention or discovery is used by him in carrying on the activities authorized by his license under section 7.

The owner of the patent shall be entitled to a reasonable royalty fee for any use of an invention or discovery licensed by this subsection. Such royalty fee may be agreed upon by such owner and the licensee, or in the absence of such agreement shall be determined by the Commission.

(3) No court shall have jurisdiction or power to stay, restrain, or otherwise enjoin the use of any invention or discovery by a licensee, to the extent that such use is licensed by paragraph (2) above, on the ground of infringement of any patent. If in any action for infringement against such licensee the court shall determine that the defendant is exercising such license, the measure of damages shall be the royalty fee determined pursuant to this section, together with such costs, interest, and reasonable attorney's fees as may be fixed by the court. If no royalty fee has been determined, the court shall stay the proceeding until the royalty fee is determined pursuant to this section. If any such licensee shall fail to pay such royalty fee, the patentee may bring an action in any court of competent jurisdiction for such royalty fee, together with such costs, interest, and reasonable attorney's fees as may be fixed by the court.

(c) ACQUISITION OF PATENTS.

The Commission is authorized to purchase (1) any invention or discovery which is useful in the production of fissionable material or in the utilization of fissionable material or atomic energy for a military weapon, or which utilizes or is essential in the utilization of fissionable material or atomic energy, or (2) any patent or patent application covering any such invention or discovery; and to take, requisition, or condemn, and to make just compensation for, (1) any invention or discovery which is useful in the production of fissionable material or in the utilization of fissionable material or atomic energy for a military weapon or (2) any patent or patent application covering any such invention or discovery. The Commissioner of Patents shall notify the Commission of all applications for patents heretofore or hereafter filed which in his opinion discloses such invention or discoveries and shall provide the Commission access to all such applications.

(d) COMPENSATION AWARDS AND ROYALTIES.

(1) PATENT COMPENSATION BOARD.—The Commission shall designate a Patent Compensation Board, consisting of two or more employees of the Commission, to consider applications under this subsection.

(2) ELIGIBILITY.

(A) Any owner of a patent licensed under subsection (b) (2) or any licensee thereunder may make application to the Commission for the determination of a reasonable royalty fee in accordance with such procedures as it by regulation may establish.

(B) Any person seeking to obtain the just compensation provided in subsection (c) shall make application therefor to the Commission in accordance with such procedures as it may by regulation establish.

(C) Any person making any invention or discovery useful in the production of fissionable material or in the utilization of fissionable material or atomic energy for a military weapon, or which utilizes or is essential in the utilization of fissionable material or atomic energy, who shall tender to the Commission a free license under such invention or discovery for all Governmental purposes, may make application to the Commission for, and the Commission may grant, an award.

(D) Any person making application under this subsection shall have the right to be represented by counsel.

(3) STANDARDS.

(A) In determining such reasonable royalty fee, the Commission shall take into consideration any defense, general or special, that might be pleaded by a defendant in an action for infringement, the extent to which, if any, such patent was developed through federally financed research, the degree of utility, novelty, and importance of the invention or discovery, and may consider the cost to the owner of the patent of developing such invention or discovery or acquiring such patent.

(B) In determining what constitutes just compensation under subsection (c) above, the Commission shall take into account the considerations set forth in paragraph (A) above, and the actual use of such invention or discovery, and may determine that such compensation be paid in periodic payments or in lump sum.

(C) In determining the amount of any award under paragraph (2) (C) of this subsection, the Commission shall take into account the considerations set forth in paragraph (A) above, and the actual use of such invention or discovery. Awards so made may be paid by the Commission in periodic payments or in a lump sum.

(4) *Judicial review.*—Any person aggrieved by any determination of the Commission of an award or of a reasonable royalty fee may obtain a review of such determination in the United States District Court for the District of Columbia by filing in such court, within 30 days after notice of such determination, a written petition praying that such determination be set aside. A copy of such petition shall be forthwith served upon the Commission and thereupon the Commission shall file with the court a certified transcript of the entire record in the proceeding, including the findings and conclusions upon which determination was based. Upon the filing of such transcript the court shall have exclusive jurisdiction upon the record certified to it and upon any further evidence offered by any party to affirm the determination in its entirety or set it aside and remand it to the Commission for further proceedings. The findings of the Commission as to the facts, if supported by substantial evidence, shall be conclusive except as affected by additional evidence presented to the court. The court's judgment shall be subject to review in accordance with title 28, United States Code (1948 edition), sections 1291, 1292, and 1294, upon appeal, by the Commission or any party to the court proceeding.

SEC. 22. (a) Any patent heretofore revoked in whole or part under former sections 11 (a) (1), 11 (a) (2), or 11 (b) of this act is hereby reinstated, effective as of August 1, 1946.

(b) Any patent application on which a patent was denied by the United States Patent Office under former sections 11 (a) (1), 11 (a) (2), or 11 (b) of this act is hereby reinstated and shall be deemed to have been continuously pending since its original filing date.

(c) No application for patent on any invention or discovery for which a patent was previously barred under former sections 11 (a) (1), 11 (a) (2), or 11 (b) of this act shall be denied solely because of title 35, United States Code, sections 102 (b) or 102 (d), where such application is filed within 1 year from the date of enactment of the present section 7 of this act.

C. SUMMARY OF THE GENERAL EFFECT OF THE VARIOUS SECTIONS AFFECTING PATENTS

Section 3 repeals the patent-revoking and patent-barring provisions of the present act.

Section 4 limits the power to acquire inventions or patents by taking, requisition, or condemnation, to those inventions or patents relating to production of fissionable material or to military weapons.

Sections 5 and 7 are editorial changes to make the present act consistent with section 1 of the proposed bill.

Section 6 modifies the award system, in view of the reinstatement of patent rights, so that awards are made for tenders of free license on any atomic-energy inventions. If no such awards are considered advisable, section 11 (e) (2) (C) of the present act should be repeated entirely.

Section 8 modifies the judicial-review provisions to permit introduction of new evidence before the United States district court as the reviewing court, and to permit regular appeals to the United States Court of Appeals.

Section 9 adds a new section 22 which reinstates revoked patents and patent applications actually filed but turned down because of the present act, and removes a possible disability in the filing of new applications where, during the period when such patents were prohibited, a prior publication, public use, or foreign patent grant occurred which might under present patent law (35 U. S. C. 102 (b) and (d)) require denial of the new application. The net effect of this provision is as nearly as possible to restore the situation to what it would have been had there been no revocation or barring of patents in the present act.

As an alternative to subsection (a) or proposed new section 22, all revoked patents might be reinstated as of the date of enactment of the proposed bill, and have their lives extended by the period during which they had been under revocation.

D. DISCUSSION OF PRESENT PATENT PROVISIONS OF THE ATOMIC ENERGY ACT AND THE RELATION THERETO OF THE SECTIONS OF THE PROPOSED BILL**1. REVOCATION OR BARRING OF PATENTS**

Patents for inventions or discoveries useful solely in the production of fissionable material or in the utilization of fissionable material or atomic energy for a military weapon or patent rights to the extent that such inventions or discoveries are used in the conduct of research or development activities in the fields of nuclear processes, the theory and production of atomic energy, utilization of fissionable and radioactive materials, and the protection of health during research and production activities, may not be granted after August 1, 1946, and any patent rights of this type in existence before August 1, 1946, were revoked, subject to just compensation.

These provisions should be eliminated, permitting patenting of all such inventions or discoveries, subject to the further provisions of the act. Furthermore, any prior revoked patents or applications for patent denied because of the existing act, should be reinstated, and impediments to new applications created by the present act should be removed. This is set forth in sections 3 and 9 of the proposed bill, creating a new section 22 for the act.

2. REPORTING OF MILITARY ATOMIC-ENERGY INVENTIONS

All inventions or discoveries useful in the production of fissionable materials or in the utilization of fissionable materials or atomic energy for military purposes must be reported promptly to the Commission.

This provision is left unchanged.

3. COMPULSORY LICENSING

The Commission has the duty to declare any patent to be affected with the public interest if the invention or discovery covered by the patent utilizes or is essential in the utilization of fissionable material or atomic energy and if the licensing of such invention or discovery is necessary to effectuate the policies and purposes of the act. When thus declared affected with the public interest, the Commission is automatically licensed to use the invention or discovery and any licensee of the Commission is also so licensed, the patent owner being entitled to a reasonable royalty fee to be agreed upon between the owner and the licensee or, in the absence of such an agreement, to be determined by the Commission, subject to court review as discussed below. Also, the patent owner

cannot secure an injunction to restrain the use of such invention or discovery by a licensee because of patent infringement. In any action for infringement he may recover only the royalty fee, plus costs, and reasonable attorney's fees.

These provisions, of course, amount to compulsory licensing in the entire field of atomic energy. However, when compared with the general statute (28 U. S. C. 1498), there is little difference in substance. In both cases, the Government and its contractors (or licensees) are not subject to injunction. Recovery is permitted in the one case of "reasonable compensation," and in the other of "reasonable royalty fee." In one case action lies in the Court of Claims, in the other the Commission determines the reasonable royalty, subject to court review; when revised as suggested below, such court review will amount to a new trial in the United States district court, considered more advantageous than action in the Court of Claims. The defenses to a Court of Claims action, and the factors to be taken into account in determining a reasonable royalty fee, are nearly the same. In view of these considerations, it is not believed expedient at this time to attempt to modify these provisions and they have been left unchanged.

4. ACQUISITION OF PATENTS

The Commission is authorized to purchase, or to take, requisition, or condemn, for just compensation, any invention or discovery, or any patent or patent application covering such invention or discovery, useful in the production of fissionable material or in the utilization of fissionable material or atomic energy for a military weapon, or which utilizes or is essential in the utilization for fissionable material or atomic energy.

It is believed that this power to forcibly acquire patents of inventions is too broad, since it extends beyond the production of fissionable material or the utilization of fissionable material or atomic energy for a military weapon, and includes any invention which utilizes atomic energy or fissionable material or is required for the utilization of atomic energy or fissionable material. It is recommended that this provision be modified to limit the authority to acquire patents or inventions by taking, requisition, or condemnation to those useful in the production of fissionable material or in the utilization of fissionable material or atomic energy for a military weapon, leaving broader uses of atomic energy subject to the general provisions of 28 United States Code, 1949, item E attached, or to the general condemnation procedures of rule 71A of the Federal Rules of Civil Procedure. These changes are made in section 4 of the proposed bill.

5. DETERMINATION OF JUST COMPENSATION, AWARDS, AND REASONABLE ROYALTY FEE

The Commission is also required to designate a Patent Compensation Board consisting of employees of the Commission to consider applications for just compensation, awards, and reasonable royalty fees. This Board is to determine the reasonable royalty fees for compulsorily licensed inventions, the just compensation for requisitioned or condemned inventions, and awards to persons making inventions or discoveries. Such awards are for persons making inventions or discoveries useful in the production of fissionable material or in the utilization of fissionable material or atomic energy for a military weapon, who are also not eligible for compensation for revocation of patent rights and who have properly reported to the Commission their inventions or discoveries.

The provisions with respect to determination of reasonable royalty fees and of just compensation are left unchanged, except as to court review, discussed below. With respect to the determination of awards, it is apparent that such awards are intended to be in lieu of the granting of patents and to stimulate military inventions in this field. In view of the changes suggested above, eliminating the revocation or the barring of patents, no awards of this type are necessary. However, it is suggested that such awards be continued, limited to those persons making inventions or discoveries of the instant type who shall tender to the Commission a free license on such invention or discovery. This would permit inventors voluntarily to tender inventions and would permit the Commission to make awards for such inventions, thereby stimulating the efforts of inventors in this field. This change is made in section 6 of the proposed bill.

6. JUDICIAL REVIEW

Any persons aggrieved by any determination of the Commission of an award or of a reasonable royalty fee may obtain a review in the Court of Appeals for

the District of Columbia, solely upon the record presented before the Commission, where the findings of the Commission as to the facts are deemed conclusive if supported by substantial evidence.

Just compensation for patents (or other property) taken or requisitioned are determined by the Commission; if unacceptable to the claimant, the Commission pays 50 percent of the amount determined, and the claimant may sue in the court of claims (or the United States district court if for less than \$10,000) to recover the balance of proper just compensation. In condemnation cases, rule 71A of the Federal Rules of Civil Procedure applies; while its relation to the Atomic Energy Act is not spelled out, it is believed that the Commission would still find the amount of compensation in such cases.

It is suggested that the mode of review as to awards or reasonable royalty fee be modified to permit introduction of further evidence by either party. Since the court of appeals is not a trial court, it is further suggested that the first reviewing court be the United States District Court for the District of Columbia, subject to ordinary appeal. This change is set out in section 8 of the proposed bill.

ITEM E

SEC. 1498. PATENT CASES.

Whenever an invention described in and covered by a patent of the United States is used or manufactured by or for the United States without license of the owner thereof or lawful right to use or manufacture the same, the owner's remedy shall be by action against the United States in the court of claims for the recovery of his reasonable and entire compensation for such use and manufacture.

For the purposes of this section, the use or manufacture of an invention described in and covered by a patent of the United States by a contractor, a subcontractor, or any person, firm, or corporation for the Government and with the authorization or consent of the Government, shall be construed as use or manufacture for the United States.

The court shall not award compensation under this section if the claim is based on the use or manufacture by or for the United States of any article owned, leased, used by, or in the possession of the United States prior to July 1, 1918.

This section shall not confer a right of action on any patentee who when he makes such a claim, is in the employment or service of the United States, or any assignee of such patentee, and shall not apply to any device discovered or invented by an employee during the time of such employment or service (as amended October 31, 1951 (ch. 655, sec. 50 (c), 65 Stat. 727)).

Representative VAN ZANDT. Will you please describe your firm in terms of its age and number of employees and its major activities?

Dr. COHEN. This firm is 15 months old. It has 40 technical employees. Our major activities: About one-third is for the Atomic Energy Commission on various reactor development projects. There is possibly a third for the Army Chemical Corps in a field related to atomic energy. There is some work on an aircraft subcontract, and some private work.

Representative VAN ZANDT. To what extent does your firm depend upon financial assistance from the Atomic Energy Commission, direct or indirect?

Dr. COHEN. Our contract work is about one-third from the AEC. I don't think it is fair to say that we depend upon them at all. They have no obligations to support us at all.

Representative VAN ZANDT. Any questions?

Representative HOLIFIELD. The rest of your contracts are with the Government, also, in the military field, you say, or most of them?

Dr. COHEN. Most of them, yes.

Representative HOLIFIELD. Most of your work at the present time is dependent upon Government contracts, that is, most of your people are engaged on Government contracts?

Dr. COHEN. Yes; that is right.

Representative HOLIFIELD. Is this capital investment a paid-in capital investment of \$300,000?

Dr. COHEN. Yes, sir.

That is, \$250,000 has already been paid in and the balance has been subscribed and is callable at our discretion.

Representative HOLIFIELD. I notice that you have a proposed bill, and then I believe a comment or summary of the general effect of the various sections of the act affecting patents. I see you have gone rather thoroughly into the patent problem in your summary.

Dr. COHEN. It interests us.

Representative HOLIFIELD. I want to compliment you on presenting to us a definite statement here which shows a great deal of thought, particularly on the bill, without commenting on the merits of the bill one way or another.

I realize it is a very complicated subject, and I want to compliment you on the study which you have apparently given to this.

At some future time, Mr. Chairman, after we have had a chance to study more thoroughly the bill and his summary and his statement, it might be desirable to call this gentleman back and question him further.

At this time, it being as late as it is, I will refrain from asking questions.

Representative VAN ZANDT. Thank you, Dr. Cohen. We look forward to your return so we can question you further on your remarks.

Dr. COHEN. Although I do not know that this is true, I believe the president of our company is scheduled for a hearing by this committee, and possibly you might take that opportunity to ask questions on this statement then.

Representative VAN ZANDT. Thank you very much.

Dr. COHEN. Thank you, Mr. Chairman.

Representative VAN ZANDT. Our next witness is Mr. John Menke, president of Nuclear Development Associates, Inc., a wholly privately owned corporation engaged in both AEC and privately financed work.

We are glad to have you with us today, Mr. Menke. You may proceed with your statement.

STATEMENT OF JOHN R. MENKE, PRESIDENT, NUCLEAR DEVELOPMENT ASSOCIATES, INC., WHITE PLAINS, N. Y.

Mr. MENKE. Mr. Chairman and members of the Joint Committee on Atomic Energy, I am honored by your invitation, and I appreciate the opportunity to be heard in this high, democratic process.

I first became associated in the nuclear field with Dr. John Dunning at Columbia University in January 1942, and have continued in it since that time. I am a professional engineer licensed in New York State. I have served apprenticeships under Dr. Zinn and Dr. Weinberg here, to both of whom, among many others in the field, I am very much indebted.

I have been president since its founding in 1948 of Nuclear Development Associates, Inc., of White Plains, N. Y., a research and engineering company which we call NDA. NDA has been engaged since 1948 in nuclear reactor design for the Atomic Energy Commission, the Air

Force, the Navy, and private enterprises. Since mid-1951, it has served the Dow-Detroit Edison group as nuclear engineers.

I am an advocate of changing the present law now and would support the Atomic Energy Commission statement of policy that economic competitive nuclear power is a goal of national importance. In the large, I would accept their recommendations for changes in the law. Specifically, under 4b of the statement, I would add the words "source or" in front of "fissionable materials." This meaning may already be implied.

With respect to patents on new developments under 4c of the statement, I would recommend that the law be modified to restrict only rights to patents for weapons and the production of weapons. Patents are a useful form of incentive, just as profits are, and without them American progress would suffer. A serious patent problem that needs recognition and discussion is the formidable patent position achieved with public funds and now held by the Atomic Energy Commission for the Government. Today the Commission forwards public policy and growth in the industry by granting royalty-free unclassified licenses to all who request, but what policy might a different Atomic Energy Commission administration follow?

Generally, I believe that the best method to permit buying, owning, and selling facilities and materials would be licenses rather than individually negotiated contracts. Uniform licensing conditions should be prescribed by public hearing and law—for example, the Administrative Procedures Act of 1946.

But the form of the law is not well within the competence of this engineer. Let me speak of the goals and the substance which we should seek. What is the shape of the world which the law should try to create? I believe that the law should strive for a dual result: The first part, a strong and substantive civilian Atomic Energy Commission; and the second, a large and vigorous civilian nuclear power industry.

In very broad strokes the Atomic Energy Commission should continue to have the major and satisfying responsibilities of:

1. An arsenal providing for a safe minimum production of source and fissionable materials for weapons and all of the manufacture of weapons themselves.

2. A strong system of national laboratories—not unlike the National Advisory Committee for Aeronautics, NACA—responsible for a sufficient measure of technical excellence and advancement.

3. A supervisory and regulatory body at least responsible for security and accountability problems and, with the States, for health and safety, too.

This last is a large area to which the Commission must grow. Clearly, I do not mean this brief list of responsibilities to be complete, but only roughly descriptive of the present day.

To this existing world we should strive to add a strong competitive civilian nuclear power industry. It should have a production capability for fissionable materials which will be eventually many times, let us say 10 times, greater than that of the Government arsenal today. I believe in dual-purpose plants. This large civilian production capability would transform the present Atomic Energy Commission production goal from an upper limit to the minimum which it really is if the country's defense objectives depend upon it. This large

civilian production capability would eliminate the nagging worry, whether or not anyone can really predict a war's demands for fissionable material for nuclear weapons and nuclear-powered ships and planes and remote bases and all the things that we haven't thought of yet.

The new industry would provide a material strength entirely consistent with and analogous to the many reserve strengths which free enterprises provide for our country today, "standby" defense strengths which cost the Treasury nothing in peacetime, but are taxpaying, and which are so priceless in wartime.

It would also provide that other strength, the insurance against total error, which comes from multiple centers of decision and from incentives, different in kind. It would provide physical dispersal of plant and would multiply the number of people competent in the field. All of these advantages would combine to forward our defenses and to improve our standard of living. In this "cold war" world, I can't emphasize that too much.

The central problem before this joint committee is: How to start the ball rolling toward this goal. In a small way it is already started. And what a start. Five similarly constituted groups studied the same information and came up with five wholly different technical and different legal plans. They run the gamut from conservative, presently feasible designs to aggressive development and large risk-taking plans. I remember the recommendation made by this committee—to be bold. This is a more valuable result even than could have been hoped for and truly protects the public interest. I believe that the changes envisioned in the law and those outlined above will permit this good start to grow and flourish. The interest exists now and the law needs to be changed soon.

I do not believe that Government subsidy—other than that provided by vigorous, healthy national laboratories—is best for growth. If Government is to build prototypes, then I believe that the kinds to be built and the reasons therefor should be very carefully considered, and the advice and recommendations of the national laboratories sought. The national prestige does require speed and application and accomplishment, but I doubt that it is really served by a gesture.

If any member fears that only big companies can get into this field, he may be interested in the experiences of NDA.

I deeply appreciate this opportunity and thank you.

Representative VAN ZANDT. Thank you very much Mr. Menke.

Would you describe your firm, the number of employees, and so forth?

Mr. MENKE. Yes, I would be very glad to.

Our firm has currently about 75 employees. It has been in business since 1948. It is wholly independent. It has no capital derived from any outside source or company at all.

Representative VAN ZANDT. What is the mission of your firm?

Mr. MENKE. We are in the atomic energy business. If this business does not flourish, we won't eat. We have staked our professional and economic futures on its growth and success.

Representative VAN ZANDT. Do you have any contracts with the AEC?

Mr. MENKE. Yes; we do have contracts with the AEC, and have had them on and off since 1948.

Representative VAN ZANDT. Are you wholly dependent on them?

Mr. MENKE. No. Our AEC contracts are a small fraction of our total business.

Representative HOLIFIELD. Do you have other contracts with military departments?

Mr. MENKE. Yes; we have. As a matter of fact, part of our contracts will soon change. We are working for the Air Forces on the development of a nuclear-powered aircraft, and that will be sponsored in the near future, I believe, by the AEC.

Representative HOLIFIELD. What is the total percentage of your Government contracts in relation to your private business?

Mr. MENKE. Approximately 75 percent of our business is Government, and 25 percent is private.

Representative HOLIFIELD. What is the capitalization of your company?

Mr. MENKE. I think you will be very much interested in that. The original capitalization of our company is \$2,000. We are doing business nearing a million dollars this year. The current capitalization of the business is very largely composed of retained earnings.

Representative HOLIFIELD. You own your own plant and equipment, I suppose.

Mr. MENKE. Yes, sir. With very minor exceptions we own every piece of equipment in our plant.

Representative HOLIFIELD. You believe that small business can get into this business and flourish?

Mr. MENKE. That is my belief.

Representative HOLIFIELD. Have you had pleasant relations with the Atomic Energy Commission? Have they been cooperative in working with you?

Mr. MENKE. Yes.

Representative HOLIFIELD. By that I mean, they have not been dictatorial nor tried to make you achieve a result in any particular way. They have left it up to your engineers and your scientists in their ingenuity to accomplish the results which they wanted?

Mr. MENKE. Yes, sir.

Representative HOLIFIELD. I believe that is all, Mr. Chairman.

Representative VAN ZANDT. Thank you very much, Mr. Menke.

The hearings will now stand adjourned. The Wednesday meeting has been canceled because of the press of other business, and also to meet the convenience of our witnesses. The next meeting is scheduled for 2 o'clock Thursday, July 9, when the witnesses will be:

Mr. McCune, general manager of the nucleonics division of General Electric;

Mr. Price, president of Westinghouse;

A representative of American Machine & Foundry; and

Dr. Eugene Wigner, a reactor specialist.

(Whereupon, at 5:20 p. m., Monday, July 6, 1953, a recess was taken until 2 p. m., Thursday, July 9, 1953.)

ATOMIC POWER DEVELOPMENT AND PRIVATE ENTERPRISE

THURSDAY, JULY 9, 1953

CONGRESS OF THE UNITED STATES,
JOINT COMMITTEE ON ATOMIC ENERGY,
Washington, D. C.

The joint committee met at 2 p. m., pursuant to recess, in room 318 of the Senate Office Building, Representative W. Sterling Cole (chairman) presiding.

Present: Representatives Cole, Van Zandt, Patterson, Holifield, and Price; and Senator Pastore.

Professional staff members present: Corbin C. Allardice, executive directors; and Francis P. Cotter, Walter A. Hamilton, J. Kenneth Mansfield, and George Norris, Jr., of the professional staff of the joint committee.

Chairman COLE. The meeting will come to order.

The meeting today is a continuation of the committee's hearings on the subject of the power policy of the Atomic Energy Commission. Today we are to have as witnesses, representatives of two corporations which manufacture equipment used or contemplated to be used in the power program, and corporations who are prime contractors of the Atomic Energy Commission in some of its operations.

We will also hear from one scientific expert on some of the problems incident to a definition of Federal policy on atomic power development.

The first witnesses are representatives of the Westinghouse Electric Co., the president, Mr. Gwilym A. Price, and Mr. Weaver, general manager of the Westinghouse Atomic Power Division.

Westinghouse is one of the two largest electric equipment manufacturers in the United States. It was asked in 1949 to undertake the detailed design, development, construction, and operation of the first atomic-powered submarine. To achieve this objective, a laboratory was built at Pittsburgh at Government investment of several tens of millions of dollars. A land-based prototype is now operating at the Idaho testing station, and construction of the first shipboard unit is under way. The total Westinghouse submarine program will cost about \$150 million, including the U. S. S. *Nautilus*, which is being built by General Dynamics Corp.

Last year Westinghouse was also assigned the job of designing and preparing to construct an atomic-power plant prototype for large naval ship propulsion. This project has recently been dropped by the Navy, and the data involved are expected to be incorporated in whatever program evolves from the newly authorized atomic-power plant project for advancement of both civilian power and ship propulsion technology.

Mr. Price, I am not aware of just how or in what order you and Mr. Weaver wish to appear; whether you, Mr. Price, will speak for two corporations or whether you will share it with Mr. Weaver. We will be glad to hear from either or both of you.

STATEMENTS OF GWILYM A. PRICE, PRESIDENT, AND CHARLES H. WEAVER, MANAGER, ATOMIC POWER DIVISION, WESTINGHOUSE ELECTRIC CORP.

Mr. PRICE. Mr. Chairman and gentlemen of the committee, Mr. Weaver and I appreciate very much your invitation to appear before you today.

It was about 4½ years ago when Westinghouse was assigned, with Argonne Laboratory at that time, the study contract for the STR or submarine thermal reactor program. At that time we had to decide who we would put in charge of the project.

The ideal person, if we could have found him in one man, was a combination of scientist, engineer, administrator, and businessman, with a great deal of aggressiveness and imagination. We combed the company over, and we selected for this job a man who was not a great scientist, who was not then engaged in any basic engineering in the company. We selected a young man out of our sales department, because we thought he had the qualities of aggressiveness, drive and administration ability that we wanted to head this project. His name is Mr. C. H. Weaver, and for the last 4½ years he has been living and sleeping with this problem.

All of my own experience until 1943 has been in the law and in banking. I have no technical training. My knowledge of this subject is broad enough and basic enough, I believe, to enable me to make the basic decisions which the corporation is called upon from time to time to make, but because he has lived with this problem for 4½ years, I am going to ask Mr. Weaver, who is the head of our Atomic Power Division, to make the statement to you.

Chairman COLE. Very well. We are glad to see you and to hear from you, Mr. Weaver.

Mr. WEAVER. Thank you, Mr. Chairman.

Mr. Chairman and members of the committee, the management of Westinghouse is most conscious of the vital part which the Congress, the Atomic Energy Commission, the Department of the Navy, and many subcontracting firms have played in carrying out the assignment to construct an atomic-power plant for a submarine. We all may feel pride that the land-based prototype model went critical last March 31 at the Idaho test station and that, consequently, the world's first atomic-power plant designed to produce power beyond laboratory quantities is today a reality. As you know, this success means that the same Government-industry team can press ahead with the atomic-power plant which will actually be installed in the submarine *Nautilus* now under construction.

No such pioneering endeavor in the atomic field could have gone forward unless our Nation met two requirements. One was initiative from the highest levels of policy, and this your committee has been at the forefront in supplying. The other requirement was, of course, teamwork; and I would cite as remarkable the collaboration between

men in naval uniform and men in the laboratory, and between men on the Government payroll and men on industrial payrolls.

Our Westinghouse Atomic Power Division feels in close contact with the joint committee, partly through your members who have personally inspected the plants we operate and even more through the sense of direction and urgency you have communicated to us from Washington. But this afternoon is the first occasion when any representative of our company has testified before the committee. In behalf of Westinghouse we want to thank you for inviting our comment on the hard and complex problems you are now exploring.

Our main company business is making and marketing equipment, much of it for use in the electric-utility industry. Turbines, transformers, generators, switchgear, and similar apparatus have for decades formed a central part of our production. Seldom, except as part of its production facilities, does Westinghouse itself use such equipment. Our business interest lies in manufacturing and selling it at a profit to customers who take over ownership and operation.

Before the outbreak of World War II some of the original basic nuclear fission research, upon which the Government later drew, was accomplished by Westinghouse at company expense. We built one of the first particle accelerators. Thereafter, we performed work for the Manhattan Engineer District. From the early days we have felt strongly that atomic energy would become in time a great source of power; and the modern world has an almost insatiable power hunger.

It was natural for us, therefore, to be interested in possibilities of manufacturing and selling equipment that would harness this new resource to power production—whether our customers might wish the power to turn a ship's propeller or to drive a dynamo making electricity. When, in late 1948, the Atomic Energy Commission asked us to build a power plant prototype for the first atomic submarine, such a task seemed a logical extension of our private activities in the past; and we accepted the responsibility. In doing so, we were calling upon a reservoir of knowledge and trained people built over many years at our own expense. From the company's viewpoint, and strictly in business terms, the Government was our customer; and on its order we were developing, building, and selling power equipment, just as has been our service for the Government and utility companies since the turn of the century.

It seems clear that in the early postwar period the Government was the only customer financially able to call upon us for this atomic powerplant; and Government itself acted under the spur of military need. No private-utility management responsible to its directors and stockholders could even have considered asking Westinghouse to build and sell a similar powerplant for industrial purposes, in view of the technical unknowns and unpredictable cost. The existence of the Government as a specific customer, despite these deterrents, has, of course, led toward advances that promise to conquer the unknowns and reduce the cost. When atomic plants for industry are built, our Nation will see another example of the oft-repeated application of a military development to civilian use. Just as the 300-mile-per-hour commercial passenger planes owes very much to the bomber of a few years ago, so the commercial atomic plant of the future will owe much to the naval atomic plants of today.

This illustration, as a matter of fact, leads me to raise the question of whether too much stress may not have been placed upon the unique aspects of atomic power and too little upon its similarity to other developments. Only a government-industry partnership of much the same kind that produced the atomic submarine prototype could have carried radar and electronics to the levels of progress attained for military purposes during the late war; and yet such progress lies behind the television sets which industry, now without the assistance of government, is bringing to millions of American homes. I do not know the private firm, or combination of private firms, that could afford jet engine research on the scale which industry and government are today jointly conducting for national defense; but I have little doubt that, given time, industry alone will furnish jet engines to the commercial airlines tailored to meet their particular requirements. In appraising atomic power we cannot help but remember the past and ask ourselves whether peacetime uses of the atom depart as radically from earlier patterns as many have presumed.

We expect the fundamental business interest of Westinghouse to continue the same as it was when we started the atomic submarine job and as it has been through the years. We will hope to manufacture and market high-grade power equipment, regardless of whether it utilizes atomic energy or conventional fuel, or both, and regardless of whether the customer is the Government, a utility, a manufacturer, or any other organization.

Thus, as potential sellers of atomic machinery, our concern with possible changes in the law to permit private ownership of such equipment is less direct and primary than that of purchasers and users. In other words, a utility employing a nuclear reactor as a heat source for generating electricity over a 20-year or 30-year period would have a higher stake than ourselves in the question of control over this reactor, even though Westinghouse had originally constructed and sold it. On the ownership and control question, we would, therefore, suggest that your committee give special weight to the legislative views of companies, such as utilities, who will be the purchasers of atomic equipment. They are the ones who will have to operate the equipment and make a profit from its use, while living with such Government regulations as the Congress may deem to be necessary.

Mr. Chairman, in your letters inviting representatives of Westinghouse to appear before the committee, you express the thought that it may be possible to bring out some of the more practical problems confronting equipment designers and manufacturers in the field of atomic power and to benefit from some of our experience as designers and operators of major reactor complexes. There is indeed one overriding practical problem which we should like to emphasize—the sheer, stubborn, time-consuming difficulty of designing and engineering in detail and putting together any reactor that will do what one wants it to do.

Where the scientist leaves off and the engineer takes up, and especially where their work overlaps, is the point at which problems become intense. Except for the genius of the scientist, there would, of course, be no such thing as a reactor. But this very fact has tended to divert from the painful, creative role of the engineer who must, in one sense, bring a scientist's dream down to earth and make it into a real structure of fuel elements, control mechanisms, moderator,

shielding, pipes, pumps, pressure vessel, heat exchangers, and all the specially adapted gear that comprise an atomic powerplant. Building such a plant on paper is one thing. Building it in fact is a very different matter. As the only company that has actually built a large atomic powerplant designed to produce substantial quantities of useful power, we must state that developing and constructing a still larger and longer-lived advance-design reactor would remain a most arduous task, even given the type of complex facilities and going organization which have been built up over the past 41½ years. And certainly we are far from being able to offer a firm price bid on such a reactor.

Achievement of STR Mark I—that is, the submarine thermal reactor prototype—strained the capabilities of Westinghouse. In fact, it was the toughest job we ever took on—harder by far than jet engine research, for example—and we could not even have attempted to do it all by ourselves. The contribution of subcontractors, to whom we farmed out about two-thirds of the work as measured in dollars, was invaluable. We have concentrated our company effort upon the hardest phase of the job, which was the reactor core; and toward this end we weakened the technical staffs in our bread-and-butter lines of business through the transfer of about 500 employees to the Atomic Power Division. Some 200 of these are key men who fill 75 percent of the division's supervisory positions and constitute 46 percent of the division's engineers and scientists. From the beginning, our atomic assignment has had first call upon all company personnel, and its problems have regularly received priority attention from top management. Considering the task force of experts trained over the years that we could and did assemble from Westinghouse ranks, I think it fair to say that if any company had credentials to do this job cheaply and effectively for the Government, it was our own.

Yet we went through a series of reactor fuel element troubles. We were forced to learn how to manufacture unprecedented quantities of the metal zirconium, and in unprecedented purity, because the unforeseen requirements of our reactor gave us no choice. We were forced to develop an entirely new type of pump, because leakage of radioactive liquids into the hull of a submarine would be intolerable and because only a radical pump development could meet necessary standards. We encountered other roadblocks and detours, and we suspect these are inherent in the still primitive reactor art.

Actual construction of the STR plant was easy and relatively cheap, measured alongside the research and development necessary to be done first. Nobody had ever tried to cover ground like this before. For several years we faced the nightmare of becoming committed to a technical concept which, with experience and hindsight, would turn out to be a multimillion-dollar mistake; and I do not mind saying we had more than one narrow shave. Before we were ready to break ground at Arco, Idaho, and start building, the overall research and development budget had reached about twice the size of the construction budget.

However, in spite of all the obstacles we reconnoitered and went around, we are told that our reactor project has progressed more smoothly than any other in the postwar period. If this is so, we would dislike taking part in one which did not go smoothly.

Two very important tools provided us by the Government have been most significant factors in the satisfactory progress of the submarine thermal reactor project and it appears pertinent to recognize them at this time. One is the definite goal we were given—a reactor to build instead of studies. And the goal was definite as to time also, with a working schedule having been established early in 1949. The other important tool has been the centralization of Government contact and control in Washington in the Commission's Naval Reactors Branch and the resultant direct, effective, and prompt action which has permitted us to concentrate on our technical and production problems. Such a setup appears to Westinghouse to be essential to the efficiency and effectiveness of our development program for the Government.

We hope no one will underestimate the time, skilled manpower, and money needed to overcome the difficulties of developing and building a large power reactor. Such a miscalculation could produce a blow to hope and progress.

I have borne down heavily upon this warning because, in the interests of balanced perspective, we think it a proper introduction to telling you our own belief in the promising future of atomic power. We are in fact convinced of that future. Our experience makes us sharply aware of the mass of problems, but still firmly optimistic. The constructive atomic power uses that everyone wants can indeed be realized—and they can be realized fastest in full knowledge that success is far from easy.

Guided by such an evaluation, Westinghouse recently reached a decision which, so far as we know, commits more private money to the future of atomic power than any other company has yet determined to risk. I speak of the new Westinghouse atomic-equipment department. We founded this department on our own initiative and at our own expense to supply specialized equipment for use in conjunction with atomic reactors. The department's work at the start will be almost entirely nonsecret, having to do primarily with accessory parts of the reactor. An 86,000-square-foot plant is currently being built in Harmar Township on the Allegheny River above Pittsburgh and will be leased by Westinghouse on a long-term basis. Our capital investment in tools and equipment for the department is approximately \$2 million.

We feel the decision to go ahead with our new atomic-equipment department was hardheaded and realistic, and that it was an act of confidence bespeaking, louder than words, how we view the prospects for atomic power.

As this committee knows, we have been working for a year or more upon a powerplant having implications not only for the propulsion of large naval vessels but also for the generation of central-station electrical power. The submarine powerplant we now have behind us represents a striking advance in undersea propulsion and meets the unprecedented requirements which the Navy laid down. But it has two important limitations from the viewpoint of uses other than in a submarine: First, it simply does not put out the power needed to propel a big ship moving on the surface. Second, it does not give the long life—or the power—essential for central-station generation of electricity.

The problem we have been studying, then, is how to take a second step forward into power uses, a step just as big or bigger, as the step already taken through the submarine plant. We could not begin to consider this second step without the benefit of the experience and momentum gained in the first. The one follows indispensably from the other. But we have already learned enough about atomic power for big ships or big blocks of electricity to appreciate that doing such a new job would mean new headaches, new sobering risks, and the same intensive effort as in the submarine project. Once again, we think, actual construction of a prototype would be the comparatively easy part. The hard part would be research and development.

As you see, despite my basic optimism, I have returned to the theme that building a reactor is no picnic. It seems to us that hammering this theme is the most useful task I can strive to perform here today. However, if there is a customer—either the Government or private utilities or a combination of both—we can go ahead and build a central-station atomic powerplant able to produce tens of thousands of kilowatts. We do not know, and no one knows, whether the first plant could produce competitively with ordinary plants. Much would depend upon conventional power costs where the atomic plant was located. Much would also depend upon the kind of book-keeping to be used—rates of amortization and the like. This we do know: Much could be learned from the first plant that would fertilize progress.

The same basic atomic powerplant could, of course, be used in large naval vessels if constructed with special attention to space and weight and the operating requirements of the Navy. A land-based prototype of the naval version would, like the purely civilian version, produce sizable blocks of electrical power.

If you were to inquire whether Westinghouse might consider putting up its own money to construct such a plant, we would have to say "No." The cost of the plant would be a question mark until after we built it and, by that sole means, found out the answer. The time needed would be another question mark until after we took the necessary time—again the only means of finding out the answer. We would not be sure of successful plant operation until after we had done all the work and operated successfully. This is still a situation of pyramiding uncertainties. The amount of money which Westinghouse could itself appropriate to meet the situation would be but a trickle compared with that required.

On the other hand, as I commented earlier, we have already committed \$2 million of our own funds to the future of atomic power. We are going to commit more funds. The only question is when and how much. There is a distinction between risk-taking and recklessness. We shall appropriate more and more Westinghouse money as and when such action ceases to fall into the category of recklessness for Westinghouse.

I judge that everyone concerned with atomic power matters welcomes the decision of your committee to hold hearings and to consider whether changes in the law may be desirable. For our part we think the present law deserves solid recognition for the the progress already made under its provisions. It was skillfully drafted, with unusual foresight; and it has been ably administered. Further-

more, the present law displays the becoming modesty of stating, in its preamble, that any legislation is temporary and subject to change in so rapidly changing a field as atomic energy.

If, this time last year, you had asked us whether the present law is delaying atomic power development, we in all probability would have said we thought not. Today our view is changing because 1953 circumstances are different from 1952 in the significant respect that STR, the first nuclear powerplant producing substantial quantities of useful power, is actually operating. We are now increasingly impressed by the need of mobilizing more minds and more resources for a broader attack upon atomic power problems. We estimate that qualified technical people working upon these problems, outside Atomic Energy Commission Laboratories, are currently numbered only in three figures. Napoleon is once supposed to have said that when he had a hard job to do, he put so many men on it that the job disappeared. The time may be ripening when a similar tactic in the atomic power field could produce major technical breakthroughs.

The overall industry of the United States is basically the creation of private initiative. In the factories and production lines that give our country world leadership is evidence of what free enterprise can accomplish. But under the present atomic energy law, enterprise is not free. We suggest it is almost academic to speculate on what enterprise might undertake if some of the curbs were lifted. So long as these remain, enterprise is severely handicapped even in thinking and planning. Relax the curbs and, judging by past experience, our economic system will find its own ways of helping to bring the promise of atomic energy to fruition.

Factors such as these indicate that it is not too soon to consider amending the law. We think the broad policy statement prepared by the Atomic Energy Commission and made public by your committee last May is a constructive contribution. Even so, time will doubtless be needed to give the problem the full, searching, and earnest thought it demands. In the atomic power field, as in certain others, there are still no experts; there are only varying degrees of ignorance.

With due allowance for this fact, we would in general recommend that the Congress move toward giving free enterprise a chance to function normally, so far as national security permits. It goes without saying that the defense of our country must remain the paramount consideration. But, this apart, the ideal approach would be for the atomic power industry to operate much like any other industry in our economic system. Needless to say, the incentive for a private firm to build an atomic powerplant at its own expense will grow or decline depending upon the degree of ownership control that it could exercise over the plant. The incentive for private investment must also suffer if, after spending millions for a plant, the investor had no satisfactory assurance of obtaining the fissionable material essential to plant operation.

But the questions of ownership and availability of fissionable material, as I have already indicated, mainly affect purchasers and users of power equipment. On the other hand, the patent question particularly affects equipment manufacturers such as Westinghouse; and here, therefore, I venture to comment more specifically.

It is possible to foresee three broad cases where private money will bring about advances in the art of producing electricity from atomic

power. These cases are, first, an invention having almost exclusively a weapon application; second, an invention having both military and commercial application; and third, an invention having only commercial interest. As to the first, where the national defense is alone involved, there can be no question that Government should enjoy complete control.

We would suggest, however, that atomic power inventions flowing from private money and having only commercial use should be patentable like other inventions. As for cases where the application is both military and commercial, the same should be true except for the important qualification that the Government would enjoy full privileges of using the invention toward weapon purposes.

Although there have been one or two problems arising with a few subcontractors, I would like to add that the patent regulations of the present Atomic Energy Act as administered by the Commission have not retarded the submarine thermal reactor job.

There is another area of special interest to equipment manufacturers—the area of security. The expense and delay of present procedures, formulated at a time when experience was meager, are of a high order. From our perspective, much can be said for legislative action to give even greater protection to vital secrets and downgrading or declassifying information that has little or no sensitivity. At the same time, we know how difficult is this problem. Its difficulty is not reduced by the fact that it will doubtless have major bearing upon the incentive of equipment manufacturers to risk their own money.

This afternoon we are prepared to offer no more than general comment because, frankly, we have been preoccupied trying to carry out our own assignments. At such time as you may proceed to consider a specific bill, or at any other time, we hope you will call upon us for whatever assistance we are able to render.

Chairman COLE. Thank you, Mr. Weaver. You have presented a very fine statement, and I especially compliment you upon the emphasis which you have made to bring out the fact that industrial power from atomic energy is not going to be here this week or this year: that there are many, many rough roads to travel before we can even hope to prove that it is available.

I do not know of any group or of any individual who is in a more qualified position than you and your equipment division to speak from experience in advising us and in advising the public generally of the tremendous difficulties that still lie ahead before proving the feasibility of this highly desirable goal.

I appreciate very much the fine statement you have made, and, in addition, the fine work you have done personally and through your division in the submarine reactor program.

Mr. WEAVER. Thank you, Mr. Cole.

Chairman COLE. Are there questions from members of the committee to Mr. Weaver?

Representative VAN ZANDT. I am glad to see you again, Mr. Weaver.

Mr. WEAVER. I am glad to see you, Mr. Van Zandt.

Representative VAN ZANDT. Are you the lone contractor in the construction of this atomic-power reactor for the submarine?

Mr. WEAVER. Westinghouse has a direct contract from the Atomic Energy Commission for the nuclear plant, and another direct con-

tract from the Navy Department for the more conventional engine room propulsion equipment.

Representative VAN ZANDT. How many subcontractors are there involved in this effort?

Mr. WEAVER. Mr. Van Zandt, I believe that number is well up in the thousands. I think at last count there were in the neighborhood of 3,000 or 4,000 subcontractors and suppliers to the mark I and mark II programs.

Representative VAN ZANDT. The purpose of asking the two questions is to develop just what benefit industry in general has enjoyed as a result of the construction of this submarine by your firm.

Mr. WEAVER. I could expand on this point by emphasizing again that Westinghouse has concentrated on the more nuclear aspects of the problem, and we have been aided by such concerns as Babcock & Wilcox in designing and building the pressure vessels; by Foster-Wheeler in designing and building the boilers, and so on up and down the line.

Representative VAN ZANDT. Has it not also developed new techniques used not only by your firm but by others?

Mr. WEAVER. There has been no subcontracted activity that I can think of that did not have a mass of problems of its own created by new requirements and resultant new techniques in order to satisfy them.

Representative VAN ZANDT. Therefore, this effort has somewhat educated business in general in this field of atomic power; has it not?

Mr. WEAVER. It certainly has.

Representative VAN ZANDT. That is all, Mr. Chairman.

Chairman COLE. Senator Pastore?

Senator PASTORE. I have no questions.

Chairman COLE. Mr. Holifield?

Representative HOLIFIELD. Mr. Weaver, I want also to say that you have given us a very valuable statement here, and I want to add my commendation for the work which your company has done all through the years on atomic energy and power development, reactors, and so forth.

Mr. WEAVER. Thank you, Mr. Holifield.

Representative HOLIFIELD. There are some things in your statement which I think need to be emphasized.

On page 6, after going into the troubles which you have had in building reactors, you say that you are far from being able to offer a firm price bid on such a reactor. That statement is a rather different one from the statement we have had from many who have not built reactors, and this committee must take cognizance of the fact that you speak from the standpoint of experience and not from the standpoint of speculation. I think that is a very important thing for some of these people who are dealing in what I term to be overoptimistic speculative plans, without any real knowledge of the reality of the subject.

It is something which is important to us, I think, in our considerations.

On page 9, you say, again along the same line:

We hope no one will underestimate the time, skilled manpower, and money needed to overcome the difficulties of developing and building a large power reactor. Such a miscaluation could produce a blow to hope and progress.

I would gather from that that you are indicating that there is still such an element of risk in this, not from the standpoint of building a power reactor that will produce electricity, but from the standpoint of building one which would be competitive in nature; that by this statement, you would encourage such people who would plan to invest 75 or 100 million dollars of their stockholders' money in taking a second look at it?

Mr. WEAVER. I certainly would.

Representative HOLIFIELD. If they did go to that expense and there was a miscalculation and this money was lost, if it was really risk capital, it is your opinion if that was the only project, it would be a blow to continued progress in developing atomic-power reactors?

Mr. WEAVER. I believe the other thing that I had in mind in making this statement is brought out in a statement I recall Chairman Cole having made at the opening of these hearings. It was that we must not lose the momentum of our current development program. I believe it would be a severe blow if we were to drop of the type of development that we are carrying on today on reactors under the assumption that it can be picked up by inadequate facilities and inexperienced staffs of people.

Representative HOLIFIELD. And private funds?

Mr. WEAVER. That is implied.

Representative HOLIFIELD. You do call attention in the first part of your statement to the successful industry-governmental teams that have been in existence during the past 7 years, and to the progress which they have made in this field.

On page 11, you go ahead and say:

We do not know, and no one knows, whether the first plant could produce competitively with ordinary plants.

That is a considered statement on your part, I suppose?

Mr. WEAVER. Yes, it is, because of the developmental unknowns, again emphasizing the size of the job ahead. Until considerably more work has been done, we will not have the answer to the economics of this powerplant.

Representative HOLIFIELD. You say in that same paragraph:

Much could be learned from the first plant that would fertilize progress.

I suppose you mean by that that you do feel that it is necessary to build, as soon as possible, a first plant along these lines, along the lines of solving the problems of civilian power production.

Mr. WEAVER. I do, and in building it we would be extending the valuable knowledge which has already been gained in building the submarine thermal reactor. Certainly even in that plant we have learned very many valuable lessons which are applicable to civilian powerplants, but we still have a long way to go.

Representative HOLIFIELD. At the bottom of page 10, you say:

* * * we think, actual construction of a prototype would be the comparatively easy part. The hard part would be research and development.

I would like to explore that for just a moment. We have had two different theories advanced to this committee. One theory has been advanced by several people who say that now is the time to go ahead and build a full-scale prototype plant. Other equally sincere scientists have come before us and said that in their opinion the present development would be actually increased and the time of achievement

would be reached quicker if we would do research and development on several pilot plants and get some operating experience from those pilot plants, and then we would be able to go ahead by that knowledge and develop a full-scale plant much more surely and possibly much more economically.

Would you give us your thoughts on those two different approaches?

Mr. WEAVER. Certainly I think that parallel development efforts are always valuable to some extent, but you must consider the money available and the resources available for the development work in determining the policy of whether or not you can afford to have more than 1 or 2 development efforts in parallel.

Representative HOLIFIELD. On a full scale?

Mr. WEAVER. Yes.

Representative HOLIFIELD. It would be possible, in your opinion, for us to select 5 of the most promising types of reactors—and I use the figure 5 loosely—with an expenditure of 10 or 12 or 15 million dollars apiece, and obtain great knowledge along that line?

Mr. WEAVER. I believe you are very optimistic in your cost of even pilot-plant development.

Representative HOLIFIELD. I am asking that question because one of the companies recently put an ad in the papers in which they offered to build one for \$10 million.

I might explore that a minute and ask if a pilot plant of that cost would be valuable in research and development, or would it, in your opinion, cost more than that to get a pilot plant which would give you answers to questions which we do not have at the present time? We have the questions, but we do not have the answers.

Mr. WEAVER. There are unquestionably some types of nuclear power-plants that could be built today more reasonably than other types. I do believe that Government, if it is going to finance the program, must consider very carefully the types that it would support.

Representative HOLIFIELD. If you had \$100 million to gamble on this problem, would you, as a private industry, put that in 1 large type of reactor, or would you put it in 2 or 3 or more pilot plants at this stage of research and development?

Mr. WEAVER. I must speak again from the manufacturer's viewpoint, and knowing again the difficulty and the cost of developing these plants, I think that I would want one definite goal; and I believe that definite goal, if it was a sizable plant, would quite effectively use up the \$100 million.

Representative HOLIFIELD. In the construction of a pilot plant?

Mr. WEAVER. In the development and construction.

Representative HOLIFIELD. Of a pilot plant, or a full-scale plant? That is the point I want to make.

Mr. WEAVER. A full-scale plant.

Representative HOLIFIELD. If that be the case, then would you favor at this stage in this industry's life going ahead and building a full-scale plant at this time, rather than several prototypes, two or more pilot plants?

Mr. WEAVER. I think it is questionable as to what value you obtain from a pilot plant, as such. If you are reaching out for greater powers and longer lives in your reactors, I doubt if you are going to prove your point through a pilot plant. I think you are going to have to develop and build what you want. And this, of course, is the ap-

proach that we were in solid agreement with the Government on in tackling the aircraft carrier reactor, the CVR program.

Here there was a definite requirement for a given block of power to do a specific job. This is still the way Westinghouse would like to tackle any nuclear plant development.

Representative HOLIFIELD. You would like to tackle that on the basis of the Government-industry partnership that has obtained in the past?

Mr. WEAVER. We believe it essential to maintaining a virile reactor development program which is going to keep the country ahead in nuclear power.

Representative HOLIFIELD. I think most of the committee believe that, too, but I want to be specific that you believe that that objective of obtaining that successful reactor would be by continuing the present arrangement, in which the Government finances and in which private industry contracts, and puts its best brains and initiative forward to obtain the results.

Mr. WEAVER. I do.

Representative HOLIFIELD. I notice that you say on page 11, the last paragraph:

If you were to inquire whether Westinghouse might consider putting up its own money to construct such a plant, we would have to say "No."

That is the same as you have answered to the previous question.

You bring up the point later on that free private enterprise should be given a chance to function normally as far as national security permits. I think we are all in accord with that, but we have a particular responsibility in the security field which is going to put the brakes on us a little bit, like obtaining private risk capital puts a brake on private industry.

You have given us three cases here in discussing the patent problem.

First, an invention having almost exclusively a weapon application. Of course, there is no controversy on that, as far as I know.

Second, an invention having both military and commercial application.

Third, an invention having only commercial interest.

On the second type of invention, having both military and commercial application, we are faced with a peculiar problem in making that available to industry if, in making the commercial application available to industry we thereby reveal some of the military application.

So that is a very questionable area there as far as legislative relaxation is concerned.

The third field, an invention having only commercial interest. I believe under the present Atomic Energy Act, such inventions can be declassified and used on a wide basis, can they not?

Mr. WEAVER. That is right, and I believe we have records of such cases in our own experience.

Representative HOLIFIELD. Who would decide what would constitute a weapon applicable development? In other words, who would draw the line between strict weapon application and commercial application?

Mr. WEAVER. I believe that the Government would have to do that.

Representative HOLIFIELD. The Atomic Energy Commission, which

is now charged with that responsibility as far as declassification is concerned, would have to function there, would it not?

Mr. WEAVER. Yes.

Representative HOLIFIELD. In the latter part of your statement you say that when a specific bill is considered you would be glad to give us additional cooperation. I think when the time comes that we can draw up a draft of legislation, your company will certainly be one that we will want to consult, because of your peculiar and almost sole interest and experience along certain lines.

Mr. WEAVER. I also had in mind that there are some men in the company who are expert in the fields that I certainly do not feel qualified to speak of today, the field of patents broadly, for instance, and they may be of help to the committee.

Representative HOLIFIELD. The present patent program as outlined in the act, and as administered by the Atomic Energy Commission, has been in your experience a completely workable program, has it not?

Mr. WEAVER. For the job that we have been doing with Government funds, yes.

Representative HOLIFIELD. Thank you for your answers.

Chairman COLE. Mr. Price?

Representative PRICE. Mr. Weaver, first I want to pay tribute for the remarkable job I know you have done in your participation in reactor development.

I had the pleasure of visiting your installation in Pittsburgh, and I have been out to the Idaho Testing Station, so I speak with authority in saying that you have done a remarkable job and have contributed much toward this program.

Mr. WEAVER. Thank you, Mr. Price.

Representative PRICE. Regarding the design and construction of the submarine reactor, the STR, what is the relationship between your work and the Navy? How do you operate? How do you function?

Mr. WEAVER. We function entirely, as I have pointed out in one portion of the statement, through the Naval Reactor Branch of the Atomic Energy Commission. They are our point of contact and the point of Government control.

Both the Atomic Energy Commission contract for nuclear parts of the plant and the Navy contract for the engineroom equipment are administered by that group.

Representative PRICE. How has that relationship worked out?

Mr. WEAVER. Very fine.

Representative PRICE. You think it has been a good setup? Would you see any difference in your program if you had not had a setup of that nature?

Mr. WEAVER. I think that the best thing I can say there is that the job has been tough enough back in Pittsburgh and out in Idaho without having to worry about all the multitude of contacts and problems that we might encounter in dealing with the Government unless there was one such centralized and aggressive setup.

Representative PRICE. That particular phase in which Captain Rickover has done such a marvelous job?

Mr. WEAVER. Yes. He is Chief of the Naval Reactor Branch.

Representative PRICE. It is also tied in, of course, with the AEC. It has all the tie-ins there. It is a sort of tied-down directorship, placed

in such a way that the head of that group can really act and get things done; is that right?

Mr. WEAVER. He pulls together all of the ends over in the Bureau of Ships in the Navy Department, and at the same time functions for the Atomic Energy Commission.

Representative PRICE. Have you been able to utilize the ingenuity of your company freely in this work?

Mr. WEAVER. As I have indicated in the statement that I read, I believe that we have used to the *n*th degree the facilities of the company to the point that it has really hurt and left many of our normal operations bleeding. We have pulled out some of the best men throughout the company to come in and fill our key jobs.

Representative PRICE. You have already answered in your prepared statement the question that I was going to ask you, so I can read your answer to that. I was going to ask you about the different types of participation, the AEC, Navy, and industry; and you have said that it was a question of teamwork, and you have cited the remarkable collaboration between men in naval uniform and men in the laboratory and between men on Government payroll and men on industrial payroll.

It has been a very successful operation in that regard?

Mr. WEAVER. It certainly has, sir.

Representative PRICE. What is your position on the CVR project?

Mr. WEAVER. At the present time we are awaiting action of the Government.

Representative PRICE. How do you feel about it? It was just about a year ago that you were given a contract, that you entered into contractual relations on the CVR; is that correct?

Mr. WEAVER. It was in July of 1952 that the Commission put us to work on the CVR. We were just getting a good start on it when the current discussion arose.

Representative PRICE. A moment ago, in reply to a question from my colleague, Mr. Holifield, you referred to the loss of momentum. Was something like that in your mind?

Mr. WEAVER. It certainly must be, sir.

Representative PRICE. You said very wisely that if you lose momentum in this game you never regain it.

Personally, I felt it criminal on the part of the Navy to yield to economic pressure and to agree to any relaxation and delay in the reactor development program.

My colleague suggests I should not use the word "criminal," but I feel pretty strongly about it, so I will say "very unwise."

Certainly this relaxation amounts to loss of momentum. Do you not agree with that?

Mr. WEAVER. I do not believe that we have lost momentum yet, because we have had a great deal of effort that has been necessary to put into the submarine job currently, and because the very major part of the work done to date on the CVR is equally applicable to any type of large plant.

Representative PRICE. Would you not like to get going on this project?

Mr. WEAVER. Just as I said before, there is nothing that Westinghouse wants more than a definite goal. Certainly, however, I am sure that Mr. Price would want to say also that we cannot and do

not want to be in the position of indicating what the Government should do, what your reactor program should be.

We stand ready to pitch in and continue the CVR job, or a similar plan.

Representative PRICE. The earlier you get started on such a program, though, would contribute to the development of industrial power that much quicker, would it not?

Mr. WEAVER. Yes.

Representative PRICE. That is all.

Chairman COLE. Mr. Patterson?

Representative PATTERSON. No questions.

Chairman COLE. Mr. Van Zandt?

Representative VAN ZANDT. Mr. Weaver, in regard to the new plant you are building at Harmar Township on the Allegheny River above Pittsburgh, I notice it is being constructed for the purpose of supplying specialized equipment for use in conjunction with atomic reactors.

Have you had actual inquiries from concerns who are interested in building reactors?

Mr. WEAVER. Our inquiries to date have been limited to the items that we have identified for engineering and construction by this department, particularly the canned-motor pump that was developed for the submarine thermal reactor. This has been an item that has always found considerable usage in the laboratories, as well as in other reactor-development projects.

Representative VAN ZANDT. When will the reactor be a reality; that is, actually producing power for domestic use?

Mr. WEAVER. For domestic uses?

Representative VAN ZANDT. Yes; for domestic uses.

Mr. WEAVER. It certainly depends upon the aggressiveness with which we all tackle the problem, and I can hardly say more than I did in the prepared statement, which is that we won't really know the time until we get into the problem.

Representative VAN ZANDT. Can you give us an estimate of time on the pilot plant?

Mr. WEAVER. We know that the Mark I submarine thermal reactor is in operation now. The job was started from scratch without any facilities to work in or an organization to work with, in December of 1948.

A larger reactor for the production of electrical energy certainly is a tougher job, as I have stated.

Mr. PRICE. May I interject a remark there, Mr. Van Zandt? Perhaps it has something to do with Mr. Holifield's question about pilot plants or one large plant.

Looking back on this thing, on the last 4½ years, it seems to me that the most important decision made, which contributed to the success of the project, was a decision early in 1949, I believe it was, to lay down a definite timetable for every component that entered into the submarine project.

By a certain date the decision would have to be made on the development side, which road they were going to take. They would discard some possibilities and pick up the road they were going to take.

That followed for every important component that went into the reactor. That was early in 1949.

They didn't by any means keep the schedule that they drew up then, but the mere fact that they always had a schedule and that they were always working to a time schedule made the thing possible in the time in which it was accomplished.

I think that bears on the question of whether you get more out of 3 or 4 or 5 pilot plants, or 1 good sized plant that could be useful.

Mr. Weaver says about two-thirds of the cost here is within the research and development part, as against the construction cost. If you built one real plant, certainly other better roads of building the next one would be opened.

I do not know the answers. I am not a scientist or an engineer. But I think more would be gained out of one real plant than wasting time with too many pilot plants.

Mr. WEAVER. I agree with that.

Representative PRICE. I think you can say, from what you already know about the submarine reactor, that the manner by which you approached that has been a very successful approach.

Mr. WEAVER. A very desirable and successful approach.

Representative VAN ZANDT. As I was going to say, your statement is based upon experience in the development of the submarine power plant.

Representative HOLIFIELD. Would you care to comment at this time as to whether, if you were given the opportunity to build a full-scale plant by Government financing at this time, you would know the type of reactor that you would want to build? Could you select the type of reactor at this time, the type of coolant, design, and so forth, at the present time?

Mr. WEAVER. Yes, sir.

Representative HOLIFIELD. You have pretty definite ideas as to the desirability of a particular type?

Mr. WEAVER. This is based on our experience, both in the submarine thermal reactor and studies which went ahead after the CVR contract was awarded to us last year.

Representative HOLIFIELD. Would that indicate that you would go along in building a reactor along that same line of scientific theory, or would it mean that from that you have learned how to go ahead on a different type, or do you want to answer a question like that?

Mr. WEAVER. I believe I should not answer that question, sir.

Representative HOLIFIELD. I withdraw it.

Chairman COLE. Why not? Security?

Mr. WEAVER. Yes.

Chairman COLE. Dr. Beckerley.

Dr. BECKERLEY. I am not sure what he has in mind.

Representative HOLIFIELD. It might be an unfair question, I might say to the chairman, to ask one business firm to reveal—

Chairman COLE. I know, but we have already asked other business concerns to reveal what their selection is. It seems to me it would be entirely unfair to allow a different concern to withhold the information.

Representative HOLIFIELD. They raised no objection, however.

Chairman COLE. That is why I raised the question whether this had security aspects or industrial trade-secret aspects.

Mr. WEAVER. Specifically, Mr. Chairman, the Commission, as far as I know, has never stated publicly the type of reactor which was planned for CVR.

Chairman COLE. That is what Mr. Holifield asked you.

Representative PRICE. What he did ask him ties in with the STR, and that brings it under security.

Representative HOLIFIELD. I have doubts as to whether my question should be answered. I withdraw the question.

Chairman COLE. Let me be assured that the hesitancy of Mr. Weaver to respond was not because of any company concern.

Mr. WEAVER. Very definitely not, sir.

Chairman COLE. But it was because of security?

Mr. WEAVER. That is right.

Representative VAN ZANDT. One more question, Mr. Chairman.

Mr. Weaver, during the course of your statement, you stated it was necessary from time to time to bleed other projects in order to continue your program in the construction of this submarine atomic-power plant. Could you tell us in round figures what Westinghouse has spent in dollars and cents above and beyond what you have received from any Government source, in the construction of the submarine plant?

Mr. WEAVER. Mr. Van Zandt, that is a difficult question to answer. Where Westinghouse divisions or departments, other than the atomic-power division, have done work for the atomic-power division, they have been reimbursed for the cost of such work. I would say that the only cost that is difficult to measure is the value of the men who have been assigned to the project, the value of the management effort that has been placed on the project.

Representative VAN ZANDT. Is it proper to say that the Westinghouse Co. has actually sacrificed to reach the point where they are today in the construction of the submarine atomic engine?

Mr. WEAVER. I believe Mr. Price could answer that question.

Mr. PRICE. I would answer it this way: We are not by any manner of means where we would like to be in our development of jet engines. We are behind in one very important program for the Navy.

If we could have had just one-third of the men on this job within our aviation-turbine division, I am certain we would be on schedule.

So goes it with many of the important commercial activities of the company.

Chairman COLE. You feel that has been a sacrifice?

Mr. PRICE. Yes, sir, definitely.

Chairman COLE. In spite of that fact, while you may be behind in jet-propelled engines, you are away, 'way out in front in atomic engines.

Mr. PRICE. Looking down the future, the sacrifices are well made, but at the moment they hurt. At the moment they hurt.

Representative VAN ZANDT. The purpose of the question was to develop the fact that free enterprise in this country has made a contribution to the construction of this atomic powerhouse for the submarine.

Chairman COLE. From what you know of the CVR proposed program, can you evaluate percentagewise as to whether the lessons that might be learned from it predominate in the electric-power field or in the propulsion field?

Mr. WEAVER. The reactor problems are going to be essentially the same regardless of which application the reactor is directed toward. It will be more the plant arrangement, its size, its weight, the ruggedness, the type of steam equipment which utilizes the steam from it, that will be affected by the application.

Chairman COLE. So that if we continue with the dual function of the CVR program, which is electric power and ship propulsion, we will learn nearly as much for the purposes of electric power as we would have learned then, had there been no ship-propulsion factor involved.

Mr. WEAVER. Yes.

Chairman COLE. You indicated that there were fewer than a thousand scientists in this country knowledgeable in the atomic field who were not already engaged in the program, is that correct?

Mr. WEAVER. That is correct.

Chairman COLE. That made me wonder how apt your Napoleon's illustration was when you said by applying tremendous numbers of men the problem disappeared. If you do not have very many men to work on the problem, you are not going to be able to vaporize the problem.

Mr. WEAVER. I believe the statement indicates that the men who number in three figures are the ones who are working on atomic-power problems outside of the Government-supported programs. In other words, that there is a considerable resource of men available.

Chairman COLE. By that, then, you feel that 1,000 scientists, not presently engaged in the Government phase of the work, is a large number to apply to this new program?

Mr. WEAVER. No; I believe that the statement was that those now engaged in atomic-energy work outside of the Government program were numbered in three figures. In other words, implying that there are not enough people at work.

Chairman COLE. That is what I thought you meant.

Mr. WEAVER. Yes.

Chairman COLE. Even those approximately 1,000 might be made available to study and research, and it still would be a large problem which is not going to be solved readily?

Mr. WEAVER. That is right.

Chairman COLE. And we need more scientists than we have even today, even those who are not presently engaged in the atomic program?

Mr. WEAVER. That is right.

Chairman COLE. Let me go back and make certain that Mr. Weaver in his responses to the questions that have been put or may be put speaks for the Westinghouse Co. Will you tell me that, Mr. Price?

Mr. PRICE. Yes, sir.

Chairman COLE. From the fact that your company has decided to invest \$2 million in the construction of atomic equipment plant, would that indicate that you have the feeling that a program of industrial power from atomic energy is in the near future? I will express it differently. What I want to find out is whether it is your feeling from the experience you have had in the field that the time is now ripe for the Congress to give serious and constructive consideration to amendments in the law looking toward a greater participation in the industrial field from atomic energy.

Mr. WEAVER. We have stated that, Mr. Chairman.

Chairman COLE. And the evidence of your belief is the fact that you have constructed the plant to make the equipment that you hope will go into these plants?

Mr. WEAVER. Or into naval plants or similar applications.

Chairman COLE. With respect to your observation on the patent provisions, I am not quite clear just what you had in mind. You said that any new ideas which had an exclusive military application should be under the sole and exclusive control of the Government. By that did you mean that the Government should have the sole and exclusive and free use of the patent irrespective of who the patentee was or under whose auspices the patent was obtained?

Mr. PRICE. I think, Mr. Cole, that has been true in other fields besides atomic power. I cannot think of a single case where during World War II any patents or knowhow that Westinghouse had acquired that would be helpful in the war effort was not given to others at the Government's request. I can think specifically of one case on the west coast where we gave all of our know-how in building ship propulsion to another company and sent engineers out there to help them get started. I am sure there were some patent situations involved there.

To make this thing a little more concrete, Mr. Weaver and others in the company and I have been talking about this, and we have this general feeling on the patent question, that when large sums of private money are ready to flow into this field, in the field of central electric power stations, for example, that just is not going to happen unless the companies that are putting their own money into it get the benefit of whatever ideas and inventions and patents that are worth anything commercially. I do not know whether that time is right now. I do not know whether it is January 1, 1954, or January 1955. I do not know when the time is ripe. But certainly when private industry starts to spend money in this field in large volume, I think they are going to want whatever commercial advantages develop from the patentable and new inventions that they make.

Senator PASTORE. That is not going to happen for some time, Mr. Price.

Mr. PRICE. I say I do not know. If one large plant is built and is found commercially feasible, it might come very quickly.

Senator PASTORE. Is it not Mr. Weaver's thesis that for the time being, and in the distant future, all the money that will be required to build this plant will have to be Government money?

Mr. PRICE. At first it will probably have to be that way.

Mr. WEAVER. I think I did not intend to give the impression that all for some time would necessarily be Government money.

Senator PASTORE. Returning to your manuscript on page 11—

If you were to inquire whether Westinghouse might consider putting up its own money to construct such a plant, we would have to say "No." The cost of the plant would be a question mark until after we built it, and by that sole means found out the answer.

Then dropping down to the last sentence—

The amount of money which Westinghouse could itself appropriate to meet the situation would be but a trickle compared with that required.

The question that bothers me, and I thought bothers most people, is that here is something where you presume the Federal Govern-

ment is going to put up most of the money for the building of this plant, and yet you want the law changed so that you would have patent rights that would develop as a result of this invested money. Is that your position or is that not your position? Do you take the position that you expect the law to be changed with respect to patent rights only when we get to the stage where private industry invests its own money exclusively?

Mr. WEAVER. I think that is so. I should also add, and I believe it has been said many times before in these hearings, that our feeling regarding modifications to the law is based on the desirability for planning purposes as much as anything else. So that the users of this equipment, more than ourselves, the manufacturers, will know whether they can look forward to in the future to owning these plants and controlling the fissionable material required for their operation.

Senator PASTORE. But it is fair for me to say that your argument is that these patent rights should be granted to private industry only where private industry exclusively invests its own money in the development of this atomic power. Am I correct in that?

Mr. WEAVER. That is right.

Chairman COLE. Understand, Mr. Weaver and Mr. Price, I am not arguing with your thoughts on the patent problem. I am simply trying to clarify what your thoughts are. You have indicated that you feel that any patents having a commercial use should be considered as a property right of the owner the same as any other patent. But with respect to a patent having solely a military application, would not the same argument apply to that, admitted that the Government would have control of that patent and the right to use it? Is it not consistent with your previous position to say that you would expect the owner of the patent to be compensated for the use of it?

Mr. WEAVER. That is right. I believe that the present act, does it not, recognizes compensation in some form to the inventors? I am not familiar with the details of patent law or necessarily the act, but I believe that is the case.

Chairman COLE. What I am trying to point out is that when you stated that patents having a military application, solely, should be under the control of the Government, you meant that the Government would pay for that control?

Mr. WEAVER. Where the invention has been financed with private funds, certainly that is the case.

Chairman COLE. That brings up the next phase of the patent problem that I was going to inquire into, and I think you have answered it, although I would prefer to have you answer it in your own way, rather than for me to ask the questions and you simply say "Yes." What is your feeling concerning patents that might result from research and studies made by private industry in Government laboratories?

Mr. WEAVER. And the effort financed by the Government?

Chairman COLE. We will treat them separately. The effort financed by private industry, except that Government laboratories are used.

Mr. WEAVER. I cannot visualize such a situation, because I am quite confident if the Westinghouse Co. contemplated doing any work in a Government-owned laboratory, it would be paying the Government for the use of that laboratory, and its facilities, just as if it were renting from any other landlord. So the net result, if it was

spending its own money on the effort, would be the same whether it was in its own facilities or Government facilities.

I think the question is quite different, however, when it is work such as we are doing in Government-owned facilities with Government funds. In that case, the practices which have been followed by the Atomic Energy Commission under the present act have been quite satisfactory.

Senator PASTORE. May I ask another question, Mr. Weaver? Is it your opinion that a plant will not be built unless the Government builds it?

Mr. WEAVER. Senator, I cannot say that. I can only again emphasize the difficulty of building these plants. Anyone who has the necessary money to support that difficult venture should certainly be able to get the plant built the same as the Government.

Senator PASTORE. I realize that. I do not mean to confuse you or to complicate this. I am trying to get this down to basic terms. Everyone is speaking about building a powerplant and many speeches are being made here by representatives of industry, and scientists which are always expressed in great platitudes and generalities.

Specifically I ask the question. We all say that a plant should be built. We all say we have to build the first one if we are going to improve on the second one. We are all saying that this is a pretty big investment and it envisions more money than people think, and atomic power is not around the corner as some people think. We all admit that it should be built soon. We cannot say now in terms of weeks, months, or years. But the fact of the matter is that we do say that an enterprise like a big company like Westinghouse cannot take it on itself and it presupposes that the Government should do it.

Mr. WEAVER. In my opinion, it is fair.

Senator PASTORE. Therefore, it is fair for me to assume that unless the Government gets into the building of this plant, we are not going to have it.

Mr. WEAVER. That is right.

Senator PASTORE. That is all I wanted to know. I want to put it down in clear language.

Chairman COLE. What do you estimate the power reactor generating of the order of 200,000 kilowatts would cost?

Mr. WEAVER. I do not know, Mr. Cole.

Mr. PRICE. We were talking about that the other day, Mr. Cole, a little group of us in the company, when we were going over this statement with Mr. Weaver. If we could have an escalation clause of 100 percent to cover contingencies, we still would not want to take on the job.

Chairman COLE. That does not help me in arriving at your estimate of the cost of a reactor.

Mr. PRICE. It does not. The answer is that we do not know.

Mr. WEAVER. To clarify that a little bit, though, certainly for planning purposes we must have such estimates; and I think that just as we have made estimates with the Government in the case of the CVR project when it was a definite thing, so estimates could be made based upon the specifications and type of plant which might be required after the current discussions.

Chairman COLE. I do not understand how these companies that have had no experience at all in reactor construction—the closest they have

come to the program is to look over some records and peek over somebody's shoulder—seem to arrive at a common level of the order of \$75 million to \$100 million for a 200,000-kilowatt reactor. Yet you people who have actually built a power reactor of lesser proportions and who anticipate a contract with the Government for construction of a reactor of that proportion are not able to estimate the cost. I do not understand that.

Mr. WEAVER. I think there are two factors involved. One, they do not know these difficulties that we feel very keenly, and second, we have not tried to estimate the cost of a plant of the particular characteristics you state, because up to the present time we have not had occasion to. In other words, we have cooperated with the Commission in estimating the cost of the CVR project for future budgeting.

Chairman COLE. That is right.

Mr. WEAVER. But we have not had the occasion to do that in the case of any other reactor.

Mr. PRICE. In making an honest attempt to estimate and making a firm bid would be an entirely different thing.

Chairman COLE. I was only asking for an estimate and not for a firm bid. Certainly in the CVR program the estimates given by the Navy to the Congress as to the cost of that program must have been arrived at after collaboration with the Westinghouse people.

Mr. WEAVER. That is right. For the CVR program which is considerably different than the reactor you speak of.

Chairman COLE. The Navy has been able to tell the Congress and the committee that it estimates the power phase for the CVR program was \$75 million to \$100 million. Where did the Navy get that figure if it was not after consultation with your people.

Mr. WEAVER. Mr. Cole, with the ratings comparable to the rating which you speak of, of 200,000 kilowatts, I do not believe so.

Chairman COLE. You mean the CVR does not contemplate 200,000?

Mr. WEAVER. That is right.

Chairman COLE. I see. Does Westinghouse have any agreement with the Commission to study industrial uses of atomic power?

Mr. WEAVER. In the sense of five study groups, no.

Chairman COLE. In any other sense?

Mr. WEAVER. No; no agreement with the Commission.

Chairman COLE. Are you engaged in any studies of the industrial application of atomic power?

Mr. WEAVER. To a limited extent.

Chairman COLE. But not under Government contract?

Mr. WEAVER. That is correct.

Chairman COLE. Nor with Government money?

Mr. WEAVER. That is correct.

Chairman COLE. What is your attitude toward the patents or data or lessons you may learn from these independent studies in the atomic field that you have been making?

Mr. WEAVER. The effort is so small that I cannot conceive any such inventions arising from them.

Chairman COLE. Have there been any?

Mr. WEAVER. No.

Chairman COLE. Have there been any patentable ideas which have not yet been patented?

Mr. WEAVER. Not coming out of such study work.

Chairman COLE. Does the Commission or its representatives have access to all information in the atomic field that you have, either through Government-contract operations or through your independent private operations?

Mr. WEAVER. They have full access to any information on atomic energy throughout the company.

Chairman COLE. What about your employees and consultants who have had access to restricted data? Have they signed patent waivers covering ideas that they may develop?

Mr. WEAVER. Yes; they have, both employees and consultants.

Chairman COLE. How does Westinghouse regard itself? As primarily an atomic powerplant equipment or Navy ship-propulsion manufacturer?

Mr. WEAVER. There is no distinction. Just as in the case of steam turbines, we build steam turbines to power vessels for the Navy, and the merchant marine, as well as to power generators for the generation of electrical energy.

Chairman COLE. So you consider yourselves in the broad field of atomic power whether for ship propulsion or electrical generation?

Mr. WEAVER. That is right. We would serve all industries interested in having an application for atomic power.

Chairman COLE. Do you have any plans or prospects with respect to the AEC Laboratory at Pittsburgh which you are now using concerning the acquisition of it?

Mr. WEAVER. I should point out that the Westinghouse Co. owns the 200 acres of land and the original buildings and has leased them to the Atomic Energy Commission, which illustrates a basic interest in the facility.

Chairman COLE. You do not have any present plans looking toward the acquisition of equipment of the laboratory?

Mr. WEAVER. We have no present plans; no.

Chairman COLE. Why do you emphasize present plans?

Mr. WEAVER. Because this is such a changing business and dependent entirely upon where it takes us. Whether or not Westinghouse can foresee a return on an investment it might make in those facilities is another point.

Chairman COLE. You would not want now to say that you at no time in the future would consider acquiring the plant for yourself?

Mr. WEAVER. That is right.

Mr. PRICE. We just never thought about it.

Chairman COLE. I think that covers my questions. Do you have any more, Senator?

Senator PASTORE. No; I want to add my congratulations to Mr. Price and Mr. Weaver for a very frank and candid statement.

Mr. PRICE. Thank you, sir.

Chairman COLE. It has been very helpful. If you have any specific suggestions regarding the changes in the law, which would remove the curbs that you speak of, and I am sure Westinghouse has highly competent legal talent available for that problem, we would appreciate very much any suggestions you may have to accomplish the goal of a legislative legal climate which will invite and attract greater interest and activity in the atomic power field.

Thank you both very, very much.

Mr. PRICE. Thank you, Mr. Cole. Neither Mr. Weaver nor I know very much about patent law. We have been so much engrossed in this job that we really have not thought much about patent questions. When you get something before you that is specific, we will talk the thing over with our legal department and our patent lawyers, and I hope we will be more definite than we have been today.

Chairman COLE. The next witness is Mr. McCune, of the General Electric Co. The other largest electric equipment manufacturer in the United States, General Electric, is also one of the largest AEC contractors. It has operated the Hanford plutonium plant since 1946, the Knolls Atomic Power Laboratory since 1947, and a principal portion of the aircraft nuclear propulsion program since 1951.

Most of the plutonium produced in the United States has been produced at Hanford in reactors. The Knolls Atomic Power Laboratory at Schenectady, N. Y., was built partially as a supporting home laboratory for GE in its Hanford operations, and partially to stimulate early activity in the field of atomic power development. Design and development of the intermediate power breeder reactor occupied principal energies of the laboratory until this project was dropped as unfeasible at reasonable cost in 1950. Since then, the laboratory has devoted most of its efforts to design and construction of the submarine intermediate reactor. The land-based prototype is now being built near Schenectady. KAPL has made major contributions to the reactor art in the fields of liquid metal as a heat transfer agent, processing of atomic fuels, and selection of reactor types for other projects.

In 1951 the Nuclear Energy for Propulsion of Aircraft project (NEPA) was closed at Oak Ridge and a series of contracts were let by the AEC and the Air Force with airframe and engine manufacturers. GE also has a major effort in the Gas Turbine Division near Cincinnati, Ohio, on the design of equipment for the propulsion of aircraft by nuclear power. Recent shifts in this program have not lessened the importance of GE's role. Testing facilities are under construction at the Idaho Testing Station.

STATEMENT OF F. K. McCUNE, GENERAL MANAGER, ATOMIC PRODUCTS DIVISION, GENERAL ELECTRIC CO., ACCOMPANIED BY STUART MacMACKLIN, COUNSEL, ATOMIC PRODUCTS DIVISION, GENERAL ELECTRIC CO.

Mr. McCUNE. I have with me Mr. MacMacklin, who is counsel of my division.

Chairman COLE. Do you have a prepared statement, Mr. McCune?

Mr. McCUNE. Yes, sir, I do. May I read the statement?

Chairman COLE. Yes, sir. You may proceed.

Mr. McCUNE. Mr. Chairman, you requested Mr. R. J. Cordiner, president of the General Electric Co. or his designate, to discuss with you some of the problems incident to definition of a central policy on industrial atomic power development. It was further requested that an unclassified statement be prepared for the record. Mr. Cordiner has designated me as his representative and the following is the statement previously referred to.

For the record, I would like to call to the committee's attention that any comments I may make are based on the General Electric Co.'s

experience in the atomic-energy field. This experience started substantially before the war in our research laboratory and continued through the war. In 1946 we assumed responsibility for the operation of Hanford and for the construction and operation of the Knolls Atomic Power Laboratory at the request of the then Manhattan Engineer District with this assignment:

I am quoting this, because I want to emphasize how we were originally directed into the program, and what we had our mind on all these years:

Now that you have had an opportunity to review the problem, I wish to request that the General Electric Co. enter into contract with the Manhattan Engineer District for assumption of responsibility for research and development pertaining to the utilization of the transmutation method for production of fissionable materials and power and the operation of the Hanford Engineer Works.

Since the middle of 1946, we have continued these responsibilities, and in addition, have undertaken many others, including a program for development of an atomic aircraft engine. Furthermore, as in the case of many other industrial enterprises, we have continued to supply goods and services for the atomic energy program whenever we could do so to the advantage of the Government. During this time, we have seen the requirement for weapons material increase greatly. To meet this challenge we have been successful in obtaining tremendous improvement. We have greatly increased quantity from existing facilities, produced entirely new facilities, and made tremendous cost reductions. I mention these facts because I feel that we have had an almost unique opportunity to see how gigantic can be the gains of applied technology and good management in the atomic energy field.

In the Knolls Atomic Power Laboratory we have worked on chemical, metallurgical, and basic physics research, and have undertaken substantial reactor engineering design work. At Hanford we have also undertaken major reactor design work and have been successful in producing units of far greater economy and capacity than I believe you or we would have expected a scant 5 years ago. Again, I mention this lest you should fear that in what I may have to say further on, we are not alive to the rapid rate of progress which can be made in this new field.

It is my understanding that the ultimate purpose of these hearings is that you may have the facts, as varied groups see them, on which to base possible future modifications of the Atomic Energy Act. Let me, therefore, briefly outline certain principles which we believe could profitably be incorporated in such a revision.

Let me first say that we believe heartily in the declaration of policy which prefaces the existing act; the common defense and security of the United States is paramount, but atomic energy holds great promise for the public welfare in other fields. We believe, therefore, that the time has come where the Congress should be carefully studying the possibility, as we know you are, of permitting ownership of fissionable materials and of plants producing them by private operators. Where private ownership is desirable, the Government must establish security regulations, and possibly safety regulations, and these should probably be in the form of specific requirements to be met by the owner, rather than responsibilities undertaken by the Government. We suggest that if the ultimate purpose of such

a plant is for civilian products that private ownership is indicated, while for defense potential, the present arrangement may be best.

It would be essential to the above that at the proper time fissionable material be made freely available to all who are ready to pay the cost and who do not violate proper regulations. It is believed that the stockpile of fissionable material should be looked upon as in the case of any other stockpile of great national significance. Furthermore, the Government agency should be required to license bona fide applicants to develop, manufacture, use, or own apparatus or facilities for industrial, commercial, or other nonmilitary uses wherein fissionable material is used or produced. We believe that the license to develop, manufacture, use, or own apparatus or facilities should not carry with it the requirement that technical data and information, other than that reasonably necessary to administer health, safety, or national security, be furnished the Government, or in other words, become the property of the Government.

We believe that patentable inventions relating to the field of atomic energy should be on the same basis as patentable inventions in other items of highest importance to the national defense, and in this connection that in contracts between the Government and private contractors, the patent clauses in such contracts should conform to existing practices prevailing in the Armed Services Procurement Regulations.

There appears to be much sincere concern in this area as to whether these several provisions would result in favoritism, private monopoly, or other undesirable results. Frankly, I think the Congress should be concerned with the results of the present system of atomic energy operation if continued for many years in the future. Fundamentally, withholding from the public is monopolistic—release is the way of freedom. But release alone is not enough; release must be accompanied with incentive. I believe that both our standard of living and our potential for defense, by far the greatest in the world, are really based on recognition by the public that reasonable incentive for private gain is what produces results above and beyond any other system ever tried.

Notwithstanding the above, we believe that the Atomic Energy Act was, and is, an outstanding document, that it recognizes fully the unknowns surrounding this new field and that it gives necessary wide latitude to the governmental agency which is set up. If we have fault to find, it is with the administrative procedures which have resulted from some portions of the act. This interpretation and administration is centered around, I believe, two facts. First, it is our belief that both the Congress and the administrative agencies should be continually reviewing the position on security classification. While the Commission is given broad power to discriminate between that which should be restricted and that which may be released, in practice the great body of pertinent information in this country is restricted. The Congress in the end, I believe, must clearly and positively decide between the relatively slower progress made in a restricted atmosphere and the dangers of fully disclosing much that is presently classified. In other words, I believe that the Congress should make the decision between the security to be obtained through more rapid progress than the rest of the world, and that security which might be obtained through secrecy and inevitably relatively slower prog-

ress. If you will permit me an aside, that is really a heavy responsibility which you have.

Obviously, certain products, data, quantities, and other information should be withheld from any possibility of coming within knowledge of a potential enemy. The present language of the act, however, has in general been construed in such a way that the release of important information is the exception rather than the rule. Here I have tried to put in a rather homely illustration.

It really comes down to this. Most important work is being done not by the Government, not by laboratories, not by corporations, but by people. All the classified information starts in someone's head and becomes classified, if it does, when he puts it down on paper or tells it to someone.

Now, what is a scientist or engineer going to do when he talks to someone, writes up his experiment, issues his report, or writes a letter asking someone else to do something? If he were an expert in security matters, conversant with all the instructions and rulings, he might take a chance and write an unclassified document. But what does he really do? He probably says, "I don't know that this does not concern the manufacture or utilization of atomic weapons. I'm not entitled to know about weapons. Almost anything scientific may have a bearing on production of fissionable material or the use in production of power—and here, too, I'm not entitled to know much about the field, because of security, the need-to-know concept—but I'm responsible if I disclose it." So it is classified, and it usually stays that way forever.

I believe that improvement in the act in this respect can greatly increase our country's progress.

The second fact is that while the act contemplated, I believe, a mechanism whereby the dynamic energy of our industrial concerns could be unleashed in a Government-controlled enterprise, in practice this has not always been fully done. As a matter of fact, to us as operators on the firing line, it has seemed that more and more we were being forced into a pattern of Government operation, rather than bringing about more and more an industrial atmosphere. We hope the Congress will see fit to encourage the Commission to fully exercise the wide latitudes given it by the law in this respect.

Under the existing law, however, great progress has been made. Many thousands of people have become familiar with various phases of the atomic energy field. In turn, these people are thinking of ways in which the new knowledge can be used for the public benefit. As I see it today, within that portion of the overall atomic energy program with which we are familiar, we have made great progress in applying all the knowledge of a technical business such as ours to the work at Hanford.

However, on the assumption that the principal interest of the committee is in the areas where such progress has not yet been so clearly demonstrated, I would like very briefly to develop our philosophy on reactors for principal uses other than the production of fissionable material. I believe we are now making good progress in this field. The problem here has been both an economic and an organizational one from the start. It has seemed to us that the first steps in this field should be along the lines of finding places where the result of using atomic material as a source of energy produces a highly valuable

specific end result. Industrial development shows that this is a straightforward method of getting started.

In our case, we are embarked on the development of atomic propulsion systems for submarines and aircraft. In each of these cases, the end result, that is to say the expected performance of the submarine or aircraft is different from that available by any other means, and hence has a high economic value. This, unfortunately, is not the case in the production of electric power, at least in the continental United States. The electricity produced is exactly the same and worth no more than electricity produced by any other means. Hence, the reactor applications other than for the production of commercial electric power have taken precedence and, we believe, rightly so.

In the case of the submarine, the Navy and the Atomic Energy Commission have set up a central and coordinating group under one strong head to obtain the described result. This is a most effective arrangement. The projects have been recognized as combining a high degree of skill, both from scientists, the practical design engineers, and those who must eventually operate the end products. I think it is of highest importance that everyone recognizes that this work and other like it, requires far more than top scientific skill. As a matter of fact, our organization has been continually strained to develop or provide the diverse practical experience and skill required. They, in fact, are more complicated and more taxing than almost any engineering project of which we have knowledge. In an organization such as our Knolls Atomic Power Laboratory, we have been able to supply the proper type of background for our part of the program. We believe strongly that these are sound procedures and that the way they are conceived, organized, and are progressing is in the public interest. Equally, we believe, for example, that the combined knowledge and experience of the Navy and AEC have been effectively applied. While we have been identified with the aircraft propulsion project a somewhat shorter time, we believe that in this relatively short time great progress has been made by the same kind of a combination, that is to say, an individual representing the Government and bringing together the knowledge of the AEC and of the Air Force who must use the result, working with the laboratory supplied with the various skills of an industrial concern. We would be greatly surprised, furthermore, if there are not other applications where significant differences in the end-product would justify substantial development.

The point here is that we believe that such development is bound to coincide to a great extent with the lines of ultimate civilian use and when conducted to produce present real benefits is likely to be carried on by the best balanced scientific, engineering, construction, and operating organizations. Furthermore, in the drive to obtain the benefits needed to make these projects economical, we are continually attacking the one basic problem of expanding atomic energy the economics of the process. So far, the General Electric Co. has not had, nor desired, a contract for the production of an economical electric-power-producing reactor. We have in the past, however, worked extensively on some of the technical problems which it was felt must be overcome before any such thing could come about. Furthermore, in our own interests, as well as of that of the public, our top people have given sincere study to the problems in this field.

By and large, we see two problems. The first a technical one. In the coal furnace in the average citizen's cellar, ashes accumulate which stop the fire. When this occurs, he shakes the grate and gets rid of the ashes. In any reactor we have studied, this figurative shaking of the grate is tremendously expensive. Nevertheless, we believe that technical solution can, and will be, forthcoming. These are the areas of needed scientific progress.

Much more disturbing to us, however, has been the fact that even though we have examined structures varying from those resembling a refinery to static buildings full of complicated mechanical, electrical, and hydraulic machinery, the probable cost of these structures for atomic-power generation has been so high that they could not be justified even with negligible fuel costs. We have by no means reached the end of possibility, but this is where we stand today.

As for the future, we have every confidence that the thousands of scientists and engineers now contributing to sound economic programs, such as the production of weapons material, atomic-propulsion units, and so forth, will inevitably solve both the technical and practical problems standing between us and wide-scale production of electrical power. This effort should be accelerated by providing incentive and freedom which will enlist many thousands more. We are, however, by no means certain that this will occur in any short period of time, not because of any lack of basic scientific design or operating knowledge but simply because atomic energy can replace only a small portion of a system for generating and distributing electric power, and the cost of that small portion is itself being steadily reduced.

On the other hand, what we have accomplished is to make certain that the Nation in the foreseeable future has no need to fear the exhaustion of its natural-energy supplies, almost regardless of how magnificently we continue to increase our standard of living and our defense potentials.

It has been a privilege to give you our sincere beliefs in the field in which you carry such heavy responsibilities. I hope that you may, adding our opinions to those of others, continue to set our national policy wisely and well.

Chairman COLE. Thank you, Mr. McCune. You can be very certain that the committee values the opinions of the General Electric Co., which has rendered such a fine service in this program.

Are there members of the committee who wish to raise any questions of Mr. McCune?

Senator BRICKER. I do not believe so right now.

Chairman COLE. Mr. Holifield?

Representative HOLIFIELD. Mr. McCune, at the bottom of page 2 you take up the subject of ownership of fissionable material. Why in your opinion would ownership of fissionable material by private sources be more desirable than the utilization through a lease basis with the Government?

Mr. McCUNE. I frankly have not considered the question of a lease. All my remarks are directed toward this question of what are the incentives that make people move. I think, however, that the man who operates a plant feels that he should have complete responsibility. This can be so if he rents the plant, although I would expect that a man with a rented facility would certainly move more cautiously than the man who owned the plant. If you rented your coal pile, if

you rented your buildings on the basis of a fixed term, you are still faced with the problem of what next steps to take when the fixed term comes to an end. When you own it, you own it. I feel strongly on that.

Representative HOLIFIELD. You bring up the problem of shaking the grate, which is a novel way of indicating that, once this fuel is obtained by an operating plant, it gets to the point where it needs to be cleaned. Now, the Government, as you know, owns the only processing plants for cleaning this fuel. Private industry, if it is going to own the fuel, is either going to have to clean its fuel or contract with the Government to get the Government's services. If it is going to clean its own, it is going to have to build additional facilities. That is why it seemed to me that from the standpoint of leasing the material necessary to fuel a reactor that might be just as desirable a way as ownership, and it might simplify the problem of accountability which runs all through your presentation; that is, the question of classification and declassification of security. As you mentioned, it is a real responsibility, and particularly where this committee will be called upon to write legislation which will in effect tell the Atomic Energy Commission to accelerate declassification. Their reason to us has been that further declassification would contribute to knowledge of weapon development and use. They are putting in full time at the job of considering the technical details of this knowledge, its applicability to weapons as well as to commercial processes, and the Members of Congress cannot give it the full consideration that they give it.

While we in the last analysis will have to pass the legislation, we still must rely upon them for technical advice, particularly in the fields of declassification, because their advice is based on a fuller knowledge than any of us as individuals have. So, while we sympathize with the objective which you propose, yet we find ourselves in the position of the layman who goes to the doctor and has to take the doctor's advice. When we get the advice that further declassification is dangerous to the welfare of the country, what would you suggest that we do?

Mr. McCUNE. It seems to me that this is the same as a little question or a big question. This is a big question. Therefore, you approach it more cautiously.

Representative HOLIFIELD. That is right.

Mr. McCUNE. I think we all make up our minds by two means: one by studying the problem, and the other by listening to people. Our expression of opinion here is that the act as it stands leads to a perfectly honest administrative procedure, which I tried to describe with a simple illustration. It leads to thousands of people building a brick wall and a handful of people taking it down a brick at a time, you see. I would hope that further study might show areas in which it could be clearly brought out to the many people that there is no need to classify. There are such areas. Then it seems to me that the Congress itself ought to have—here I am advising you about your business, but I suppose I should not.

Chairman COLE. That is why we invited you down.

Mr. McCUNE. It seems that you might examine potential results from certain procedures.

I am not advocating this particular approach, but what would happen if we declassified everything over 2 years old except quantity and some similar things? How should one decide? One method would

be to go through the files on some such basis and take random samples, hundreds of them, and see if there is anything which it would be damaging to declassify. I think in the end it is going to be a matter of the best possible judgment, because I have no idea but what any declassification is a departure from the security of secrecy.

You gentlemen are the ones who are going to have to decide in your minds whether the departure from the security of secrecy will be outweighed by the security of progress. I think that any thing you declassify represents some loss. The point is that it is going to be pure judgment whether there is not going to be some gain.

Our considered opinion is that in the great body of things which we have seen and which we have had to classify, the gain through declassification would be greater in many cases than the loss.

Representative HOLIFIELD. I know that is the opinion of a great many scientists who come before us. Of course, scientists traditionally have believed in complete and free exchange of scientific information, and most of us are in sympathy with that objective. But we find ourselves in a field which is so dangerous from the standpoint of the effect of the weapon, and the effect of the material that we are dealing with that it has put unusual restraints upon us in this matter. It is very difficult to know just how to take those restraints off.

I wanted to ask you another question.

Mr. McCUNE. I appreciate the difficulty, but I commend it to your study, because there are some real gains to be accomplished, I am sure.

Representative HOLIFIELD. I am sure there are. What would you think of this type of approach to the patent problem? Recognizing that the bulk of this information has been paid for with public funds and that the benefits, therefore, should be passed to the public to as great a degree as possible, of preserving royalty rights to people who would contribute real patentable improvements in the future, but making those patents accessible for the wide participation of industry and political subdivisions of our Government?

Mr. McCUNE. As I see the patent situation, if I can expand on that a little bit, the basic patents in the atomic-energy field are probably behind us. That is good. They should be freely available, subject to security, of course. So then it seems to me we have to search for a patent procedure mechanism that has proved that it will work, a mechanism that is politically sound.

We have been looking for such a thing, and our answer is that the principles outlined in the Armed Services Procurement Regulations pretty much meet those characteristics.

There are cases where it is proper and desirable for the Government to acquire title. Acquire title means contract so that you own the patent automatically. There is a long list of procedures covered. We do not always agree with these regulations and their application but, as a result, there has been created an orderly body of background and knowledge and procedure which has worked out efficiently on items of the highest significance to the defense of this country and which is still being developed in an orderly manner by the interchange between the armed services and industry.

Representative HOLIFIELD. This is a complicated field and it has to be studied very thoroughly.

Mr. McCUNE. So our thought was that the move should be probably to an orderly body of background, such as this, rather than to try

to write a whole new law or whole new procedure, and then try to experiment and see whether that produces incentive or not.

Fundamentally a patent, as you know, is simply a question of the inventor making a bargain with the public. The bargain he makes is that if he writes the idea down so clearly that anyone in the public can adopt it and use it successfully, he can keep it for a length of time told him by Congress. The patent law is based on trying to get ideas for the public. The result of a patent is that an idea has been gotten for the public in a final, preserved, and defined form. Patent lawyers tell me that if, in a patent application, you do not describe the idea well enough so someone can copy it, the patent is no good. You obtain all the ideas for the future use of the public, and the Congress is the one that sets the time the man has before the public can jump in. I think that is a pretty good system.

I think through a media of a body of procedure, which is flexible and has been proved to work, the Army and Navy get plenty of contractors to supply their material. This appears to be a good way to shift from one philosophy to another similar philosophy and not from one philosophy to a completely untried philosophy.

Representative HOLIFIELD. Of course, we are in a little bit different situation I think on the development of this new science of atomic energy in that we have developed that from its very inception and up to a very high state of development by Government funds. We cannot ignore that. Neither can we, it seems to me, allow some favorite company to come in within the period of the next 3 or 4 years and patent a basic patent on some improvement which must rest of necessity on this base of knowledge which has been paid for by the public, and then by restrictive patenting of that process preclude its use by the rest of private industry, and other political subdivisions that have assisted in paying for the basic knowledge.

Mr. McCUNE. Is not this again a question of how you approach the question of what is a patent? Your desire is to elicit these ideas from the people so eventually they will be free to the public, and you let the man take a patent. That is the proven way of eliciting these ideas.

Representative HOLIFIELD. I certainly have no objection to an individual being amply compensated for a basic invention along this line, but I question whether that compensation should go to the point of restricting the rest of industry from using it. I think they should have ample compensation, but it seems to me that the invention should be available to all the other companies that want to build reactors, to produce power for the people, both private industry and municipalities who may want to build their own power industry up.

Mr. McCUNE. Again, I think we are exchanging opinions on things which are not obviously a matter of fact. In my opinion, the patent system, which I believe starts with the Constitution of the United States empowering Congress to allow inventors a period of time in which they can have free and exclusive use to their ideas, is one of these proved and working mechanisms which society has integrated. It has advantages; it has incentives. We move with incentives. This country is built on incentives. I believe we need to get as many incentives as we safely can into this program.

Of course, I am not a patent lawyer. I am not sure that is the approach. The approach is to get an ordered body of procedure that has worked.

Representative HOLIFIELD. We have that now. The Atomic Energy Commission does compensate for patents and does make them available.

Mr. McCUNE. But it is different from accepted procedure, and it is tailored, I believe, to give less incentive for people to dig in and spend their own money than the armed services regulations. I am in favor of the armed services regulations for that purpose.

Representative HOLIFIELD. Within the bounds of security, of course.

Mr. McCUNE. The armed services regulations have effective security provisions—again, I am not too familiar with them.

Representative HOLIFIELD. They have a provision where they can withhold the use.

Mr. McCUNE. It is given with a warning that if a man takes the contract, he must be careful of the security.

Representative HOLIFIELD. I am going to study the armed services procurement patent law more closely.

Chairman COLE. In that connection, Mr. McCune, do you feel that the Armed Forces procedure relating to patents provides for sufficient incentive and at the same time adequate security safeguards?

Mr. McCUNE. Yes, sir. If I may expand on this for a moment from our own experience, as a company on a given contract, we can be arguing with the Armed Forces at any given time to the effect that we think the work should be in the area where we get more rights. The Armed Forces may think the work might be in an area where the Government has more rights. Therefore, we argue about these things. But in taking off our company hats and looking for some procedure in the atomic field which would be far closer to what we think would produce the right incentives, we would pick the Armed Forces rules. We recognize you cannot start and write a whole new procedure.

Chairman COLE. Generally speaking, it is your feeling that the procedures of the Armed Forces procurement are adequate to the private incentive goal and at the same time adequate to the national security?

Mr. McCUNE. Yes, sir, and at the same time protect our national security.

Chairman COLE. You might have disagreement as to a specific application of that procedure.

Mr. McCUNE. Yes, that is correct.

Chairman COLE. But generally speaking you feel it would be adequate if applied in the atomic field?

Mr. McCUNE. Yes, sir, I do. I feel, as we all do, that the armed services do a good job in protecting the security of this country. Furthermore, all industry is applying their rules and has very much in mind the incentives to itself.

Representative HOLIFIELD. On that point, one of our staff members has just informed me that that complete section is applied administratively and not on a statutory basis.

Mr. McCUNE. Yes, sir.

Representative HOLIFIELD. Of course, that is the same situation that your Atomic Energy Commission at the present time applies the patent provisions of the act. They administer under the broad patent privileges of the act.

Mr. McCUNE. Of course, I cannot answer as far as the Government is concerned what is the authority for a set of regulations. The regu-

lations I speak of are applied in uniformity to all contractors, and they seem to provide incentive and provide security. We should have the situation where security is safe, where people are free to produce what the Armed Forces need, and at the same time where people have a vital interest in getting in there and doing the job. These, I think, are the three things we want.

Representative PRICE. Mr. McCune, I have had the pleasure of visiting Knolls Laboratory and Hanford, and also the Aircraft Propulsion Laboratory just outside of Cincinnati, and I want to compliment General Electric on the very fine job you have done in this program.

Mr. McCune. Thank you.

Representative PRICE. I am interested in your statement as to the effectiveness of the arrangement that the Navy and Atomic Energy Commission have worked out in setting up a central coordinating group under one strong head. I presume you refer to Captain Rickover?

Mr. McCune. That is right.

Representative PRICE. I wonder what you think, if we departed from such a system, the effect on the future progress of the reactor program would be?

Mr. McCune. Maybe I could answer that best by talking of some of our experiences in the operation. As you know, we undertook the Hanford operations at a time when it was considered to be almost a standby. You may recall that. The country quickly found out that was not the proper policy. So we had a tremendous building job to undertake. You well know what this has involved. We learned a lot by experience, particularly in this field where the structures were those which no one had ever conceived or built before, in many cases.

The one thing we learned is that from the start—and I second a great deal of what Mr. Weaver said—you must have a definite and positive objective. You must have a timetable. You must have the interests of the scientists, the engineer, and you must get the combined and deep and intense participation of the group who are going to use this thing when it is finished, if you are going to get anywhere.

That is exactly what has been worked out in this case. You cannot do without it. You must have the using group, the designing group, the scientific group, and the building group all working to a single common objective. You all know how difficult this is with the changing times, with the changing trends in economy, the needs of the civilian economy, the needs of our defense potential, and it takes a lot of strength to keep something together and get it finished in a given time successfully.

Representative PRICE. You feel it would be very unwise to change the system?

Mr. McCune. That is my feeling; yes, sir

Representative PRICE. I wonder if you could tell us the status of the aircraft-propulsion project.

Mr. McCune. The status of it?

Representative PRICE. Yes.

Mr. McCune. We cannot tell you the status as to how far we have gotten or numbers of people.

Representative PRICE. I am not referring to the progress you made

on the reactor, but is the project still in effect and force, and are you still operating?

Mr. McCUNE. Yes. Can I answer that by putting in a little background information?

Representative PRICE. I think the committee would be interested in knowing about the aircraft propulsion project because we have been interested in it for some time.

Mr. McCUNE. As I see it, the atomic propulsion of aircraft as such is a job of the magnitude of that which the country undertook when we changed over all existing air force from piston engines to jet engines. That is a big program. The General Electric effort at this time is comparable to the job that we had during the war when we collected a number of engineers and scientists in some rather small buildings over in our Lynn works and we put them to develop the first American jet engine. As far as the overall program is concerned, I read in the papers that it is very much cut back, but Congress is making the final determination on the budget bill.

To the best of my knowledge, the activity which is equivalent to that when we undertook when we developed the American jet engine is still going on. I believe and hope that it is planned to continue that way.

Representative PRICE. That is all I have, Mr. Chairman.

Chairman COLE. Does General Electric have any agreement with the Commission covering a study of industrial uses of atomic power?

Mr. McCUNE. We have no formal agreement with Commission, although we have recently written the Commission asking for such an agreement. I want to amplify that a little bit. We have always, of course, as I said in this statement, given a great deal of thought to the general situation. We have had people throughout our company in the various affected areas thinking on that with our own money and on our own time. We have felt that the time has come when we should expand and centralize some of that effort. It is only appropriate to ask for a contract with the Commission on that basis to be on the same basis as others.

We have approached or are approaching the Commission specifically for a contract to cover that which we need to expand such a program.

Chairman COLE. But as of the present time, you do not have any independent studies in the industrial field?

Mr. McCUNE. We have nothing except that covered by our main prime contract, and the work that is going on under that.

Chairman COLE. And not being conducted with your own resources?

Mr. McCUNE. We are with relatively few people and without special facilities, let us say, studying this thing all the time. This effort has been from the very beginning entirely independent of the work for the Atomic Energy Commission.

Chairman COLE. What happens to any patents or patentable ideas that you may develop?

Mr. McCUNE. There have been none developed in that work.

Chairman COLE. Have all of your people who are engaged in this atomic program either under direct operation of the contracts or in your independent studies signed the patent waivers?

Mr. McCUNE. Yes; our people have signed the standard forms.

Chairman COLE. Are there any further questions?

Senator BRICKER. In what field do you anticipate that there would be any development that would require patent protection in the future?

Mr. McCUNE. Senator, that, of course, is the kind of question which is very difficult to answer. A patent in itself is not granted unless the idea is a departure from the normal train of thought. A patent is something that would not be obvious to someone versed in the art.

Senator BRICKER. If you knew what it would be, you would do it now. I do not mean it in that light. My question is does not the basic patent field encompass it for all the practical needs for the development in which you are interested?

Mr. McCUNE. I am not sure that I understand the question. I feel that a large number of businesses require two things to become more fully aware of what is going on, and to promote their own interests. The two things having to come along inseparably are more information and some incentive. The information is pretty well restricted. We have discussed the reasons why. The incentive which would make people go after the information would be the idea that if they did find something worthwhile—and they might not—it would be theirs to keep, rather than something to turn over immediately to somebody else. It seems to me it is quite simple. If you are going to make something available, you have to give people incentives to make them plow into it.

Chairman COLE. Thank you, Mr. McCune. I suggest that if your organization has any specific suggestions to make concerning changes in the law, which you feel necessary, that you submit them to us whenever they become available.

Mr. McCUNE. We would be very glad to do that.

Chairman COLE. Thank you for coming down.

Mr. McCUNE. Thank you, Mr. Cole.

Chairman COLE. The next witness is Mr. Arnold K. Brown, the executive vice president of the American Machine & Foundry Co.

We are glad to see you, Mr. Brown, even though the hour is late.

STATEMENT OF ARNOLD K. BROWN, EXECUTIVE VICE PRESIDENT OF AMERICAN MACHINE & FOUNDRY CO.

Mr. BROWN. Thank you, sir.

Chairman COLE. First, for the purpose of information publicly and for the record, let me indicate something about the American Machine & Foundry Co. While it is one of the large heavy equipment manufacturers in the country, the American Machine & Foundry Co. has not been a prime contractor to the AEC at any time. Their largest job in the atomic-energy program to date is the development and construction of a major component of the Savannah River plant being built by the Du Pont Co. The American Machine has made known both to AEC and publicly its desires and intentions of getting into the business of building major components of atomic-power systems. That I think gives a bit of a background of your company, Mr. Brown, and of your interest in the subject.

Mr. BROWN. Thank you very much.

Mr. Chairman. I am the executive vice president of the American Machine & Foundry Co. In response to your invitation, I have been asked by Morehead Patterson, president of our company, to give you a statement of our position on industrial participation in

the atomic energy field. Mr. Patterson is now in Europe and regrets not being able to be present today to speak with you on these matters himself.

During the past few weeks, you have heard testimony from representatives of companies and institutions which have in various ways gained considerable technical and administrative competence in the atomic energy field. They have been, therefore, in a position to speak with authority on the many broad problems bearing on the further development of the United States atomic energy enterprise. These problems include such things as feasible reactor designs, nuclear power economics, the state of development of practical power producing reactors, the need for continued or for less government support, and so forth.

I should like to state at the outset that the American Machine & Foundry Co., at present, is in no such position to speak with confidence on these problems. I believe one can say, fairly, that we are more representative of a company, expert, perhaps, in a segment—a relatively small segment—of the atomic energy field, seeking entry into the broader aspects of atomic energy. We are, therefore, profoundly interested in the conclusions which your committee will reach and in the legislation which will result largely from your committee's deliberations. We are hopeful that a statement of our interests will contribute to your conclusions on the attitude of industry as a whole toward broader industrial participation in the various nonweapons applications of atomic energy.

The American Machine & Foundry Co. is a manufacturer of a diversified field of products with a history in engineering and manufacturing of intricate, automatic machinery. Over the past half century, we have introduced new equipment to previously unmechanized industry and have mechanized operations once thought to be too intricate to be done by machine. The company has flourished largely as a result of its ingenuity, inventiveness, and aggressiveness in attacking new complex engineering problems. During the past 10 years, the company has been active in diversifying and expanding its operations, originally starting in the field of tobacco machinery and later bakery machinery, its principal products for some 40 years, so that we now manufacture over 30 proprietary items, along with a large number of devices for the Ordnance Departments, Air Force, and the Atomic Energy Commission.

During the past 2½ years the American Machine & Foundry Co. has been associated with the atomic-energy project as a subcontractor to the Du Pont Co. on the program at Savannah River. In this capacity, it has developed and designed control and fuel-handling systems for the Savannah River reactors and has taken part in other activities closely allied to our special abilities. Prior to this time, the company developed and manufactured equipment and components for the General Electric Co. at Hanford. We are confident that we can continue to make contributions in our specialized field of developing and manufacturing precision electro-mechanical systems; but we are equally confident that we could, in time, make contributions in other phases of the atomic energy program as well, such as in reactor design, fuel and control rod fabrication, and the like.

I wish to make three main points concerning the company's attitude toward broader industrial participation in further atomic energy

developments. The first is that the American Machine and Foundry Co. is highly interested in entering the nuclear power field and in participating in the further development of the United States atomic energy enterprise. Our interest is motivated by a basic desire to exploit possible new profitable fields, recognizing at the same time that this desire is consistent with improving the industrial strength of the country in the atomic energy field.

While we have as yet made no exhaustive studies on reactor design or reactor economics, our engineers have studied with great interest the published accounts of work in these fields. Based on what we have read, we feel that the production of nuclear power is both feasible and practicable in the not too distant future. But over and above the immediate applications, if we may call them immediate, our long experience with new developments gives us the feeling that most of the significant applications are as yet hidden from view, and that with healthy and devoted attention, new and unforeseen applications will develop rapidly.

The second point is that, as a general policy, the American Machine and Foundry Co. has for years invested in long range developments and has expended considerable money and effort on new programs with a view toward future profits. We can choose as examples the cigar machine in the 1920's, the improved cigarette machine in the 1930's, and the pinspotter in the late 1940's. We would like to look forward to making similar expenditures of money and effort in the industrial atomic energy field in the early 1950's, and are prepared to do so under appropriate incentives.

The third point is that the company is anticipating a favorable climate for industrial participation and has started taking steps toward readying itself for broader participation in the atomic energy program. Along these lines we have had discussions with representatives of the Atomic Energy Commission, its principal contractors, and with the various participating companies on the manner in which the American Machine and Foundry Co. could best fit into further industrial atomic energy developments. We are contributing the services of several of our engineers to the Commission "package power" study at the Oak Ridge National Laboratory in exchange for the opportunity of gaining experience on reactor technology. We have recently added to the senior staff of our engineering department a man experienced in the atomic energy field. In addition, we are, of course, bringing to a satisfactory conclusion our work for the duPont Co. on the development and design of reactor mechanisms. Also during the next several months we will make an independent study of the possible future atomic energy picture which we will use as a guide for actions we will take for shaping our participation in the atomic energy field.

In summary, the American Machine & Foundry Co. is ready, willing and able to participate in further atomic-energy developments provided certain minimum incentives are granted. We feel these incentives should include, mainly, more liberal patent rights than are granted by existing laws and a more liberal information policy (so that, at the very least, companies having capabilities and an expressed interest in the field could, with appropriate clearances but without contracts necessarily with the Atomic Energy Commission, obtain technical information). In addition, we feel that other incentives

should be provided, such as permission for companies to own and operate nuclear power facilities and to lease or sell fissionable material under safeguards adequate to assure national security, and permission for companies to use and transfer fissionable and byproduct materials subject to regulations by the Commission in the interest of security and public safety.

We have set forth these incentives at the risk of oversimplifying the problems they imply. We clearly recognize the role atomic energy plays as a vital element of the Nation's defense policy, and we understand the responsibilities of the Government in securing the national defense and enhancing the national welfare. I am not able at this time to propose precise and detailed recommendations on changes to the existing legislation, and I foresee as a monumental task the spelling out of the procedures and controls, under which broad industrial participation is to be accomplished. I do strongly believe, however, that the benefits to be gained from tapping the huge reservoir of industrial effort for the further development of nonweapons atomic energy applications, will prove a sufficient incentive to bring to these problems a successful solution.

In our company's development three factors have been especially important. First, there has been the fact that machines can make men free and serve them well; second, there has been the fact that the constant development of new and better machines depends on the constant flow of ideas; third, there has been the fact that machines and machinery products reach their highest utility only when they serve people—which is to say, when they serve the public interest. We believe that the development of atomic energy applications fits this framework well, and we are anxious to train a good portion of our efforts in this direction.

I am grateful for the opportunity of being able to present to your committee our feelings on the broader participation of industry in nonweapons atomic-energy developments. I trust the expression of our interest in assisting in the further development of this new field will be of some value to the joint committee.

Chairman COLE. Thank you, Mr. Brown. That expression of your interest has been of value. We are happy to learn of the interest which a company such as yours has in this field.

Do you have any questions, Mr. Price?

Representative PRICE. No.

Chairman COLE. Are there questions from the committee? I am sure, Mr. Brown, had you been on the stand earlier in the afternoon, there would have been many questions. But in view of the hour, I will pass the few that I have in mind, except to inquire if all of your employees who have been engaged in this atomic program, either as subcontractor or in your independent studies, who have had access to restricted data have signed the patent waiver?

Mr. BROWN. Yes; they have.

Chairman COLE. That apparently is required of everybody.

Mr. BROWN. Yes, sir.

Chairman COLE. Thank you very, very much, Mr. Brown.

Mr. BROWN. Thank you, sir.

Chairman COLE. Our next and concluding witness is Dr. Eugene P. Wigner, who is professor of physics at Princeton University. He is

also a member of the General Advisory Committee. Any extensive perusal of the history of reactor development would soon disclose that Dr. Wigner has been among those few men who have generated the ideas on which others have been able subsequently to design and build the many reactors now known to be possible. He has been most closely associated in recent years with the Oak Ridge Laboratory at which he is a consultant, and where he is working this summer.

Dr. Wigner, we are happy to have you here with us this afternoon. I am not sure whether you had been scheduled to appear at an earlier time when your scientific colleagues appeared on Monday of this week, but at any rate we are happy that you could make it eventually.

You do have a statement. We will be glad to hear from you.

STATEMENT OF EUGENE P. WIGNER, PROFESSOR OF PHYSICS, PRINCETON UNIVERSITY

Dr. WIGNER. Thank you very much, Mr. Chairman, and thank you also for your very kind words. I am privileged to be here. May I read my statement?

Chairman COLE. Yes; proceed, Doctor.

Dr. WIGNER. I wish to state, first of all, that the opinions which I am going to express are my personal ones. They are not the views of either Princeton University, or of the General Advisory Committee to the United States Atomic Energy Commission, of which I am a member, nor of any other organization with which I may be connected.

When discussing the problem of a nuclear reactor which can stand on its own feet in our economy, let me start with two premises which, I believe, are generally accepted.

1. So far, there has been no determined and sustained effort dedicated to the purpose of designing and building such a nuclear reactor. The reason is, briefly, that private industry, on the one hand, had no incentive to initiate such an effort nor was it in a position to judge its chances for success. The Atomic Energy Commission, on the other hand, was too preoccupied with the problems of weapon production in the interest of our national defense to make such an effort.

2. The ability to build nuclear reactors and to produce economic nuclear power is a national asset just as surely, and probably to a higher degree, as is our ability to drill oil wells, to produce gasoline, or to build and operate railroads. For this last reason it appears desirable that the Government extend its help to bring the day of economic nuclear power closer just as it helped to advance the age of the railroad.

Recently much thought has been given to the role which the Atomic Energy Commission on the one hand and private industry on the other should play in the development of economic nuclear power. There are those who believe that the task should be assumed by the AEC and others who consider it to be in the realm of private enterprise. It is on this problem that I would like to make a few comments.

In my opinion, it would be a mistake to decide now either that the AEC should assume this task or that it should be left to private enterprise. Rather both types of institutions should be given an opportunity to participate in the program. This opportunity is given to the laboratories of the AEC by the yearly appropriations to its reactor

program, the amount of which is decided upon on the basis of a judgment of the relative importance of this program and the other obligations of the Government.

The opportunity to be given to private companies may consist of two types of help. The first is of a purely legislative nature and would consist of an amendment of the present Atomic Energy Act. As far as I could ascertain from previous testimony, the weight of present opinion seems to be in favor of such an amendment.

A second type of help to private industry may be the assumption of some obligation by the Government which would make the ownership of a nuclear-power reactor more attractive economically. This obligation may consist in a guaranteed price for nuclear power for a certain period of time, or in a similar guarantee for the price of fissionable material that may be produced, or in a variety of other means which could make it more rewarding for private industry to design, build, and operate a nuclear-power reactor. Any support of the price of the reactor's products would be much preferable to paying part of the cost of the reactor or of its development.

In this way, the choice of the type of reactor to be built and its design could be left in the hands of the company, and the incentive for building a simple and inexpensive unit would remain fully effective. A price guarantee for the reactor's product, on the other hand, may enable a company to decide on building a reactor at an earlier date than would be possible otherwise.

Similar to the support of the reactor effort of the AEC's National Laboratories, the magnitude and kind of help which the Government might be willing to offer private industry will depend on the judgment of the importance of private participation in the development of nuclear power and will have to be consistent with the other obligations and objectives of our Government. In my opinion, both problems should be decided on the legislative or highest administrative level. They are problems which affect the AEC and in the solution of which prime consideration should be given to the advice of the AEC. They are not problems of the AEC.

An estimate of the magnitude of help to be offered to private industry could be arrived at by considering the amount of money which would be spent by the AEC laboratories and installations to arrive at the same goal. It would seem to me that it would be better to develop economic nuclear power through Government institutions rather than privately, if the price is the same. The techniques and know-how would be more accessible in the former case. It is to be hoped, however, that if support of AEC and offer of help to private industry are properly balanced, both will successfully participate in the business.

The offer of help to private industry should be, furthermore, clear and firm. Only if private industry can clearly understand and fully rely on the offer for help, such as a price guaranty, will it be able to make full use of it and to plan and assume risks under the conditions created by the price guaranty or other form of help. It is quite possible that, for some time, the offer of help will not be taken up by any company—that the incentive will be deemed to be too small to compensate for the risks to be assumed. This would be disappointing. However, one should not feel disappointed too soon. Because of the present lack of familiarity of industrial establishments with the atomic energy problems, it may take considerable time for them to

explore the possibilities created by the new situation, to find ways in which they would profit by it. In fact, I hope that nobody will take up the offer without full and mature consideration, but once he has done so, he will persevere.

The formulation of the offer for help will involve a great many legal questions beyond those encountered in the amendment to the act. Nuclear energy will have to be defined, the price of the raw materials, which now are the exclusive property of the AEC, will have to be fixed in relation to the price guaranty, et cetera. Finally, a difficult situation may arise if too many companies would wish to make use of the opportunities to be offered. It is my conviction that all these legal difficulties can be overcome.

The above ideas envisage a kind of competition by private companies with each other and with the AEC laboratories and installations under the conditions created by the support of AEC work on the one hand, and offer of help to private industry on the other. In contrast to this competitive method, it has been proposed that the Government and private industry be made to cooperate on the problem. It has been proposed, for instance, that the AEC installations build pilot plants for nuclear power and demonstrate its feasibility and private industry take over from there on. It does not seem to me that such a procedure would be advantageous. I say this not only because I believe in competition and because much that I have seen within the atomic energy project supports my belief that competition is useful for the achievement of technical progress. In addition to this, there are, in my opinion, three specific reasons which support the procedures I have tried to outline above.

1. We like to believe that all undertakings of our atomic energy program have been successful and there is surely little question that many of them represent major technical and scientific accomplishments. However, all we have evidence for is that they were directed at a possible task which has been accomplished. In order to have a measure of our accomplishment in an undertaking, we should know the time and money that were absolutely necessary to achieve it and compare with this absolute minimum the time and money actually spent. An approximation to such a measure can be obtained only if several people undertake the task; that is, if there is competition in the field. Thus, competition will provide us with a measure of our success and make an effort toward such success really worth while. We know, from Russia's success in producing fissionable material and atomic bombs, that some of our accomplishments were less spectacular than we first were led to believe.

2. Several independent enterprises striving toward the same goal encourage an atmosphere which creates people who are dedicated to the purpose of economic atomic energy. In spite of some familiarity with the AEC laboratories, I know of very few people who would be willing to devote the next 20 years of their lives to the problem of economic nuclear power. However, the program needs such people. It needs people who are willing and eager to start research on this problem and follow it through all adversities right down to the final conclusion. It will be much easier to find such people if they do not wander alone toward a distant peak, if they know that there are other people, at other and very different institutions, who strive toward the same goal. Under the present arrangement, the ambition

of the members of the National Laboratories is more naturally directed toward proving themselves useful members of their laboratories—a very worthy purpose—than toward a specific technical goal. Also, it is not in the nature of Government institutions to give economic considerations a dominant role. This will be changed, to the benefit of all, when they meet the challenge of groups of people to whom economic considerations are the natural thing to undertake.

3. The problems connected with the handing over of a job from one institution to another have not been solved in the atomic-energy program with full success. This is, for me, the strongest argument against the National Laboratories building pilot plants and private enterprise the full-scale plants. Fully understanding the principles of design is almost as difficult and almost as time-consuming a job as to mold that design in the first place. It is rarely accomplished fully by the group which takes over the design at the pilot-plant stage. The lack of full understanding of the design on which they have to build may induce the second group to create something big and spectacular, rather than something inexpensive and purposeful. As a result, one too often hears the boast, "We have built a \$100 million plant," and too rarely the boast, "We built a 100-million-watt plant for as little as \$20 million." As to economic nuclear power, it is hard to see how private enterprise can assume responsibility for its being really economical if it is not responsible for the decisions of the basic design.

What I said before, in particular in the last paragraph, should not be construed to mean that I am against cooperation between the National Laboratories and private enterprise. Such cooperation will indeed be most useful if it develops naturally, as a result of an understanding between two groups and without having to follow a predetermined pattern. Above all, every group should remain responsible for its own undertaking, and the cooperation should not obscure the responsibilities for the various undertakings.

Let me say one last word. I do hope that eventually, or perhaps rather soon, private industry will have an opportunity, alongside the National Laboratories, to participate in the nuclear energy program. I hope equally strongly that this opportunity will not be expected to create miracles. The human mind works slowly and a long time will be needed by every responsible enterprise before it can appreciate the value of such an opportunity. I hope, finally, that the work of the National Laboratories toward the same goal will be adequately supported because it is quite possible that ultimately they alone may have to carry the burden of creating economic nuclear power.

Chairman COLE. Dr. Wigner, we appreciate your statement, knowing the full knowledge you have in the field and the high degree of competence which you personally possess.

Are there any questions of Dr. Wigner from the committee? If not, I got the impression from hearing your statement, Doctor, that you seem to prefer that this power development of nuclear energy be undertaken by private enterprise. Then I was struck by your statement on page 3 where you said it seems to you that it would be better to develop economic nuclear power through Government institutions rather than private if the price is the same. You underscored the qualification "if the price is the same."

I would like to have you amplify the thought that you had there. First, why do you feel it would be better if done by the Government, assuming the price is the same?

Dr. WIGNER. I think the know-how would be more accessible to everyone, and the situation probably would be simpler if the economic atomic energy would be developed by National Laboratories.

Chairman COLE. You were speaking of the research and development in connection with nuclear power and not the actual construction and operation and generation of power itself by government?

Dr. WIGNER. I was. I would like to refer in this connection to the statement of Mr. Weaver, who emphasized that the larger part of the job at the present time and probably for some time to come will be research and development. It is only a smaller part of the job that is the actual construction.

Also, I would like to refer in this connection to the last statement which I made; namely, that I think it would be unfortunate if the research and development would be done by one organization and the actual building of the reactor by another organization. I feel that this would be dividing the responsibility in such a way that none of the two organizations would make a wholehearted effort to do as good a job as it can. I would not like to divide the responsibility for design and development work from the responsibility of detailing and of actual construction.

Chairman COLE. How would you distinguish, if at all, between laboratories actually owned by the Government, the National Laboratories, and those laboratories that are financed with Government funds, but operated under contract, such as the General Electric and Westinghouse laboratories? Should they be on the same basis?

Dr. WIGNER. I would think so; yes.

Chairman COLE. You would consider a Westinghouse laboratory constructed and operating under Government contract to be on the same basis as a laboratory that is constructed and owned and operated by the Government?

Dr. WIGNER. As a matter of fact, one does not notice the difference if one visits those laboratories.

Chairman COLE. Are there any other questions?

If not, Doctor, thank you very much, and again my compliments to you for your fine contribution in this very important field.

Dr. WIGNER. Thank you, Mr. Chairman.

Chairman COLE. This will conclude the hearing for the day. The next meeting will be on Monday, when we will hear representatives of the North American Aviation Co., Allis-Chalmers Manufacturing Co., Bendix Aviation, and Combustion Engineering Co.

The meeting is adjourned.

(Thereupon, at 5:10 p. m., Thursday, July 9, 1953, a recess was taken until Monday, July 13, 1953, at 2 p. m.)

ATOMIC POWER DEVELOPMENT AND PRIVATE ENTERPRISE

MONDAY, JULY 13, 1953

CONGRESS OF THE UNITED STATES,
JOINT COMMITTEE ON ATOMIC ENERGY,
Washington, D. C.

The joint committee met at 2 p. m., pursuant to recess, in room 318 of the Senate Office Building, Representative W. Sterling Cole (chairman), presiding.

Present: Representative Cole (chairman), Senator Hickenlooper, and Representative Price.

Professional staff members present: Corbin C. Allardice, executive director; and Walter A. Hamilton and J. Kenneth Mansfield, of the professional staff of the joint committee.

Chairman COLE. The meeting will come to order.

There have been many hundreds of companies which have done business with the Atomic Energy Commission. In the course of this procedure, it is inevitable that some of these companies have sensed that with the development of atomic power there may come an opportunity to diversify and expand their own roles in the atomic-energy business.

We have already heard from one such company last week, the American Machine & Foundry Co. Among others in this group of companies is to be included the North American Aviation Co. and the Allis-Chalmers Manufacturing Co. They are manufacturers who have expressed interest in becoming atomic powerplant and equipment manufacturers in addition to their numerous other activities.

North American Aviation has already a sizable share in the atomic-reactor-development program, to which Dr. Starr of North American testified before the committee on July 1. This company has also done work related to production and weapons. The other company, Allis-Chalmers, has done many jobs for the AEC, not the least of which has been outstanding developments in new types of pumps and circulation systems.

Representing North American Aviation Co. this afternoon is Mr. Lee Atwood, president. I will ask Mr. Atwood to come up to the witness stand.

Will you sit right down and make yourself comfortable? I am glad to see you. I assume you have a statement.

STATEMENT OF J. L. ATWOOD, PRESIDENT, NORTH AMERICAN AVIATION, INC.

Mr. Atwood. I appreciate this opportunity to appear before the joint committee, Mr. Cole.

North American Aviation is primarily known as an aircraft-manufacturing company and is now in its 25th year of operation. Our company now operates three principal plants in Los Angeles and Downey, Calif., and Columbus, Ohio. We employ approximately 51,000 people, of whom 9,000 are engaged in engineering, research, and development work.

Shortly after the end of World War II, North American Aviation began atomic-energy studies and research as part of our normal advances into important technological developments.

Our first specific study of atomic energy began in 1946 as a propulsion source in connection with North American's program leading toward the design of a long-range guided missile. An atomic-energy research group was established to investigate the possibilities of atomic-powered rocket and ram jet engines.

After careful study, the group concluded that nuclear-reactor development had not reached the stage where application to guided-missile work would be feasible. Other studies were then launched by North American to examine the possibilities of atomic propulsion for aircraft.

Essentially the same conclusion was reached concerning atomic propulsion for aircraft as was resolved for guided missiles. The research group demonstrated that a great amount of fundamental development with nuclear reactors, atomic fuels, and fuel assemblies must be done before a practical atomic aircraft engine could be designed. Further work with atomic energy for missiles and aircraft was set aside for the more fundamental approach to the new power potential.

Early in 1948, under contract with the Atomic Energy Commission, intensified work began in the general field of nuclear-reactor technology. The goal of the recent work has been to develop nuclear reactors for the practical production of power. Since 1948 the company has made many contributions to atomic-energy technology. Among these are various designs for reactors to perform many services for both military and peacetime applications. Designs of small research reactors, suitable for medical, industrial, and academic research with atomic radiation have been made, some of which are now being proposed for actual construction. Other reactors, with more specialized applications for military use, have also been designed.

To further assist in general reactor development North American designed and built a reactor now operating in the Atomic Energy Research Department at the company's Downey, Calif., plant. This reactor provides a high production of neutrons for advanced nuclear research.

The atomic-energy research department numbers about 300 persons. Of these, about 150 are scientific and professional personnel.

Located at the company's Downey, Calif., plant, a few miles east of our main plant in Los Angeles, the atomic-energy research department utilizes 50,000 square feet of floor area. In addition, North American has provided specialized equipment for this research and development work.

Our program of research and development for the Atomic Energy Commission has involved an expenditure of over \$10 million to date. This work has been performed as part of our expanded research and development programs in many advanced technical fields, including electromechanics, aerophysics, guided missiles, and electronics, and amounts to a total volume of about \$40 million each year. This is in addition to engineering and development work devoted to airplane design.

Our accomplishments in atomic-energy work include design and development of a pilot plant suitable for construction; design, construction, and operation of a water-boiler-type reactor producing neutrons for research and development work for all types of reactors; design and construction of research reactors for research, medical, and industrial uses; designs and component development for plutonium and power-producing reactors; evaluation of economics of atomic-power plants utilizing uranium and thorium; nuclear-physics experiments with reactor components; development of reactor safety devices and low-cost chemical processes; and experimentation with reactor materials.

Your committee has shown great interest in the problem of industrial application of atomic power and is concerned with the possible amendment of the Atomic Energy Act of 1946. I would like to comment on two aspects of the law which may be subject to amendment, either now or sometime in the future. My comments will be confined to (1) the patent aspects of the law, (2) the ownership and operation of small research or special industrial process reactors, and (3) the ownership and operation of nuclear-power facilities by private industry.

With respect to patent rights, it seems to me that the law could well be changed to permit individuals to hold patents respecting all aspects of fissionable materials and atomic energy. Certainly, the subject matter of such patents may, in many cases, involve secrets of the highest order, but I believe that adequate safeguards exist under present patent procedures to protect such classified matter and prevent its dissemination until security clearances are appropriate. It is our belief that protection under the patent laws of this country should not be denied to inventors in this relatively new and fertile field.

With further respect to patent rights, we believe that inventors should enjoy commercial rights under patents developed while working under Government contracts. In view of the fact that the investment required to prepare an invention for commercial sale and to develop the market for such an invention is very large, the possibility of patent protection is a real incentive to such development. For this reason, a nonexclusive license from the Government is not adequate protection and, in fact, discourages commercialization of any inventions developed with Government funds.

Patentable ideas are frequently developed by individuals and organizations engaged in the performance of Government contracts. Such a situation has very few counterparts in normal industrial practice. Usually the entire rights in inventions made while working on contract for commercial installations are left with the inventing contractor and do not flow to the person for whom the work is being done.

However, a large body of information has been and is being developed as a result of contracts with the Atomic Energy Commission and other Government agencies. These contracts are, of course, for research and development work, usually involving inventive activity. In such cases it is, of course, proper for the Government to retain a license under any inventions originated as a result of the contract work in any case. However, commercial rights in such inventions should not be required by the Government as a condition of the contract. Such commercial rights could serve as a great incentive toward furthering scientific arts and development activity. It is our recommendation that the law provide that, in contracts with individuals and industrial firms, the Government retain only patent rights necessary for governmental purposes, releasing commercial rights to the inventors.

Another significant use for reactors, in addition to power, is for research or for special industrial processes. In order to permit ownership and operation of such an industrial process reactor, the law does require changes. The development of these commercial aspects of this type of nuclear reactor will be hampered if each application must be the subject of special legislative action. We feel these developments will be largely, if not entirely, carried out under private enterprise if the process are commercially accessible. We recommend that the law provide for use and/or ownership of small amounts of fissionable material and related equipment for commercial and medical processes.

With respect to the ownership of large amounts of fissionable material and nuclear-power facilities by private industry, we have no reason to feel that the time has arrived where a pressing need for such provision exists. We do feel that, at the proper time, the law must be changed so that the development of this vital power source will not be artificially held back, recognizing at the same time that governmental licensing and security surveillance will always be required in the interests of national safety. Such a change lacks urgency at the present time, in our opinion, as a great deal more development work must be done before these large commercial installations can be confidently undertaken.

All of the information available to us indicates that it is commonly accepted that:

(a) Commercial atomic power as would be installed with current knowledge is more expensive than conventional power;

(b) The Government does not appear to be currently prepared to subsidize an uneconomical major power installation for production of industrial power; and

(c) No private industry or industry groups appear to be prepared to invest their own funds in such uneconomic installations.

The question is then the current economic status of industrial power from the atom. If economical installations were presently possible there would be no difficulty with respect to the financing of such plants, and in the interests of progress the law should be changed at once. Since this is not the case, we advocate continued studied, deliberate consideration of those changes which would permit private participation in the development of the field.

We do believe that the commercial use of atomic power will be justified on the basis of economics alone within the reasonably near future.

There is nothing basis in the atomic-power cycle that dooms it to perpetual high cost. The answer is engineering and development.

In order to achieve the maximum performance of any engine, a great deal of detailed development engineering is necessary. Where performance is unimportant, an engine can be made from rudimentary designs based on rule-of-thumb and handbook-type specifications. Where the ultimate in performance is involved, years of time and hundreds of thousands of man-hours are involved in the development. An engine for economical production of industrial power must emphasize two of the basic powerplant parameters—efficiency and reliability. Factors of weight and size which are of great importance in other applications need not compromise these fundamental requirements for the stationary industrial powerplant.

For example, one of the basic measures of efficiency will be the temperature at which the reactor can operate and at which heat can be extracted and transferred to a heat exchanger. In general, the higher the temperature, the more efficient this engine will be. However, the high temperature, in many ways, tends to defeat the objective of reliability, which is also a basic requirement. It is our opinion that since the present estimates of cost of atomic power are based on known factors and current engineering practice, significant improvements are possible if sufficient test activity is undertaken. As a consequence, we have suggested and still advocate the construction of a pilot plant of adequate size to determine basic operating characteristics as the next step in the development of atomic power. Such a pilot plant would not be a mere demonstration of atomic energy generating electric power, but would be an actual engine-test facility wherein the powerplant and technical-design improvements can be reduced to practice and proved under actual operating conditions.

It is our belief that such an evolutionary development process will bring the cost of atomic power into line with that of conventional power generation, and furthermore, may actually improve on such costs.

Our company looks forward to the day when industrial atomic power is financed by private funds. In order to stimulate this eventuality, we have utilized the medium of advertising to indicate that we are ready to build pilot plants now, and will welcome an opportunity to assist any industry, industry group, or industry-Government combination to start this project now. We have not received any material response to this offer, which seems to indicate that private industry is not ready to undertake this work in its present stage of technical development.

Under present circumstances and in consideration of the governmental background on atomic energy work, it is difficult to see how these developmental steps can be taken except under the sponsorship of the Atomic Energy Commission. In view of the great importance of this matter to the future of the country, we do believe that it is appropriate for the Government to pay for this fundamental addition to knowledge which is necessary at this time. Once this difficult technology is available and the economics of atomic-power production is brought into line, the question of exploitation will take care of itself.

Chairman COLE. Thank you, Mr. Atwood.

Mr. Price?

Representative PRICE. Mr. Atwood, I was very much interested in your statement. I have followed the work of North American Aviation in this field for some time. As a matter of fact, I have been a visitor at your installation at Downey.

I have been particularly interested in the advertisement that you referred to in your statement. I have a copy before me of a full-page ad which ran in the Wall Street Journal on June 8 of this year. How many other newspapers was that ad carried in, Mr. Atwood?

Mr. ATWOOD. I don't have the list, Mr. Price. I have one here from the Los Angeles Times, and we had it in 1 or 2 newspapers in the East.

Representative PRICE. Did you have any response at all from the ad?

Mr. ATWOOD. We have not received any constructive customer-type inquiries. We have received a number of interesting comments, and as Dr. Starr told you a week ago, we received inquiries from chambers of commerce and that type of organization, wondering if their community would be considered for such development, and that type of thing.

Representative PRICE. What were the circumstances behind the decision to go into the newspapers and advertise the availability of a pilot plant of this nature?

Mr. ATWOOD. Mr. Cole, I think, outlined our basic interest in his introductory statement. We do hope to diversify, to develop a position in this new field, and we feel this is a most legitimate promotional activity, to attempt to establish in the minds of potential customers the position of North American's research and development in the atomic field and to attempt to develop a background for future participation to the extent that it is feasible under the laws and regulations.

Representative PRICE. Your program, of course, is based on contractual relations with the AEC, is it not?

Mr. ATWOOD. Yes.

Representative PRICE. Was the AEC involved in the decision to advertise in the newspapers?

Mr. ATWOOD. No, sir, definitely not. This is purely the work of our own company. It is our own idea. We are responsible for it. We had all our newspaper releases cleared by the security personnel of the Atomic Energy Commission.

Representative PRICE. The material in this ad also was cleared?

Mr. ATWOOD. The text was cleared by the Atomic Energy Commission for security; not for subject matter or the opinions that we might have expressed.

Representative PRICE. Well, now, summing up your statement in the final paragraph, you treat with the problem that industry would face in going into the search for industrial power through atomic energy. If you had had response to this advertisement, wherein you offered this to industry at a cost of say, \$10 million, what would you have been able to hold out to them? What would you have indicated that they might attain from this pilot plant?

Mr. ATWOOD. We feel, as I have stated today, that economical production of atomic power can be made a reality. If a group decided to venture into the atomic-energy field, they would obviously have to spend a good deal of money in development. We feel we would be

instrumental in that development, in preparing technical equipment, making designs, tests, and studies leading toward the ultimate economical construction of a successful power-generating system.

Now, the fact that this cost is materially higher than that normally experienced in experimental work by industrial corporations is only a matter of degree. Everyone that ventures into a new field must make some investments. Investment in this case is likely to be quite high. We do not guarantee results, quite obviously. However, we feel that we would be an effective instrumentality in aiding any such organization that might have the money, that might be prepared to back such a venture, and who would then presumably be in a position to gain economic benefits from it later on.

Representative PRICE. Does this pilot plant represent the completion of a study by your company for the AEC, which was followed up by recommendations, that you have the feeling that they could attain close to economical power by further development? Or what was the report that you made to AEC, and what recommendations did you make to AEC?

Mr. ATWOOD. It is a most complex topic, and I am not nearly as well prepared technically as some of your other witnesses. However, Dr. Weinberg last week, as I read his testimony, took about a page to describe the great variety of atomic reactors that were possible and the infinite number of possibilities that lie before us in improvement and possibly selection of improved designs.

We do not conceive of this as a complete, final, ultimate design. We rather conceive of it as a starting point. And it is subject to change, subject to development, and, we certainly hope, major improvement. That is the technical evolutionary cycle.

Representative PRICE. Is North American continuing its study in connection with the contract that they have with the Atomic Energy Commission?

Mr. ATWOOD. We are continuing the study. We have a number of tasks, Mr. Price. They are concerned in large measure with some of the fundamentals. Many, many things are still unknown or only partially known. The behavior of materials under atomic radiation, high temperatures, the control equipment necessary to control a reactor of this kind, the combinations of material, and reflectors, shields, and such things—we are working on some of those problems. We are contributing to the great body of information that the Atomic Energy Commission is accumulating under the Atomic Energy Act and the appropriations which you have made. We have only a small part. We only have a section of that spectrum.

We feel that this design approach is fundamentally in the right direction, quite a way in the right direction. We feel that it will have to be materially improved before it is an economic power generation source, but we also feel, as I pointed out, that improvements are inevitable, and will come as a result of the design work and the operation.

Representative PRICE. But North American itself has not constructed a pilot plant?

Mr. ATWOOD. No, sir, North American has not. Our investment in this is quite limited. We are contractors.

Representative PRICE. I mean, in your contractual relations, the studies that you have been doing for the Commission did not result in the actual construction of a pilot plant?

Mr. ATWOOD. No, except for the small rudimentary reactor that I mentioned in my text. No; we are not building a power-generating reactor of any kind at this moment. We are doing only technical work.

Chairman COLE. In order that the record may show the advertisement to which Mr. Price has referred, let me take the time to read the advertisement into the record.

As Mr. Price has indicated, it is a full-page ad in the Wall Street Journal issue of June 8, 1953. At the top of the ad in large type are the following words:

Here is an atomic power reactor.

Then in smaller type, but still relatively large:

that can be built right now!

Then at the left-hand side of a photograph of a model of the proposed reactor are these words, in smaller type:

North American Aviation stands ready to build an atomic-powered generating pilot plant right now. Until such a pilot plant is built, America will not know the answers to vital practical questions regarding the use of atomic energy as a source of commercial power.

This plant was designed by North American Aviation's Atomic Energy Research Department under contract with the Atomic Energy Commission. Since 1946, North American's engineering team—one of the Nation's largest independent groups of outstanding scientists and engineers—has been studying the practical application of atomic energy to both military and nonmilitary uses under the auspices of the AEC and other Government agencies.

North American is not in the business of selling electrical power, but welcomes the opportunity to assist any industry, industry group, or industry-government combination to start this project now.

North American is not trying to influence the national policy decisions on financing atomic power development. North American does submit the following facts on the technical requirements of such development: (1) Pilot plants are needed; (2) North American's engineering and production facilities are ready to go—now—with an actual design; (3) such a plant of our design will cost about \$10 million.

Under the photograph are these words:

This is a photograph of the model of the atomic power generating power plant designed by North American Aviation, Inc.

At the bottom of the ad are these words:

Designers and builders of the F-86 Sabrejet and the new air superiority Fighter F-100 Supersabre, North American Aviation Co., Inc., Los Angeles, Downey, Fresno, Torrance, and Columbus, Ohio.

You indicated that the response to that ad was not material. Can you tell us what responses you did have?

Mr. ATWOOD. I am afraid I can't, Mr. Cole, in any detail.

Chairman COLE. Well, did you have any responses?

Mr. ATWOOD. I don't have the file here. Well, I had some more or less personal responses. I had one from a chamber of commerce in California, who wanted to get more information. We told them what we thought was suitable. They had hoped that their own power needs might be improved through the future development of atomic power. And we might have had a couple more. I just don't recall anything that would be of interest to you or that would be material to this discussion.

Chairman COLE. I am rather surprised that, in view of the apparent widespread interest in this subject of power from atomic sources, there

had been no inquiries made of you. The ad apparently indicates that you are now in the position to build such a reactor right away.

Suppose I had called you up on June 9, if that is the day following the date of the ad, and told you I had \$10 million and I wanted you to start building the reactor which your ad referred to. What would you have done about it? Could you have started work right away?

Mr. ATWOOD. We are prepared to do the technical work. Here is the only thing: I do not know what you are getting at, but obviously your engineers or your personnel that were interested in this, would have to have Q clearances to come in and investigate. The problem would then be taken to the staff of the Atomic Energy Commission for a determination as to whether the atomic fissionable material could be allocated under the law to experimental applications on this plan. If the response were favorable and you approved of our design and wished to put up the money in the form of a contract, we would have started to work immediately and undertaken to build the plant.

Chairman COLE. Would the only consent that would have been required from the Commission been the clearance of personnel to be engaged in the construction work and the availability of the fissionable material?

Mr. ATWOOD. That is my understanding, Mr. Cole. There may be other legal provisions that would have to be complied with, but in any event we would attempt to take care of that.

Chairman COLE. Well, the design of this plant which you had in mind: was that the result of your own studies in the field, independent of your work with the Commission?

Mr. ATWOOD. The design work is primarily the result of all contract work done for the Commission, but the actual production of any particular bit of hardware would have to be done against the contract on which the plant was ordered.

The details of this construction, the working drawings, do not exist. They would have to be made, and they are part of this \$10 million cost. The body of theoretical information and technology are embodied in reports and other information which we have prepared under contract to the Atomic Energy Commission.

Chairman COLE. You indicate that your company had not spent much money in research in this field, so that all that you or your people know about the field are lessons that have been learned through your contractual relationship with the Commission?

Mr. ATWOOD. Through working under contract; that is right.

Chairman COLE. Am I correct in assuming that all of your employees have signed a patent waiver?

Mr. ATWOOD. I believe that is required by the law and under our contract. I believe that has been done.

Chairman COLE. Well, then, in constructing such a reactor as your ad contemplated, it would have been necessary, would it not, to have used some of the reactor ideas you learned in the course of your contract with AEC?

Mr. ATWOOD. We would have had to use many, many patented devices that are owned by the Government. We would have to use all the background of technical information that has been developed since the initial Government work was undertaken on atomic energy.

Chairman COLE. So that there would have been a third element of consent that you would have had to obtain from the Commission?

Mr. ATWOOD. Yes.

Chairman COLE. In addition to clearance of the personnel engaged in the project, and in addition to the fuel required to run it, you would have had to have permission from the Government to use the patented ideas.

Mr. ATWOOD. Certainly. I may not have made that clear, but that is true.

Chairman COLE. I bring that out only to give my own personal feeling that the ad was a bit misleading to the public generally; indicating that all they had to do was to call you up on the phone and tell you they had the money, and they could expect that you were ready to commerce tomorrow to start to build.

Now, there are other complicating factors involved, which might not make it quite so easy as that ad indicated. However, let me say this: I do think the advertisement served a useful purpose in arousing public interest in this subject generally, and I am not being critical of the company for having placed the ad. I only raise the point as I have to indicate that it is not quite as simple as the ad indicated.

Mr. ATWOOD. That is undoubtedly true. There are many conditions, and to list them all in fine print would serve no particular purpose, although we have no intent in mind to go behind the spirit or letter of the law or regulations, as you, I am sure, are aware.

Chairman COLE. You have stated that the aggregate of contracts by the Commission with you has totaled \$10 million in the atomic field.

Mr. ATWOOD. Yes, sir.

Chairman COLE. And that this \$10 million was a part of an annual Federal fund of \$40 million which your company has used, in the atomic field as well as other areas, of guided missiles, electronics, and so forth. Over what period of time has this \$10 million which you have had from the Commission extended?

Mr. ATWOOD. It covers the period since 1948. We were under contract to the United States Air Force prior to that time.

Chairman COLE. What do your contracts with the Commission now provide with respect to patents that may result from your operation under the contract?

Mr. ATWOOD. The patents are classified in various ways. The patents relating to fissionable processes I believe are the property of the Government; that is, those related to fundamental atomic nuclear fission, and certain apparatus connected with it. Other patents which may be worked out by the personnel doing design work on auxiliary apparatus do not necessarily belong to the Government, but it may be required that they be transferred to the Government and that certain residual rights may remain with the company. But I believe that for the basic atomic energy patents the title to the patent is vested in the Government.

The CHAIRMAN. Then what is the significance of the waiver which your employees have signed, which I understood to be tantamount to a release by them of any claim or right to a patentable idea that they may develop in the course of work done under the contract?

Mr. ATWOOD. I believe that you may refer to our employment agreement, I am not sure. We have, in common with most companies, an arrangement whereby any patentable ideas developed while working for our company are the property of the company, unless they are specifically released to the employee.

Chairman COLE. By the company?

Mr. ATWOOD. By the company. Now, that is under our employment agreement. I believe there may be a special agreement for the personnel working in atomic energy, but I do not happen to be familiar with the provisions of that.

Chairman COLE. Then from my understanding of your description of the contract which you have had with the Commission for the last 5 years, any patents developed in the course of that contract which have a direct relationship to the production of fissionable material, or perhaps to go even further, have any relationship to the military application of atomic energy, are the sole and exclusive property of the Government.

Mr. ATWOOD. That is my understanding, Mr. Cole.

Chairman COLE. The company has no claim to it whatever.

Mr. ATWOOD. I believe that is correct.

Chairman COLE. On the other hand, with respect to ideas which may be developed that have a commercial application, the company retains to itself the sole and exclusive right to that patentable idea.

Mr. ATWOOD. No, sir. I believe we do not retain any sole and exclusive right in such cases. Where we have a commercial product developed as an auxiliary to Government work, under the military contracts, such as aircraft contracts, we do maintain the sole commercial rights. If the invention was made by our personnel, that is, under our direction. On the other hand, with the Atomic Energy Commission there are some intermediate degrees of ownership or release of patentable rights that we are involved with in connection with the terms of our contracts.

Chairman COLE. How has that worked out in actual practice during the past 5 years?

Mr. ATWOOD. Well, it has worked out perfectly all right, Mr. Cole.

Chairman COLE. I do not mean whether it has been satisfactory to you. I mean the mechanics. Has your company been granted a determination by the Commission that your company has the exclusive right to an idea that it may have developed?

Mr. ATWOOD. We have, generally speaking, run into this kind of a situation. We had a patent some of our people worked out in the atomic energy department for blocks. They were cleverly designed in interlocking section so that they would act as a more effective shield from atomic energy radiation. They were jointless so far as the neutron passage was concerned in some fashion. We licensed another company to make them. They undertook to make the blocks. But they found that the Commission, under its rights under our contract, had licensed a couple of other firms to do the same. They then decided not to go into production, with the tooling necessary to make those blocks. Now nobody is making them, and I don't suppose anyone without some patent protection would be interested in going to any expense to prepare to manufacture.

Chairman COLE. How about the two companies whom the Commission licensed?

Mr. ATWOOD. They have not yet exploited the product, either.

Chairman COLE. Well, do you feel that that failure, that apparent failure, of the Commission to see that its licensees had moved and progressed under the license has tended to slow up the program?

Mr. Atwood. I think it is symptomatic. I believe that it reflects only in very, very minute degree the eventual problem of patents going, in effect, into the public domain. I believe it is the equivalent of having no patent law but rather of requiring everyone to disclose his patentable ideas and then letting anyone else use them. And I can't help but feel from my experience and background that that would not be constructive as far as industrial development in this country is concerned.

So I would rather advocate that even though Government money, Government background, in one way or another has contributed to the conditions under which a man makes an invention or a company makes an invention, with respect to commercial rights that do not interfere with the Government's right to pursue its governmental activities, but rather with respect to commercial rights, patent rights be granted, and that exclusive rights to the inventor be recognized and supported.

Chairman COLE. You do feel, do you not, that it would be helpful and wholesome if private capital were interested in money being spent for research and inquiry in the field of power reactor?

Mr. Atwood. Well, I certainly do, Mr. Cole.

Chairman COLE. I frankly was somewhat surprised to hear you indicate your feeling that since the art has not reached the state of perfection so that we know today how to go out and build an economic reactor, therefore it is premature to consider changing the law. I can't reconcile that with what appears to be your further viewpoint that private capital should be encouraged to probe into the field. What inducement is there for a person with private capital to run that risk of probing unless he knows at that time that the law is such that if he is successful he will be able to apply it?

Mr. Atwood. It is all in your point of view. I related in large measure to my conception of the time element in the evolution of something that can be taken hold of by private capital. I certainly feel that each session of Congress has the opportunity to amend the law, to modify the law, and that it will be more than 2 years certainly, possibly 5 years, and even if pilot plants or other basic operating experiments are undertaken, it will be something like 5 years before we can refine our fundamental knowledge to the point where it can be picked up and utilized economically by private industry.

Now, if the law were amended, and we were free to undertake experiments such as we have outlined in our advertisement, it is conceivable that such a thing might be financed by private industry. But until the law is amended, I seriously doubt that we will know—let me put it another way. Until we do have more knowledge as to the future economics of it, there is serious doubt in my mind whether we know just how the law should be amended. And the longer we consider it, possibly the better amendments we will achieve.

Chairman COLE. Do you mean by that that there should be no changes in the act in the very near future?

Mr. Atwood. I have recommended the amendment to permit the utilization and ownership of small amounts of fissionable material for process reactors. We feel that those are reaching the point where they can be applied relatively soon, that is, for medical purposes and for industrial processes. They do not, in any event, involve large amounts of fissionable material or large amounts of heat.

Chairman COLE. But you do not think the law should be changed in such fashion as to make it possible for private capital to build a land-based industrial power reactor?

Mr. ATWOOD. I don't object to any such changes. I didn't come here for that purpose. I tried to point out that from the body of information that we have been able to get together we could see no immediate need or immediate reason for making that change at this time. Rather it is our feeling that a period of engineering development is indicated, and that in a little longer period possibly we can make a more constructive change in the law.

Now, I don't come here to actively oppose or offer any negative reasons in that regard.

Chairman COLE. In your statement you stated:

It is our opinion that since the present estimates of cost of atomic power are based on known factors and current engineering practice, significant improvements are possible if sufficient test activity is undertaken. As a consequence, we have suggested and still advocate the construction of a pilot plant of adequate size to determine basic operating characteristics as the next step in the development of atomic power.

You failed to indicate who you thought ought to do that. I judge you feel it should be done by the Government.

Mr. ATWOOD. In the final paragraph, I attempted to summarize our conclusions in that regard. I do feel that the Government has come so far along this line in support of this program, and we are so near, monetarily speaking, it seems to me, to the goal of economic power, that it would well be in order for the Government to finance additional pilot plants leading toward this specific purpose, in addition to the weapons programs, which have been the principal objective of most of the atomic energy expenditure.

Chairman COLE. You do not anticipate we will ever reach the point of perfection, do you?

Mr. ATWOOD. Certainly not. I rather feel, though, that we will reach the point of economic power production; and at that point I believe that the law will then be amended to permit, under certain limiting circumstances, many, many private organizations to participate in the production of atomic power, and that they, and the Atomic Energy Commission, will evolve continued improvement. I think that will go on ad infinitum.

Chairman COLE. Then it is your feeling that Government sponsorship should continue to direct the development of industrial power reactors until it has been established that those reactors are competitively economical with conventional systems?

Mr. ATWOOD. I feel that I can't see far into the future, obviously. I can't even project my ideas too far into the future. But I do feel the next step under the circumstances should be financed by the Government; the next step, involving pilot plants. Perhaps these pilot plants will be disappointing, even with our best efforts in engineering application. But I feel something will come from the pilot-plant program.

Chairman COLE. Do you have any feeling as to how important the program is; that if private capital is not available to start these experiments and run these risks, the Government should do it?

Mr. ATWOOD. I feel it will take a long enough period in any event, and it will be quite a long while before atomic power can generally replace coal and water power. I am not an economist. I don't have

much background on the supply of fuel and coal in this country. But from what I hear and from what I have been led to believe, we will find that this is a more and more pressing national problem. And certainly within 25 years we are going to be much more concerned about it than we could possibly be at this moment.

Chairman COLE. Do you feel it is important that we should learn about it?

Mr. ATWOOD. I do consider it of great importance, Mr. Cole.

Chairman COLE. To the extent that if it is not possible for private capital to begin learning about it, the Government should do it?

Mr. ATWOOD. I definitely feel that.

Chairman COLE. Thank you, Mr. Atwood. That covers my questioning.

Senator Hickenlooper?

Senator HICKENLOOPER. No questions.

Chairman COLE. Thank you very much, Mr. Atwood.

Mr. ATWOOD. Thank you.

Chairman COLE. Mr. Stevenson?

We will now hear from Mr. Robert Stevenson, whose statement will indicate who he is.

Mr. Stevenson, we are very glad to see you.

**STATEMENT OF R. S. STEVENSON, EXECUTIVE VICE PRESIDENT,
ALLIS-CHALMERS MANUFACTURING CO., ACCOMPANIED BY C. R.
BRAUN, MANAGER, ATOMIC POWER SECTION, ALLIS-CHALMERS
MANUFACTURING CO.**

Mr. STEVENSON. Thank you very much, Mr. Cole and gentlemen.

As your chairman has indicated, my name is R. S. Stevenson. I am executive vice president of Allis-Chalmers Manufacturing Co. With me I have Mr. C. R. Braun, who is manager of our atomic-power section.

If I may be permitted a brief introduction, I should like to sketch in a little background which will give you an idea as to why Allis-Chalmers is interested in the development of power from fissionable materials. Allis-Chalmers began as a machinery manufacturer in Milwaukee a little over 100 years ago—first product millstones. Within 10 years the firm was building complete portable flour mills, including the water wheels to produce the power and the shafting, pulleys, and various devices for transmitting it. By 1874 the company was in the steam-engine business, and by 1904 counted its installations in the thousands, largest uses being pumping water for cities and generating electricity. By that time we were also building hydraulic turbines in large sizes. Shortly after the turn of the century, the firm produced its first steam turbine, has been a consistent factor in the business ever since and, as proof of keeping up to date—or in advance—last year installed the first steam turbine generating unit to use a supercharged coolant.

You are probably familiar with Allis-Chalmers as a farm-machinery manufacturer.

Naturally, the firm's position as a major producer of farm tractors requires a deep and constant interest—and considerable skill—in the development and production of internal combustion engines. I merely

cite a minimum number of these facts to indicate our logical interest in any method of producing power.

Now, as to our specific interest in atomic power: Before World War II some of our engineers and technicians began to interest themselves in specific projects in the field of nuclear physics. Therefore, considering this interest and our considerable know-how in the production of machinery and equipment, it was perfectly logical for us to be called into the Manhattan project; and it is a fact that Allis-Chalmers produced more equipment for that operation, measured by weight, than was supplied by any other single manufacturer. Since then we have continued to cooperate with various atomic projects by assigning or loaning engineers and technicians to those projects. Further, we have cooperated in the design of various rather complicated devices for some of the projects, and are now producing, on a semimass production basis, a piece of equipment of primary importance to one of the larger installations. Now, this work has all been for the Government, and, of course, is connected with one phase or another of our national defense. We mention these latter facts for two reasons: One is to further qualify our interest in the nuclear-energy field, and the other is to indicate something of the extent to which industry has already been required to cooperate in these atomic projects—as a technical adviser, as a designer, and as a supplier.

Our interest in some opportunity to participate in the development of electric power from nuclear sources is of course tied to our customers' interest in the possibility. It seems there is a logical step from waterpower to fossil fuels to atomic energy—even though that last step is a very much larger one and presents challenges that we've never met, much less conquered, before.

It is not my opinion that you want a technical discussion here, for if you did I should have to call in some technical assistance. I am not a technical man. Neither is it my belief that you want categorical statements as to the specific contents of the revised law which you are considering writing. However, I would urge you to consider opening—to the greatest extent consistent with national security—the atomic-energy field, to the end that we, and other concerns qualified to work in this field, have the broadest possible opportunity to do so for the benefit of our whole society. We believe that these firms, within the proper restrictions as to the national security, health, and safety, and the number of other areas to which you will give attention, can be safely entrusted with the job.

Now, there are a very great number of factors to be considered and settled; in fact, some of them won't be settled very fast. Although there are the usual number of positive opinions, there is no complete unanimity as to the type of reactor which will be used to extract the energy. There are variances of opinion as to whether or not plutonium will be a byproduct and what will be done with it. There are wide differences as to estimates of the cost of a reactor and as to whether or not private financing can handle it. There are many other questions and many opinions as to answers—but my point is that this situation is normal at this stage of a scientific and industrial development, and the size of the project and its tie with national security don't make them any easier to solve quickly.

But I do believe we'll solve these problems more quickly the sooner we get at them and that—and again, consistent with national secu-

riety—you will be contributing to the benefit of our total society if you can work out a revised law which will allow industry to go to work in the nuclear-power field.

Thank you, Mr. Cole.

Chairman COLE. That was a very fine statement. It is certainly right to the point, especially on the question of immediacy of considering the changes in the law.

Senator HICKENLOOPER?

Senator HICKENLOOPER. Mr. Stevenson, if the law were altered at this time to permit private companies to go into this field independently on their own, either as contractors for others or for their own account, do you think Allis-Chalmers would be prepared to spend a substantial amount of money in experimentation and research and development on their own? By a substantial amount of money, I mean somewhere in the millions of dollars. I do not mean \$50,000 or something like that.

Mr. STEVENSON. I could only answer that, Senator, by citing what we are starting to do, within the limits of the area in which we can operate. And that is that, as you probably know, we have joined with a group of some 18 power companies and 4 other industrial firms with the avowed purpose, within the law, of trying to build a reactor to produce electrical power.

Senator HICKENLOOPER. Which group are you identified with?

Mr. STEVENSON. It is the Detroit Edison-Dow Chemical group.

We have already assigned some men to that job and are cooperating on some designs, which are aimed at trying to decide which kind of a reactor to approach, Senator. And the expense is beginning, and we will spend some money. I can't tell you how much.

Senator HICKENLOOPER. I am personally concerned and interested in private enterprise getting into this as quickly as it is reasonably possible, but I am also concerned as to whether or not the situation is advanced far enough so that maybe some of these activities in the near future would be merely operating under a hunting license, or whether there is enough game in the woods to bring home a little something for the pot.

Mr. STEVENSON. Well, that is a good question.

Senator HICKENLOOPER. The alteration of this law will be a major alteration, if it is made. In some ways it will alter the basic concept of the law. I happen to be one who believes that the Atomic Energy Act needs a major overhauling in many particulars, of which this is one. But before we start issuing hunting licenses indiscriminately, here, we want to be sure that the situation is such that there is every reason to believe, first, that people will put a lot of their own money into it, providing they can have some protection in that investment; secondly, that their efforts will be successful, not from the standpoint of necessarily making a success for the individual, but successful in the whole operation of this thing, so that we will really be getting some advanced power systems in this country.

Mr. STEVENSON. Of course, we are aiming in that direction. And unless we in this group felt that there was some possibility of success, we just could not afford to go into it very deeply. But as we do make progress, we think there is a possibility that we can move into the area.

Senator HICKENLOOPER. I think that is what troubles a great many people now about this matter. To merely open up this law—and of course it will have to be opened up; there is no private capital group, no private company, that is warranted in spending anything except just a little venture money to open the gate a little bit to be in shape to go ahead if things do permit them to. But there is no particular object in making a major change in the structure of this basic law unless some very substantial results by way of improvements and new developments can be expected.

The security features of the law alone are enough to make us go cautiously, I think. We still have the, at least to me, paramount duty of protecting the security of this country, until the atmosphere in the world is just a little bit more cordial than it is now, and until we can probably, I hope, take some steps that will give us more assurance against the use of atomic weapons for destruction. Whether that time will ever come or not, I don't know, but I think it is a worthy objective.

But meanwhile it is entirely possible we could take the genie out of the bottle, and then could not put it back in again. It would be gone, and we would lose it. There are calculated risks that would have to be taken. I think if we could be sure, of course, that great results would come from this, that would be one thing. If we could reasonably be sure, that might be an inducement to change this law. But as I say, if it is only going to be a license for somebody to go out and tinker with it and see what they might be able to do with it in the future, that is a different thing. I think that is what the committee is searching for, and we are trying to see what the balance of his situation is. It is a great field. Its possibilities are unlimited. But whether we are now at the point where we ought to be unshackling this thing to the extent which private enterprise has got to have, if it is to have any chance for success with its own venture, I think is a big question in the minds of most of us. Because we will agree that you cannot expect private individuals to carry on a more or less aimless experiment, or experiments that have a highly speculative or questionable success even at the very end of the road.

Mr. STEVENSON. You can't even expect anybody to do that, can you?

Senator HICKENLOOPER. Well, then, that gets down to this point: as to whether or not the responsibility of the Government at the moment, in the public interest, in the overall public interest, might not be to continue a little longer with certain basic experiments in connection with or in cooperation with its contractors as a Government operation until we can see a bit further into the future in this thing, and then say, "We will turn it loose now for people to go as far as they can with it."

Mr. STEVENSON. I agree that that is the problem.

Senator HICKENLOOPER. We have a very nice statement on the problems here. I guess no one can give the minute answers to it at this moment.

That is all, Mr. Chairman.

Representative PRICE. Mr. Stevenson, your company has done considerable work in this program ever since the Manhattan District days; is that right?

Mr. STEVENSON. Yes, sir.

Representative PRICE. Has most of your work been done with the prime contractor, rather than directly with the Commission?

Mr. STEVENSON. Yes, Mr. Price, it was. Being machinery manufacturers, our work was the development and refinement and adjustment of machines to do the production job.

Representative PRICE. You found it necessary to come up with a lot of new machines and new equipment meeting the demands of the contractors that were building the different installations?

Mr. STEVENSON. Yes. They in most cases came through refining a piece of apparatus that we were already working on. And we finally ended up with a new one; there is no doubt about that.

Representative PRICE. Your interest in the prior development program has been more or less as equipment manufacturers?

Mr. STEVENSON. That is our business; yes, sir.

Representative PRICE. Are there many of the other large equipment manufacturers that are connected in any way with these other study groups that you know of?

Mr. STEVENSON. I don't know the content, Mr. Price, of the other groups. I don't know whether there are or not.

Chairman COLE. I was very much interested in your opening reference, Mr. Stevenson, to the fact that your company was organized originally, a hundred years ago, for the purpose of going into the business of making millstones to grind wheat, and that within 10 years after that you had found other methods of milling wheat that made your grindstones obsolescent—which I think is a very apt illustration for us to bear in mind as we try to look into the future, which is behind a very dark curtain. The only thing we have to tell us what is behind that curtain is what we can see back over our shoulder of what has occurred in the past.

And I judge that it is your feeling that we should try to pierce that curtain of the future as soon as possible in order to learn what might be behind it.

Mr. STEVENSON. Yes, sir.

Chairman COLE. And as you have emphasized a number of times, always holding primarily to the basic requirement of our national security.

Mr. STEVENSON. Right, sir.

Chairman COLE. As well as the safety of the people who might be engaged in the program.

Mr. STEVENSON. That is right.

Chairman COLE. I am curious to know what your experience was in the work that you did with the Manhattan District and later with the Commission on the point of the extent that you were held back or circumscribed by Government requirements, by directives of the Commission.

Did the Commission give you a job to do and let you be free to do it in your own way, as you thought best, or was the Commission constantly, in an effort to help, of course, trying to tell you how to do it, circumscribing your latitude of operation?

Mr. STEVENSON. I could say that we had quite wide latitude in the matter. Of course, our particular portion had to fit into the entire project. But I feel that we had no more complaints than the situation at the time would have brought up.

Chairman COLE. Your company has no interest in building reactors, as such, I judge, but primarily has an interest in making the various types of gadgets that go to make up the reactor?

Mr. STEVENSON. Yes. I wouldn't know, as of right now, that we would be interested in building a complete reactor. Naturally, thinking ahead in the future, we hope to participate in these programs by providing the type of equipment that we have this so-called skill to provide, and that could later, Mr. Cole, go into building a complete reactor. But we are not proposing that at the moment.

Chairman COLE. Since your company is generally known, as one primarily engaged in the manufacture of farm equipment, including tractors, I will ask you a question on behalf of the farming element in the country. Does your present interest in power from fissionable materials lead you to believe that you might harness that power to the point that it could be used to run a tractor? I am not talking about electrical energy. I am talking about direct application of the power.

Mr. STEVENSON. There are so many limitations on the weight of a farm machine, which must go over the ground, of course, that as of this moment anything we know about shielding and the actual building of an atomic machine would be probably above the weight factor that could be efficient in farming as we know it now. Weight is, of course, only one factor in a tractor.

Chairman COLE. It would rule out the consideration of an atomic reactor, as it is now known, to be applied to a tractor?

Mr. STEVENSON. As it is now known; yes, sir.

Chairman COLE. And the important factor in that is the degree of shielding that is necessary?

Mr. STEVENSON. Yes, sir; that would be one of the factors.

Chairman COLE. Now, if the time comes when they can find some type of shielding which is less bulky and weighty and less difficult to handle, then you think that it might be applied to motive power comparable to the gasoline engine?

Mr. STEVENSON. I have seen dreams. I would say, almost, that this type of power could be packaged in that kind of a quantity.

Chairman COLE. Of course, you were not present at the time, but would you be willing to agree that the portable milling machines that your company made 10 years after it went into existence were dreams at the time your company started?

Mr. STEVENSON. Mr. Cole, there are a lot of dreams in the history of a company like this and a Nation like this. That is right.

Chairman COLE. Do you have any more questions, Mr. Price?

Representative PRICE. Yes.

Mr. Stevenson, your company has been in the business of supplying equipment and different materials to the atomic-energy program almost since its inception. I know, I have seen a lot of your handiwork in the installations of the facility. Do you have a separate division handling your atomic-energy business?

Mr. STEVENSON. We have what we call a section. We have an atomic-power section, of which Mr. Braun is manager, and it, Mr. Price, is a part of what we call our power department, which is a very much larger department, but which allows the atomic-energy group to draw various skills and abilities which can be available to it on call. So we feel that it magnifies the possibilities of the group that are working in the atomic-energy projects.

Representative PRICE. What percentage would you say of the work of Allis-Chalmers at this time is devoted to atomic-energy activities?

Mr. STEVENSON. I am sorry. I can't answer that, Mr. Price.

Representative PRICE. Is it large now, or small?

Mr. STEVENSON. No; it is not a great amount in dollar volume. We are working on a contract, the one I mentioned in my prepared statement, which runs up to 1956, which is a fairly large total, but it strings out over about a 3-year period.

Chairman COLE. Mr. Braun, do you have anything you care to add to what Mr. Stevenson has said?

Mr. BRAUN. I might mention this, Mr. Cole, in elaborating just a little bit on the organization, that I believe Mr. Price raised a question on. In this power development, we have a number of groups, each of which have specialized personnel, engineers, with research and engineering development facilities, for the particular product or the particular part of the power equipment, such as the steam turbine. And in the activities of the atomic section, if a problem comes up on the steam turbine, for example, or a pump, a special pump, or a special heat exchanger, or any special equipment that we feel we need assistance on, we call in these people and get their advice. And that can be carried on to any extent that is necessary on the particular project that we are involved in.

Chairman COLE. How many people do you have engaged in nuclear work?

Mr. BRAUN. We have approximately 40 directly engaged, and in the power department I think there are probably some 1,500 engineers and technicians and a corresponding number of draftsmen, and so forth, that we cooperate with.

Chairman COLE. Can you tell me what your arrangements are with the Commission concerning patents that may result from your contract with the Commission?

Mr. BRAUN. They belong to the Government.

Chairman COLE. Irrespective of the nature of the gadget?

Mr. BRAUN. Yes. On any work that we do under contract with the Commission, under a development contract with the Commission, the patents belong to the Government.

Chairman COLE. If in that developmental work you should learn that a 5-pronged handle of a valve was preferable to a 4-pronged handle, that idea would belong to the Commission?

Mr. BRAUN. That is my understanding; yes, sir.

Chairman COLE. Have there been actual applications of that provision of your contract?

Mr. BRAUN. I can't answer that, sir. I can probably clarify your question by saying one patent was issued to us in connection with atomic-energy work, and it is assigned to the Government in accordance with our contract. Further, we are now processing some ideas into a position where patents will probably be applied for, with the full understanding that those patents, if obtained, will be assigned to the Government, unless the Government chooses to waive its rights.

Chairman COLE. Well, that does not mean that you have not learned anything in the course of your experiments about it, that you have not developed any new ideas, does it?

Mr. BRAUN. Oh, we have a number of things that have come up that will eventually, we feel, if they are pursued, involve other parts

of a power plant. I can cite special pumps to handle fluid metals as one example of the experience that we have gained in our work in atomic energy.

We are pursuing at our own expense other developments which we feel have application in industry and in the utility field.

Mr. STEVENSON. Mr. Cole, I think that that gets back to what I mentioned here a little while ago: that a lot of these things that you do are refinements of what you were doing already. You need a pump. You knew how to build a pump. But suddenly you had to build a pump that would be so completely leakproof under certain conditions that no radioactive material could get out. So then you designed that pump with that sort of a seal in it, which wouldn't allow this radioactive fluid to get out. And that is a variation of a type of pump you always have been building. A great amount of our work, Mr. Cole, is that sort of thing. It is like your allusion to millstones.

Representative PRICE. Would the ideas, though, involve new patents, separate patents?

Mr. STEVENSON. In this case that idea wasn't patented, was it?

Mr. BRAUN. I don't believe it was. We are still investigating it.

Chairman COLE. Thank you very much, gentlemen, for taking the time to come down.

That completes the schedule of the rather light program for today.

The next meeting will be on Wednesday at the same hour, when we will hear witnesses from the Kaiser Engineering Co., the National Rural Electric Cooperative Association, and Dr. George Weil, who was formerly Deputy Director of the Reactor Division of the AEC and is now a consultant nuclear physicist.

The meeting will adjourn.

(Whereupon, at 3:30 p. m., Monday, July 13, 1953, the hearing was adjourned until 2 p. m., Wednesday, July 15, 1953.)

ATOMIC POWER DEVELOPMENT AND PRIVATE ENTERPRISE

WEDNESDAY, JULY 15, 1953

CONGRESS OF THE UNITED STATES,
JOINT COMMITTEE ON ATOMIC ENERGY,
Washington, D. C.

The joint committee met at 2 p. m., pursuant to recess, in room 318 of the Senate Office Building, Representative W. Sterling Cole (chairman), presiding.

Present: Representative Cole, Senators Hickenlooper and Pastore, Representatives Van Zandt and Holifield.

Professional staff members present: Corbin C. Allardice, executive director; and Walter A. Hamilton, Francis P. Cotter, and George Norris, Jr., of the professional staff of the joint committee.

Chairman COLE. The meeting will come to order.

It had been scheduled today that we would hear from the representative of the Kaiser Engineers. Today we have received a letter from that organization, indicating their reasons for not being able to appear. I will not include the letter in the body of the record but will include it in the appendix.

I also have a letter from E. I. du Pont de Nemours & Co., of the same nature, explaining the reasons for their nonappearance.

(The letter referred to will be found in the appendix, p. 599.)

And I have a letter from David E. Lilienthal, former Chairman of the Commission, who had been invited to give the committee the benefit of his views. His letter indicates that at the time when the committee will be having these sessions, Mr. Lilienthal will not be available.

(The letter referred to will be found in the appendix, p. 603).

I also have a letter from Carbide & Carbon Chemicals Co., explaining their nonappearance at the hearings.

(The letter referred to will be found in the appendix, p. 596).

The first witness this afternoon is Dr. George Weil, former Deputy Director of the Reactor Division of the Atomic Energy Commission.

Dr. WEIL. Well, there was one that I recall and that is pertinent atomic power experts in the country. He began his work at Columbia University in 1939 with Dr. Enrico Fermi and the team which conducted the first experiments on sustained nuclear fission. Dr. Weil worked at Argonne and Oak Ridge during most of the Manhattan Engineer District days. He became the Acting Director of the Reactor Development Division of the AEC when it was set up in 1948 and was its Assistant Director under Dr. Hafstad from 1949 until early 1952.

He is now an atomic power consultant without special attachment to either the AEC or any single industry group. His proposal for a

single purpose experimental reactor of pilot plant size was published in the Joint Committee Power Print Report last December.

Dr. Weil, I assume you have a statement. If so, you may proceed. We are happy to have you here this afternoon.

STATEMENT OF DR. GEORGE L. WEIL, FORMER ASSISTANT DIRECTOR, REACTOR DEVELOPMENT DIVISION, ATOMIC ENERGY COMMISSION

Dr. WEIL. Thank you.

Mr. Chairman and members of the Joint Committee on Atomic Energy, I appreciate this opportunity to present to you my views with regard to the important questions of public policy with which the committee is now concerned.

I have had the privilege of appearing before this committee on a number of occasions in the past while I was associated with the Atomic Energy Commission as Assistant Director of the Division of Reactor Development. Since my resignation about a year ago, I have been engaged in practice as a consultant to the Commission and other organizations in the field of reactor development and nuclear power, and have been actively interested in furthering the development of economic nuclear power. My interest and activities in the field of atomic energy have been continuous since 1940.

The basic question confronting this committee is, Should the Atomic Energy Act be revised at this time, specifically with regard to certain provisions affecting ownership of fissionable materials, ownership of plants that produce them, and the right to establish patents in the field of atomic energy? It is generally understood that the purpose of such changes would be to establish legislative conditions in the field of nuclear power development which are normal practice in other fields of technological development. It is clear that legislative action to achieve this specific purpose would involve numerous major policy decisions affecting the national interest, and the formulation of specific legislative provisions would not be an easy or a short-term task. My view is that the act should be amended only if specific developments are in mind and only in relation to those anticipated developments.

It appears to me that the answer to the question whether legislative action should now be taken must depend upon:

First, a clear definition of our immediate national interests in the development of nuclear power;

Second, the formulation of a specific technical program consistent with those interests, and

Third, the selection of those arrangements for financing and executing the program which will provide the greatest assurance that the goals will be achieved at the earliest possible time.

Before discussing these questions I should like to state my position on certain matters which will provide background.

First, there is no question concerning the technical feasibility of producing useful power from nuclear-fueled plants.

Second, the unsubsidized cost of power produced by nuclear plants designed to operate on the basis of the most advanced demonstrated technology available today would be considerably higher, perhaps by a factor of 2 or 3, than the current average cost of power from

conventional plants in this country. However, the relative competitive position would be much more favorable in many foreign areas.

Third, there is every reason to believe that further engineering and technological development of nuclear powerplants can at some time in the future make the cost of nuclear power competitive with that of conventional power in this country.

Fourth, there is today a significant lack of realistic information on the economics of nuclear power—the type of information that is most needed to allow wise national planning and sound decisions affecting public policy. This information can be obtained only by designing, constructing, and operating power-only nuclear plants.

With this as a starting point then, What are the national interests in the development of economic nuclear power that would justify the effort required to carry out even a minimum program of designing and constructing a single power-only nuclear plant? If an adequate program to meet short-term national goals is to be established and maintained, then financial support must come from those groups that have the greatest interests and strongest incentives in achieving the short-term goals.

I believe that the urgency to develop nuclear power at this time derives from such considerations as national prestige; establishing leadership in the field of atomic-energy development; availing ourselves of the opportunity of counteracting adverse propaganda by positive means, advancing our abilities to promote the strength of the free world by offering technological aid to our allies who may have more immediate economic interest in nuclear power and assisting in raising the standards of living in underdeveloped areas; and finally by improving our ability to develop new sources of vital raw materials and making it possible to use more effectively the natural resources available to us and the free world. These, I believe, are the immediate goals that would justify this country's engaging in a substantial and expensive nuclear-power-development program at this time.

It is hardly necessary to point out that the short-term goals I have just listed do not include the development of nuclear power for industrial use in this country. In view of the present estimated differential in cost of nuclear power and conventional power and our very fortunate position with regard to availability of resources of fossil fuels, it is difficult to see the requirement for a substantial program at this time or the incentives to expend large sums of money, either public or private, for this purpose alone.

If these are our national goals, then what should be the technical program? In my opinion, a determined effort to develop central-station nuclear power should involve as the next phase the design and construction of one or more proto-type nuclear powerplants. The selection of the power-generating capacities of these plants would depend upon a number of considerations which I will not discuss here. However, I would like to point out, parenthetically, that a 10,000 or 50,000 kilowatt plant is as full scale for certain installations as a 150,000 kilowatt plant is for others. Once the production capacities have been selected every effort should be made in designing the plants to make the power costs as low as possible. This can be achieved only if the effort is undiverted by dual purposes or dual objectives. The value of the information, in evaluating and planning a future program and upon which major policy decisions will be made, that can

be derived by building and operating plants, will be almost completely vitiated if there is any suggestion that design compromises to satisfy secondary objectives have been made. My views on this subject are expanded in a prospectus which is appended to the print Atomic Power and Private Enterprise prepared by this committee's staff last December.

I turn now to the question of how a nuclear-power-development program can be established which will achieve our immediate national goals. Such a program, if it is to be effective, must be supported by a group or groups that have strong interests in the achievement of these goals and correspondingly strong incentives to provide the funds during the period necessary to complete the program. Essentially three approaches have been suggested at these hearings. A program supported entirely by private industry, entirely by public funds, and cooperative support by Government and private industry whereby public funds, by one mechanism or another, would assume all financial risks.

Assuming, and I believe this is true, that the nuclear-power industry in this country should in the long run be developed by private enterprise, can we expect that by turning the responsibility over to this group now, private-risk capital will support the aggressive construction program that should be undertaken? In my opinion the answer is "No." Even if the most favorable legislative provisions were to be enacted, the economic incentives to private risk capital to invest in a nuclear powerplant development program are not compatible with either the magnitude of the financial risks or the extent of the effort required to meet the schedule of our short-term national goals.

Is the solution, then, for the Government to undertake the immediate program with public funds? I believe that, in principle, this would be the most desirable way to proceed at this time. However, I can foresee difficulties in this approach, also. To attract financial support from private industrial sources a project must have sound economic goals. To obtain and retain financial support from public sources now and in the foreseeable future a project must have either a high military priority or at least uncontroversial goals in the national interest. A project to construct a single-purpose nuclear powerplant has neither of these advantages. It has certainly a low military priority and, I believe, many people question its importance to our national interests at this time. This committee, I know, is aware of reactor-development projects that have been eliminated for lack of sufficiently widespread support in the executive or legislative branches, or have had their objectives shifted in order to improve their position in competition for funds. It is not difficult for me to imagine that a Government project initiated today with the single objective of producing power for civilian or industrial use would have its objective changed to provide power for an aircraft carrier at some later stage in its development. We have already witnessed a shift in one direction—the process is far from being irreversible. It is my conviction that such a project would have small chance of survival during the next 4 or 5 years required for its completion, if the major fraction or all of its financial support derived from public funds.

What about cooperative efforts between Government and private industry? In my opinion these approaches would suffer from one

or more of the difficulties associated with either all public or all private financing and, in addition, raise new problems of public policy and of an administrative nature. I believe such a partnership approach offers one advantage over going it alone by Government and that is that a program would have somewhat more stability with regard to both its objectives and continuity of financial support. However, if a major portion of the financing were to be provided by public funds, then the improvement in stability would be of relatively minor significance.

Believing as I do that the early demonstration of at least one prototype single-purpose nuclear powerplant is an important national goal, and the formulation and financing of a sound development program our most pressing problem at this time, I have searched for a possible solution to the problem. I believe that there may be a solution, namely, enlisting the interest and financial support of private nonprofit organizations. The active participation at this time of nonprofit organizations would remove difficulties that are associated with other approaches.

First, if a major fraction of the required funds were derived from nonprofit organizations, the continuity of financial support and program objectives would be far better assured than if derived from public funds.

Second, since the motivations of nonprofit organizations correspond closely with those of public agencies, the legislative conditions required for enlisting their financial support would in all probability not involve major decisions affecting public policy.

Although nuclear-power development is an area quite foreign to the usual activities of nonprofit organizations, there are two major reasons why it is not unreasonable to be hopeful that their interest might be aroused. First, operating principles of foundations have considered it appropriate to make expenditures in areas where other private or public funds do not appear to be available. Second, the short-term goals including aid to underdeveloped areas and conservation and effective utilization of natural resources are in the general areas of activity now supported by a number of large foundations.

The private nonprofit approach would provide a means of accomplishing the next important stage in the development of nuclear power while preserving the public's interests in the field. It would provide a means of achieving the Nation's goals in strengthening the free world. It would at the same time provide the factual information on the economics of nuclear power which is of major interest to industry and is a prerequisite to the intelligent planning and the making of decisions affecting public policy in this field.

I have been actively engaged in soliciting the interest of nonprofit organizations in a program of nuclear-power development. Unfortunately it has as yet not been possible to develop a specific proposal. However, I respectfully wish to call to the attention of the committee the potentialities along these lines in the event that other approaches prove abortive for one reason or another.

In concluding I should like to summarize briefly my views:

1. An immediate program to design and build one or more single-purpose nuclear powerplants has a high degree of national importance.
2. The problem today should be phrased how we can get such a

program underway as soon as possible and what revisions of the Atomic Energy Act are required to accomplish this purpose.

3. I believe that it is extremely unlikely that private industry will finance such a program. Therefore, the question whether to revise the act to encourage participation of private enterprise is unrelated to the immediate problem and can be considered separately and at leisure.

4. I believe that a program supported entirely or largely by public funds would be subject to many pressures to change its objectives and/or reduce or eliminate its appropriations. To that extent its initiation on a vigorous basis would be uncertain and its future doubtful.

5. I believe that if substantial financial support can be obtained from private nonprofit sources, a new element of flexibility will have been introduced and the chances improved for arriving at an adequate nuclear-power development program. Although a private nonprofit approach may require some legislative changes, it offers the possibility of avoiding the major issues of revising patent policies.

Changes in the act designed to encourage participation of private enterprise and without subsequent substantial and adequate activity on the part of private enterprise, might have the effect only of making the availability of funds from other sources more difficult. This might well result in a period of relatively little activity on the part of all groups at the expense of the national interest. I have only one general recommendation which I respectfully submit, namely, that the Atomic Energy Act be revised only after conviction that changes are necessary to proceed with a program and that an adequate program in the national interest would proceed if and when the revisions are made.

Chairman COLE. Dr. Weil, that is a very fine statement.

Dr. WEIL. Thank you.

Chairman COLE. Containing a great deal of good advice, and a realistic conception of the problem, in my opinion.

Are there questions which the members desire to ask of Dr. Weil?

Representative HOLIFIELD. Dr. Weil, I wish to commend you for this very fine statement, sir. It is so plain and answers so many of the questions which I usually ask that I do not believe at this time I will have any questions to ask you.

Chairman COLE. Mr. Van Zandt?

Representative VAN ZANDT. Doctor, you have mentioned the part which nonprofit organizations can play in this effort.

Dr. WEIL. Yes, sir.

Representative VAN ZANDT. In your opinion, do these nonprofit organizations have the necessary capital to tackle such a problem?

Dr. WEIL. Well, Mr. Van Zandt, I believe that all of the foundations or nonprofit organizations in this country have capital assets well over a billion dollars, with annual grants well over \$50 million. What I have in mind would be a joint enterprise involving a large fraction of support from the nonprofit organizations and at the same time support from private and public agencies to the extent that they are willing to participate. I think a cooperative effort has many advantages, and from my conversations with nonprofit agencies I believe this is how they would like to have it also.

Representative VAN ZANDT. Then what you actually are advocating is a 3-way effort?

Dr. WEIL. Exactly.

Representative VAN ZANDT. Thank you.

Chairman COLE. Dr. Weil, I wish you would amplify your thought that by using the nonprofit sponsorship approach you would thereby avoid the major issue of revising the patent policies. Does that mean that nonprofit organizations would not make claims for patents that might ensue from the project?

Dr. WEIL. Let me say this, Mr. Cole. If they don't, then I don't think there is much difference between this approach and a purely private-enterprise approach.

Chairman COLE. If they don't what?

Dr. WEIL. If they do request revisions in the patent policies, then I think the approach is comparable to the private-enterprise approach. My only reason for believing that this might not be true is that their position does not depend or their incentives do not depend, on the monetary value of patent rights. Now, it is true that certain nonprofit organizations do obtain some of their operating funds from patents which they own, and in those cases possibly patent rights might be a requirement. However, many of the foundations do not have such an interest, and their incentives are purely the incentives of being active in fields related to the general welfare of the country.

Chairman COLE. Except is it not true that these nonprofit organizations do have the incentive of maintaining intact if not adding to the corpus of their trust fund, rather than to dissipate it? And to that extent they would have an interest in capitalizing on any lesson that may flow from the venture.

Would you concur in that, or not?

Dr. WEIL. I believe there have been some instances where a nonprofit organization has expended its capital. An example is the Mellon trust, which provided the funds for the National Gallery here in Washington.

I might add, as a general statement, that I realize that there are many problems in working out such an arrangement, and I certainly can't speak for any foundation. However, I have suggested this as a possible way. If it does not provide a program in the most rapid possible way, then it has no value.

Chairman COLE. But the Mellon fund could hardly be used as an apt illustration, because there was no risk in that involved whatever. The sponsors knew it was going to be a success once they decided to undertake it.

Dr. WEIL. I merely use that as an illustration of a nonprofit organization dispensing some of its capital funds. Now, I would not expect that a nonprofit organization would go into such a venture with the expectation that it would make money. I believe it would be done solely with the high purpose of doing something in the national interest.

Chairman COLE. Yes, but on the other hand, would you not expect that a determining factor in the decision on the part of the nonprofit organization would be not to lose money, thereby not dissipating and exhausting its funds?

Dr. WEIL. I think it may be.

Chairman COLE. What has been the result of your discussions with nonprofit organizations in this connection?

Dr. WEIL. They have expressed an interest at this time. The principal obstacle is the uncertainty as to what the Government's program, or a program by private enterprise, will be. At the moment, I have not felt that it is an appropriate time to press the issue with nonprofit organizations. I think their interest can only be obtained if it becomes obvious that other ways of raising the funds are not successful.

Chairman COLE. When you speak of prototype and pilot plants, what do you have in mind?

In order that when we use certain terminology we may have an understanding of what we are talking about, can you draw a distinction? Is there any acceptable distinction in the scientific world between a pilot plant and a prototype plant?

If there is a distinction, what is the distinction?

Dr. WEIL. I can only give you my own distinction; whether it is acceptable to others I can't say. To my mind, a pilot plant is one that tests many of the features, the engineering features and overall operation, of a full-scale plant or a prototype plant; whereas a prototype plant to me means one that copies exactly the type of plant which one would build at a particular location. The pilot plant is more of a test plant. The prototype plant is one which you actually copy, if you want to build one and use it for industry.

Chairman COLE. Then the pilot plant would be one that might probably be built in connection with some laboratory, and the prototype is the full, land-based, real, completed, functioning thing?

Dr. WEIL. Yes, sir, except that it might not have a particular economic application at the moment. I believe that the only way we are going to get economical nuclear power is by hitting hard the problems of cheap construction and cheap fuel, and I believe that you have to prove that you can do these things, and I don't think that a pilot plant would prove that. You can only prove it when you show somebody that you have a plant that costs so much money and is producing power at so much per kilowatt-hour.

Chairman COLE. Are you at liberty to tell us the considerations involved in your leaving the Commission?

Dr. WEIL. Well, they are rather varied, Mr. Cole.

Chairman COLE. First, you severed your connections voluntarily?

Dr. WEIL. That is right.

Chairman COLE. Now can you tell us the considerations which prompted you to leave the Commission?

Dr. WEIL. One of them has been, or was, my interest in the nuclear power development program. And some thought along the lines I have proposed had occurred to me while I was with the Commission. I had been conscious of the difficulties involved in a Government-supported project. I discussed my thoughts with Mr. Dean and others on the Commission at the time. For a number of reasons it seemed advisable to pursue my interests as an individual. I had been with the Commission for 5 years, and this seemed like a very interesting field to engage in.

Chairman COLE. Your decision to leave the Commission because of your interest and desire in contributing to the progress of the development of power reactors could stem from either of two factors, or perhaps both: One, that you felt a bit impatient with the degree of progress made under the Commission's auspices and that you felt you

might hasten the progress by being out on your own, and the other one, that you felt it might be to your financial advantage to work independently. Now, either of those objectives is entirely laudable. I am not for the moment criticizing either approach. But I am curious to know if either or both of those considerations were involved; and if one of the two outweighs the other.

Dr. WEIL. I would say the first one is the real reason, sir.

Chairman COLE. Your impatience with the pace that had been set up until the time you left, and the apparent unlikely prospects of an acceleration of the pace; and your feeling that it was important that greater progress be made, and through a degree of self-confidence that you might contribute to that accelerated pace. Is that correct?

Dr. WEIL. That is correct. I felt that there was a job that could be done outside of the Commission in promoting this type of a development program. I felt that there was a good deal of misinformation among people who were not connected with Government programs in one way or another. I felt that this was an area of activity that would interest me, and in which I had some confidence, that I might be effective.

Chairman COLE. Then apparently it is your feeling that the time has arrived when we, as a country, should take positive steps toward using nuclear energy for industrial purposes?

Dr. WEIL. No, sir; I wouldn't say that the time has come to use it for industrial purposes.

Chairman COLE. I said that the time has come when we should take positive steps toward using nuclear power for industrial purposes.

Dr. WEIL. Well, if I may rephrase my answer—

Chairman COLE. Of course, you may.

Dr. WEIL. I believe the time has come for this country to find out what nuclear power is and how much it costs. I think that when we have determined this then we may then decide that we should let this thing sit for 10 or 15 years. Or we may determine that there is a local national goal that should be served and nuclear power should be developed for that purpose, or that there are goals or applications outside of this country for which it is to this country's interest to provide help. But I don't believe that we can make any decisions until we have what I call good engineering economic information on the subject.

Chairman COLE. The phases of the problem which you have indicated were the steps, the progressive steps, which I had in mind; not that the time has arrived when we are justified in opening the doors wide to the use of nuclear energy for industrial purposes, because, in the first place, we just do not know whether it can be used, and to what extent.

Now, you are familiar with the original program of the Commission identified as the CVR?

Dr. WEIL. Yes, sir.

Chairman COLE. Are you familiar with its present status?

Dr. WEIL. Only through the press, Mr. Cole, and through copies of Commission statements and appropriation bills.

Chairman COLE. What is your feeling about the CVR program as it is currently scheduled, with respect to the value of any contributions that program may make toward learning these factors about the economic as well as the technological aspects of industrial power? Will it be a really worthwhile program, or do you fear that it may be so diluted with military considerations, principally in connection

with ship propulsion, that the primary objective of obtaining lessons related to industrial power will be lost?

Dr. WEIL. As I understand the program, it has the dual objective of being a land-based nuclear powerplant which could be adapted for propulsion of an aircraft carrier. I think that such a program suffers from two disadvantages.

First, it will not give the information which is most needed at this time with regard to the economics of nuclear power; and, second, it starts out with two strikes against it, namely, that the interest of the military in such a program might be changed next year or the year after for one reason or another, in which case its objectives could easily be transferred back purely to an aircraft carrier.

I would have no hope that such a program would either provide the unequivocal economic information that we need, or that if it were initiated according to the present objectives it would not be changed to a strictly military objective at a later date.

Chairman COLE. What is your feeling as to the result of a decision to proceed with the CVR project for the primary and sole purpose of determining its potential in the industrial power field? If that is done, would it not be still possible for such a project to provide lessons of great value on the military applications of that reactor in ship propulsion? Or is it necessary, in order to learn anything of reasonable value regarding ship propulsion, that that consideration be in mind as the project is established and carried out?

Dr. WEIL. I believe if such a project were established with the sort of provision that its use as an aircraft carrier propulsive unit should be kept in mind, there would be serious question when the project were finished whether its design had not been compromised in one way or another.

I think it is fortunate that for economic nuclear power there are a number of different basic designs that are potentially adaptable, so that even if one selected for the project one particular type, it wouldn't necessarily compromise the development of economic nuclear power.

But depending upon who executed the project, and what their interests were, and so on, I think it is questionable that it would serve a useful purpose in the area of developing economic nuclear power, or at least as useful a purpose as if it did not have the tinge of military interest attached to it.

Chairman COLE. Now respond to the converse of that: a decision to concentrate solely and exclusively on the objective of industrial power. Would such a project, upon completion, provide valuable lessons in connection with the problem of ship propulsion?

Dr. WEIL. I believe it would.

Chairman COLE. Of course, whatever you learn has some value, even the negative information.

Can you indicate the degree of benefit that might come from such a decision, the degree of benefit and learning in the field of ship propulsion?

Would you say it would be minor, moderate, substantial, great, or can't it be characterized in that general fashion?

Dr. WEIL. I don't believe I can give a specific answer.

I can say that there would naturally be a possibility that whoever selected the design of this plant for central-station power might pick

one that is completely inapplicable to putting in a ship. I don't know.

On the other hand, I think you might have a design in which pumps and fuel elements and other components would have very direct bearing on an aircraft-carrier propulsion plant.

But I would doubt that any organization that might later be required to build an aircraft-carrier plant would be able to do so by adopting directly a central-station plant to a floating vessel.

Chairman COLE. Then it is conceivable that having completed the single purpose, the single objective, of industrial power, in order to prove out nuclear power for ship propulsion, they would have to start all over again?

Dr. WEIL. That is what I have said, and I would like to qualify it by saying I think you can only answer the question concretely once you have seen a project.

Chairman COLE. Would you mind indicating why you feel that it is better to concentrate on a single-purpose rather than a dual-purpose reactor? And I am not speaking of ship versus industrial when I refer to dual purpose. I am referring to power and fissionable material.

Dr. WEIL. Well, I believe that ultimately, if we are going to have a nuclear-power industry in this country, it will be based on single-purpose plants. And when I say "single purpose," I include breeders. Whether a plant is single or dual purpose is defined by the value that is attached to the plutonium or any other fissionable material that may be produced. If its value is taken as a fuel, then it is single purpose. If its value is taken as a military material, then it is a dual purpose.

Keeping this in mind, then, that ultimately the single-purpose reactor is the one we are shooting for, I think that the next step is one that should tell us how much that single-purpose reactor will cost for how much it will produce power. I believe that a dual-purpose reactor project would have the same objection that an aircraft carrier dual objective reactor project has, namely, that it would take the engineers' and designers' minds off the principal product. And certainly asking it to do 2 things will make the machine more complicated than if it has only 1 thing to do, particularly when that so-called byproduct—plutonium—is worth several times the power—the primary product of interest—that could be obtained for the same amount of fuel burned.

So the dual-purpose approach, I think, might be a very good one for the Government to proceed with if it wants to produce plutonium more cheaply, although I don't think that it is even proved that this is the case.

However, as a step in the development of economic power, I don't think that it would provide the information that is needed.

Chairman COLE. While you were with the Commission, did you have any opinions or viewpoints and recommendations which the Commission did not accept? Perhaps I had better rephrase it.

In what way were you impatient with the Commission's attitude on the power aspects of nuclear energy?

Dr. WEIL. Well, Mr. Cole, I wouldn't confine it to the Commission. I think the Commission was and is faced with difficulties outside of itself in going ahead with any program.

At the time that I was with the Commission, it was principally a matter of appropriations, and a single-purpose or power-only plant has a low priority, as I mentioned in my statement. If there is a necessity to trim budgets and programs, then the lowest priority projects are the ones that suffer first. I think this is still the case, and that is why I have doubts as to whether such a program can be supported only by Government funds.

Chairman COLE. But there was no specific recommendation or position which you had while in the Commission which was not adopted by the Commission?

Dr. WEIL. Oh, I think the answer to that is that there were. In 5 years there were a number of such occasions.

Chairman COLE. Were they in your mind of sufficient importance for you to indicate them to us? Or were they the normal disagreements that any two people might have, no matter what the subject is?

Dr. WEIL. Well, there was one that I recall and that is pertinent here. I did have a proposal for the Commission to build an experimental powerplant only several years ago. As I recall, this proposal was not acted upon for budgetary reasons.

Chairman COLE. And that is the only reason it was not acted on, so far as you know?

Dr. WEIL. So far as I know; yes.

Chairman COLE. It was not from the standpoint of lack of feasibility, lack of need to learn the information that such a program would provide, but rather that there was not enough money to do everything that the Commission felt needed to be done?

Dr. WEIL. Well, it is hard to say. I think that if there is a strong interest within an organization to do something, a fight can always be put up to see that it gets done. Priority is set not only by the external circumstances but to some extent by the Commission itself.

Chairman COLE. By the pressures from within as well as the pressures from without. Then apparently the pressures from within were not as great as you felt they should have been.

Dr. WEIL. Of course, I am not so familiar with the pressures from without, so I wouldn't judge.

Chairman COLE. When I speak of the pressures from without, I have in mind the resistance of the Congress to making available money that is not absolutely necessary for the proper functioning of Government. That is the type of pressure that I have in mind.

In your present work as consultant, how do you arrange for your access to restricted data?

Dr. WEIL. I have a consultant agreement with the Atomic Energy Commission, which gives me access to the restricted data. I have an Atomic Energy Commission clearance.

Chairman COLE. Is that a contract making information accessible to you only when you are acting as a consultant to the Commission, or is it a continuing general permission?

Dr. WEIL. It is a continuing general permission. I have access to the restricted documents and others. I don't have access to Commission internal documents.

Chairman COLE. Then it would be possible, it must be possible, for you as a consultant to a private corporation to have access to the restricted data which you feel you must have in order to perform your responsibility to your employer?

Dr. WEIL. That is correct.

Chairman COLE. Are there any other questions from the members of the committee of Dr. Weil?

If not, Doctor, thank you again for having given what I regard as a very helpful contribution to the committee's deliberations.

Dr. WEIL. Thank you, Mr. Chairman.

Chairman COLE. Mr. Holifield?

Representative HOLIFIELD. Mr. Chairman, I received through the mail today a statement on our subject from former Congressman Jerry Voorhis, who is now executive director of the Cooperative League of the United States, and he asks that that statement be included in our record of presentations.

I ask unanimous consent that it follow Mr. Ellis' testimony.

Chairman COLE. Without objection, it is so ordered.

But let me inquire: Does that mean that Mr. Voorhis will not appear in person?

Representative HOLIFIELD. That is my understanding; because of the pressure of time in our hearings, he has accommodated himself to the request of the committee and has presented it in written form.

Chairman COLE. We have had some correspondence with him, and it is my recollection that at one time he indicated a desire to appear personally.

But if you have heard from him since, and if this statement will suffice, we need not be concerned about his later personal appearance.

If Mr. Ellis is ready and will come up to the table—

Mr. Clyde Ellis is the representative of the National Rural Electric Cooperative Association. His association has indicated to the Atomic Energy Commission that some of its members are concerned about protection of the rights of cooperatives to develop or own atomic powerplants in parallel with private companies. Their concern stems from the possibility that large private utility companies might in some way gain a competitive advantage to the detriment of the interests of the cooperatives.

Mr. Ellis has been invited to express the views of the association on problems involved in formulation of policy towards atomic power development.

Mr. Ellis, as a former colleague and an associate of the House members of this committee, we welcome you here this afternoon. We will be glad to have your statement.

STATEMENT OF CLYDE T. ELLIS, EXECUTIVE MANAGER, NATIONAL RURAL ELECTRIC COOPERATIVE ASSOCIATION

Mr. ELLIS. Thank you, Mr. Chairman and gentlemen of the committee.

My name is Clyde T. Ellis. I am executive manager of the National Rural Electric Cooperative Association, the national service organization of over 90 percent of the rural electric systems in the country. Our organization represents 936 rural electric systems serving 3,450,744 consumer families and rural establishments.

We, of course, are vitally interested in any proposed amendments to the Atomic Energy Act which would affect the fuel or energy supply of our country. The REA-financed systems, cooperatives and power districts, have borrowed from the Government and invested over \$2½ billion in 46 States and Alaska. For the fiscal year ending

June 30, 1952, these systems purchased 10,764,660,930 kilowatt-hours of electricity. For this power, wholesale, the rural electricians paid a total of \$85,569,592. We paid more than half of that, or \$49,311,076, to the commercial power companies.

Every year our systems' demands for electric energy are growing rapidly and there are no signs of them leveling off. I have two charts which show this better than I can state it.

Chairman COLE. Mr. Ellis, may we have reprints of those charts for reproduction in the record?

Mr. ELLIS. Yes, sir; we will be happy to supply them. May we have a day or two to supply them?

Chairman COLE. Oh, surely.

Mr. ELLIS. Thank you.

(The charts referred to follow:)

**BILLIONS
OF KWH**

1000

900

800

700

600

500

400

300

200

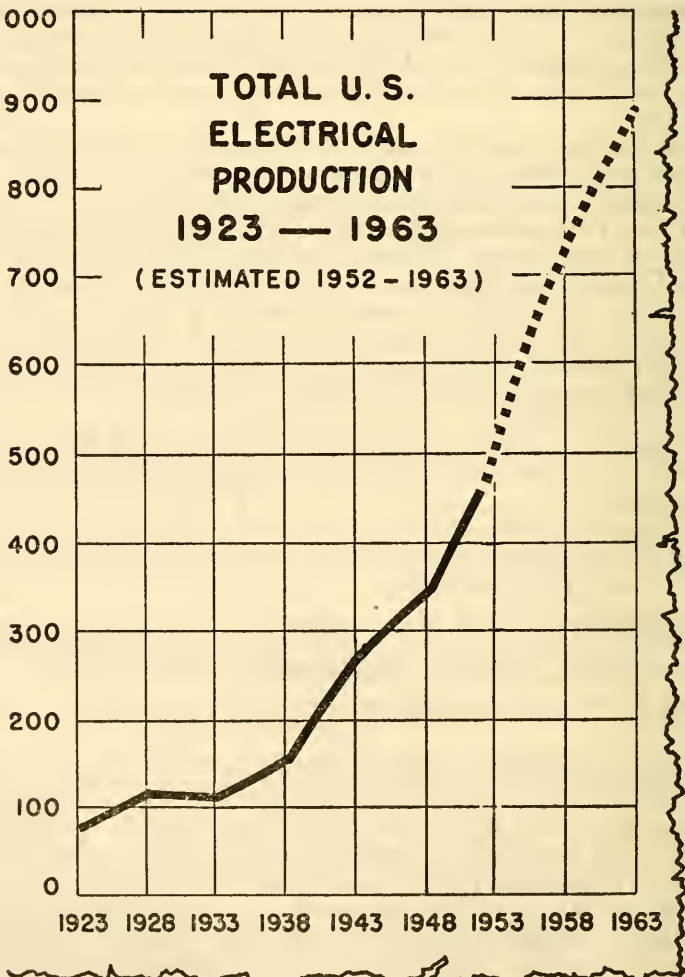
100

0

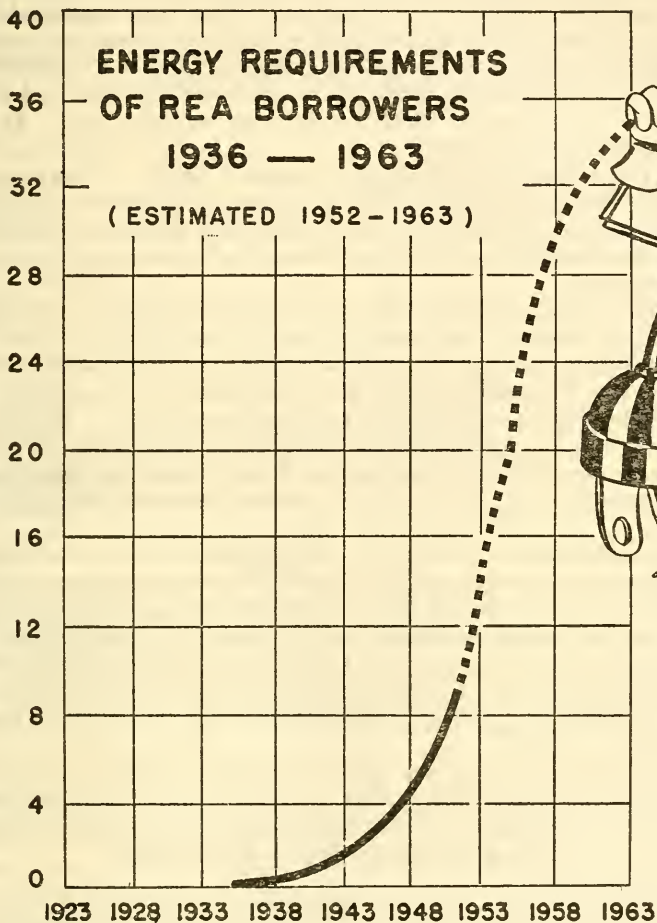
**TOTAL U. S.
ELECTRICAL
PRODUCTION
1923 — 1963**

(ESTIMATED 1952 - 1963)

1923 1928 1933 1938 1943 1948 1953 1958 1963



BILLIONS OF KWH



Our American levels of living, growing out of the high productivity of modern industrial society, are the result of harnessing inanimate energy to machines. Between 1850 and 1944 energy generated from the mineral fuels, coal, oil and gas, increased 500 times. Today 94 percent of all work in the United States is done by the mineral fuels plus hydropower. Men and animals now produce only 6 percent of the energy. This is not true yet of the farms, of course. It is estimated that by 1960 human beings will account for less than 2 percent of the total energy going into production in this country. Farmers may require much longer to approach that figure.

The farmer was a latecomer in the use of machines and inanimate energy to run them. The widespread use of the tractor and other machines is only a little over a generation old. Electricity, the most flexible and economic of all energy sources, came to agriculture when

the cooperative and rural power districts put it there, or caused it to be put there. Farmers were waiting for it and hastened to use it to the extent they could afford the instruments and to the extent electrical contrivances had been adapted to farm use. First they hastened to install the things that lightened the drudgery of the home and made for decent living: lights, refrigeration, irons, radios, and so forth. Then they began to utilize electricity in the well, the brooder, and the barn. Now it is beginning to work its way out into the field. It is truly a rural power revolution.

The energy requirements of the private electric utility industry are doubling every 7 to 10 years while those of the rural electric systems are increasing at an even faster rate. They are doubling every 4 years. This means that new additional sources of power supply must be found constantly.

We are heartened by the statement of the Atomic Energy Commission that "atomic power is technically feasible and (that) there is widespread confidence as to its ultimate commercial practicability." We agree with the Commission that the attainment of economically competitive nuclear power is a goal of national importance. It is our desire to do as much as possible to cooperate in the furthering of that goal so that our rural electric systems will be assured of adequate, dependable sources of wholesale power at prices the farmers can afford to pay.

Senator HICKENLOOPER. I think, Mr. Ellis, that we could state it a little more strongly than the term "feasible," because certainly we know that heat can be produced, and that the power can be produced at a tremendous cost at this moment. So it is not only possible, but it is being produced. It is a question of the economically competitive rate. In other words, I take the position that there is no question but what we can produce this, but it is a question of the competitive rate in the economy.

Mr. ELLIS. Thank you, Senator. That is the big problem, I am sure.

Senator HICKENLOOPER. I think that is probably the main concern at the moment, as to whether or not the costs can be brought within some kind of a range for use in the economy of the country.

Mr. ELLIS. Yes, sir.

At the present time, our systems are faced with power-supply problems which cause them to look with hope on the development of atomic power. Each year NRECA conducts a survey of the rural electric systems. Our January 1, 1953, annual survey indicates that over 28 percent of our systems do not have enough power in sight for future growth, and 13 percent are handicapped by a present shortage of wholesale power. Over 26 percent of our rural electric systems have unsatisfactory voltage regulation at their substations. All of these power-supply problems are serious matters. I'm sure that some of our systems experiencing these wholesale power problems would welcome the opportunity to have their areas selected as sites for Atomic Energy Commission-sponsored pilot nuclear powerplants. It is our understanding that because of the costs involved it may actually be desirable to proceed at first with the development of such small pilot plants. In that regard, we have noted that George Weil, former Chief of the Reactor Branch of the Atomic Energy Commission, recommends, in an article in the June 1943 issue of the Bulletin of the Atomic Scien-

tists, that consideration be given to the construction of a nonprofit 10,000- to 50,000-kilowatt nuclear powerplant.

Many of our systems are also experiencing high wholesale power costs. Here is a table which brings this out.

Average cost per kilowatt-hour of energy purchased by REA borrowers from all suppliers, by States, fiscal year ended June 30, 1952

[In cents]

United States average-----	0. 79	Colorado-----	0. 86
Alaska-----	2. 96	Illinois-----	. 85
Maine-----	1. 51	Kansas-----	. 85
Minnesota-----	1. 39	Kentucky-----	. 79
New Jersey-----	1. 37	Wyoming-----	. 79
Wisconsin-----	1. 36	North Carolina-----	. 77
Utah-----	1. 32	Virginia-----	. 74
North Dakota-----	1. 29	California-----	. 71
Iowa-----	1. 28	New Mexico-----	. 70
South Dakota-----	1. 28	South Carolina-----	. 68
Michigan-----	1. 27	Arizona-----	. 66
Vermont-----	1. 26	Georgia-----	. 64
Delaware-----	1. 19	Oklahoma-----	. 60
New Hampshire-----	1. 14	Arkansas-----	. 58
New York-----	1. 12	Texas-----	. 58
Pennsylvania-----	1. 10	Louisiana-----	. 57
Maryland-----	1. 00	Alabama-----	. 56
Florida-----	. 97	Mississippi-----	. 54
Missouri-----	. 96	Montana-----	. 50
Ohio-----	. 91	Tennessee-----	. 48
West Virginia-----	. 90	Idaho-----	. 45
Nebraska-----	. 89	Nevada-----	. 45
Indiana-----	. 87	Oregon-----	. 38
		Washington-----	. 32

You will note on the attached chart that for the fiscal year ending June 30, 1952, our systems paid an average of 0.79 cent for wholesale power, but in 24 States the cost was higher than this. In fact, the cost was higher than this. In fact, the cost was 2.96 cents in Alaska, 1.51 cents in Maine, 1.26 cents in Vermont, 1.36 cents in Wisconsin, 1.29 cents in North Dakota, 1.28 cents in South Dakota, 1.27 cents in Michigan, and so forth. Most of these areas where wholesale power costs are so high are also areas of high fuel costs.

Therefore, we are most interested in the possibilities of nuclear power for those areas. Lawrence R. Hafstad, director of the Division of Reactor Development, Atomic Energy Commission, states in an article in the September 15, 1952, issue of Chemical and Engineering News:

* * * Since electricity is, or would be, high in areas isolated from conventional fuel, such locations are attractive for electricity from nuclear energy.

Gordon Dean, former Chairman of the Atomic Energy Commission, stated in a speech before the Edison Electric Institute on June 4, 1953:

We need atomic power because atomic fuels are virtually weightless fuels. They can be taken anywhere in the world—to the source of the raw materials upon which industries are based—to deserts, to mountains, and to islands.

To us this offers great hope that in those rural areas with high-cost power, nuclear power may be feasibly developed to overcome the problems of high fuel costs, high transportation costs, and so forth. This may enable the farmer to more fully utilize electric power to increase his production and make farm living a little easier.

Also, we are interested in the nuclear-power program for still another reason. Our cooperatives for the year ending June 30, 1952, generated themselves 13.6 percent, or 1,550,030,708 kilowatt-hours of their total energy requirements. Thousands of farm consumers are dependent on these generation and transmission cooperatives for their power needs. Many of these generation and transmission cooperatives are operating under unfavorable conditions because of high fuel costs and low load factors. It has been stated that energy from 1 pound of fissionable material is equal to 2,600,000 pounds of coal. Such concentrated energy should aid in overcoming the high fuel costs of some of these generation and transmission cooperatives. Some of these generation and transmission co-ops look forward to the opportunity of being able to participate in the Atomic Energy Commission's nuclear-power program. I have personally accompanied the manager of our largest generating co-op, Dairyland, to discuss the possibilities with Atomic Energy Commission officials. Therefore, it is obvious why we are so vitally interested in any amendments to the Atomic Energy Act.

We wish to comment on proposed change to the Atomic Energy Act in the following context. We understand the Government has already invested more than \$10 billion in the atomic-energy program. This, of course, represents a great investment by the people and one which must be protected. Also, it is our understanding that some 12 teams composed of various private utilities and industrial firms are now participating in nuclear-power research and development with the Atomic Energy Commission. Some of these teams have been participating since 1950 and as a result have acquired considerable technical knowledge and experience in nuclear power. It is also our understanding that most of this research has been carried on at public expense. In fact, we read that in April 1952 the Commission approved a Dow Chemical-Detroit Edison project which was to cost \$1 million and to be financed one-quarter by these companies and three-quarters by public funds. With such a large initial and continuing investment of public funds, it seems of paramount importance that the public interest be fully protected.

It would seem to use very harsh, then, to permit, out of that kind of arrangement, patents or exclusive rights, which would lead to monopolies, and would tend to cut off the smaller industries and utilities including the electric co-ops. That is what we fear, at least.

Chairman COLE. But it would provide you with the electrical energy you have indicated you sorely need.

Mr. ELLIS. Yes, sir; and if that kind of arrangement would step up the production of electrical energy, there would be that benefit. Certainly there would. We have a very strong feeling that the whole economy of this country is being held back by the lack of adequate electric power.

Now, here is how we feel. Take last year in the case of the Bull Shoals Dam, which was being completed in north Arkansas.

The rural electric systems had contracted for all of the firm power in that dam, 150,000 kilowatts. The defense officials came to us and said, "We have got to build another aluminum plant somewhere in this country. We have explored every possibility. In the Northwest there is no power. In the TVA area there is no power. In the Southeast there is no power. In the areas of the greatest Federal

development of hydro-multipurpose projects there are no available large blocs of power. Here is the only chance we have, that we can find, of putting in this new aluminum plant, and that would be to take your power. We are asking you to give up that 150,000 kilowatts of power."

The rural electric co-ops agreed to it, with the understanding on the part of the Corps of Engineers, the President, defense officials, and several Senate and House Members, that they would immediately start Table Rock Dam above Bull Shoals Dam on the White River and accelerate it to completion. The Congressmen and the Senators and the Defense officials and the President all kept their word, and it was started.

But we saw there what happened when defense needs power. It is going to take it. It must take it. And we may suffer. We did suffer in that case. There will be a considerable lag, during which time we won't have enough power in that area.

It is our understanding that nuclear power development is still in the development stage. In fact Gordon Dean told the Edison Electric Institute that—

the next 5 years are development years—years in which we will be working toward the realization of economically feasible atomic power, not enjoying its fruits.

Therefore, it appears that as yet we do not know the full economic, social, and political implications of nuclear power. Our people as yet have had neither sufficient facts nor sufficient time to develop a policy with regard to atomic energy. In view of this, it seems even more imperative that the public interest be safeguarded and that no changes be made in the act at this stage.

It also is our impression that the present atomic-energy law was enacted to provide for the full development of nuclear power with both private and public participation and also to provide for final determination by the Congress of any legislative changes when it received a full report of the implications of the successful development of nuclear power. In particular, I refer to sections 7 (a), (b), and (c) of the Atomic Energy Act of 1946, as amended.

Section 7 (a) provides that:

It shall be unlawful * * * for any person to manufacture, produce, or export any equipment or device utilizing fissionable material or atomic energy or to utilize fissionable material or atomic energy with or without such equipment or device, except under and in accordance with a license issued by the Commission authorizing such manufacture, production, export, or utilization. No license may permit any such activity if fissionable material is produced incident to such activity, except as provided in sections 3 and 4 * * *

It seems to us that on this point this safeguards the public interest by permitting the Atomic Energy Commission to license such activity utilizing fissionable material or atomic energy. It is more in the sense of a regulatory activity rather than an actual hindrance to private participation in nuclear power development. The Atomic Energy Commission certainly is the only agency which is competent to license such activity in the public interest.

Section 7 (b) significantly states:

Whenever in its opinion any industrial, commercial, or other nonmilitary use of fissionable material or atomic energy has been sufficiently developed to be of practical value, the Commission shall prepare a report to the President stating

all the facts with respect to such use, the Commission's estimate of the social, political, economic, and international effects of such use and the Commission's recommendations for necessary or desirable supplemental legislation. The President shall then transmit this report to the Congress together with his recommendations. No license for any manufacture, production, export, or use shall be issued by the Commission under this section until after (1) a report with respect to such manufacture, production, export, or use has been filed with the Congress; and (2) a period of 90 days in which the Congress was in session has elapsed after the report has been so filed * * *

We feel that this matter is so important and has such wide ramifications that this procedure should be followed. To do less would seem to bypass and short circuit not only the people, but most industry, except for a few corporate giants. Even Congress would be bypassed. The Congress should not be asked to take the momentous step of amending the act until it has a comprehensive report of the social, political, and economic implications of the successful, practical development of nuclear power. But the Commission is unable to make any such report. At the same time it is proposing changes in the law. It seems that such proposals are premature and circumvent the intent of Congress to fully examine the implications of such atomic power development once it is out of the development stage and into a practical operating stage.

We think it is hasty, it is too soon, to be changing a law as basic, as vital, as this, that perhaps affects the life of every person on this earth.

Our rural electric systems have been interested in this atomic problem for quite a while. On our national programs we have had Dr. Joe Szilard, who, I believe, carried the first message to the President at the time he decided to launch the atomic-energy program. Szilard was then at Chicago University. We have had Dr. Pauling of California Tech. We have had Dr. Smedley of your own Iowa Tech, Mr. Hickenlooper. Our people are interested. But we don't have policy established. I am here today for the first time, I think, appearing before a congressional committee without the policy of our organization established on the thing that I am talking about. I know how our people feel on power, and this is power, but they just haven't studied the atomic situation as such yet and developed a policy on it.

We would like to have time at least for our people to study it before we enter into any agreement to change the law.

Section 7 (c) states:

After such ninety-day period, unless hereafter prohibited by law, the Commission may license such manufacture, production, export, or use in accordance with such procedures and subject to such conditions as it may by regulation establish to effectuate the provisions of this Act. The Commission is authorized and directed to issue licenses on a nonexclusive basis and to supply to the extent available appropriate quantities of fissionable material to licensees (1) whose proposed activities will serve some useful purpose proportionate to the quantities of fissionable material to be consumed; (2) who are equipped to observe such safety standards to protect health and to minimize danger from explosion or other hazard to life or property as the Commission may establish; and (3) who agree to make available to the Commission such technical information and data concerning their activities pursuant to such licenses as the Commission may determine necessary to encourage similar activities by as many licensees as possible. Each such license shall be issued for a specified period, shall be revocable at any time by the Commission in accordance with such procedures as the Commission may establish, and may be renewed upon the expiration of such period. Where activities under any license might serve to maintain or to foster the growth of monopoly, restraint or trade, unlawful competition, or other trade

position inimical to the entry of new, freely competitive enterprises in the field, the Commission is authorized and directed to refuse to issue such license or to establish such conditions to prevent these results as the Commission, in consultation with the Attorney General, may determine. * * *

It seems to us that the intent of this section in requiring licensing by the Commission once the Congress has had an opportunity to fully consider the implications of practical atomic power development, is in the public interest. Such licensing certainly should not restrict private development of this resource. To say this would be similar to stating that licensing of hydro sites by the Federal Power Commission has prevented private development. In fact if anything, it has encouraged extensive private development of our hydro sites. Also further, it seems to us that the intent of this section is to permit the fullest possible development of atomic power and not to permit monopolistic development. This, we believe, affords a degree of protection to the ultimate consumer by ensuring that atomic power will be fully and competitively developed. It will mean that the rural electric systems will be able to avail themselves of this atomic power technology and apply for a license if they desire. Without such opportunities atomic power development would offer little possibility of lower cost power for them.

In this context of the large public investment, the progress already made and still to be made under the present law, I wish to comment on several of the proposed changes to the Atomic Energy Act.

The Atomic Energy Commission has made two recommendations which, at the present stage of atomic power development, certainly have serious implications. They recommend (1) interim legislation to permit ownership and operation of nuclear power facilities by groups other than the Commission; and (2) interim legislation to permit lease or sale of fissionable material under adequate security safeguards. We believe such legislative changes are undesirable. Since no one fully knows the social, economic, and political implication of this energy source, how can one advocate private ownership of something that is not understood?

Such recommendations must be considered in light of the tremendous existing public investment—which is most of the total investment to date and which must be considered as an extension of the public domain. Also in the future there will probably have to be an annual large Government investment in the development of an atomic powerplant. The Congress only recently passed an appropriation of \$7 million to begin construction of such plants. We wholeheartedly endorse the vision of the Congress in appropriating such a sum and we firmly believe the results of this investment must be fully protected in the public interest.

It becomes even more important that at this stage of atomic power development, private ownership of atomic plants be prohibited because by some means, direct or indirect, the public will probably be paying the cost of such plants. The Wall Street Journal on June 8, 1953, states that "Monsanto and Union Electric Co., of Missouri, recently proposed to the Atomic Energy Commission construction of a \$6 million commercial-scale energy power plant." But the article continues, "the two firms would finance the project, but most of the cost would be charged to plutonium, which would be sold to the Government." Should atomic powerplants under such conditions be pri-

vately owned? Also wouldn't it be more desirable at this early stage of atomic power development to make the technology and experience of constructing such plants available to all?

The Government would underwrite the risk in this case. The Government would not own the plant.

Senator HICKENLOOPER. How do you mean the Government would underwrite the risk in that case?

Mr. ELLIS. They say it can be done, as I understand, only by the Government buying the plutonium and buying it at a price which will pull down the cost of power production salable to what they call a feasible figure.

Chairman COLE. But that does not necessarily underwrite the cost of the entire project.

Mr. ELLIS. No, not of the entire project, but of course, if the Government assumes the risk in that way, then there is no hazard to them, and they will get the power at, let us say, the same price they would get it at if they produced it with coal, maybe more, maybe less, but in any case the Government assumes the risk, as we see it.

Senator HICKENLOOPER. I do not quite follow you there. If the Government needs the plutonium, and if it can buy it at a price which is competitive with what they can make it at themselves, I do not see that they are underwriting it. They are buying a product which they would need, if they decide they need it, and they are getting it at a fair price.

Mr. ELLIS. I would agree with you, Senator Hickenlooper. This is a pretty fine point, but I believe that the presumption is that the price of plutonium would have to be fixed in order to make up this difference. Now, if in so doing it is found that it is less than or equal to, not in excess of, what the Government could produce it for otherwise, that would be right.

Senator HICKENLOOPER. I would doubt a contract of that kind would last very long once it was found that the Government was paying a subsidized price for plutonium. It probably could be justified if they were paying a competitive price for it.

Mr. ELLIS. Of course, there are many ways in which it could be figured, and I don't know if there is any practice or experience or yardstick as yet by which the price of it could be figured.

We strongly support ownership and construction of a pilot atomic power plant by the Atomic Energy Commission. We hope that co-operatives and public power systems will be invited to participate in such development and that the results will be made available to them.

Finally, there are the practical factors of national security and safety which must be considered in any proposed private ownership of atomic power plants. It is our belief that the national security can only be protected by the strict supervision and licensing of atomic power developments by the Atomic Energy Commission. We believe that this is adequately covered in sections 7 (b) and (c) of the present act.

In regard to the safety requirements of private ownership of atomic power plants, we agree with the Atomic Energy Commission that consideration must be given to a "progressively adjusted code for safety and exclusion area requirements." Without a fairly definitive safety code we believe the private ownership of atomic power plants may endanger human life and safety. Such a definitive safety code certainly

is not now available or are there signs that it will be available in the near future. We are only too well aware of the years of painstaking research and experience that have gone into our present National Electric Safety Code.

Another recommendation of the Atomic Energy Commission is that "such research and development work (be carried out) in Commission laboratories on specific power projects deemed warranted in the national interest." We wholeheartedly endorse this proposal. We are also heartened that the Congress has evidenced interest in this by appropriating \$7 million for the beginning of construction of pilot atomic power plants. In all such activities we hope that the Atomic Energy Commission will make every effort to invite and encourage the participation of cooperatives and public electric systems. We believe these systems feel that their contribution is being made by the Federal Government in its tremendous investment in atomic power research and development. Further, we believe such research carried out primarily with public funds is a part of the public domain and should be available to all.

We are certain that at the same time private companies will continue to participate in atomic research as the 12 teams now are doing. We believe the technical knowledge and experience they are acquiring is invaluable; that it will pay them substantial dividends. The commercial power companies, of course, should benefit from atomic power when it arrives, but they should not be granted monopolies. They must realize they should not have sole right to the results of such research, but it must be made available to all within the limits of security requirements.

In connection with research, we feel some thought should be given to the Atomic Energy Commission's developing the pilot atomic power plant in conjunction with one of its present atomic weapons plants. If successful, the Atomic Energy Commission could economically utilize the electric energy for its own requirements and also the plutonium for its weapons needs. At the same time this would release vast quantities of public, and in some cases private, power for civilian needs where it can be readily utilized. If this were successful for instance at Oak Ridge, Tenn., the whole TVA area would be assured of needed power not now in sight. The situation there is that by the end of 1955, when the steam plants under construction are completed and in service, TVA will be selling the Atomic Energy Commission alone more kilowatt hours than could be produced by all the dams in the TVA system, including the output of the dams owned by the Aluminum Company of America, which are operated as a part of the TVA system, and those in the Cumberland Valley built by the Corps of Engineers. Why not build one of these atomic-power plants alongside one of these atomic-energy plants, as an experimental job, and let it help relieve the situation generally in power supply in the area?

Representative HOLIFIELD. Mr. Ellis, I think your suggestion is timely. It is also in accord with the written language in the present Atomic Energy Act. I point out that just recently in the Portsmouth and Savannah area the Government negotiated a contract which will involve an investment of a billion dollars on the part of private utilities, and before the private utilities would go into that type of a contract they insisted on some very high cancellation bonuses in case the Government did cancel the contract before a 30-year period.

Am I right on that, Mr. Hamilton? Thirty years?

Mr. HAMILTON. Twenty-five, sir.

Representative HOLIFIELD. It is a 25-year contract.

Mr. ELLIS. Thank you, Mr. Holifield. We just think it makes good sense.

Chairman COLE. I think in fairness, on the questions of the cancellation of those contracts, it should be pointed out that the rates which those private companies are to charge the Commission for the energy they produce are absurdly low. So that while the Government does run the risk of having to pay out in case it cancels at some time in the future, until that time arrives it has the benefit of the use of electrical energy at a very, very low rate.

Representative HOLIFIELD. I believe the figure involved is 3.8 mills. But I do not believe the contract specifies that that is a firm and rigid price. It provides for acceleration of the kilowatt-hour cost under certain conditions. So that is an additional protection to the plants. And I think they should have it, because if wages or fuel costs go up, I think they will have to raise their price. I see nothing unjust about it. I am just calling attention to the facts of that negotiation.

Now, in my opinion that is probably a lot cheaper than they would get with a prototype atomic plant. The cost of production would undoubtedly be higher than by conventional fuel, and part of that would undoubtedly have to be charged off to research and development.

Mr. ELLIS. Right.

Representative HOLIFIELD. But we would be gaining valuable experience, which could be in turn given to the whole economic setup of America, private and public.

Mr. ELLIS. And you would be providing a yardstick there by which you could determine what the real costs were.

Furthermore, if you built a plant any place else than near some Government installation that could use the power, and if the plant is subsidized, and if somebody else purchases the power, the howl will immediately go up that somebody is buying subsidized power. Here you would have, all within a vertical operation, the total factors by which you could measure what the costs really are.

Representative HOLIFIELD. If that yardstick plant was built, it would give us costs, which we do not as yet have. And I point out that if the Government goes into private contracts for atomic-energy plant development, it must go into it blindly, because it cannot go into it on the basis of knowledge of costs of atomic energy electrical power production at this time.

Mr. ELLIS. Right, sir.

Senator HICKENLOOPER. That is nothing unique about the atomic-energy project. It has been on the blind side all the way up. It has been a pioneering operation. There have been no cost yardsticks on it, generally speaking, except some routine construction.

Representative HOLIFIELD. That is right. I agree. But my point in calling attention to the fact is that the Government cannot at this time negotiate with private industry on the basis of adequate knowledge to protect the interests of the Government or to protect the interests of private industry in an equitable way, it seems to me.

In other words, it is premature. We are not to the point yet where we can deal on the table with known facts, as we are in the electrical

industry, where today we do have yardsticks, do have cost figures, and we are able to negotiate equitable contracts.

Mr. ELLIS. And you mentioned the cancellation clause in the Ohio case. Evidently somebody thought on some day the Government may withdraw and not be producing on as grand a scale as it is at the moment, and even may close that plant down.

Senator HICKENLOOPER. Well, the Government itself specified that, that the Atomic Energy Commission would not enter a firm contract for this power except with the privilege of canceling at any time, even before they took a kilowatt of the power.

Mr. ELLIS. Right.

Senator HICKENLOOPER. And the AEC would not go into the situation without that cancellation clause.

Now, there are 3 outfits in this, 2 private utilities and TVA. They have all gone together to produce the necessary plants, costing about a billion dollars. There is not the demand for the electricity in that area at this time for those plants. They are being built especially for the atomic-energy plants. And in view of the cancellation requirements of the Commission, the TVA and the other two said, "We just cannot put the money in here and build billion-dollar installations, where the AEC may say to us, and demand the right to say to us, the day they are finished, 'No, we do not want any more electricity. We are going to use something else'." Maybe by that time they may have their own atomic powerplant or something of that sort. So the cancellation figures, on a graduated scale downward, were arrived at by mutual agreement as to what would be an equitable damage settlement, in view of the lack of customers for that power except the atomic energy plant. And that is the way it was arrived at—full participation by the Federal Power Commission, and everybody else had a finger in the pie in examining these plants and arriving at the yardstick for equitable damage under certain circumstances in the ensuing years on a diminishing scale, until finally it carries no damage if the contract is canceled.

Mr. ELLIS. Suppose a Government nuclear powerplant were established alongside the plant in Ohio, likewise in any other of the areas, and the Government then should cease producing at that plant, or should cease needing, let us say, the power from that plant. The Government might have on its hands a generating plant for which it would not have immediate sales of power as the power companies might have.

In connection with such power development at an atomic plant, we believe consideration should be given to a method of distributing the surplus atomic power, if any. In particular we would like the Congress to consider the Federal preference laws as applying to the marketing of atomic power developed with public funds. We feel this has worked equitably in the development of Federal hydropower. In fact, in the fiscal year 1952 the cooperatives purchased only 5.9 percent of all Federal hydropower, the municipals 26.8 percent, while the private utilities purchased 20.7 percent and private industry 24.3 percent. We recommend this model for the marketing of atomic power developed with public funds. It will ensure the fact that the benefits from this power accrue to the ultimate consumer.

Senator HICKENLOOPER. Mr. Ellis, let me ask you this. It is a little collateral to what we are talking about.

What percentage of the rural population of this country do you estimate does not have access to REA or to power?

Mr. ELLIS. The best figures we have indicate that it is around 600,000 farms, Senator Hickenlooper. It is very small now.

Senator HICKENLOOPER. By "access" I mean that there is power available in the vicinity. Sometimes they are not hooked up, or they have not run the lines out to them yet.

Mr. ELLIS. Our systems have made various checks on that. In your State of Iowa, the number of farms not served is practically nil now.

Senator HICKENLOOPER. I know it is a hundred percent, to all intents and purposes.

Mr. ELLIS. There are very few farms now, even very few shacks anymore, that are lived in by people, that do not want electricity. They just do. They didn't when the program started. There were many who didn't take it. But now they do take it, and they take it from the commercial companies as well as the electric co-ops.

Senator HICKENLOOPER. On your increased use of electricity, what factors make up that increase? Is it increased accessibility? I mean, new farms being hooked up? Or is it the fact that once a fellow gets electricity in the farm he thinks he will just use it for 1 or 2 things, and then in a couple of years he is using it for 15 or 20 things?

Mr. ELLIS. Yes, that is right. The uses are now up to 400 known uses. I just was reading last night in my home paper about some of the farmers down in my home State of Arkansas suing some farmers upstream for pumping all the water out of the stream for irrigation purposes. Now, you never think of irrigation in Arkansas. I never heard of a lawsuit over the water in the streams before. But you can now look out of the airplanes as you fly over this country and you can see these sprinkler irrigation systems all over the East, all over the West. You can drive down the roads and see them. That is one new use. And those electric pumps pumping that water out of the wells and the streams and the ponds run around the clock. It is a worthwhile use of electricity.

Senator HICKENLOOPER. Yes. The projected need for kilowatt-hours on the farm that you have shown in this chart is very interesting, and I am wondering what factors will contribute to that increase now. Because in the farm areas they are almost all accessible to electric power at the present time. Will there be multiple uses of electricity? Will they keep on developing new means to use it, or new tools to use electricity for?

Mr. ELLIS. Yes, Senator Hickenlooper. We think so.

Right now, this year, many air-conditioners are being installed in the homes, in the rural homes throughout the country. There are known uses which will be continued. There are many new uses, which are just, we feel, around the corner.

We have advocated for several years the farm electrification research in the Agricultural Research Administration at Beltsville. Their experiments now indicate that they are practically to the point of being able to kill the weevil in grain with the use of supersonics. The experiments show they do it. You can have them bring them in and show them to you in your office. They would be glad to do it if you would like to see them, the different samples of the grain on which they have applied these supersonic treatments. No weevil. And eaten up where it has not been used.

There are so many other things that are just around the corner: Automatic controls in the barns, in the chicken brooders, the pig brooders. They just seem to be endless.

Of course, television is just coming to the rural areas. We do not know how much that will add, however, to the use of electricity. They turn their lights off when they see the television, it seems. That hurts as well as helps.

The Atomic Energy Commission further recommends more liberal patent rights as may seem appropriate to the Commission and consistent with existing law. We oppose any liberalizing of patent rights and instead believe that the Commission should continue to strictly interpret section 11 of the Atomic Energy Act.

Section 11 (a) (1) of the Atomic Energy Act states:

No patent shall hereafter be granted for any invention or discovery which is useful solely in the production of fissionable material or in the utilization of fissionable material or atomic energy for a military weapon * * *.

We believe the Atomic Energy Commission should continue to strictly interpret this section.

Section 11 (d) of the Atomic Energy Act states:

The Commission is authorized to purchase, or to take, requisition, or condemn, and make just compensation for (1) any invention or discovery which is useful in the production of fissionable material or in the utilization of fissionable material or atomic energy for a military weapon, or which utilizes or is essential in the utilization of fissionable material or atomic energy, or (2) any patent or patent application covering any such invention or discovery. * * *

We believe this section protects the public interest because it makes available to the Commission any patents or inventions or discoveries covered in the above section 11 (d) (1) and (2). This section should be continued to be strictly interpreted so as to fully protect the public interest.

The Atomic Energy Act especially in section 7 (c) is written so as to prevent the monopolistic development of atomic power and make all technical information and data available to "as many licensees as possible." The intent of this section of the act would, of course, be destroyed by the granting of private patents for atomic power development.

Asking the Congress to permit such private patents is like the Congress telling the private power companies years ago when the possibilities of falling water for electric power were first considered, but not foreseen, that they could go out and dam any stream and thus forever prevent the full utilization of these streams. Before the Congress is asked to take such a step, it seems at the very least they should be furnished with the comprehensive report required by section 7 (b) of the act and they should thoroughly consider the social, political, and economic consequences of such a report. But due to the early stage of atomic-power development, the Atomic Energy Commission is unable to furnish such a report. How can the Congress possibly authorize more liberal patents when they are uninformed of the implications of such action or even what may be patented?

This is aside from consideration of the tremendous investment already made by the Government and the fact that the Government will still have to invest large sums in atomic power research and development. Also just consider the advantage of such action to the 12 teams now participating in atomic power research. They already

have a considerable amount of knowledge and know-how not available to other groups. Should they be permitted to apply for exclusive patents and perhaps forever deny to others the results of this research carried out with public funds? It appears to us that the age of atomic power can be hastened if the results of atomic power research are made available to all.

Since 1942 when the successful operations of a nuclear chain reactor first occurred, we have made tremendous progress in nuclear power development. This progress has been achieved by the Government and the industrial teams working together. In the future, we hope there will be more participation by the consumer-owned electric systems. But this rapid progress was made and will continue to be made by strict interpretation of the patent provisions of the present Atomic Energy Act.

Finally, the Atomic Energy Commission recommends a "progressively liberalized information policy in the power reactor field." We endorse this recommendation and believe it is consistent with the intent of the Atomic Energy Act. Again, we believe it is most important that as much information as possible concerning atomic power developments be made available to the widest number of people possible. In this connection we also wish to recommend that the Commission more fully publicize the present availability of information on atomic power development. We, ourselves, were surprised to learn of the considerable amount of information now available. We believe that we have a responsibility to make this information available to our member systems so they can become aware of the future potentialities of nuclear power development.

Again we wish to express our faith in the future offered by this great new energy resource. Also we are confident that this committee and the Congress will give the most thorough consideration to any proposed changes in the Atomic Energy Act so as to fully protect the public interest and continue the widest possible participation in the development of this new energy resource.

Chairman COLE. Thank you very much, Mr. Ellis.

Earlier in your statement you referred to an article written by Mr. Weil, whom I assume you do not know, since you referred to him as Dr. "Weel." I think you also do not know that Dr. Weil appeared as a witness immediately ahead of you this afternoon.

Mr. ELLIS. No, sir; I did not know that.

Chairman COLE. And further that Dr. Weil is one of the outstanding nuclear physicists in the country, who has no contractual connections which limit his activities; that Dr. Weil's viewpoint is that it would be preferable if nonprofit organizations become actively interested in this program of generating power from atomic fuels.

Since your organizations qualify from that standpoint, as being nonprofit, and since you have indicated your organizations even presently need more electrical energy than they have available, and anticipate even a greater need than it is expected will be available, and since Dr. Weil is still in the room right behind you, I suggest that in view of the very happy attitudes and conditions of your organizations and Dr. Weil, you might get acquainted with him before you leave.

Mr. ELLIS. Will you introduce me? I would like to meet him.

Chairman COLE. He is sitting right behind you.

We will insert a statement by Mr. Jerry Voorhis at this point.

(The statement is as follows:)

STATEMENT OF JERRY VOORHIS, EXECUTIVE DIRECTOR OF THE COOPERATIVE LEAGUE OF THE U. S. A.

Mr. Chairman and gentlemen of the committee, my name is Jerry Voorhis, I am executive director of the Cooperative League of the U. S. A., with headquarters at 343 S. Dearborn Street, Chicago, Ill. The league is a business association and educational agency for cooperatives and mutual-type businesses in the United States. Our membership includes regional wholesale farm supply and consumer cooperatives, mutual insurance companies, and national associations of credit unions and rural electric cooperatives. Excluding the national associations our membership would be about 2 million families. The 2 national associations have together nearly 10 million member families, but there is of course some duplication in these figures; that is, some families are member-owners of both a farm supply and a rural electric cooperative or a city consumer cooperative and a credit union and so on. Almost three-fourths of the league's membership is farm and rural people, about one-fourth city people.

The American taxpayers—that is all the people—have spent somewhere in the neighborhood \$12 billion on the development of atomic energy. By every standard of right and decency the basic entitlement to such benefits as may accrue from this development belong to all the people of the United States.

Whatever peacetime or constructive benefits may in the future flow from atomic energy are at present virtually eclipsed by the danger to the very life of mankind in this and other nations which it represents. And no decision regarding its further uses can conscientiously be made without primary consideration of this central fact. We have to learn to live with this engine. We have to attempt to use it to promote and protect peace if that is in any manner possible. Otherwise it will someday spell the death of probably half the human race in this country as well as others.

I am neither scientist nor technician, but even I can see that unless the central control of this new energy continues to vest in the whole America people—who incidentally have paid for it—the chance to employ atomic energy as a force or leverage for a firm, enforceable peace will be gone. And I do not believe that such central control in the people's interest need be inconsistent with an ever broader use of peacetime applications of atomic energy by private industry than would be possible under any other circumstances.

Furthermore we have visited upon this and future generations enough misery of soul with this discovery so that we ought not to compound that distress. We could easily do exactly that. Already the American economy is in grave danger of loss of its dynamic element which is effective competition. Already, according to the Twentieth Century Fund, 1 percent of the private corporations hold 74 percent of all industrial assets, carry on more than 50 percent of all business, and collect 60 percent of the net profits, thus continually adding to the relative strength of their capital position. These huge companies are beyond the reach of failure. They are already in control of so much capital and in so strong a position that they are immune to the mortality which so regularly afflicts all their smaller competitors, if indeed such exist.

It appears that at present adaptation of atomic energy to peaceful uses will be very costly and require very large capital investment. At public expense a great deal of work is constantly going on, but to date no proposal has been made by private companies which does not involve continuance of very substantial public subsidy. Another fact is that there are a handful of companies which have had all the advantages of participation in this atomic-energy development and are therefore in position of being already halfway around the track in any race for exclusive patent rights or other opportunities for private exploitation, should such a race be started. And these are, necessarily, of course, among the companies which are now in the select powerful group. So the more expensive the process the more certain would it be that control would rest exclusively with those companies.

Whatever the present situation, certain it is that atomic energy has a potential of becoming an all-powerful factor in our economic life. All that would be needed under such circumstances to pronounce the final death knell over economic freedom in the United States would be for Congress to commit the unpardonable breach of public trust of giving to some of the companies which are already in the driver's seat a key to an advantage which might prove unchallengeable.

I do not believe we can treat atomic energy in the same light as economic factors have been treated in the past. Here is power capable in future of either

transforming the economic life of man, or else destroying it. Is not a new type of institution called for to meet this unique situation? May Congress not have wisely taken first steps toward creation of such an institution when it passed the Atomic Energy Act? I believe it did exactly that, and I had the honor to be a Member of Congress at that time. I do not believe the basic provisions of that act should be lightly changed.

Everything we do with respect to this awesome new resource should be done with the protection of the welfare of future generations in mind. This requires three basic considerations. The first is the national security. Whatever other arguments there might be for farming out to private enterprises the manufacture of plutonium or other essential elements of atomic weapons, or permitting private ownership of fissionable materials, it is surely evident that this would involve an inevitable weakening of national security measures. Therefore it is clear that no such steps should be taken unless the most compelling reasons existed for such action.

Some compelling reasons certainly do not exist. On the contrary, development of atomic energy for peacetime purpose—or any other purposes for that matter—must, by all the testimony, be dependent upon very substantial subsidy of the Government from the tax funds of all the people. Already the people as a whole have invested \$12 billion in this atomic enterprise—more than the combined investment of General Motors and United States Steel put together. Again the new institution in the form of the Atomic Energy Commission seems to the average citizens for some of whom I speak to have made about as rapid progress as was possible up to this point. Furthermore, have not the new relationships developed between the Commission and private companies proven on the whole quite satisfactory and may we not be in process of developing relationships which can stand us in very good stead as we attempt to deal with this brand new and potentially very dangerous power? For one can see little possibility of a change in the situation where tremendous financial resources are going to be required for continued development of atomic energy. We come, therefore, to the conclusion that it would be both unjust and very dangerous to our American-type economy to grant the right to any sort of exclusive patents to private interests in this atomic field. To do so would confer on those few large companies already having the tremendous advantage of participation in this great enterprise an heretofore unheard-of competitive advantage. And this would be conferred on companies already in positions of near-monopolistic power. What would happen to our economy under such circumstances I leave to the committee to judge. I would only add that such results would flow from the giving away of a resource for which the American people as a whole have paid and paid heavily. Central control over and basic benefits from this atomic energy should remain the inalienable possession of the American people as a whole. Nor is it possible for me to see why this should stand in the way at all of such peacetime development as may be possible. But that development should take place under circumstances which will protect the opportunities of all business—large and small—to have a part in it. It should not flow from any exclusive patent rights. And it should take place under such licensing provisions as will protect the right of the whole people to royalties or licensing fees which one day might be a means of balancing our budget under almost any circumstances.

The third basic consideration which should guide our action in attempting to protect future generations is the hope of using atomic energy as a means of building a firm peace in the world instead of a world of terror. It will lead to one or the other of these results. The chance of its becoming a factor in building a firm peace will depend directly upon our ability to employ it as an instrument of Government policy to that end. I will not attempt to outline the many ways in which this could conceivably be done. The committee will have considered them, I am sure, even more carefully than any of the rest of us. But it is obvious that unless basic rights and basic controls remain in the hands of the Government as custodian of the people's interests, it will cease to be possible to employ atomic energy in this manner as an instrument of national policy.

And so from every point of view—from the viewpoint of present national security, from the viewpoint of preserving economic freedom, and from the viewpoint of the hope of establishing peace in the world, it is most fervently to be hoped that the basic provisions of the Atomic Energy Act will not be changed.

Chairman COLE. Our next meeting will be tomorrow, when we will hear the president of the Babcock & Wilcox Co., Mr. Iddles, and Mr. Rowley, production manager of the National Lead Co.

With that, the meeting will adjourn.

(Whereupon, at 3:50 p. m., Wednesday, July 15, 1953, the hearing was recessed until 2 p. m., Thursday, July 16, 1953.)

ATOMIC POWER DEVELOPMENT AND PRIVATE ENTERPRISE

THURSDAY, JULY 16, 1953

CONGRESS OF THE UNITED STATES,
JOINT COMMITTEE ON ATOMIC ENERGY,
Washington, D. C.

The joint committee met at 2 p. m., pursuant to recess, in the Old Supreme Court room, the Capitol, Representative W. Sterling Cole (chairman) presiding.

Present: Representative Cole, Senator Pastore; Representatives Van Zandt, Patterson, Holifield, and Price.

Professional staff members present: Corbin C. Allardice, executive director; and Wayne P. Brobeck, Walter A. Hamilton, and J. Kenneth Mansfield, of the professional staff of the joint committee.

Chairman COLE. The meeting will come to order.

The first witness this afternoon is the president of the Babcock & Wilcox Co., Mr. Alfred Iddles.

Babcock & Wilcox is one of the largest manufacturers of heat exchangers, pressure vessels, and other heavy equipment in the world. The company has played a significant role in the development and manufacture of a great many pieces of equipment for atomic-energy plants during and since the war. This company has been an associate of the Dow-Detroit Edison atomic-study project since its inception over a year and a half ago. In recent months, Babcock & Wilcox has indicated an increasing interest in the atomic-power business by establishing a separate division within its organization devoted to atomic power. Construction of the heat-producing end of the atomic power plants—the reactors themselves—is quite in line with the established activities of the company.

Mr. Iddles, we welcome you here this afternoon, and we will be happy to hear you in any statement you might have to make.

STATEMENT OF ALFRED IDDLES, PRESIDENT, THE BABCOCK & WILCOX CO.

Mr. IDDLES. Mr. Chairman and members of the committee, we appreciate the invitation to appear and will be glad to be of whatever help we can and to answer any questions that are appropriate.

The Babcock & Wilcox Co. has been in the business of manufacturing equipment for the generation of heat from fuels, and the utilization of such heat for power and industrial purposes, during the past 86 years. Throughout this period the company has been faced with many changes in available fuels. In the early days it was coal alone, and later oil and natural gas as well as waste materials from industrial

processes were added. There were not only changes in the quality of the fuels available but also in the economics dictating their use. Throughout this time the company, in a highly competitive industry, has striven to improve the methods and apparatus employed for the utilization of these fuels and the efficiency of their use. Due in large measure to the competitive situation, significant contributions to this art have been, and still are being, made, all leading to a progressively decreasing cost of power per unit of fuel consumed.

The most recent addition to the fuels available is nuclear energy. In view of our background of constant search for cheaper and better ways to produce power, we are naturally interested in exploring the possibilities of this new source of heat along with our work with other fuels, with the object of being able to supply equipment for its utilization to any and all customers, whether they be the Government, public utilities, or industrial organizations in general.

The Babcock & Wilcox Co. has participated in nuclear energy projects to an increasing extent since the days of the Manhattan Engineering District project. At the request of the AEC and/or its contractors, and the United States Navy, we made available a number of highly trained and qualified engineers to serve as consultants, and others to serve as full-time designing engineers on nuclear projects. This work, incidentally, was done during a period when such engineering manpower was badly needed by the company for its normal business activities. In addition, we have cooperated by designing and constructing equipment for AEC and Navy contractors such as Westinghouse Electric Corp. on the STR development, and General Electric Co. on the SIR development. In view of these activities we have recognized the possibilities of the utilization of nuclear fission as a new source of heat for power generation in our field of business, and have recently established an atomic energy division in our company to handle such AEC and Navy work now under contract, and to pursue all possible avenues of investigation and design for the industrial use of atomic energy, including the large-scale development of power. We are now, in one such case, furnishing technical assistance to the Dow-Detroit project in the AEC industrial participation program.

We believe that the utilization of nuclear fuel for power purposes can be more rapidly developed to the greatest advantage of the people of the United States by permitting it to grow in an atmosphere of free enterprise, just as other industries have developed, such as the electric power, automobile, and airplane industries and, more recently, television, jet engines, and the like.

The generation of power by the recovery of heat released from nuclear fission has been demonstrated, and it is now the economics, involving specific reactor design and similar problems, which remain to be established. Industry, by fully and freely participating in the development at its present stage, could bring into play its tremendous accumulated experience in related fields of heat transfer and utilization. Industry, however, cannot afford to undertake such work to this extent unless it be given the privilege of legally protecting the improvements which it may make and the normal way in which this could be done would be under the patent laws of the United States. The Atomic Energy Act of 1946 does not, however, now permit this to be done, and an appropriate modification of this act is desirable.

Basic changes in the Atomic Energy Act will be essential to permit ownership of fissionable materials and the facilities for producing or utilizing fissionable materials, which would include such nuclear powerplants. Private capital would be reluctant to invest in such undertakings without assurance of having the necessary amount of control of such facilities to insure continuity of operations.

It is our opinion that changes to the act to accomplish these objects can be made without impairing national security, health, and safety. In the event of a national emergency, all patents, know-how, and techniques of private industry would be available to the Government for its use.

The argument has been made that the United States taxpayers, who have paid the bill to the extent of some \$10 billion to date in the development of atomic energy, will not receive any return on their investment if the law is modified to permit private industry to utilize the accumulated knowledge, and that only a relatively few industrial companies will benefit. We believe that the taxpayers' expenditure has been primarily a military investment and, as such, we have already received the benefit in terms of national security at a critical period when equal security was unobtainable by other than atomic weapons. In the development of atomic power, we believe that the taxpayers' best interests lie in the direction of minimum power costs. We confidently believe that costs will be less if industry is allowed to participate on a competitive basis and, furthermore, this will undoubtedly result in many new jobs being made available. We further believe that the development of atomic energy for power and other purposes will result in improvements not now fully conceivable and will be of such benefit to the people of the United States as to ultimately make the Government expenditure to date minor by comparison.

A powerplant utilizing conventional fuels represents the collective work of a large number of equipment manufacturers. No reason is known why nuclear powerplants would not be constructed on a similar basis. The possibility of any commercial monopoly in such work by a relatively few companies is, therefore, remote, and in any event would be subject to the existing antimonopoly laws.

There have been some fears expressed that by liberalizing the existing patent restrictions in the Atomic Energy Act of 1946 there would be danger of individual companies or groups of companies obtaining a patent monopoly in the atomic energy power field. The reverse is probably more nearly the truth as the fundamentals upon which nuclear power developments will be predicated are already known and, where patentable, are presumably now covered by patent applications owned or controlled by the Atomic Energy Commission. It would be expected that the Commission would grant only nonexclusive licenses to responsible companies or groups of companies which might wish to work in this field, and the patents that will undoubtedly be sought by such companies on inventions resulting from their subsequent efforts will, in all probability, be of a secondary or improvement nature rather than of a fundamental character. This is a similar situation to that which exists in practically every other basic industry in the country today.

The Atomic Energy Act of 1946 states that the problem should be—subject at all times to the paramount objective of assuring the common defense and security, the development and utilization of atomic energy shall so far as

practicable be directed toward improving the public welfare, increasing the standard of living, strengthening free competition and private enterprise, and promoting world peace.

In conclusion, therefore, we believe that the intent of Congress as expressed in that act can best be carried out by modifying the present act so that industry will be free to devote its efforts to developing its own designs of nuclear powerplants utilizing fundamental information received from the AEC. The important changes in the act from the viewpoint of equipment manufacturers would be those concerned with the right to obtain presently classified information to enable industry to do design and equipment research independent of the Government, and to obtain patents on inventions resulting therefrom. The present status of the art is such that we believe the interests of all, including the Government, industry, and the people of the United States, can best be served by these changes being made to the act in the very near future. We are of the opinion that this can be accomplished without in any way impairing the necessary provisions for the maintenance of national security, health, and safety.

Chairman COLE. Thank you, Mr. Iddles.

Mr. Holifield, any questions?

Representative HOLIFIELD. Mr. Iddles, I would like to ask you a few questions.

On page 5, at the bottom of the page, you say :

It would be expected that the Commission would grant only nonexclusive licenses to responsible companies or groups of companies which might wish to work in this field * * *

You mean by that, of course, that anyone that is qualified can have access to licenses, providing they will fulfill the requirements of the Commission regarding security and financing, and so forth?

Mr. IDDLES. I would think so. I would think if the Government wishes to have industry assist in developing, then of course they would have to give those rights, and with proper supervision.

Representative HOLIFIELD. Then you would not be in favor of granting licenses only to, let us say, those who have participated in the development of this great project. You would be willing for all of American industry to have a chance to participate?

Mr. IDDLES. I would think so, sir. That is what made America.

Representative HOLIFIELD. Now, you bring out the point that any patents that might be obtained would be of a secondary or improvement nature rather than of a fundamental character.

By that I imagine you mean that designs of machinery and processes, chemical processes, and so forth, which would further the art of reactor development above that which is now obtained would be in the nature of a patent claim, rather than evolving a completely new theory or new device in the way of producing?

Mr. IDDLES. That is right, sir. If someone should be able to invent an absolutely new physics principle, presumably the Government would have a paramount interest on account of defense. But it is a bit like steam power. All of the fundamentals of steam and thermodynamics have been available to the world for years.

Representative HOLIFIELD. They are known, and nonpatentable.

Mr. IDDLES. Yes. And now we have the odd circumstance of the Government being in possession of very rapidly accumulated fundamental information which, in normal events, would have been ac-

cumulated over a hundred years. And the Government, I would think, would be justified in giving that to industry, under proper safeguards.

Representative HOLIFIELD. For security of the Nation, of course.

Mr. IDDLER. That is right.

Representative HOLIFIELD. I agree with you on that. In view of the fact that this is a unique situation, and that this great fund of information, as you say, has been accumulated within a period of 7 or 8 years, as far as its application to fission is concerned—of course, we know that the principles of physics have been in existence much longer—it does put this industry in a little bit different situation than the other industries which you call attention to, such as the automobile and others, because they were developed over a period of many years, mostly by private investment, private capital, and so forth; and we come to this industry at a time when it has achieved a position of advanced development strictly on the basis of Government investment. And therefore there is a difference there, and we must look at it from that standpoint and therefore try to protect those who have the present equities in it.

Mr. IDDLER. That is correct, sir.

Representative HOLIFIELD. Now, you in your statement on the objectives of the act, on the last page, indicate that one of the principles is strengthening free competition and private enterprise. Would you say that the granting of restrictive patents on machinery designs, for instance, would be a detriment? Or would it be an added advantage in bringing to the people the benefits of civilian power development?

Mr. IDDLER. Well, in the overall it would be of benefit.

I think we must look at it from the standpoint that to get those improvements there must be incentive to put effort to get them. And the pay for that is in the form of some restriction in their use, as the patent principles in the United States have set forth for a long time.

And I don't fear its monopolistic implications, because we are in competition constantly, and other people are just as smart as we are, and they will do something a different way and obtain a patent on it. And in the long run the public uses that equipment.

Representative HOLIFIELD. I certainly agree that if a company, through its own ingenuity and investment, produces a new and patentable improvement, they should be compensated. I wonder if you would subscribe to the theory that because of the basic knowledge which has been accumulated at public expense, the type of patent granted should be one which would recompense to the inventor financially for his investment, but it would also be written into the law that these patents should be made available to all of the American economy on a nonrestrictive basis; in other words, compulsory, as far as licensing is concerned.

Would you carry your thoughts that far? Or would you stand on the normal patent provisions, which allow you, for a certain number of years of restrictive right, to grant to others the use of that equipment?

Mr. IDDLER. I should say, sir, that the latter thought is the basic conception that we have, because that is our history in this country. It is conceivable that a sufficiently important invention might be made by some person, that it might not be in the public interest to let that person keep it for 17 years, and it might be a reason for saying that

similar rights should be licensed to other makers. But that is not the history of the art of making manufactured equipment. Seldom does that happen.

Representative HOLIFIELD. That is true. But I believe that we have established that the development of this new science has been unique in that it has been wholly financed by the Government, and it appears to me that because of that tremendous investment, the benefits should be widespread, without penalizing the companies from the standpoint of royalty return on it.

It seems to me that if we are going to strengthen free enterprise, then these patent rights should be made available throughout the Nation, both to private and public bodies, so that the widespread benefit of it could be brought as quickly as possible to the public, at the same time preserving the right of industry to an adequate return on its investment and discovery rights.

Mr. IDDLES. I don't think I can disagree with your philosophy at all. In any instance, you immediately have a question of degree. And if it were a tremendously important and fundamental patent, probably a manufacturer would be willing to sublicense it.

Representative HOLIFIELD. You see, we of this committee do have that responsibility to the people of the United States, as well as to the perpetuation of free enterprise, and sometimes modifications of law seem to be in the public interest, as have occurred many, many times.

Mr. IDDLES. That is quite so, but on the other hand, of course you have to supply sufficient incentive to arrive at that invention.

Representative HOLIFIELD. That is true. Now, are you of the opinion that in this interim period of further development, to the point where this power would be of practical value, American industry can at this point come forward and finance the development that is needed, and can they finance it as fast as if we proceeded as we have proceeded in the last few years? At some period in the future, say 3 to 5 years from now, the Government could make available to all of American industry the impending developments which we anticipate.

Mr. IDDLES. Well, it appears clear to me that the continued governmental research might well be continued.

Representative HOLIFIELD. In cooperation with industry?

Mr. IDDLES. In cooperation with industry; but that industry must be free to go its own way, subject to security restrictions, to use its ingenuity without the holdback of the conservatism that is inevitable in Government work.

I think there is a feasible combination, which is workable. And for instance, we are working now on AEC-authorized programs, developing pieces of equipment which require methods of making that have never been used before.

Now, at the moment we are, of necessity, giving that information to AEC.

Representative HOLIFIELD. Well, of course, on the other side of that point, you are being paid for it by Government funds.

Mr. IDDLES. To an appreciable extent, but not entirely. We do not get paid for all of our overhead and night work.

Representative HOLIFIELD. Well, neither does the Congressman.

Mr. IDDLES. No; that is right.

Representative HOLIFIELD. I have not heard of any time and a half being proposed.

Well, I do not want to depreciate the tremendous contribution which private industry has made to this art, because without it we could not have had it. I realize that.

Mr. IDDLER. And you see, industry necessarily has that dollar idea, the dollar viewpoint; and the Government unfortunately does not always have a dollar viewpoint. It sometimes should not have, and sometimes it does not have when perhaps it ought to—I mean the individual in Government work.

Representative HOLIFIELD. Well, thank you for your answers, sir. That is all.

Chairman COLE. Mr. Van Zandt?

Representative VAN ZANDT. What is the proportion of your effort in this field of atomic energy, as measured in dollars and manpower?

Mr. IDDLER. At present we are operating with a budget of between four and five hundred thousand dollars of our own money in wages, salaries, travel expense, office expense, and so forth, and in addition we have been recently and are now engaged in between five and six million dollars' worth of equipment making under contract, for Government projects. Our budget is a good-sized contribution from the standpoint of our net profits. We are doing it on the long-range basis that it is another fuel. Our business is fuel and its use.

Representative VAN ZANDT. What part of your contracts are with the AEC?

Mr. IDDLER. Directly?

Representative VAN ZANDT. Yes.

Mr. IDDLER. Not a great deal now. We did a considerable amount of research work directly for the Atomic Energy Commission in our research laboratories. But the fabrication of equipment is now being done under the STR and the SIR projects for the submarines largely, and studies, recently stopped, for the aircraft-carrier atomic-energy power situation. And, of course, Dow-Detroit, which is a utility industry proposition, to which we are supplying engineering talent.

Representative VAN ZANDT. Is there a current demand for this particular type of equipment you are manufacturing in the domestic field?

Mr. IDDLER. No.

Representative VAN ZANDT. Do you anticipate such a demand in the near future?

Mr. IDDLER. I do. And if I may, I would like to explain that just a little.

When I was very much younger than now, I polished the brass on the No. 3 Westinghouse turbine. That was a long time ago. And the old chief engineer who was then my tutor said, "Boy, don't pay any attention to that. It is no good. Look up there." And "up there" was a 45-foot reciprocating steam engine. He said, "That is the way to make power, boy." If I had paid attention to that and forgotten the possibilities in the steam turbine, I wouldn't have been a participant in the progress that has been made since then, which presently results in our working on a 250,000-kilowatt turbine, which is quite a development over the 1,500-kilowatt unit on which I started.

Now, I can conceive of that happening in the atomic-energy field. I don't know when or exactly how it will occur. You just can't foresee such situations. And with our increasing use of power and fuel, there will come a time when we will be anxious to use other kinds of fuel

than coal and oil, which will then be less available. There is a tremendous amount of atomic-energy fuel available in the world, if we can find out how to use it. And we may be able to afford to pay more for it 20 years from now than we are able to pay now.

Representative VAN ZANDT. Have you any former AEC engineers with your company?

Mr. IDDLES. That were directly employed by the Atomic Energy Commission?

Representative VAN ZANDT. Yes, sir.

Mr. IDDLES. May I ask my associates, Mr. Wilcoxson, who is head of our research, and Mr. Gay, who is head of atomic energy?

"Not engineers," I am told.

Representative VAN ZANDT. Would that also apply to scientists?

Mr. IDDLES. Yes.

Representative VAN ZANDT. So you are really training your own personnel in this field.

Mr. IDDLES. By and with the assistance of the Atomic Energy Commission. Because we have been permitted, since 1946, to be on the inside of the information that they have.

I personally went down to Oak Ridge in 1946 and began to dig into this question. And we have been assisted materially. But, Mr. Van Zandt, we have brought to bear upon it what we learned from them plus what we learned from commercial business and engineering experience.

Representative VAN ZANDT. In other words, your company is keeping abreast of the developments in the field of atomic energy for the purpose of being in a position someday to supply equipment to those who would use it?

Mr. IDDLES. Yes, sir. That is our business. And if I don't help preserve the company along that line, I will probably be fired.

Representative VAN ZANDT. Have you any idea in your own mind when we might have a reactor actually in operation that will produce this power that we are talking about?

Mr. IDDLES. Well, I think you could make one in 2 or 3 years if you wanted to. In fact, I am sure you can. But as I said in here, it is a question of economics, and a matter of great consideration, to try to find out how to build one that would be economically justifiable, either for the Government or for industry. You can't afford to make power for 3 cents a kilowatt when you can make it for 4 mills with the present equipment. But it is quite probable that it can be made for a reasonable price and in a reasonable length of time, 5 or 10 years; and the quicker we get at it, the quicker we are going to arrive at that answer.

Representative VAN ZANDT. Have you any idea as to the cost of the reactor?

Mr. IDDLES. Well, I would go at it backward. You can afford to pay for a reactor only that which will be justified by the saving in coal that you do not have to burn; plus, momentarily, some extra expense, perhaps, chargeable to finding out how to do the next one. But, by and large, that is what the problem is, and the answer would be substantially different in Ohio than it would be in Portland, Maine, or in the desert somewhere.

Representative HOLIFIELD. Mr. Chairman, will you indulge me in one more question?

On page 4, Mr. Iddles, you say as follows :

The argument has been made that the United States taxpayers, who have paid the bill to the extent of some \$10 billion to date in the development of atomic energy, will not receive any return on their investment if the law is modified to permit private industry to utilize the accumulated knowledge, and that only a relatively few industrial companies will benefit.

I would say that I am unaware of that type of an argument. I certainly do not subscribe to it. I would like to modify that by saying that I would like to see more than a relatively few industrial companies benefit. I would not want to see it restricted by restrictive licensing to a few. I would want to be sure that it was extended to all industrial companies.

And then as to the balance of your statement there, where you say that :

We believe that the taxpayers' expenditure has been primarily a military investment and, as such, we have already received the benefit in terms of national security at a critical period when equal security was unobtainable by other than atomic weapons.

Now, I certainly agree with you that it has been a military objective and goal, and that the money that has been expended in my opinion has given more protection to the free world than any money we have spent for armament of any other kind. However, I would not use that as an argument to say that if correlative peacetime benefits, principles, whether it be in the medical, biological, or industrial field, have been developed, that therefore we should ignore the right of the people to have access to those benefits the same as to the military benefits.

Mr. IDDLLES. Oh, you are quite right. I want those benefits to accrue to the public through the efforts of what has already been done by the Government and the efforts of industry, which has the competence to help carry on.

Representative HOLIFIELD. That is all, Mr. Chairman.

Chairman COLE. Mr. Iddles, there is an aspect of this problem related to the patent situation which has occurred to me as I have been sitting here and listening to your statement and your discussion, which I have not yet heard brought into the discussion. I am not certain of my knowledge of the history of patent law, but I daresay the fact is that originally the patent was a property right which the inventor owned indefinitely.

Mr. IDDLLES. For a limited period of time.

Chairman COLE. No; I mean at the very beginning a patent right was permanent.

Mr. IDDLLES. That is right.

Chairman COLE. That right gave to the inventor the right to have the exclusive use of that idea perpetually. As time progressed governments, people, realized that that was not in the best public interest, because it discouraged use of those inventions. It discouraged new inquiries for improvements on those inventions. So that eventually governments passed laws which said that the inventor could not have an exclusive right for a longer period than a maximum number of years, and that thereafter the public generally would have the right to use that idea without having to pay any royalty or a fee of any kind to the inventor.

Mr. IDDLLES. That is so.

Chairman COLE. The goal was to bring into free and open public use as quickly as the incentive of private profit would allow public use of inventions.

Mr. IDDLES. Right.

Chairman COLE. Now, bringing that thought down to application with these new lessons in the atomic field, these patents that have been developed in the last decade on nuclear energy, at Government expense, under Government ownership, we have achieved the historic goal of public use or availability of the patents. And to say that by releasing them to public use now we are giving preference to certain individual groups or certain large companies is no more true than at the end of a 17-year period on any patent, which might become available to anyone who might want to use it, large or small.

So much for that. I do not need necessarily to ask your comment on it, unless you may want to comment.

Mr. IDDLES. I understand that the earliest records of patent grants in the Middle Ages were all restricted to a period of enjoyment on the order of 10 to 20 years. There is always the balance between the amount of incentive that is needed and how to arrive at that. And human beings do work for private advantage, harder depending upon the bigger the advantage, usually. On the other hand, it is certainly true that as our civilization has progressed we all recognize the increasing importance of benefits to the public.

Chairman COLE. Now, the thing that you are concerned about in the patent field is not that you should have the free use of existing patents on the subject, but that any improvements on those patents, any refinements of them, that may be developed in the course of your studies and your research will be retained by you for a period of time under the patent laws as payment for your expenditure, your initiative, your zeal.

Mr. IDDLES. That is exactly right.

Chairman COLE. And it is only through refinements of existing patents in the nuclear field that you seek to have patent protection.

Mr. IDDLES. That is correct. And as I think I said to Mr. Hollifield, if, by some long chance, we should discover a fundamental patent, the Government might very well say, "Well, that has to do with the defense, and in any event it is secret, because we do not want a foreign power to have it." The right to deny us the use of that would be paramount, I should think. But that is not likely.

Chairman COLE. Not likely?

Mr. IDDLES. It is not likely that we will make a fundamental invention on this situation.

Chairman COLE. Well, if I were in your position I would not admit that my company is not likely to invent an improvement of great value.

Mr. IDDLES. Thanks for the compliment, sir. But the Lord made most of this physics, you know, and we aren't going to change it very much.

Chairman COLE. In your statement you said that the important changes in the act from the viewpoint of equipment manufacturers are those concerned with the right to obtain present classified information to enable industry to do design and equipment research independent of Government.

Well, as I understand the law, no change is needed for that to be made possible, because you now have the right to go to the Commission and, after disclosing to them what your purposes are, to ask them for classified information. If they are impressed, convinced of your reliability, they will give that information to you, and you can take it back in your own laboratories, work on it, and make new devices, which may be patented. But you cannot disseminate the information if it is of a certain category.

Mr. IDDLLES. Well, we must give all of the information to the Atomic Energy Commission in return for that right, and presumably they then will dispense that to the public, or to our competitors, or to whom. And only by the sufferance, albeit very graciously offered, of the Atomic Energy Commission, are we permitted to own material or to do that research work. We are not permitted to own material or to do that research work on our own, absolutely independently.

Chairman COLE. I am not talking about owning material. I am talking about having access to classified information. And then you take that information back in your own laboratory and, at your own expense, make these laboratory studies.

Do you mean, under present practices, the Commission, just for having given you access to information, requires of you that anything you learn on your own, independent of Government, must be reported to the Commission?

Mr. IDDLLES. I believe so. Would you interpret it otherwise?

Chairman COLE. That is not entirely in conformity with the law, which says that the Commission may make arrangements for private research, but that those arrangements, those conditions, those contracts, shall not contain any provision or condition which prevents the dissemination of scientific or technical information except to the extent such dissemination is prohibited by law; that is, if it is of a vital classified nature.

Mr. IDDLLES. For security reasons.

Chairman COLE. But you do have, at present, do you not, some degree of latitude of operation in the research area of atomic energy?

Mr. IDDLLES. We have some; yes. We believe that it would be feasible to have more, which would provide more incentive to a manufacturer and still not damage the Government or its security.

Chairman COLE. Is your company now engaged in any nuclear research on your own, independent of any Commission arrangements you may have?

Mr. IDDLLES. Only as part of the AEC projects that have been authorized by them, and we have been authorized to participate in them.

Chairman COLE. Then the only research that your company does is that which is covered by a contract with the AEC?

Mr. IDDLLES. Yes, up to the present time.

Chairman COLE. Or which you do for the AEC?

Mr. IDDLLES. Either or both, or as a subcontractor to an atomic energy program of some kind. But we have understood that the results of any such studies and research automatically come under the control of the Atomic Energy Commission.

Chairman COLE. Now, directing your thoughts to your position in the study group of the Dow-Detroit Edison group, what is the status of that so far as requiring changes in the act is concerned?

Mr. IDDLLES. Well, I don't know that any immediate need for a change in the act exists, because there we and they and many others are proceeding to make the studies. But there will shortly come a time when they will need to own materials and perhaps to have the permission to use them, which is now contrary to the law, to carry out the next step.

Chairman COLE. When you say there shortly will come a time when you will have to own this stuff, does that mean that there will shortly come a time when your group will make a concrete proposition to the Atomic Energy Commission to permit you to go ahead and build one of these things, in which is involved the necessity to own and use this stuff?

Mr. IDDLLES. I can't speak for the group, Mr. Cole, because we are only supplying our somewhat limited field of engineering information. But I will give you an example. We have recently wished to take some uranium and work with it, and we went through quite an experience to obtain permission to have a little bit.

Now, that is all right under presently existing conditions. But we can't play with this material unless we can have some of it, legally.

Chairman COLE. Did you get any of it?

Mr. IDDLLES. We got a very small amount.

Chairman COLE. Did you get all you needed for the purpose?

Mr. IDDLLES. For the moment, and perhaps we will get more when we do need it. I am not complaining. I am just saying it is a restricted situation.

Chairman COLE. From your knowledge of the status of this program in your group, and without making any commitment either on your own part, or committing your group to anything, is there a reasonable prospect that in the fairly near future your group will be in a position to make a definite proposal to the Commission?

Mr. IDDLLES. I think so. That is certainly the definite intention, to arrive at that as soon as ingenuity will permit.

Chairman COLE. How important do you feel it is, Mr. Iddles, that your group or anybody embarking in this field should have a right to own the fissionable material?

As I understand, there must be the right to build and own the facility. But how important is it that you own the material, as against having the right to use it, under a leasing or licensing arrangement, rather than ownership?

Mr. IDDLLES. Well, theoretically, I guess, they are the same. If we can use it, and lose it, by accident or by consumption because of the experiments we run, without being called to undue account for having lost it, then that is all right.

Representative HOLIFIELD. Well, now, Mr. Chairman, if you will yield at that point.

Of course, in the statement you have made, that you would have the right to lose it, there is something, of course, that enters into the whole security problem. Because assuming that material is given to you in quantities sufficient to make a bomb, we are not going to want you to lose it. That is one of our responsibilities. That is one of our security problems. I am sure you did not mean that.

Mr. IDDLLES. You are quite correct, sir. You cannot work with materials without wearing them away, or having parts of them wear away

because of what you do to them. I did not mean losing it in a manner which would not be subject to some check and accountability, of course. Because always the Government's interest in the use of this material for defense purposes is paramount.

Representative HOLIFIELD. Because of its double purpose, defense and civilian.

Mr. IDDLES. Quite so. And if we should discover some process that would materially improve the ability of the Government to make defense material, we would not want that to be disseminated publicly. We would not want Russia to know how to vastly improve the making of a bomb material by some discovery that we would make. So there is an area of overlap between what private companies can own and patent and what the Government must control. All the way through, I would think that the new law might very appropriately put regulatory powers in the hands of the Atomic Energy Commission, of course.

Representative HOLIFIELD. It seems to me that ownership in fee, as we ordinarily consider the word "ownership," is not a necessary requisite to further development. And if it turns out—and I am not saying that it will, but it appears to me possible—that it may be easier for the Government to retain its accountability insurance or safety by leasing certain quantities to people to use, under a charge, of course, which would be fair to the company—if it does turn out that way, I cannot see where actual ownership of the material itself would be a primary factor in further development.

Mr. IDDLES. No; the fundamental is the right to use it up for useful purposes.

Representative HOLIFIELD. That is right. Now, one further question. You have studied section 11 of the Atomic Energy Act, which is the patent and invention section, and which sets up a board which has the right to issue patents or to restrict the use of patents if they are against the national interest. It also sets up a Patent Compensation Board. It sets up standards by which these patents shall be granted, or withheld in case it is against the public interest. It also provides for judicial review as to the justice of their actions. I suppose you have studied that?

Mr. IDDLES. Yes. Not as a lawyer but from a business standpoint; yes.

Representative HOLIFIELD. This is a very important section, and I would suggest that your expert advisers consider this and submit to us changes that you feel will be necessary in that section, specific changes addressed to the language of the act, and giving us reasons why those changes are necessary.

Mr. IDDLES. Very well, sir.

Representative HOLIFIELD. At some time in the future. There is no immediate urgency so far as I am concerned.

Mr. IDDLES. Yes. Thank you.

Chairman COLE. Are there any other questions?

Thank you very much for coming down, sir.

Mr. IDDLES. Again I express my appreciation for the invitation, sir. Thank you.

Chairman COLE. The next witness this afternoon is a representative of the National Lead Co., Mr. Rowley.

The National Lead Co. is the operator of the new Fernald Feed Materials Center north of Cincinnati, Ohio. This plant is the first fully integrated feed-processing plant in the atomic energy program. As the operators of this plant this company has been called upon to do considerable thinking about the organization of uranium fuel preparation, the economics of plant design, and the prospects for long-term use of the facilities. It is entirely possible that this plant would have to compete with privately owned plants in preparation of uranium for commercial atomic power plants.

Mr. Rowley, would you give us your full name, please?

**STATEMENT OF EDWARD R. ROWLEY, PRODUCTION MANAGER,
NATIONAL LEAD CO.**

Mr. ROWLEY. I am Edward R. Rowley, production manager of the National Lead Co. Mr. Martino, our president, regrets being unable to be here and asked me to take his place.

Chairman COLE. We will be very happy to hear you.

Mr. ROWLEY. Perhaps a little background on National Lead Co. might be helpful. We are manufacturers of a number of chemicals and pigments made from lead, barium, titanium, zirconium. We produce paint and allied products. We are fabricators and producers of nonferrous metals, a number of them, and manufacturers of die castings.

The National Lead Co. directly entered the atomic energy field in 1951 when it took over the operation of a source material sampling and storage depot at Middlesex, N. J. On May 1, 1951, it was chosen contract operator for the Fernald, Ohio, Feed Material Production Center, then just under construction. This plant processes source materials to reactor fuel elements.

The authors of the Atomic Energy Act of 1946 wisely recognized that the time would come when peacetime uses of atomic energy would require changes in the act. It appears that the time for such changes is nearing if we desire to take advantage of the act of fission in providing a more abundant peacetime economy.

Power from fission is the most likely immediate benefit to be expected. The full weight of American industrial ability should be applied against this challenge. Several major changes in the act appear desirable to provide incentives sufficient to secure adequate effort to bring about an early solution to economic power from the atom. In addition to power, other benefits may well be realized also.

First, the act should be amended to allow the ownership of source and fissionable material, under proper regulation, by private enterprises. Without denying to Government the right to serve and protect the public interest, it appears that the necessity of securing affirmative Government approval for each use of such material restricts the play of initiative and energy of industry.

Second, the private ownership of production facilities for fissionable material should be permitted. Rapid development of atomic energy, under our American system, should follow the investment in facilities conceived to return a profit to their owners, as it has in other industries.

Third, the patent provisions of the act should be changed to make them conform to the principles of the American industrial incentive

system. In general, discoveries and inventions dealing with fissionable materials are not patentable. To the extent that they do not involve military weapons, there should be recognition of private patent rights in the atomic-energy field.

Although brief, the above-suggested changes in the act should go far toward providing the proper climate for energetic development of power from the atom.

Chairman COLE. Thank you, Mr. Rowley.

Senator PASTORE, do you have any questions?

Senator PASTORE. The question I should like to ask you, sir, is this. About the timing: When do you think we ought to proceed with the changing of the atomic-energy law, with relation to when a greater effort will be demonstrated by private industry to explore the possibilities of atomic energy for industrial power?

Mr. ROWLEY. I would think now now; the sooner, the better.

Senator PASTORE. And do you feel that the changing of the law will have a great deal to do with a renewed initiative on the part of private enterprise? Or does this thing boil down to what the return will be from these experiments and research?

Mr. ROWLEY. That would be the ultimate answer, I believe. But providing the incentive to do it would start the ball rolling.

Senator PASTORE. You mean to infer from that that the law is not rolling because the law has not been changed?

Mr. ROWLEY. No; the ball is rolling, and the Atomic Energy Commission is doing a great deal along those lines. More people thinking about it would make it roll faster.

Senator PASTORE. Well, it appears to me that somehow this whole business of amending the law is being used more or less as an excuse or a means of excuse, really, to delay this development, more than anything else. Because at one time you argue that industry does not seem to be too much interested in these patent rights, but merely wants them for protection, as that protection may develop, and then in the next breath you say that the ball is not rolling because the act is not being changed.

Mr. ROWLEY. Perhaps I used the wrong words. I did not say the ball was not rolling, but I mean that a ball, under private incentive, would start to roll. One is now rolling—a different ball, aimed at perhaps different things, aimed at military uses of atomic energy.

Senator PASTORE. I do not mean to confuse, but I have listened now for several weeks to various witnesses, who have all testified more or less along the same line. And I am a little confused as to exactly in what way industry expects us to amend the law. I am a little bit confused as to when they expect us to amend the law. And I am a little bit confused as to just when they are going to invest all this money that they think should be invested, in order to develop energy for industrial purposes.

Mr. ROWLEY. I think the matter of timing will be one that will come along and develop. I think as Mr. Iddles has said, the steam-turbine generator took a number of years from a 1,500-kilowatt unit to the 250,000-kilowatt one. This, I think, would follow the same path, over a long period of time. There is effort being applied against it now. This thinking is going on, I think, in most companies.

Senator PASTORE. We heard a witness yesterday who said he did not think Government will ever do it, that is, build the first plant.

He does not think private industry will ever do it, because conventional fuels are cheaper. And his only solution or suggestion was that these nonprofit organizations ought to do it. It strikes me that the more we listen to this, the more we get confused as to how this should be done. Do you think that private industry is in a position to undertake this task if Government would amend the law?

Mr. ROWLEY. I have heard it said that one group is willing to do it, one of these power study groups. We are not in that position, in the the power field, now. We produce for the Atomic Energy Commission as a contract operator which makes reactor fuel elements. We are not in the power end of the business. Nor do we produce anything as a commercial company directly entering the power field.

Senator PASTORE. Do you feel if the law were amended you would invest more money in these experiments?

Mr. ROWLEY. When the right opportunity arose; yes.

Senator PASTORE. What do you mean by "the right opportunity"? I mean, I would like to get something concrete. We seem to be talking here in generalities and platitudes, and we do not get a definite, clear-cut answer to the many questions that are in the minds of the men who have the responsibility of amending this law.

Mr. ROWLEY. I think if the National Lead Co. felt that there were a profitable enterprise having to do with the manufacture of fuel elements, and we were allowed to gain patent rights from some of our developments, those that come after the work we are doing now, those that we are doing now are for the benefit of the Atomic Energy Commission, and we could supply to someone interested in manufacturing power a reactor fuel element at a lower cost to them, at greater advantage to them, then we would be willing to invest money in such an enterprise.

Senator PASTORE. And whether or not you will do that depends, you think, greatly upon whether or not the law is amended?

Mr. ROWLEY. I think so; yes.

Senator PASTORE. All right.

Chairman COLE. Mr. Holifield?

Representative HOLIFIELD. Mr. Rowley, you have studied section 11 of the Atomic Energy Act, titled "Patents and Inventions," have you?

Mr. ROWLEY. I am roughly familiar with it; yes.

Representative HOLIFIELD. You are familiar with it?

Mr. ROWLEY. Yes.

Representative HOLIFIELD. You know that it provides methods for filing for patents. It provides a method of compensation on a royalty basis. It also provides a Commission that sits in judgment on whether it is of national interest to make it public. The writers of this act realized that we were not dealing with a normal substance which could be given the publicity that is ordinarily given to the filing of patent applications and the making available of information concerned with ingenious devices and secret processes, and therefore they found it necessary to set up a particular way of handling these patents.

Now, we have been repeatedly asked to change the patent laws so that they will conform to the normal American industrial patenting processes. And yet we have never had specific suggestions that will take into account this problem which the committee has, of security, that is involved in normal patent applications, and the publicity attendant thereto, giving us a solution to it where we can do the job

that you are asking us to do. Therefore it seems incumbent upon those who advocate the change of the act to go through the patent provisions very carefully, keeping in mind the national security factor, and make specific recommendations to us as to how we can change the patent section of this act and yet maintain primary interest in the national security. And it would seem to me that it is incumbent upon you gentlemen from the industrial world who come before us asking for these changes, that you address yourself specifically to the act and give us exactly the changes you want, and also help us to assume the responsibility of maintaining security.

Mr. ROWLEY. We would be happy to supply such a specific proposal—

Representative HOLIFIELD. I believe you would be doing something of real value to the committee if in place of telling us to change the act, tell us how to change it, you put yourself in our shoes for a moment with our responsibilities to the public.

That is all, Mr. Chairman.

Chairman COLE. Mr. Van Zandt? Are there any further questions from the committee?

Representative PRICE. Mr. Chairman, I would like to ask one.

Chairman COLE. Mr. Price?

Representative PRICE. Mr. Rowley, the National Lead Co. came into this program, you said, in 1951?

Mr. ROWLEY. Yes.

Representative PRICE. In addition to that obtained at the Middlesex, N. J., plant when you took over the operation, has your company developed any know-how in this field on its own, or just through operation of plants for the Atomic Energy Commission?

Mr. ROWLEY. No, we have done no private work in atomic energy. We have applied our history and background of information toward atomic energy problems, but we do not carry on any atomic energy work on our own.

Representative PRICE. You made the statement that the National Lead Co. was ready, if there was a proper incentive on patent rights, to develop different ideas in this field, indicating that if there were proper changes in the act that would be favorable to your operation, you are ready to go into it on a full scale basis. To what extent? Would you build a plant of your own, along the line of Fernald? Or what would you do?

Mr. ROWLEY. I think I said we would consider such a thing if we would be able to come up with some manner by which we could then produce a fuel element which would be economically advantageous to someone else.

I do not say that we have such ability to do that now, or the ideas to do it now. We are rather new in this program.

Representative PRICE. Since you have been in the program, have you had ideas of some things which you could do if you were on your own and operating on your own, that you do not do now as a contractor for the AEC?

Mr. ROWLEY. We would be very derelict in our duties. We are paid a fee to operate the feed materials production center. Any ideas which we have now are going into the improvement of the process out there.

Representative PRICE. I think that your line of work for the AEC is a pretty limited type of operation. There have not been very many contractors that have had the same type of work that you have had. Is that not correct?

Mr. ROWLEY. That is correct; yes.

Representative PRICE. Would you feel, then, that your company has a particular advantage in this field, having been selected as a contractor by AEC, that it would give you a tremendous advantage over any other corporation or company of a comparable nature?

Mr. ROWLEY. We do have an advantage in that we are now operating and others are not.

Representative PRICE. You have a considerable advantage.

Mr. ROWLEY. There are a number of other contractors who know all about what we are doing, but they are present contractors of the Commission.

Representative PRICE. You understand, I am just thinking out loud. And if you did develop a patent, for instance, it would be of great value to your company and, of course, to the development of the program. And most of that would have been on the basis of know-how that you got through being a contractor with the AEC. Do you then feel that that patent should be an exclusive patent to the elimination of the other companies?

Mr. ROWLEY. No; if we develop patentable information out at Fernald now, it must belong to the Commission.

Representative PRICE. I am not talking about Fernald now. I am talking about if you went into it on your own, and the National Lead Co. fully financed a project, and then if you came up with a new idea. Do you think it should be to the exclusion of all other companies?

Mr. ROWLEY. That would be a difficult one to decide. I would say it would be difficult to tell where our own know-how came in and where what we learned from the Commission came in.

Representative PRICE. That would be one of the difficulties that we face.

Mr. ROWLEY. Yes, it is one of your major problems.

Representative HOLFIELD. Mr. Rowley, is it not true that the concept of use of patents in the last few years has been undergoing a gradual change? There was a time when individuals received patents, and they were more restrictive in granting licenses to other people to use them, and they kept their royalties high. And we have had testimony even to this effect before the committee, that wide licensing at low royalties is gradually becoming an accepted factor in private industry, that they actually—by getting a wider use of it through cross-licensing—obtain more royalties in the end than if they had a restricted use and had high royalties. And I ask you: What do you think about this theory, which I understand is being accepted quite widely in industry? It would be, as I would call it, a cross-licensing theory, of getting the patent used by as many people as possible, maintaining their royalty rights, but furthering the development and public use.

Mr. ROWLEY. I think the courts have pretty well placed interpretations which make it very difficult for anyone to hold a patent and restrict it to such an extent; the antitrust agency would come into play at that point.

Representative HOLIFIELD. And gradually a great many people have come to the conclusion that the public gets a wider benefit out of the patent and they get a wider increase in royalties than if they kept it off the market or restricted it to the market with higher royalties.

Mr. ROWLEY. I would not think one could live on patents, attempt to stay alive just by patents.

Representative PATTERSON. I was just wondering what steps your organization has taken in preparing yourself for a step into the private field of atomic energy at the conclusion of your Government contract with AEC.

Mr. ROWLEY. We are taking none. We are relatively new in this. Our plant is not yet in full operation. We find that we can use all our energies in getting this plant running and running properly.

Representative PATTERSON. If your Government contracts were canceled, would you then continue on in the study groups or anything like that toward atomic energy uses?

Mr. ROWLEY. Our conclusions have not been firmed up yet. I would think we would. We think atomic energy is going to be a large commercial enterprise some day. We would like to participate in the commercial enterprise, where one can make an honest dollar. This should be a big enterprise. We would like to play some part in it. Those are only generalities.

Representative PATTERSON. You have no plans at all for the future?

Mr. ROWLEY. No plans for anything directly now.

Representative PATTERSON. At the present time, if the opportunity presented itself, would your organization be prepared to finance such an operation?

Mr. ROWLEY. Yes, sir.

Representative PATTERSON. Is yours an oldtime plant, or relatively new?

Mr. ROWLEY. The National Lead Co.? National Lead operates ninety-some plants. We have been in business since 1892.

Representative PATTERSON. Then it is a separate corporation?

Mr. ROWLEY. These are separate corporations. We are contract operators on cost plus a fixed fee at both of these plants, to the Commission.

Representative PATTERSON. Financed solely by the Government?

Mr. ROWLEY. Financed solely by the Government.

Representative PATTERSON. Therefore, you are solely dependent on Government operations?

Mr. ROWLEY. That is right.

Representative PATTERSON. If anything happened to the Government contract, you would be practically out of business?

Mr. ROWLEY. We would be out of this business, not out of business.

Representative PATTERSON. How would any change in the present day law help you fellows, then? You are operating now solely at the dictate of the Government.

Mr. ROWLEY. This statement was not written to say what we, as the National Lead Co., think would help National Lead Co. specifically. This was written as we understood our request to be, to suggest changes in the Atomic Energy Act which we feel would be advantageous to the future development of atomic energy.

Representative PATTERSON. That is working on the supposition that you people will be placed in a category where you are self-reliant, after the conclusion of your Government contract?

Mr. ROWLEY. We are self-reliant now. This is not a moneymaker for us.

Representative PATTERSON. Not this corporation, which is dealing solely with atomic energy at the present time.

Mr. ROWLEY. No. That one would have nothing more to do. We are large users of power in this country. It is to our advantage to have more economic power, cheaper power. As such, we would benefit by that directly, if the introduction of economic power by atomic energy comes soon.

Representative PATTERSON. But your corporation is not willing to advance any of its risk capital at the present time?

Mr. ROWLEY. I did not say that. No. I am sorry.

Representative PATTERSON. Then I misunderstood you.

Representative PRICE. I do not think you are a member of any of the study groups, are you?

Mr. ROWLEY. No; we are not a member of any of the study groups.

Representative PATTERSON. Do you anticipate becoming a member?

Mr. ROWLEY. No; not at the moment.

Representative PATTERSON. I wish to ask you this, then. Is National Lead anticipating a role as a feeder, supplier, or processor for privately owned atomic-power interests?

Mr. ROWLEY. Not under the present circumstances. We would like to be, because, in our peacetime operations, we do deal in the chemical and metallurgical operations similar to those which we are carrying on at Fernald.

Representative PATTERSON. But you are not making any provisions toward that particular time when you will be able to step out?

Mr. ROWLEY. We are learning the business.

Representative PATTERSON. And that is all?

Mr. ROWLEY. Yes.

Representative PATTERSON. That is all, Mr. Chairman.

Chairman COLE. Mr. Rowley, it occurs to me that your activity in this field is one that is not so colored with military considerations as other aspects of the nuclear program. You are concerned and actively engaged only in the refinement of the raw uranium ore into a refined uranium metal. And to that extent, it has no greater military interest or implication than the refinement of aluminum or steel or any other metal. Is that not correct?

Mr. ROWLEY. That is correct.

Chairman COLE. From what you know of your phase of the operation in the overall nuclear-energy program, do you see any necessity for imposing the rigid restrictions in the refinement field of uranium ore that are properly imposed in the use of the uranium after it has been refined?

Mr. ROWLEY. No. I think the restrictions should be a great deal less, up through the point at which we operate, than they are beyond that into the weapons field.

Chairman COLE. And your feeling that the restriction should be relaxed is not so much that you feel it would give you a greater degree of latitude of operations, as that there is no real justification for continuing these rigid restrictions in the refinement of uranium.

Mr. ROWLEY. Only seeing one part of the operation as we do—we have some familiarity with the other—it is difficult for us to place proper values on that. We do know that it might be helpful to someone to know how much uranium passes through our plant. We feel that there should be a restriction on that information. How much reliance one wants to place on the know-how which we develop in a plant such as ours, which might be helpful to someone else, is difficult to decide. On one hand, it would be very helpful to have restrictions relieved so that we could talk freely to our suppliers of materials, so that we could pass ideas back and forth between various people in our company who are not cleared, so that we could try out our thinking. Many an idea comes a little bit from rubbing off one fellow and a little more rubbing off another. Put together it means something. But if there is not the free chance to talk to those people, we may never reach a conclusion which is helpful. That is restrictive in our operation.

Other people feel that the lead we have on the Russians is our process and project engineering know-how rather than our science. They know scientifically what we are doing, but do not know just how we are doing it. And if we can keep that information from them, we will get a lead, maintain a lead, or make them work harder or expend more effort in order to keep up. That is the point where the security restrictions may be helpful.

Security is a restriction on the development, and this has nothing to do with whether it is privately or publicly owned. Security does have a restrictive influence on the advancement of any technical operation.

Chairman COLE. I see. Uranium has been referred to as a weightless fuel, and when we are told that a pound of uranium has the heat equivalent to $2\frac{1}{2}$ million pounds of coal, it is understandable that people would get the conception that it is weightless. But that should not carry with it the implication that it is therefore costless, should it?

Mr. ROWLEY. No.

Chairman COLE. Dr. Backerley, may I inquire of Mr. Rowley the approximate cost of the refinement of a pound of uranium?

Dr. BECKERLEY. I don't believe there have been any public statements on that. There have been statements comparing it to silver refining. In fact, a factor of 10 times the raw material costs is a reasonable approximation of a refinery cost. But there have been no releases of the dollar values in the source material field, other than the ore itself.

Mr. ROWLEY. Our budget is restricted information.

Representative PRICE. One of the scientists testified that it took \$10 worth of uranium as against \$10,000 worth of coal.

Chairman COLE. That was assuming a cost of \$10. That was not an affirmation of fact.

If it is a subject we should not delve into, we will pass it up.

Dr. Beckerley?

Dr. BECKERLEY. I might just say for the record that as to the sensitivity of some of the previous testimony, our concern is that the unit cost, when coupled with more or less publicity available data on total cost, will reveal the amount of materials put through the feed materials plants. It is on that account that we are a little bit restrictive on the economic data.

Chairman COLE. I do not expect you to justify the decision with respect to classification, Dr. Beckerley. If you advise us it is classified, that is enough for us at the moment.

It might be of interest to the committee, Mr. Rowley, for you to tell the committee just what you do at Fernald. I do not mean you personally, but what your process is.

Mr. ROWLEY. We receive uranium-bearing materials from a variety of sources, sample them so that we may get proper assays to pay the vendor. We extract that uranium chemically from its concentrated ores. We purify through chemical operations. The flow has been published, I believe, from uranyl nitrate through oxide to UF₄. The metal is rolled and machined into reactor fuel elements of various sizes and shapes.

Chairman COLE. Do you carry the process to the point of making the uranium rods?

Mr. ROWLEY. Yes, beyond that point.

Chairman COLE. Into the uranium slugs?

Mr. ROWLEY. Yes, sir.

Representative HOLIFIELD. May I ask this question, Mr. Chairman: Has your plant had any experience at all in the purifying of contaminated material?

Mr. ROWLEY. No, sir.

Chairman COLE. Any further questions?

Mr. ROWLEY. I might add that the Fernald plant is not fully in operation, so some of these things we talk about we have done on pilot plant and smaller scale; we do not have all of the plant to speak from first hand.

Representative HOLIFIELD. Are you familiar with the Redox process? Would your company normally be interested in that type of a processing service?

Mr. ROWLEY. Yes.

Chairman COLE. If there are no further questions, thank you very much, Mr. Rowley, for appearing this afternoon.

The next meeting of the committee on this subject will be Monday afternoon at 2 o'clock, and we will not know until 1:30 of that day where the meeting is to be.

We will hear witnesses from the Edison Electric Institute, Bendix Aviation, American Public Power Association, and the New England Council.

I should also call to the attention of the members of the committee that Senator Hickenlooper is calling a meeting of the Senate members of this committee at 4 o'clock Monday afternoon in the District room in the Capitol for the purpose of considering the nomination of Mr. Joseph Campbell as a member of the Commission. Senator Hickenlooper asked me to extend an invitation to the House members of this committee to attend and participate as they may wish.

The meeting is adjourned.

(Whereupon, at 3:30 p. m., Thursday, July 16, 1953, the hearing was recessed, to reconvene at 2 p. m., Monday, July 20, 1953.)

ATOMIC POWER DEVELOPMENT AND PRIVATE ENTERPRISE

MONDAY, JULY 20, 1953

CONGRESS OF THE UNITED STATES,
JOINT COMMITTEE ON ATOMIC ENERGY,
Washington, D. C.

The joint committee met at 2 p. m., pursuant to recess, in room 318, Senate Office Building, Representative W. Sterling Cole (chairman) presiding.

Present: Representative Cole, Senator Pastore, and Representatives Patterson, Holifield, and Price.

Professional staff members present: Corbin C. Allardice, executive director; and Walter A. Hamilton of the professional staff of the joint committee.

Chairman COLE. The committee will come to order.

The first witness we are to hear this afternoon is the representative of the Bendix Aviation Corp., Mr. Malcom P. Ferguson, president.

The Bendix Aviation Corp. operates a classified plant at Kansas City, Mo., for the Atomic Energy Commission. It has also conducted studies of special-purpose reactor systems, such as might be used in isolated military stations.

Bendix officials have indicated an intention of getting into the business of building atomic powerplants eventually. The company already has a very widely diversified line of products, ranging from aircraft to household products.

Mr. Ferguson, I extend to you a very special and personal welcome this afternoon in view of the fact that both you and I originated in the same part of the country. The only difference between us is that I stayed there and you moved out.

In addition to that fact of our personal equation is the fact that your company has one of its main activities in my congressional district at Elmira, N. Y.

I judge it is Mr. Hyland who is with you.

Mr. FERGUSON. Yes. I would like to present Mr. Hyland, who is vice president of our corporation in charge of engineering.

Chairman COLE. We are very glad to have you here, and we will be very glad to have your statement, Mr. Ferguson.

STATEMENTS OF MALCOM P. FERGUSON, PRESIDENT, AND L. A. HYLAND, VICE PRESIDENT (ENGINEERING), BENDIX AVIATION CORP., DETROIT, MICH.

Mr. FERGUSON. Thank you, Congressman Cole. I will proceed with my paper.

The Bendix Aviation Corp is very appreciate of the invitation extended by your chairman to testify before the joint committee regard-

ing the further development of atomic energy for peacetime purposes.

Because our corporation is fundamentally an equipment maker in the automotive, aircraft, and communications industries, it has acquired considerable experience in the planning and operations necessary to bring along the new products and processes. Among our important product lines are instruments and controls of all kinds, and we know that to properly measure, control, and navigate, it is necessary that we ourselves have first-hand knowledge of the primary functions and products with which we are dealing.

Hence, as atomic energy and its power and other applications appeared on the horizon, we began to direct our efforts toward acquiring knowledge, organization, and facilities which would justify our participation in this new field. We have developed a small manufacturing division which specializes in radiation instrumentation. We have had for some time a nuclear department at our research laboratory where we have a balanced staff of nuclear engineers, physicists, and technicians.

We have made, largely at our own expense, four studies of power reactors for the Commission, have just completed a fifth for our own purposes, and are about to release to the Commission a detailed study of isotope reactors and markets. We have operated for the AEC since 1949 a substantial facility at Kansas City devoted to the manufacture of electronic and mechanical devices of various types, and several of the divisions of Bendix are presently producing components and functional devices associated with the military atomic energy program.

We are, of course, well aware of many of the problems faced by your committee and of the political and security considerations which are an important part of the discussions and the actions. We feel that our remarks, however, should largely be confined to those areas where we have first-hand experience and association. We should like to have our comments interpreted as applying generally to the policies and means for continuing the development of atomic energy for peaceful purposes, including power, chemistry, and radiation.

All of our relations with the AEC have confirmed our belief that its administration has been characterized by high purpose, devotion to its responsibilities, and outstanding competence.

We believe that the Atomic Energy Commission and your committee have properly taken the course of restrictive interpretation of the present Atomic Energy Act until a period of experience had been obtained. We believe, too, that the state of knowledge, technology, and military necessity have heretofore required an almost complete concentration on the weapons program.

We would like to state for the committee two broad conclusions to which we have come after thoughtful consideration of the factors that are involved.

It is our first basic conclusion that with the experience in hand and with the weapons program well advanced, the time has now come for a more liberal interpretation of the present act and a stronger support in the field of the peaceful arts.

One of the important factors in any research and development operation is the timeliness of the decision. Does the progress warrant strong support? Should it be expanded? Should more people be employed? Are the potentials being developed? We believe that

the committee is holding its deliberations at a very important time in the development of atomic energy, for we believe that the time is ripe for a review of the progress we have made and a determination of how best to extend our nuclear knowledge into peaceful fields. Some of the reasons underlying this timeliness are the following:

One, the basic information for the design of thermal reactors for the production of power is available, although many difficult development and engineering problems, such as are common to any new field, are foreseen.

Two, the technical soundness of the fissionable-material breeding process has been confirmed by the Commission. Large power reactors can also be primary emergency sources of fissionable material of weapon grade.

Three, the present active construction in England of a nuclear power reactor is independent confirmation of the timeliness of our own considerations and should encourage us to maintain our existing leadership in the atomic-energy field.

Four, the maintenance of a healthy and expanding nuclear technology depends upon the industrial application of the nuclear arts.

Five, the success factor of the activities heretofore undertaken is astonishingly good.

Six, the minimum time required to put a commercial power reactor "on the line" is probably 4 or 5 years after authorization. This time probably cannot be reduced by new discoveries, hence delays now will put reactor power correspondingly further into the future.

The first three reasons have been amply covered in the previous testimony. We shall comment briefly only on the last three.

As to (4) any healthy and expanding technology requires the steady influx of new people and the constant broadening of uses for its knowledge. This we now find restrained in the atomic-energy field. The weapons program is substantial and rapidly improving, but the rate of progress in peaceful applications under present law and policy is comparatively slow. If we are to interest new people and find new uses, we must have a breakthrough from present programs and restraints into the broader industrial markets. What may be the greatest of all technological fields warrants the widest possible participation of industry.

With respect to (5), the percentage of successful accomplishment in the work of the Manhattan District and Atomic Energy Commission is extremely high. This should give us confidence in the judgment of the scientific and technical people, within the scope of their experience, as they approach industrial use, and suggests a readiness to begin more extended applications.

Regarding reason (6) on the matter of lead time, which we view as most important, the consensus of nuclear engineers, with especial support from those who have built successful reactors, is that the time needed for critical experiments, final thermodynamic studies, detail reactor design, site selection, engineering and architectural designs, construction and testing is not less than 5 years for a thermal neutron reactor. It may be as much as 10 years for a fast neutron reactor where much research yet remains to be done.

Many of the technical areas above have been studied and restudied to the point where the next steps can be taken only after a firm national policy for power development has been pronounced by Congress

and by the Commission, and the necessary legislative and regulatory changes made to encourage wider industrial participation. Until such a policy is decided upon each passing day is a day added to the years before atomic power can be "on the line."

Our second conclusion is that broad progress of atomic development should not be confined to any single concept; nor should it be channeled in any one direction. Greater private participation may take many forms, determined by the specific needs and opportunities of particular projects and the appropriate contributions by both the Government and private industry. What the Government has to give is a fund of information and experience already acquired, a continuing requirement for further developments applicable to military needs, and invaluable support growing out of its interest in the public welfare.

What industry has to give is the dynamic energy that derives from commercial incentive, the selective judgment required for profit, the cost control resulting from competition, and the diversity of application that is born of the sheer numbers.

The specific combination of the capabilities and participation of Government and industry should vary with the requirements of each particular project. We bespeak broad purpose and administrative latitude for the Commission as the best means to arrive at the most effective combinations.

In reaching these conclusions several considerations have seemed to us to have great significance. I will discuss them briefly.

Private industry is now evidencing in a conspicuous way both enthusiasm and hesitancy toward the potentialities which lie in the field of nuclear development. Whenever organizations such as the National Industrial Conference Board, the NAM, and others have scheduled conferences on private industry's interest in this field, the meetings have been extremely well attended. Interest is undoubtedly high, but the unique legislative and administrative restrictions hedging this new frontier unquestionably are retarding what otherwise might be progress on a broad and diversified front.

The hard business view about the peaceful applications of atomic energy is that development has not yet proceeded to the point where large commercial markets or opportunities are likely to be profitable in the near future. With respect to power, we know that it is possible to generate heat by nuclear processes and that from this heat, power for the propulsion of certain naval vessels can be obtained where performance and other factors are more important than cost.

There is as yet, in our opinion, no clear evidence that power can be generated at a cost which can successfully compete with hydraulic, steam, and diesel equipment in the commercial market. We do not regard this circumstance, which has been supported by expert testimony, as either confusing or disheartening but rather as evidence of the lack of sufficient facts and experience upon which to base a sound investment. When facts are lacking, opinions do vary. The remedy is to do whatever additional research and development are required to provide those facts.

The development of any new energy principle always has been a painful process. Steam, gas engines, and diesels all had their problems and in their original concepts were not economically competitive with the then existing prime movers. As a matter of fact, they are today

competitive with each other only in certain overlapping areas and each has found a particular place in our industrial system, arrived at only after extensive experiment, trial and error, improvement, adaptation, and free selection.

To confine the development of power reactors to units of 100,000 kilowatts or larger would prejudge a potential usefulness before most of the facts had been determined. There is frequently a tendency in undertaking a new enterprise where the facts are limited, to shoot for goals that are too high. This might be likely in the atomic-power program whereby the very nature of the materials and our experiences to date lead us to talk about huge amounts of energy and tremendous installations.

In our opinion there should also be separate developments of powers of 10,000 kilowatts, 100,000 kilowatts, 100 kilowatts, and perhaps even of 10 kilowatts in order that both technical and economic information shall be ascertained over the whole range of this potential energy source. Furthermore, it is not unlikely that these smaller power units may very well provide useful pilot plant information leading to the more effective development of the long-term, large-scale units.

It is well to bear in mind that there is 50 times as much engine power used from small units in this country as is generated by the facilities of the utility industry.

With respect to the chemistry and radiation fields, the situation is somewhat different. No large specific applications such as weapons or power have yet emerged to focus development in these fields upon promising commercial areas. Our studies in these fields, however, have led to the same conclusions reached as to power; for example, that the development as yet has not proceeded to the point where major commercial opportunities can now be profitably undertaken. That is, however, a normal state of affairs in any new art and is a problem faced by managers within Government and industry almost daily. Because atomic energy is such a tremendous force, the facts to be faced have big dollars attached to them, but their basic significance is no different from those frequently met within other research activities.

Our studies of isotope and radiation potentialities indicate to us the need for a reactor having a high neutron flux whose exclusive purpose might be the production of isotopes. Encouraging progress has been made by the use of several Commission facilities to provide a fair range of research and production isotopes. This has been accomplished, however, by the sometimes inefficient use of research reactors designed for other purposes or by occasional help from reactors engaged in the primary production of military plutonium.

We want to emphasize the potential importance of nuclear chemistry and radiation. In our opinion, they may ultimately prove to be as valuable as power in the industrial world; or, as byproducts resulting from or combined with prime uses, they may assure an overall successful venture. More study and more support is needed in this area.

The pattern of other great national laboratories may very well be a helpful guidepost during the transition of atomic energy from military to peaceful uses. The National Advisory Committee on Aeronautics is a fine example of a Government institution which provides basic data with special facilities and personnel which are normally

directed to the general advancement of the aviation art but which in time of necessity direct their efforts particularly to the solution of military problems.

The free flow of basic information from the NACA has provided a valuable foundation stone in the present aviation structure of the country, both military and civil. It is noteworthy that NACA generally limits its activities to research and that industry with military and civilian requirements and specifications accomplishes the engineering and designs of the planes, the engines, and the components that are in military and civil use today. A cooperative program utilizing industry and free enterprise to its fullest has been developed over years of progress, and while atomic energy may not be so simply viewed, the broad principles of such an approach are before us.

We believe it is generally realized that new ground must be broken in working out policies and procedures that open the atomic-energy field to private competitive enterprise. For perhaps the first time a huge industry, based upon a new technology, has come into being almost as a Government monopoly. The familiar pattern whereby private industry has pioneered the use of new technologies for the greater well-being of the people is not fully applicable. That past industrial pattern has involved private investment with the use of judgment in appraising risks and possibilities of profit in a market in which the Government did not have any such original position, or where considerations such as the continuing military role of atomic energy did not have to be taken into account.

We do have, however, such precedents as aircraft, radar, and guided missiles to point to as evidence that private industry can shoulder, in the competitive market, more and more of the responsibility for developing such new industrial lines, while preserving the Government's interest in their military applications.

We feel that the attitude toward security requires thoughtful re-study in the light of the opportunities that wider understanding of nuclear developments hold for the Nation. We, in the Bendix Aviation Corp., have operated in policy and technical-security areas in association with the military departments for many years. We speak from much experience and conviction with respect to security.

Presently there is little distinction in the atomic-energy field between the security of weapons and the security of matters relating to industrial uses. We believe that there should be degrees of security, as in the military services, with weapons and military power as top security and lower or no security classification for other matters. We also advocate the policy of security by progress rather than security by prohibition. We believe that we have more to gain in the stimulation of new ideas by the judicious exchange of information in this area than we would lose to any enemy by removal of the virtually complete exclusions now in being.

We further believe that such a plan of security gradation can be effectively and efficiently applied by industry participating in the commercial phases.

We are sure that other factors, in addition to rigid security, which may be exerting a retarding influence, can be dealt with effectively. For example, we favor safety measures to protect life and property, but it is well to bear in mind that potential hazards are present in a wide variety of activities. Many industries experience potential haz-

ards, and, in fact, accidents have caused considerable loss of life and property. However, we still have large oil refineries reasonably close to populated areas and anti-aircraft ammunition dumps near our large cities. We would like to enter the plea that atomic-energy hazards be treated in the same manner as other industrial hazards with due regard to favorable experience and industry's ability and knowledge to handle them under certain regulatory requirements.

It is our opinion that the subject of patent policy should also be faced constructively. The American patent system has succeeded in giving strong incentive to invention. Inventive stimulation under this system is as great for detailed improvements as it is for broad basic invention, so that individuals and companies are encouraged to promote technological progress within their own fields and to the extent of their individual capabilities.

We are particularly familiar with the borders of invention which may surround any prime device or process, for much of our business has to do with the instruments and controls which are accessory or component devices. In many cases the prime device could not function without the specialized assistance of the component which, though created for one field, may be found to apply to many other purposes.

The far-reaching development and continuations from a basic concept are beyond the scope of any imagination. As an example, vehicle brakes have been known for a thousand years, yet recent developments in plastics, ceramics, mechanics, hydraulics, electricity, and magnetism are all employed in current improved brake devices. Could anyone have foreseen this? Many of us sometimes little realize the diverse and detailed scrutiny to which every new bit of information is subjected by the technical, sales, procurement, and production people in industry. In our opinion a too restrictive policy applied to a basic concept such as atomic energy may stifle needed and important invention not only in its own field but in many contemporary arts. We therefore recommend application of the benefits of the normal American patent system to atomic energy to the fullest extent consistent with the national security.

A similar situation is found in the Department of Defense where the considerations of Government interest, patent incentive, and secrecy have required resolution. The present military procurement policy which qualifies patent rights in accordance with the individual contract circumstances is a workable arrangement which is in the interest of both Government and industry. Our present-day aircraft testify to the benefits of incentive at work in a growing industry.

Complexity, cost, and sheer magnitude are unique factors in atomic-power development which must always be borne in mind. If we examine almost any other technical development, it has always been true that 1 or 2 men with limited resources could undertake the development job, produce, and demonstrate an operative device. Examples of these, of course, are the Wright brothers, Henry Ford, Alexander Graham Bell, Edison, and uncounted thousands of others who have taken a great faith and backed it with their untiring efforts to produce a new and useful device.

Perhaps it is indicative of the revolution to be brought about by the atomic age that no such singlehanded and simple approach is possible for the development of atomic power; that this great new force can only be promoted by the application of many diverse skills,

with support from industries, both large and small, with attention to the national security, and with the blessing of the whole people. Thus, it devolves upon the Congress, as represented by your committee, and upon the Commission to act as a body with the inspiration, the courage, and the energy which have been typified by our great American inventors and to overcome the obstacles that presently retard the broad development of atomic power.

Industry has already recognized the breadth and complexity of the approach to the development of industrial power. For example, the Detroit Edison-Dow Chemical group with which we hope to work is actively studying and organizing to play the industrial part in the cooperative effort which must be made. Other groups—note the group approach—are similarly engaged, many of them in combination with university research institutions or advisers. Small and large industries are teaming up together. The future potential of these many and different group approaches is tremendous.

This diversified attack on a new industrial opportunity is a characteristic of the competitive system and should have legislative and administrative encouragement. The testimony already before your committee and the recommendations from the Commission itself have suggested many of the areas for legislative change.

In conclusion, we of the Bendix Aviation Corp. would sum up our views in four points, which we believe merit emphasis in the deliberations of your committee:

One, that both political and technical developments show that the time for industrial atomic-energy development has arrived.

Two, that this great new force must be developed by and with the mutual support of governments, industry, and science.

Three, that we should interpret the present law in a broad rather than a restrictive sense, implement its purposes to the maximum, and adopt a clear policy for development of atomic energy for peaceful purposes.

Four, that new legislation should permit broad latitude in the administration of the law to the end that sound industrial development shall be fostered, that the necessary flow of knowledge shall be encouraged, and that the Nation shall be adequately secured against the improper use of this tremendous energy.

Chairman COLE. Thank you, Mr. Ferguson. You have given us a very thoughtful statement, well expressed and very well delivered.

On the question of patents, as you no doubt know, there is a resistance in some quarters to allowing private capital to take advantage of patents that might be obtained on improvements in the present knowledge of the art, since the present state of the art has been reached through Federal funds. You have indicated that it is your belief that the patent restrictions should be relaxed so as to bring into play the normal influences which would cause private enterprise, industry, and ingenuity to become active in the field, with the hope of being rewarded for the success of their activities.

I would like to have your thought on the effect of relaxing the patent provisions to the extent of permitting an inventor to have the exclusive right to his invention for any purposes in this country, but requiring of him that he release to the Government the ownership of that patent so far as its uses in foreign countries are concerned.

I suggest that thought out of two considerations. One is that if the Government retains the foreign rights to any patent devolved from the knowledge gained through the expenditure of public funds up to this time, that investment might be partially recaptured through control of foreign use; and also because of the part which this country as a government must necessarily play in a large measure in the atomic field in dealing with foreign countries. Then there are other aspects, such as the raw material sources, the announced Government policy of helping underprovided and distress areas of the world, and the normal interchange of Government responsibilities.

Do you think that such an idea as that might still provide sufficient incentive to private capital to work in this field, perhaps not as a permanent policy of Government but simply as an intermediate policy to cover the intervening period between the present and the time when the industrial uses of atomic power will have been proved and we can relax the law far more completely than is now considered.

Mr. FERGUSON. As an intermediate step, I think it has good possibilities from both the industry and Government viewpoints, and particularly in all the phases that may deal with national security or military end product, or application where the Government would fundamentally be interested in both the domestic and in the foreign usage factor.

In the later stages of it and in the commercial aspects of it, I think we would have to recognize that any commercial enterprise in our country has broad foreign investments, frequently, broad foreign associates, to make the most of the commercial product available abroad. So I think you could not take it as a permanent policy, but as an interim policy during this transition stage and in the interest of national security I think it would be very sound and from my viewpoint as one industrialist, I would favor such a policy.

Mr. HYLAND. May I comment on that, Mr. Chairman?

Chairman COLE. Certainly. I would welcome it.

Mr. HYLAND. There is one aspect of atomic energy that appears to me to be very important with respect to the development of power, and that is the tremendous electrical technological development that has taken place in this country, plus the fact that in effect, we are sitting on huge fuel beds of coal and oil and water power, so to speak.

From the purely competitive standpoint, it is quite likely that there are many other areas of the world than the United States that could more effectively and economically today use atomic power. So we must not lose sight of those markets.

I do think, however, that in order to strengthen the Government's hand, keeping in mind those foreign needs, and to give suitable recognition to the fact that security policy, in trading, must be considered of first importance, as the first stage in the development of our policy we would be well advised to limit the commercial exploitation of foreign patent rights.

I don't think we should lose sight of perhaps the real need for atomic energy in some of the foreign areas, even though we do not now give the unlimited privilege to use our patents in those areas at the present time.

Chairman COLE. If the patents were permitted to inventors but their right limited to the continent of the United States, do you think

that would provide sufficient incentive for them to become active in the field?

Mr. HYLAND. I believe it would as a first step.

Chairman COLE. Would not that incentive be substantially as great as though they had the patent rights throughout the world?

Mr. HYLAND. I think so, for the reason that undoubtedly the Government may want to be just as anxious as we are to exploit these other areas, except that it could be done in an orderly and protected fashion.

Mr. FERGUSON. May I make a comment, Congressman Cole?

Chairman COLE. Surely.

Mr. FERGUSON. There is one thing when we come to the commercial world market that we cannot lose sight of. While it is a far reach from where we are today in atomic energy, let's say that the Bendix Aviation Corp. were able to develop some sort of handling device, a hydraulic or electrical handling device that was used in a commercial phase, let us say for the whole power industry. Let us say it had no connection with the military phase and no connection with the prime product itself. It is a mechanical or electronic gadget, as we call it. If that became a standard item in industry, as many things we produce are, we have the problem of the exportation of that item to the world. Where we do not have a patent background or at least a neutral patent position in those countries, we couldn't develop the export market.

Industry must see the potential of developing this export market. In fact, it is in the best interests of our Government that it should do so.

So all industry is interested in not giving away or signing away its right to develop its own export market on standard items, and particularly in servicing the items which might be shipped out of this country.

That is looking away out in the future, and it is a rather detached phase of atomic energy as we think about it today, but nevertheless in these longer range facets of what we are talking about, we cannot overlook that fact.

Our plea on the patent situation is this: Here we are today up in the heart of a funnel, a very restricted region, a very basic region in the atomic-energy field. We would like to see this funnel develop out like this [indicating] with thousands of industries coming into these outlying regions, where hundreds of thousands, literally that, types of devices may be invented in the next 20 or 30 or 40 years applicable to this tremendous technology.

All you have to look at is the automobile as an example. You have heard of the Selden patent. The Selden patent was basic to the automobile engine. Mr. Ford worked years to break that patent. The patent situation surrounding the prime mover in the automobile field has been forgotten about many, many years ago, and instead we have hundreds of thousands of patents today applying to almost inconsequential things in the automotive art.

I do not know how many patents there might be in just a brake alone, but I would guess there have been over 10,000 patents applied for just on a brake alone.

It is the stimulation of that broad development of the future that we would like to see put into this atomic-energy picture at the earliest

possible date as it can be opened up to industrial use. That is looking a long way in the future, but we have to start that stimulation in some way to bring industry into this picture.

Chairman COLE. Our problem would be greatly simplified if it were possible to place in independent categories the weapon phase of atomic energy and the industrial, nonmilitary phase, but that is impossible.

Mr. FERGUSON. I understand it would be.

Chairman COLE. So your illustration of the procedures in connection with guided missiles and all those extremely important military weapons is not exactly applicable as guideposts in this field, because the guided missile has no peacetime use. But the same atomic reactor that might generate electric power with suitable adjustments can make weapon material.

Mr. FERGUSON. I cited those as examples of cooperative enterprise between the Government and industry in the development phase, and how the Government has been and is adequately protected today in the military phase of those items, and industry has a stimulation on the commercial phase such as in the radar phase, to take advantage of what ever its developments may be and to put risk money into it, in hopes the commercial phase may be stimulated.

The first radar we built was a radar during World War II for nothing but governmental purposes, but today we are building an offshoot to that radar which is used for commercial aircraft guidance and used very widely throughout the world. We were stimulated to go into it in World War II, recognizing that it had that potential. I do not think the military lost anything because they had very substantial control over it for a long time.

Chairman COLE. Furthermore, because of the simultaneous duality of atomic energy for industrial and weapon production, that makes it all the more important, it seems to me, that our Government should retain as far as possible a degree of control over the use of lessons learned and discovered in this country when applied and used in foreign countries, because it might be, it is conceivable that it might be advisable for a new idea of production to be withheld from some governments abroad.

Mr. FERGUSON. I agree heartily.

Chairman COLE. Whereas if the patent laws were relaxed so that the inventor would have the normal exercise of rights over his patent, he could control it at any place in the world, depending upon the discretion of the individual, unless the Government should pass some law to confiscate it.

In the early part of your statement, Mr. Ferguson, you indicated that your company, Bendix, had made a good bit of study and research in this field, largely at your own expense. I was curious to know the extent of your studies. How long has your company been engaged in this field? How many employees of the company have been engaged in it? How much of your own money have you spent in it?

Would you tell us that?

Mr. FERGUSON. Our first interest, of course, was when we negotiated the contract with the Commission to operate the Kansas City plant in 1949, and because of our interest in that program at the time, we

began to think about a broader interest thereafter. I would say it was about 1950 that we began to spend a little bit of our own money in it, perhaps 1951 before we did much and created the research division in Detroit.

We do not have a large number of people employed in this phase, even now. I asked Mr. Hyland to get together a little report on what we had invested in it at the present time. Our financial figures, compared to \$12 billion, isn't very much money; still this shows that we have expended of our own funds so far a little over \$500,000, up to the present time, plus \$207,000 in capital, or about \$725,000 of our own money has been put into the research laboratory, into an instrument operation which we have at one location, and into our cost on several studies we have made, as compared to what we have collected for the studies.

Mr. HYLAND. Mr. Cole, that is independent of what I might say is the disproportionate amount of executive time which has been spent because of the general interest in the field.

Mr. FERGUSON. This is the cost of engineers, direct labor, and detail people.

Chairman COLE. Approximately how many people have you engaged in the program?

Mr. HYLAND. About 100, overall.

Chairman COLE. Have they had free access to the Commission's information?

Mr. HYLAND. I would say perhaps 30 of them have had rather free access, and I must say that the Commission people, where security was involved, have been most generous in their help in the various studies, have withheld nothing, and have been as careful to present the bad side of the picture as the good side.

Chairman COLE. In Mr. Ferguson's statement on page 2 he states that the time has now come for a more liberal interpretation of the present act and a stronger support in the field of the peaceful arts.

That leads me to inquire if it is your view, Mr. Ferguson that much of the goal which you feel should be sought can be accomplished by revised interpretation of the present law rather than a change in the law itself?

Mr. FERGUSON. I think I would agree with that, Congressman Cole, except the definition of the word "much." I think considerable can be accomplished under the present act as I read the act and as I understand it.

I think that the broad possibilities of the entire field do require legislative change. As I mentioned later on in my statement, I would like to see some broad legislative changes made which would give more latitude to the Commission, or whatever regulatory body was established, to permit industrial participation.

Certainly we have the matter of ownership of material, which probably is not possible under the present act. We have the ownership of facilities, that is of questionable character under the present act.

I would like to see these items and others, perhaps, made possible under certain regulatory procedures.

Chairman COLE. It is possible now, is it not, for you to build an atomic facility with the permission of the Commission, by arrangement with the Commission?

Mr. FERGUSON. Build and own it? I do not think that it would be possible for Bendix Aviation, for instance, to build a small reactor and to get and own the material which would be needed to operate it.

Chairman COLE. I am just talking about the facilities.

Mr. FERGUSON. Wouldn't it be sort of worthless if you couldn't have material in it?

Chairman COLE. Let us take it one step at a time. Is it not possible for you, if you want to, by arrangement with the Commission, to build an atomic facility?

Mr. FERGUSON. To build a reactor?

Chairman COLE. Yes.

Mr. FERGUSON. I don't see any reason why we couldn't.

Chairman COLE. To use the facility, you would have to have some fuel. Is it not possible now for you to obtain the use of that fuel by arrangement with the Commission?

Mr. FERGUSON. I understand the Commission does loan fuel; yes. In fact, they have loaned us certain fuel elements for some of our study work.

Chairman COLE. How important do you think the question of the ownership of the fissionable material is in this problem of inducing greater activity in the private-enterprise field? I am talking about ownership as contrasted to use.

Mr. FERGUSON. In the first place, I do not want to talk from the power viewpoint, because you know that I have no familiarity beyond a certain amount of general knowledge of the power field itself.

Chairman COLE. But your company is very anxious to get into the business of building power reactors.

Mr. FERGUSON. That is correct. Looking at the general reactor situation, it seems to me that eventually—I am not talking about tomorrow, but eventually we must see the industrial participant given the right of ownership of the material that he is both using and perhaps dissipating. Certainly he would be dissipating this material in any use he might make of it.

I would think that not to have control over the dissipation of it by right of ownership might not give him the freedom that he would want to make a large capital risk in the venture.

I want to say that I think this transition period is a very difficult one. I fully appreciate that. And I am a great advocate of going into the transition period as carefully and as thoughtfully as we can to work toward this industrial participation.

Chairman COLE. At any rate, your position is that there should be some relaxation in the law itself—

Mr. FERGUSON. That is my position, yes.

Chairman COLE. In order to attract the degree of interest and activity on the part of industry and private capital to work in the field toward making greater progress?

Mr. FERGUSON. That would be my opinion, sir.

Chairman COLE. Do you have any suggestions regarding specific changes in the law?

Mr. FERGUSON. I have none. I have not studied it enough in detail to make a suggestion of specific change.

Chairman COLE. Could you have your people make such a study within the next few months and submit it to the committee for consideration?

Mr. FERGUSON. We would be very happy to make a study and submit any suggestions to you, sir.

Chairman COLE. I wish you would amplify, Mr. Ferguson, the thought you gave in your statement that by not relaxing the law now, we might learn some new means of improvement of the method, but in the overall program it would not result in any degree of acceleration. I have not worded it as clearly as you did.

Mr. FERGUSON. You mean this part which I devoted to the time-liness phase of it and the delay phase of it?

Chairman COLE. That is right.

Mr. FERGUSON. On that score, I feel that we are dealing with such a tremendous force here, with such a broad usage possibility in so many fields, and having in its development process the requirement of such a large factor of time, such as the power reactor, for example, or such as an isotope reactor, having so much time required in bringing that to commercial success, that the longer we delay now, the more we add days and weeks and months and years onto when it is going to be accomplished. I mentioned the fact of possibly 5 years.

I think we certainly have the knowledge now to go ahead. I think we have the industrial interest to go ahead. Certainly the possibilities are felt to be there. I feel that, as I say, this committee is meeting at a very opportune time, from the viewpoint of making the determination that it is in the public interest to invite industry participation so that 5 years from now we can look back on 1953 and say that it certainly was timely to have opened up this situation back in 1953.

Mr. HYLAND. I would like to amplify that a little bite, Mr. Cole. I think by and large, we have been guided to a considerable degree by the statements and beliefs of Dr. Zinn and Dr. Weinberg as to the amount of time necessary to put a reactor on the line. We regard theirs as very important experience.

It doesn't look, on the basis of any of the information we have, as though there is going to be any major technical know-how that is going to cut down the time required because, unfortunately, a reactor power supply is a very complex device. It involves almost all the technology in the electrical and generating world, plus a new and very complicated technology added to it. Just the time necessary to go through all of the steps and make the designs and a few of the technical checks adds up, and you can almost put it back together and say it is 5 years.

I have looked at the figures of Dr. Zinn in this regard, and I think that I agree with him that it is going to take pretty nearly that long to do the job with a clear start, and there are not going to be very many timesaving discoveries made to push it along any faster.

Chairman COLE. Are there other questions by members of the committee to either Mr. Ferguson or Mr. Hyland?

Representative PRICE. Unfortunately, we did not hear your statement, so there is not much we can question on, but I am interested in knowing where your research laboratory is located.

Mr. FERGUSON. In Detroit.

Representative PRICE. You state that you have made, largely at your own expense, four studies of power reactors for the Commission.

Mr. FERGUSON. Right.

Representative PRICE. I wonder if you could elaborate on that. I do not know whether you have covered that in the questions asked by Mr. Cole. Do you have a study program from the Commission for the development of a power reactor?

Mr. FERGUSON. These were study programs on what you might call smaller power reactors, in general, of a classified nature. We made it under a Commission contract.

Representative PRICE. You state in here, largely at your own expense.

Mr. FERGUSON. We found, very much to our surprise but at the same time we were happy to do it, that what we received for this was nowhere near what it cost us, by any means. I just stated to Congressman Cole before you came in that over the period of 2 years that we have been working in this venture, largely at the research and small-instrument plant we have, our total loss has been about half a million dollars.

Representative PRICE. How much did the Commission put into the four studies?

Mr. HYLAND. Those four studies were contracted by the Commission for \$25,000.

Representative PRICE. They were pretty much in basic research, were they not?

Mr. HYLAND. They were to determine the capabilities of small powers. After we got into it a little bit, as seems to be general in this field, we ascertained if we were to do a real job it would cost a great deal more. We spent in actual direct engineering labor \$67,000, exclusive of overhead and administrative time, and that sort of thing. We felt it was worthwhile, not only to inform the Commission, but to inform ourselves.

Representative PRICE. Is that \$25,000 on each study?

Mr. HYLAND. No. One \$25,000 in total.

Representative PRICE. You made four different studies?

Mr. HYLAND. There were 4 studies included in the 1 project.

Representative PRICE. Did they result in any recommendations to the Commission?

Mr. HYLAND. Very definite recommendations.

Representative PRICE. Along what line?

Mr. HYLAND. As to the suitability of small power reactors for certain purposes. They are classified, however.

Mr. FERGUSON. We emphasize in our paper, when you have a chance to look at it, that we feel that this field should not be looked at just in terms of the large power reactor of 100,000 kilowatts or whatever you want to call it. We think there should be great emphasis given to all sizes of reactors, perhaps from 100 kilowatts up. We cite the fact that, after all, the harnessed energy in this country in the form of powerplants is over 50 times as great as it is just in the power field.

Representative PRICE. I note further in your statement that you have for some time been engaged in nuclear studies at your research laboratory where you have a balanced staff of nuclear engineers, physicists, and technicians. Is that connected with a contract with AEC, or is that a private operation?

Mr. HYLAND. That is a private venture. We do have a little AEC work, but it is relatively insignificant. We are hoping for some. We

have to establish our competence before we can get the work, and that we have to do with our own money.

Representative PRICE. Do you find yourself handicapped in preliminary studies in that department by restrictions of the law?

Mr. HYLAND. I don't think so; no, sir. The Commission has collaborated very well in that regard. The handicap comes when you want to put money into hardware and that sort of thing.

Representative PRICE. Do you find it difficult to get an adequate staff of nuclear engineers, physicists, and technicians?

Mr. HYLAND. Very much so.

Representative PRICE. Where did you find them?

Mr. HYLAND. We were very fortunate in having an established interest about the time that the aircraft reactor studies at Oak Ridge were reshuffled and terminated. Some of the people came with us at that time. We picked up another one here and there over a period of time as they became available.

Representative PRICE. This question has no bearing on the power question, but I visited your operation at Kansas City and found it very interesting. When you took that over, did you have much difficulty recruiting trained personnel in electronics work?

Mr. HYLAND. Oh, yes.

Representative PRICE. What was the situation about that time in that field, speaking of the broad basis?

Mr. FERGUSON. In the first place, when we started the division, we manned it with approximately 50 people, who were top, key people from all of our divisions spread all over the country. We created the basic organization from people who had background and training and abilities in our own corporation.

The manager came off my staff, one of my assistants.

We then tried as much as possible to employ people in the Kansas City area who had the talents we needed. We got the usual number to be anticipated in a large city. We took people from universities. We advertised rather widely. It took us about a year to get together the organization that is there today, although it has been growing all the time. I would say our difficulties were average in expanding a new, highly technical enterprise such as that is.

Representative PRICE. You were not very well set in those days for workers in that particular field, were you?

Mr. FERGUSON. It wasn't what you would call an electronic community, particularly, although we found a few there who had developed great aptitudes during World War II because there was a considerable war industry in Kansas City at the time.

Mr. HYLAND. At that time, Mr. Price, the big push for technological requirements had not quite yet developed. It was before Korea. There was considerably less competition for first-rate technological people than there is today.

Representative PRICE. Did you not come into the atomic-energy field in Kansas City about the time we were promoting expansion of the atomic-energy program?

Mr. HYLAND. Our first contact there was in November 1948, and it was just before the big expansion. The time that we were negotiating with the Commission was just about the time of the German airlift. That was the time of the first measures toward expansion,

and that is about when we got into the picture. We started the negotiations just prior to that.

Mr. FERGUSON. One point I make in my paper I would like to emphasize for a minute. The technology in atomic energy I think is on the verge of what might be, 5, 10, 15, or 20 times as great as it is today. One reason I favor private enterprise and private industry in this tremendous field is that when we do that, we will shift our engineering latitude from, let us say, 10,000 a day, which I understand might be a good average of current scientists and engineers, to 50,000 through the step training of all these people in industry and in all the various facets of it. I am not talking of the facet of the military. I am talking about the industrial facet.

I think when we have such a tremendous force as we have in atomic energy to be used for peaceful purposes, we have before us as a Nation a tremendous task do institute and encourage the development of that technology through these hundreds and thousands of private enterprises.

Representative PRICE. Of course, that was the original intent of Congress in the event we reached a day when we could devote this program to the benefit of mankind rather than his destruction. We hope we are getting pretty close to that today. I think the Commission itself has recognized the value of private industry in the program, because actually it has been a private-industry program, even from the military standpoint.

Chairman COLE. Thank you very much, gentlemen.

Mr. FERGUSON. Thank you, Mr. Congressman.

Chairman COLE. The next witness scheduled for this afternoon is Mr. Morris, of the American Public Power Association. I understand that Mr. Raleigh, of the New England Council, who is the third witness scheduled, has a plane reservation for 4 o'clock, and if it is agreeable with you, Mr. Morris, we will hear Mr. Raleigh now.

Mr. Raleigh, will you come up?

Thank you, Mr. Morris.

The New England Council has been actively encouraging the idea that an atomic powerplant—either federally or privately financed—should be built in New England. A Federal Power Commission study recently indicated that northern Maine is one of the highest conventional power-cost areas in the United States. So it is understandable that the people in New England should have a particular interest in this potential for electric power.

We welcome you this afternoon, Mr. Raleigh, and will be glad to hear your statement.

STATEMENT OF WALTER RALEIGH, EXECUTIVE VICE PRESIDENT OF THE NEW ENGLAND COUNCIL

Mr. RALEIGH. Thank you very much, Congressman Cole. I am glad to be with you and to have this opportunity to make this statement.

I would like to say at the outset that we in New England do not like to underscore the fact of relatively high power cost, but it is a fact that we are not sitting on top of large sources of natural fuel, and this fact is a very important matter with us.

The New England Council is made up of about 3,000 dues-paying industrialists and others from the 6 New England States. It is an active, militant, and nonpartisan organization, formed and maintained in the belief that New England, by hard work and by making the best use of its human and natural resources, can in 1953 continue to make an important contribution to the national economy and hold its own in the business life of the Nation. The purpose of the council is to see that New England does the best with its real resources, which include a tradition of efficient industry, an intelligent labor force, and native energy and ingenuity.

The New England Council is actively participating through its membership in the worldwide advances in the field of atomic science.

I would like at this point to say that we were the first organization of this type in the country to have an atomic-energy committee of our own, and we have been fortunate in New England in having some of the outstanding leaders in the field of atomic energy serve on that committee. Such people as Mr. William Webster, of the New England Power Co.; Dr. Karl Compton, of MIT; Mr. Manson Benedict, consultant to the AEC and on the staff of MIT; Dr. Hartley Rowe; Mr. Sumner Pike—all of whom have given us extremely fine guidance in the thinking of the council in this field of atomic-energy development.

The council takes the position that the people of the United States during the last 10 years have had some opportunity to appraise the significance of this new frontier of science and to fit it into its proper place in society. We believe that it should not be treated as a unique and frightening problem, but one that can be controlled by policies used in other branches of physical science and in accordance with our democratic traditions.

In any undertaking as new and as broad in scope as atomic science, it is essential that all available talents and resources be utilized to develop its benefits for society. Such a broad-scale approach by industry, Government, trade, and educational groups can best develop in an atmosphere of confidence and mutual understanding and under conditions which offer incentives to individual endeavor.

We find that one of the immediate requirements for progress in this field is revision of the basic Atomic Energy Act to fit today's conditions. This legislation represented our national attitude at a time when atomic science was an almost undefined concept whose principal immediate significance appeared to lie in the field of weapons and national security. As a result, the act placed atomic science under very strict Federal control, both of facilities and of fundamental information.

Now, we believe, the act can be safely amended. Military secrecy can be preserved just as it is in the development of other types of weapons. Antitrust action, which is feared by some and hoped for by others, the terms of which are well understood as a result of application over a long period of time, can be followed. Most important, private investment of money and effort can be stimulated by the promise of a share in the benefits which may result.

To put these ideas into specific form, the New England Council proposes these changes in legislation:

1. To require Federal control of information only in those areas which have direct military significance.

2. To permit private ownership of equipment and facilities necessary for the production or utilization of fissionable material.

3. To permit private ownership of source materials, refined fissionable materials, and the products of nuclear reaction, including the authority to sell or transfer such materials to others under appropriate Federal license.

4. To allow normal patent protection to private inventions consistent with the requirements of national security.

5. To place the responsibility for antitrust regulation in the Department of the Attorney General.

6. To express a definite policy of encouraging participation by industry, commerce, and education in the field of atomic energy and related sciences.

These changes, based on the beliefs of well-informed leaders in the field, should do much to provide a foundation for the next stage of growth in our use and understanding of this new resource.

Chairman COLE. Thank you, Mr. Raleigh.

Senator PASTORE, do you have any questions?

Senator PASTORE. Mr. Raleigh, do you think that these changes in the basic law would encourage private industry to invest more money in the development of atomic energy for industrial uses?

Mr. RALEIGH. Yes, Senator. I know, as a matter of fact, that it would, and I know that there are cases which have come to our attention where there is hesitancy at the present time, and that hesitancy would certainly be eliminated by revision of the act.

Senator PASTORE. How soon do you think these amendments ought to be effected?

Mr. RALEIGH. Of course, this is one of those things where we could say yesterday, but in all seriousness we realize that the changes are going to be the result of some very serious thinking and deliberation and hearings of this type, and we merely hope that they will be effective as early as possible.

Senator PASTORE. It is a fact that New England, as contrasted with other areas of the country, is the one area in the country that lies without benefit of hydroelectric power; is that not so?

Mr. RALEIGH. We have some hydroelectric power, Senator, but certainly nowhere near the amount of hydropower available in certain other parts of the country.

Senator PASTORE. Are you prepared to say now what accounts for the high cost of electric energy in the New England area of the country?

Mr. RALEIGH. The hydropower which we have available in New England is not stable power, and must always be backed up by power generated through conventional fuels, and the conventional fuels available in New England are considerably more expensive than they are in other parts of the country nearer the source of those fuels. As a consequence, the power costs and prices to consumers reflect that additional cost.

Senator PASTORE. What is your feeling with relation to the investment of public money in the development of atomic energy for industrial uses?

Mr. RALEIGH. We feel that this is a transition program from an area in which it was practically all Government money at one time, and because of the extent to which the Government is going to have

to continue control of the industrial operations in this field, it would seem that the Government should be to some extent in partnership with the industries which will be making developments in this field.

Senator PASTORE. What do you think about these patent rights to private industry who have the investment of public money in that field?

Mr. RALEIGH. That is a difficult one to answer. I think if it were not for the possibility of having patent rights, there would be great hesitancy on the part of industry in entering this field at all.

While we know that there are some companies that are willing to spend substantial sums of money in this field, chemical companies, mostly, in the hopes of developing further isotope utilization, we know that power companies, which have a prime interest in atomic fuels for New England, are not in a position to make investments, because of public utility commission regulations, to the extent that they could probably develop reactors and do the experimentation necessary to come up with a breeder or more efficient forms of reactors in the future.

Senator PASTORE. I congratulate you on the statement which you have made. I think it was a good statement, Mr. Raleigh.

Mr. RALEIGH. Thank you.

Chairman COLE. Mr. Holifield?

Representative HOLIFIELD. No questions.

Chairman COLE. Mr. Price?

Representative PRICE. Mr. Raleigh, let me just put to you in a little different way the question of Senator Pastore: In the event that Congress should revise the Atomic Energy Act along the lines of the suggestions in your statement, is there any group in New England ready to build, on its own, an atomic powerplant?

Mr. RALEIGH. There is a group interested in building a powerplant which has also expressed to us an interest in building it in New England.

Representative PRICE. On its own, without any Federal participation?

Mr. RALEIGH. At the time they spoke to us they did not state that they needed Federal participation, but they did say they needed substantial financial support.

If I know New England, as I think I do, I think the financial support that they are looking for is of such proportions that probably it would not be found privately in New England, and they probably would be looking to some Government supply of funds to that job.

Representative PRICE. That is all, Mr. Chairman.

Chairman COLE. Mr. Patterson?

Representative PATTERSON. Just for the record, at the present time, Mr. Raleigh, there are people or organizations in New England who are capable of raising the necessary funds in order immediately to go into operation, provided the act is so amended?

Mr. RALEIGH. There are companies of such prestige in the field that I think they could attract substantial sums of money, depending upon the size of the original reactor development that they undertook. There will be great interest in this in New England not only from the standpoint of atomic power but from the standpoint of isotope utilization and possibly side or new uses of plutonium, because of the great concentration of research and scientific minds that we have in,

particularly, the Boston-Cambridge area of New England—minds which are now working on phases of this whole atomic energy program.

Representative PATTERSON. Therefore it would not be necessary to rely solely upon Federal funds?

Mr. RALEIGH. No; it would not. As a matter of fact, a statement made to me recently by an interest in New England, a man in a position to make such a statement and to back it up, was that, if he could find a complementary company which was interested in this program on the team basis that we were speaking about in prior testimony here today, they would be delighted to join in such a team project in New England without Government funds.

Representative PATTERSON. Geographically, have you decided from your studies that New England would be possibly the best place to start the first atomic operation?

Mr. RALEIGH. We have made no profound study of this question, Congressman Patterson, up to this time, but the studies which have been made by Arthur D. Little, industrial research consultants, indicate to us that the opportunities for the application of atomic science in New England are very great. The region has advantages over other areas because of the somewhat higher power cost in New England, which would make even a relatively high atomic power cost less; there would be less of a spread than there would be in some other area. Therefore New England would find it attractive—attractive also because it would not be in an area which was quite arid so far as scientific analysis is concerned, but one with a large concentration of people who could quickly explore the possibilities of utilization of the side products of this reaction which, as I understand it, is one of the most important things we must do in order to lower power costs in the future.

Representative PATTERSON. Coming from New England, I hope we can get this plant, and I want to congratulate the gentleman on his fine statement.

Mr. RALEIGH. Thank you very much.

Representative HOLIFIELD. Before you leave, Mr. Raleigh, if you will delay just a moment. You have studied section 11, patents and inventions, of the Atomic Energy Act; have you?

Mr. RALEIGH. I have seen it.

Representative HOLIFIELD. It would be of help to this committee if your group would make a study of this, and then submit to us specific suggestions as to changes in that section of the act.

Mr. RALEIGH. Very good, sir.

Representative HOLIFIELD. We are asked to change legislation relating to patents and inventions, and there are a great many problems involved in that, particularly the problem of security, and the problem of making known patent application papers, and that sort of thing, as you normally do in patent procedures. Yet we are dealing with a subject in which, so far, I have not been able to see in most instances how you can separate the military from the commercial applications. It is obvious that unless we can compartmentalize those two areas, we cannot follow the normal patent procedure.

Mr. RALEIGH. Yes.

Representative HOLIFIELD. If we cannot follow the normal patent procedure, then we must approach it from an angle somewhat like that we have already used, in which a special commission sits in

judgment on the type of invention or type of patent application, as to whether it has military application or industrial, or both, where it grants patent rights but retains certain rights for the Government.

If you will study section 11, you will see that there has been a great deal of thought put in on that subject, and what we would like to have are specific suggestions as to how to change the patent provisions, and yet discharge our responsibility completely.

Mr. RALEIGH. It is a very difficult problem, and I will be very glad to put some people to work on that who I think have some ideas about it.

Representative HOLIFIELD. Unless we can solve that key question, we are going to be stopped.

Mr. RALEIGH. Very good, sir.

Chairman COLE. To what extent are State governments or State agencies in New England a part of your New England Power Council?

Mr. RALEIGH. This is not the New England Power Council; just New England Council. The State agencies in New England are cooperating with us and have been for 27 years. Many of them are dues-paying members and integral parts of the council organization, and attend all of our meetings. The flow and interchange of information is extremely rapid. Complete cooperation prevails.

Chairman COLE. The council is composed of business concerns, interested citizens, and it is supported by those people?

Mr. RALEIGH. Chambers of commerce, and development organizations of various kinds, trade associations, farm groups—all of the factors in the New England economy are interested in this.

Chairman COLE. Thank you very much, Mr. Raleigh.

Mr. RALEIGH. Thank you, sir. I appreciate very much your courtesy.

Chairman COLE. Mr. Morris. Thank you for deferring to Mr. Raleigh.

Do you have an associate you would like to sit alongside of you?

Mr. MORRIS. Mr. Alex Radin, who is manager of the American Public Power Association, is with me.

Representative HOLIFIELD. As a fellow Californian, may I welcome Mr. Morris to the witness stand today. I will listen with a great deal of interest to your statement, sir.

Chairman COLE. Mr. Morris, we realize the source of your roots in California, so we gave you some real California weather today to make you happy.

You may proceed.

STATEMENT OF SAMUEL B. MORRIS, CHAIRMAN, ATOMIC POWER POLICY COMMITTEE OF THE AMERICAN PUBLIC POWER ASSOCIATION, ACCOMPANIED BY ALEX RADIN, MANAGER, AMERICAN PUBLIC POWER ASSOCIATION

Mr. MORRIS. My name is Samuel B. Morris. I am appearing here under the auspices of the American Public Power Association as chairman of the atomic-power policy committee of that organization. The American Public Power Association is a nonprofit association incorporated in the District of Columbia and represents over 700 publicly owned public-utility systems in 38 States. Among other things, its purpose is to promote cooperation between and to render service to

municipal corporations, other public or quasi-public corporations, bodies or agencies, cooperative associations, nonprofit corporations, and similar organizations owning or operating electric light or power systems or facilities. The headquarters of the organization is 1757 K Street NW., Washington 6, D. C.

My position is general manager and chief engineer of the department of water and power of the city of Los Angeles, Calif. Before taking this position in October 1944, I was dean of engineering at Stanford University.

I have served for several years as a member of the Committee on Geophysics and Geography of the Research and Development Board, United States Department of Defense. I have also served as a member of the President's Water Resources Policy Commission appointed in December 1950, and am now a member of the national water-policy panel of the engineers joint council composed of the several national engineering societies.

As chairman of the atomic-power policy committee of the American Public Power Association, I have had occasion to study the Atomic Energy Act of 1946. This act, which has served the purpose of our Government for nearly 7 years in this most important and outstanding program, is well conceived and well drawn. A high tribute should be paid to those responsible for its authorship.

As a consequence of the work of its atomic-power policy committee somewhat in advance of release of public information on the nature of the proposed legislative changes of the Atomic Energy Act of 1946, the American Public Power Association, at its recent convention in Boston on May 14, 1953, adopted a resolution defining policies which it believes should be followed in the application of atomic energy to the generation of electric power. This resolution No. 6 is as follows:

RESOLUTION NO. 6—ATOMIC ENERGY

Be it resolved, That the American Public Power Association wholeheartedly endorses the declaration of policy set forth in section 1 (a) of the Atomic Energy Act, as follows:

"Accordingly, it is declared to be the policy of the people of the United States that, subject at all times to the paramount objective of assuring the common defense and security, the development and utilization of atomic energy shall, so far as practicable, be directed toward improving the public welfare, increasing the standard of living, strengthening free competition in private enterprise, and promoting world peace": Be it further

Resolved, That, in furtherance of this declaration of policy, this association offers to the Congress of the United States, and to all officers and agencies of the United States charged with the development of an atomic energy program, the following recommendations:

"One, the controls on the use of fissionable materials which are contained in the Atomic Energy Act of 1946 should not be released until adequate knowledge and information are available with respect to the use and development of atomic energy for industrial purposes and production of electric energy. If and when such controls are modified, adequate provision should be made to prevent any monopolistic advantage accruing to private persons or corporations, through operation of the patent laws, or otherwise.

"Two, the Atomic Energy Commission should assume the responsibility for carrying forward development of a pilot plant for production of electric energy from nuclear reactors. In view of the large quantity of electric power which is needed in connection with the atomic energy program, there is ample justification for the expenditure of Government funds for the design, construction, and operation of such pilot plant or plants which are needed to advance the feasibility of commercial production of atomic power.

"Three, the carrying forward of research in the industrial and electric generation and the operation of pilot electric generating plants through several con-

tracts with electric public utilities and other industrial groups is a suitable means of getting appropriate contributions of ideas and verification of the operations meeting the tests of practicality and economic soundness. Because this energy potentiality represents one which starts as a necessary governmental monopoly and one where the advantages must be spread ultimately to the people, it is urged that publicly owned electric utilities also be afforded the opportunity of participating in such development contracts because of their experience in distributing such benefits to the public. For similar reasons, the publicly owned electric utilities should be recognized and be permitted to share adequately in the application of atomic energy to electric power production when such application has been demonstrated to be appropriate by the results of pilot-plant operation."

I might say that the statement I have prepared here is primarily directed toward the use of atomic piles for the generation of electric energy, and not toward the developments and marketing of atomic particles and chemical products such as may be commercially marketed.

Chairman COLE. Mr. Morris, since you have interrupted yourself, and in order that the record may be accurate, the resolution you have just read referred to section 1801 of the Atomic Energy Act. I do not know what the source of that reference was, but the sentence which your resolution quoted from the act is contained in section 1 (a) of the Atomic Energy Act.

Mr. MORRIS. Thank you.

The Atomic Energy Commission and your joint congressional committee have arrived at a point where a decision must be made on whether changes in the act are necessary in order to accomplish its expressed purpose of promoting progress in the development of atomic energy for the benefit of the public welfare; and also to determine the nature of the changes in legislation if such are to be made.

It is recognized that the conditions under which the atomic-energy developments were made necessitated the utmost in secrecy. Although the Atomic Energy Commission has declassified and released information as liberally as it has deemed practicable, it may well be that there is not enough general public understanding of the essential issues involved to provide sound public opinion to analyze and comment on the full significance of such legislation as may be proposed and to adequately protect the public interest. The Congress is dependent up a relatively small cross section of public opinion for its guidance. I am happy to have the opportunity to present the opinion of the American Public Power Association and my own views.

From a recent statement of policy on nuclear power development issued by the Atomic Energy Commission, it is indicated that the proposed legislation would (a) permit, under license by the Commission, the private ownership of power reactors and processing facilities, the production of fissionable material, and the private ownership and possession of fissionable material; (b) provide for Commission regulation of the safety and security aspects of licensed activities; (c) authorize long-term commitments for sale or lease to licensees of source, fissionable, or other special materials required in the development, construction, or operation of power reactors; and (d) authorize but not require the Commission to purchase any fissionable or byproduct materials produced by licensees. In addition to these, it is my understanding that possible amendments to the patent section are also being given separate consideration.

Up to this time the Atomic Energy Commission, under the law, has pursued a course of enlisting the help of private industry through the device of contracts with many public and private agencies, with the expense of such work being carried by the Federal Government. Under this method very substantial technical and physical progress has been made through the expenditure of many billions of dollars, and the Commission holds in trust a large fund of information and technical progress which is apparently on the threshold of being made available for the general welfare of the public.

It is true that while the remaining progress to be made, percentage-wise, in comparison with progress to the present time, may be small, it still represents an expensive program of development in terms of money available to private industry for such work. From testimony before your committee and information given AEC it is apparent that the complete cost of building practicable reactors and handling the processing of material to accomplish power production, combined with salable byproducts, might range from \$50 million to as much as 10 times that amount.

That such vast sums of money may be necessary to accomplish the ultimate development for economic power production is indicated by the fact that the proposals for reactor development by the several teams now working on that problem all indicate a number of different approaches and designs, which, if followed out, would represent tremendous investments to be made by each of the groups, with the probability that some of the designs would be proved less economical and not well adapted to service. Under the proposed revisions of the act the door would be open for such private expenditures of money for developments that inherently should be primarily for the public welfare. We must be mindful of the large stake the public already has in this field of endeavor.

If private expenditures are to be made for this research work, it should be specifically provided that no patents will be issued to foster or permit a private monopoly in the production or distribution of fissionable material or in the production and distribution of electric power from atomic energy. The legislation should be such that neither a private nor a public monopoly would result and that the benefits of discovery and Federal expenditure may be distributed to the public without paying tribute to a private monopoly.

When private capital takes such risks it must normally be in position to have a reasonable chance of deriving profit or economic benefits from such risks. The benefits that could come are threefold: One, the economic advantage of having a lower cost source of heat energy for the production of electric power; two, the income that could be derived from royalties resulting from patents essential to the production of electric power from atomic energy; and, three, by getting into a position where private monopoly might be substituted for a potential Government monopoly, thereby removing a threat of competition or control that would limit future profits.

If the first advantage, above-mentioned, was sufficient goal, private enterprise would be seeking no other objective than rapid development of the art and technology and would be content to work under the present patent arrangements or such revision of same as would eliminate all possibilities of monopolistic control.

The second and third goals are unthinkable and no private effort should be permitted to promote such objectives.

It is part of the American way of life that many private businesses have been established and developed as a result of patents, and where these are in the general field of industry where such products vie in competition with other products enhancing the standard of living, but with freedom of choice by the ultimate consumer, great good has come from such development.

When the patent control is in the field of an industry, which for economy and service is a monopoly, as in the production and distribution of electric power or for public communication systems, then there is grave danger that patent monopolies, combined with the service monopoly, will result in a privately planned monopolistic economy even more dangerous than a governmentally planned and dominated economy. It would not result in the most rapid development of the industry nor in the maximum benefits to the ultimate consumer.

The public welfare demands that the results of research and development programs in which the Nation has invested so many billions be made available to all utilities, corporations, and industry. It would be most unfortunate if the utility industry already monopolistic by nature should be enabled to secure further monopolistic control by gaining patents to the most effective and economic means of using atomic energy for generation of electric power. The extension of the world supply of useful energy, its conservation and economic utilization should be for the greatest public good. If there are to be savings in costs of producing electric energy, these savings should be passed on to the customers served.

If private industry is prepared to finance construction and operation of pilot or full-scale atomic plants for the production of electric energy and without the opportunity of securing patents or other monopolistic control of new methods and processes, I should like to see the door open to them as wide as national security will permit.

I believe it is generally recognized that secrecy inherent in national security is a major hindrance to the most rapid development in the atomic-energy field as it is in other fields of research.

Under any research program financed and conducted by private enterprise we must recognize that the discovery of new information properly leads to patentable ideas. It would therefore be certain that privately financed research would be clouded in additional secrecy. Each project would be cloaked in wraps to keep information from similar privately financed research projects by others, and from the public. This would be a new secrecy to be compounded with the secrecy of national security. It would seem reasonable to expect delay rather than acceleration of the time when kilowatt-hours can be generated from the atom in competition with coal, oil, and gas.

Therefore, I believe that proper national policy should require the widest dissemination of knowledge of the progress of each research or development project consistent with national security.

It should be understood that the AEC in the production of fissionable materials is one of the largest users of electric energy from both public and private sources. AEC and its various contractors have the widest experience and know-how, and AEC has the opportunity, for itself, of the greatest coordination of the production of fissionable

materials, byproduct atomic particles, and the generation of electric power.

For all of the reasons hereinbefore stated, it appears to me that the most rapid progress can be made at the lowest overall cost by the United States through AEC itself building pilot and prototype atomic-energy piles to produce electric energy for its own uses and at continually lowered costs. Public and privately owned electric utilities should be invited to participate along with manufacturers and others having personnel in position to contribute ideas toward the more rapid solution of the difficult problems involved.

I am certain members of the American Public Power Association should like to participate under such arrangements. The public, which has invested many billions of dollars in this technology, can well afford the remaining millions to round out the program for their own unrestricted use and benefit.

Such a program should bring together the best minds with full freedom of exchange of ideas. As rapidly as progress is made in development of economic processes there should be a maximum number of interested manufacturers and utilities with skilled personnel with the know-how to afford the most widespread and rapid installation of atomic-energy power-generation plants which their economy may justify in free competition.

Such a program should be free from any public or private monopoly and should assure the widest distribution of benefits to the public—the purpose which I am sure the Congress seeks. The American citizen who has invested so much of his substance in the development may thus be able to receive another benefit in addition to that of national security—the benefit of more abundant low-cost electric power.

In behalf of the American Public Power Association, we are deeply grateful to your committee for the opportunity of expressing our ideas on the proposed legislation and will follow your work with great interest.

Chairman COLE. Thank you, Mr. Morris.

Questions, Senator?

Senator PASTORE. I would like to pass for the moment.

Chairman COLE. Mr. Holifield?

Representative HOLIFIELD. I want to compliment you, sir, on this very frank statement that you have made and point out that it is quite different from a number of statements that we have had from other groups. Most of the testimony we have had has been in the nature of allowing private industry to come in and finish this job of research and development, acknowledging that we have gone a long way but that there are possibly 3 to 5 years yet to go before we reach the point of practical application of industrial power, but in return for that they have asked for subsidization in one form or another, either through the purchase of plutonium or through rapid amortization or through obtaining patent rights in this field, restrictive patent rights.

I notice that you particularly say that the Government should go ahead and finish this job and then make available to all industry, both public and private bodies, without discrimination, the benefits of this development.

Mr. MORRIS. That is my view insofar as the production of electric energy from these piles is concerned, I recognized from the testimony that Mr. Ferguson just gave some other aspects of the development and disposal of chemical materials and atomic particles separate from the field of the generation of electric energy. It is in the field of generation of electric energy to which my paper is primarily directed.

Representative HOLIFIELD. On page 6 of your statement you analyze some of the Atomic Energy Commission recommendations, and you close by saying, "In addition to these it is my understanding that possible amendments to the patent section are also being given separate consideration."

Do you believe that we could go ahead and efficiently amend the act unless we did have the recommendations as to patent policy changes?

Mr. MORRIS. The patent policy is a very important item, and we believe in the field of the production of electric energy the public should be safeguarded from patents in that field and that more rapid development can take place without the issuance of patents, because if the patents are to be issued in that field it seems to us that necessarily the research must be secret not alone with regard to national security but secret from other competing teams which are seeking themselves first to invent the better means of production of electric power.

The electric industry, whether publicly owned or privately owned, is primarily a monopolistic field. My own organization has a monopoly of the service in the city of Los Angeles, and the companies outside have a monopoly in their respective fields.

Representative HOLIFIELD. As a matter of fact, the production of electric power from the atom must of necessity be distributed through its public or private monopolies; is that not true?

Mr. MORRIS. That is correct.

Representative HOLIFIELD. If that be the case, certainly the regulation of the costs of these benefits should be a matter of public policy and would be a matter of public policy so far as setting the rates is concerned, would it not?

Mr. MORRIS. Yes, sir.

Representative HOLIFIELD. In addition to that, they would have to take into consideration private patent rights in setting the costs of the benefits to the public. If private patent rights were allowed in this interim period, that would become an item of cost.

Mr. MORRIS. Yes. If the development was to be privately financed and developed, it would appear necessary that those who performed that service would have the right to patents to recoup the expenditures which they had made.

Representative HOLIFIELD. That is right. We are speaking of patents in the normal sense of the term.

Mr. MORRIS. Yes.

Representative HOLIFIELD. If it is desirable to get large sum of money into this interim period of development and if those sums do become available, should we not consider the rights of those people to take a fair recompense, but at the same time make available without restrictive patents to all bodies, public and private, the utilization of such patents as they might require. I am speaking now of a special kind of patent, a patent which would not be restricted in use. While the royalty might be obtained for the use of it, yet through cross-

licensing it should be what you might call a compulsory patent arrangement so all the American people would get the benefit of it, at the same time recompense the inventor for his investment.

Mr. MORRIS. While those policies apply very well to the manufacture and distribution of the chemicals and atomic particles, we do not believe they go so well with the development of electric energy.

Representative HOLIFIELD. Are you not inconsistent in that position? If there are three kinds of benefits to be obtained, all based upon the tremendous expenditure of Government money and accumulated Government technology, are you not inconsistent in not wanting to pass those benefits on as cheaply as possible to the major investors, the taxpayers, in the development of this new science?

Mr. MORRIS. It is our belief that insofar as the reactors and their production of heat, energy, power, more progress would be made by the Federal Government going ahead in that field with the collaboration of all those who may be interested working with them from the electrical industry, in which case there would be free interchange of knowledge between the various teams working in the field and the AEC, subject only to the matters of security. Whereas the private teams would tend to restrict the interchange of information in order to protect the secrecy of their own developments in the field.

With regard to your question involving "major investors," it is my position that the largest major investor by many times is the general public through its Federal Government. With the general public having such a major interest, it is not appropriate to let a few minor investors, relatively speaking, dominate the situation by obtaining some patents that might constitute a roadblock to the effective use of all previous development by public funds. For the proper protection of the financial interest of the public and to guarantee free opportunity for the present technologic advance in the knowledge and applications of atomic energy to serve the public most economically, private patent rights in this field must be severely restricted.

Representative HOLIFIELD. It is your considered judgment, then, that if legislation were passed which would put these different groups of private enterprise into this project at this time, we could expect delay rather than acceleration of the time when kilowatt-hours would be available?

Mr. MORRIS. That is our view in the field of the use of the atomic pile to produce heat and energy for the generation of electricity.

Representative HOLIFIELD. Is that because of the tremendous investment involved and the lack of knowledge of whether it can be on a competitive basis?

Mr. MORRIS. According to best information we have, very large investments are involved. I think not so large investments are involved in these fields which are competitive among themselves, typical manufactured products which derive competition from each other. In that we have no interest in restricting patents, but in this field of generation of heat energy we believe that is a field where the Federal Government itself should proceed.

Representative HOLIFIELD. I believe that is all; thank you, Mr. Morris.

Chairman COLE. Mr. Price.

Representative PRICE. Mr. Morris, I was interested in your statement in which you say that over 700 publicly owned utilities are mem-

bers of your association. I wonder if you could name some of the larger cities of the country that have public power.

Mr. MORRIS. My own city of Los Angeles is the largest, serving a little over 2 million people having a little over a million kilowatts capacity. The city of Seattle is next, Tacoma, Pasadena, Glendale, Burbank, Cleveland, Springfield, Ill., and a large number of different concerns in Nebraska, a large number in the Tennessee Valley. I might ask Mr. Radin. He can better answer that question.

Mr. RADIN. I think you have named the principal ones. Also the cities of San Antonio and Austin, Tex., Lansing, Mich. There are also some large statewide systems such as the South Carolina Public Service Authority, the Lower Colorado River Authority, and the Grande River Dam Authority in Oklahoma, and a large number of public-utility districts in the Pacific Northwest. There are altogether about 2,300 local publicly owned electric systems in I think every State. They grew up along with the privately owned companies and have as long a heritage as the privately owned companies.

Representative PRICE. What specifically do those interested in public power fear from a change in the present patent provisions of the Atomic Energy Act?

Mr. MORRIS. If changes are made involving the full patent rights, we believe that there will be a limitation upon the use or an increased payment for use of the piles for generation of electricity. We favor the widest competition and use among the various organizations of such atomic piles for the generation of electricity wherever they can be developed to that stage. We are much of the opinion that the AEC itself, which uses such tremendous amounts of electric energy, is the best one to move ahead on that aspect of atomic research and the production of low-cost electric power.

Representative PRICE. Under present conditions has public power found itself restricted in any way by existing patent rights, forgetting the field of atomic energy? In the conventional power fields, has it found itself restricted in any way by restricted patent rights?

Mr. MORRIS. No. The developments have been relatively slow. We have not been faced with patents such as the Selden patent on automobiles, which Henry Ford succeeded in defeating. We have not been faced with that sort of thing. It has been a couple of centuries since Watt invented the steam engine. Things have moved along, so there have not been fundamental basic patents of such enormous proportions as might develop in this field.

Representative PRICE. In other words, going into the atomic field presents an entirely different problem and opens up a new era in the field of electrical energy.

Mr. MORRIS. Yes, it may do so. We do not know the answer to that yet. There is no claim that electric energy is now being produced anywhere for less than it can be produced from coal, oil, or gas. That lies ahead.

We believe that proper safeguards must be made in any patent program. In fact, we believe in that particular field it doesn't seem that any basic patent should be allowed which would give any private licensing of patentable methods.

Representative PRICE. Are the different public power groups legally constituted so that they could participate in atomic-energy study programs?

Mr. MORRIS. Yes. I know in the case of my own organization we can do so. I think many others can. The American Public Power Association as such would not, but units of our membership would do so.

Representative PRICE. Have they been invited to participate in any study groups?

Mr. MORRIS. We have met with AEC and have been advised that the door would be open. The door had been temporarily shut off at the time of our meeting with them.

Representative PRICE. When was that meeting?

Mr. MORRIS. My understanding is that that door will be opened up.

Representative PRICE. Is it open yet?

Mr. MORRIS. I don't know what the status is. Do you know, Alex?

Mr. RADIN. None of our systems has made any formal proposal.

Representative PRICE. When was this meeting that you are talking about?

Mr. MORRIS. Perhaps 3 months ago or 2 months ago.

Mr. RADIN. I think February 16 of this year. We met with Mr. Dean.

Representative PRICE. Why was the door ever closed?

Mr. MORRIS. I do not think the public agencies ever made any serious effort to get in, and this was the first meeting which we had, which Mr. Radin has mentioned, which was in February.

Representative PRICE. February of 1953?

Mr. MORRIS. That is right.

Representative PRICE. So there had not been any public-power group in the study programs up to this time?

Mr. MORRIS. No. I think it would be fair to say that I do not believe that they could get together the funds to carry on a total research program by themselves.

Representative PRICE. You feel even if a number of those public-power groups went together, they would still have to have Federal participation in a program?

Mr. MORRIS. Yes. I think it is our feeling that we would rather participate with the United States owning and building the reactor and our men who are familiar with design and operation of steam plants working with them in such work, rather than setting up a separate and independent research program. We could not recoup our position by any patent proposal.

Representative PRICE. At the present time you get all your equipment from the same source as the private utilities?

Mr. MORRIS. Yes. We are not manufacturers.

Representative PRICE. You have never had any difficulty, though?

Mr. MORRIS. No; no more than the normal problems of output.

Representative HOLIFIELD. I was going to ask you, sir, if the public-power groups under their corporate organization could participate in any research program, legally speaking.

Mr. MORRIS. It depends upon each of them. I cannot speak for all. We could do so.

Representative HOLIFIELD. You have spent moneys in the pas for research and development.

Mr. MORRIS. Yes. I might say we developed the first 287,500-volt transmission line in the United States and it is still the highest voltage line in commercial operation. We carried research programs on that through contributions to university staffs and so on.

Representative HOLIFIELD. On Boulder Dam?

Mr. MORRIS. Yes, sir.

Representative PRICE. Mr. Morris, I wonder if you could give us an estimate or does your association have any accurate figures on the number of consumers served by public power in the United States?

Mr. RADIN. This would be only the municipally owned, the locally publicly owned systems, slightly over 3 million, about 3,600,000, as a matter of fact, I believe.

The municipally owned and other locally owned electric systems comprise about one-tenth of the entire electrical industry. About another 10 percent of the generation is in the Federal systems.

Representative PRICE. When you say municipally owned, you are excluding the overall program like Bonneville and the Tennessee Valley Authority?

Mr. MORRIS. That is correct.

Representative PRICE. You are thinking only of the local units.

Mr. MORRIS. Yes. Our association represents just these local publicly owned electric systems; that is right.

Chairman COLE. Mr. Patterson.

Representative PATTERSON. No questions.

Chairman COLE. Mr. Morris, in connection with the success of research done by your Los Angeles organization, they were pioneers in developing the high-voltage transmission system. Was that a patentable discovery?

Mr. MORRIS. It is not exactly a discovery. It is a development to higher voltages than theretofore had been commercially used.

Chairman COLE. Is there not a mechanical patentable process involved?

Mr. MORRIS. Not essentially. There may be something in the transformers or other equipment manufactured by the electrical manufacturers which have some patents in them, but the production of that high voltage is not at all patentable.

Chairman COLE. Did your company engage in the engineering phase of it?

Mr. MORRIS. Yes. We built a section of line, installed the transformers, and carried on the research development to test its performance under all conditions of weather and climate to develop the economy of transmitting at that voltage rather than at voltages which had been developed up to that time, which was 230,000 volts.

Chairman COLE. What becomes of ideas that are developed in the laboratories of public utilities? You indicated that you have such a research laboratory. Presumably other city-owned and State-owned public utilities have research laboratories. Even if they don't it is conceivable that they have employees who would conceive of an idea in the course of their work by means of which an improvement can be accomplished. What become of those ideas? Are they submitted to the Patent Office?

Mr. MORRIS. We have in our organization a rather loose general patent policy by which employees of our department may patent items, in which we have service rights in our system and which they might sell for use otherwise.

Chairman COLE. How can you take the position of denying to other people the very right that you maintain for yourself?

Mr. MORRIS. This is just in the sole field of development of electrical energy from atomic power. We feel it is just like discovering all the coal there is in the world. It is a new field of energy for the use of everyone.

Chairman COLE. That is only because the only field you are interested in is the electrical field, but in principle you are entirely inconsistent when you say that you should have the right to permit any of your employees to patent any idea they develop in the course of their employment and that you, the association, or the municipality who is the employer, can have the restricted use of that patent. That is entirely inconsistent with your previous position in which you say that none of the people who might become interested in developing new ideas in the atomic field should have a patent right.

Mr. MORRIS. I say they should have the patents in general chemical and atomic particle field where there is such a tremendous number of adaptations of use and where there is a large number of people working in the field and where there is competition among the manufacturers. But in the field of the production of electric power from the atom, which is the field which the electric utility industry, both public and private, has such a tremendous portion of its total cost involved, we don't believe that should be locked up in a restrictive patent program and we do not think that is the fastest way to get the answers because it takes very large amounts of money to work in that field.

Chairman COLE. No larger amounts in that field than in the chemical field or any other aspect?

Mr. MORRIS. Oh, yes, we believe so. The devices which we were discussing with the Atomic Energy Commission are these piles for the production of large amounts of energy, which are going to involve very large expenditures.

Chairman COLE. It certainly seems strange to me that you would be willing to let private capital capitalize on its ideas and improvements in the atomic-energy field in every area except in electric power, and in that field you feel that they should not have any patentable rights.

Mr. MORRIS. I feel there is a difference in that. Perhaps I don't make our position clear: It is clear in my mind that the manufacturer of the isotopes, the tremendous chemical field, and so forth, which depends on that, can be in competition with many other services, many other manufacturers. Here we have one whose sole purchaser, practically, is the electric utility industry, public and private. As I understand it, many millions of dollars—the lowest cost I have seen is \$50 million—are involved in setting up the research for that field.

Chairman COLE. I noted in your argument in discussion with Mr. Holifield that since the public utilities are in and of themselves monopolies and subject to supervision by public agencies, public-service authorities, therefore patents in that field need not be under the patent laws because of the monopolistic nature of the enterprise. You have overlooked the fact, have you not, that as Mr. Ferguson indicated, electric power generated and distributed through private and public utility systems is about one-fiftieth of the power that is gener-

ated and used in this country? You cannot have a yardstick with respect to patent laws that might be used in the generation of electric power that goes into distribution systems and a different law that applies where the electricity is consumed on station. If it were true that all of the electrical energy produced in this country were distributed through public-utility systems, then your argument might have some weight and some bearing, but since the amount that is distributed through public-utility systems is negligible in contrast to the total amount that is generated and consumed, I think that your argument does not carry much weight.

I am curious to know what inducement you think there would be for persons to try to devise improvements. You say by denying them the right to patents your program would be accelerated, that more people would devise means of improvement. What would be their incentive?

Mr. MORRIS. We believe the Federal Government, which is already in the AEC program and uses such tremendous amounts of electric power, is justified in going ahead on these atomic piles for the production of electricity and carrying on research and inviting in the largest number of private utilities and public-utility personnel to collaborate in advancement in the field. The reason we feel that progress would be more rapid that way is that we believe the private job where patents are sought must be cloaked in secrecy as against another research project going on that is also seeking to profit from a patent development.

Chairman COLE. That would be equally true of any research and development program under Government sponsorship. The extent of secrecy would apply; would it not?

Mr. MORRIS. Not as I understand it. In the Federal Government as between all others working and AEC there would be full knowledge and understanding of what was going on in each of those research projects.

Chairman COLE. Your position, then, is that the Federal Government should continue and be the spearhead for research and development in this field?

Mr. MORRIS. In the field of the production of electric power from atomic piles; yes.

Chairman COLE. You do not feel that the program would be accelerated or benefited by allowing private capital to become actively interested in that if, along with that allowance was the right of patent?

Mr. MORRIS. That is correct.

Chairman COLE. Are there any other questions?

Thank you, Mr. Morris, and Mr. Radin.

Mr. MORRIS. Thank you very much, Mr. Chairman.

Chairman COLE. Subsequent correspondence from Mr. Morris will be inserted in the record at this point.

(The material referred to follows:)

DEPARTMENT OF WATER AND POWER, THE CITY OF LOS ANGELES,

July 24, 1953.

Representative W. STERLING COLE,

*Chairman, Joint Committee on Atomic Energy,
The Capitol, Washington, D. C.*

MY DEAR CONGRESSMAN: Near the end of my testimony before your committee the afternoon of July 20 you asked questions, the proper answer to which would require my revelation of information orally given to me and other representatives of APPA by Gordon Dean and others of AEC at a conference February 16, 1953. Believing in justice to your questions and more completeness to my reply I should add further facts and comments, I am writing this letter.

Our understanding from AEC differs markedly from the testimony of a prior witness that afternoon, and from some of your own comments and questions.

AEC told us that there could be no economy in an electric generation plant of 10,000 to 20,000 kilowatt capacity as the atomic pile and the equivalent of 12 feet of concrete shielding would be the same as for a 300,000 to 400,000 kilowatt installation. Only such larger units would prove economical. The difference was only in the rate of "burning," not in the size of the atomic pile and shielding.

Accordingly, we have viewed the production of economic energy for land installations as of the size and type to be expected for central station use in the generation of electric energy from heat released from atomic piles of the order of 300,000 to 400,000 kilowatts. Our testimony was upon this premise, based upon information given us by AEC. It is in this field of central station power in which we believe there should be no restrictive patents to prevent the most rapid development of this new science and art and the widest and freest use by publicly owned and privately owned utilities alike.

Just prior to my testimony a witness had expressed interest in atomic pile heat energy units of 10, 100, 1,000, and 10,000 kilowatts. This was inconsistent with what we had been advised by AEC.

Apparently you had such possibilities in mind when you stated that it seemed unreasonable for me, representing APPA, to urge against restrictive patents to the development of electricity from atomic pile heat energy for the reason that central station power in the United States is only one-fiftieth of the total power capacity, and therefore "insignificant."

After signing the statement properly required by your committee not to reveal classified atomic information and myself having Q clearance I hesitated to clarify our position and the AEC information upon which we arrived at these conclusions.

If our information is in error and the small automotive units constituting the bulk of the forty-nine-fiftieths of the Nation's aggregate horsepower are within the range of economic opportunity for use of atomic power, then I am certain that APPA would not seek to restrict in any way the play of patents and free enterprise in the manufacture of such small units.

We do, however, still hold to our opinion that every citizen, householder, and industry, large and small, is vitally interested in the production and delivery of low-cost electric power from central station plants; that this great new basic source of atomic energy should not be controlled by restrictive patents and that all publicly owned and privately owned electric utilities should have the freest access to such sources of atomic power as a free people may develop. We do not regard the production of electric power by our Nation's utilities as insignificant.

We deeply appreciate the opportunity presented to APPA of appearing before your committee, and, if permissible, we would appreciate this letter of clarification being incorporated in our testimony.

Sincerely,

SAMUEL B. MORRIS,

Chairman, APPA Atomic Energy Policy Committee.

Chairman COLE. The final witness this afternoon is Mr. Dixon, who represents the Edison Electric Institute, which has among its members many utility companies individually interested in atomic power. Institute meetings have provided central meeting points for these companies on many occasions.

Mr. Dixon, we welcome you this afternoon and will be glad to have your statement.

STATEMENT OF EDGAR H. DIXON, CHAIRMAN, COMMITTEE ON ATOMIC POWER, EDISON ELECTRIC INSTITUTE, PRESIDENT, MIDDLE SOUTH UTILITIES, INC., ACCOMPANIED BY PAUL HALLINGBY, JR., ASSISTANT TO THE PRESIDENT, MIDDLE SOUTH UTILITIES, INC., NEW YORK

Mr. DIXON. Thank you, Mr. Chairman. My associate is Mr. Paul Hallingby, my assistant.

As you have stated, my name is Edgar Dixon, and I am president of Middle South Utilities, Inc., and also chairman of the Edison Electric Institute committee on atomic power.

The membership of the Edison Electric Institute numbers 178 investor-owned electric utility operating companies. In 1952 these companies accounted for 84 percent of the electric operating revenues of the investor-owned electric utility industry. At the end of last year the member companies were serving approximately 33 million electric customers, or 85 percent of the electric customers receiving service from the investor-owned electric utility industry. The investor-owned electric utility industry, in turn, serves approximately 82 percent of the total number of electric customers in the United States.

I am appearing here today in response to a letter addressed by the Honorable Sterling Cole, chairman of the joint committee, to Mr. W. H. Sammis, president of the Edison Electric Institute. Your invitation for a representative of the Edison Electric Institute to appear before you today is very much appreciated, in view of the importance of these hearings and the vital interest which the institute, as a body, and its member companies have in these matters.

Chairman Cole's letter was referred to the Edison Electric Institute's standing committee on atomic power, and I should like to present to you a prepared statement authorized by that committee.

Chairman COLE. Are you now reading that authorized statement?

Mr DIXON. Yes.

Chairman COLE. So beginning with that paragraph it should be in quotations indicating it is such a statement?

Mr. DIXON. That is right. This is an authorized statement approved by the full committee.

The investor-owned electric power industry has an important interest in the development of atomic power for several reasons. To begin with, the production of fissionable materials, particularly the gaseous diffusion plant operations, requires very large quantities of electric power to the point where the Atomic Energy Commission is today the largest single user of electric energy in the world. In the case of the gaseous diffusion plant at Paducah, Ky., 5 investor-owned companies formed Electric Energy, Inc., which will supply 6 billion kilowatt-hours a year, or 38 percent of the required electric energy; the balance will be supplied by the Tennessee Valley Authority. In the case of the gaseous diffusion plant under construction at Portsmouth, Ohio, 15 electric

power companies formed Ohio Valley Electric Corp., which will supply the total requirements of 15 billion kilowatt-hours per year.

The electric power industry has a further special interest in the development of atomic power. This derives from the prospect of utilizing atomic energy economically for the generation of electric power, with fissionable materials taking the place of conventional fuels, and nuclear reactors and heat transfer systems replacing conventional boilers. Commercial utilization of nuclear energy in this manner could result in important conservation of the Nation's reserve of fossil fuels, a highly desirable long-range objective. Moreover, this potential source of fuel may ultimately provide a means of reducing fuel costs incurred in generating electric power. Exploring this source of fuel thus would appear to be an integral part of the everyday activities of our industry in seeking to lower costs of fuel—conventional or otherwise—for the continuing benefit of the public.

The investor-owned electric power industry has a long record of reducing the cost to the public of its service through development of new methods and processes and improved efficiency of operations, and seeks every possible means of continuing this long-term trend for the benefit of its customers.

Another area of special interest to the electric power industry regarding atomic energy relates to the earnest desire of free enterprise and private capital to further the development of nuclear power sources and the related production of fissionable materials. In this manner we can possibly take part in devising more economical methods of producing fissionable materials for national defense, and also assist in creating continuing production of and a commercial market for these products.

We recognize that in order that our customers may share in the benefits of commercial application of atomic power to electricity production, if achieved, the development of this important energy source must have the active support and leadership of competitive enterprise.

In the light of the stimulation that the subject of atomic power for commercial use has been receiving, and its prospective potential development, the problem facing members of the power industry, and particularly the electric power companies, has been to appraise what can be done within the limitations of the Atomic Energy Act of 1946.

Shortly after passage of the McMahon Act in 1946, the electric power industry began to study and appraise the Atomic Energy Commission's program. In 1951 the Commission accepted into the program four industrial groups for the purpose of studying the practicability of private investment in the nuclear power field. Each of these groups is managed or co-managed by an investor-owned utility company. A fifth group, which also includes investor-owned utility companies, recently was authorized and has initiated activities.

Last year the four original groups reported to the Commission their initial findings, and one group has been authorized to proceed with the second stage of its study, consisting primarily of developing a nuclear reactor to produce power. The two primary participants in this group have been authorized to have associated with them 25 additional companies in connection with this project. Of these companies, 18 are electric power companies. I understand that representatives of these groups have made appearances before this committee.

The electric power industry favors every effort toward advancing the solution of problems involved in developing commercial and economical atomic power. The industry is appreciative of the attitude of the Atomic Energy Commission in encouraging additional companies and organizations, which can make a contribution to development work on atomic power projects, to become associated with existing study groups or to apply for the formation of new groups.

While at the present time the success of the atomic-power program seems to be best assured by individual companies or organizations, or groups of them, working with the Atomic Energy Commission, the electric-power industry is prepared to assist in stimulating and maintaining interest in this subject among individual electric-utility companies through this or other industry organizations. The industry has traditionally shared the experience and information gathered by any one member with all other members for the benefit of the public. Historically, this same attitude has prevailed in our dealings with the many branches of engineering and manufacturing associated with the electric-power industry.

While progress is being made within the present limitations of the McMahon Act, we appear to be approaching a time when larger amounts of private capital will be required for investment in the atomic-power development program.

The terms of the present statute virtually prohibit the flow of sizable investment funds into the atomic-power development program, since they do not allow normal rights of ownership by industry and normal opportunities to recover investments.

In the interest of broadening participation and use of private capital in the atomic-power program, the large segment of the investor-owned electric-power industry which is represented by membership in the Edison Electric Institute wishes to recommend revision of the Atomic Energy Act so as to—

1. Permit industry to own both source materials and fissionable materials, and facilities for the production and utilization of such materials;
2. Deal fairly with patent rights and incentives for new developments; and
3. Permit industry to obtain workable licenses from appropriate regulatory authorities for projects in this field.

These recommended revision are considered consistent with governmental participation, since Government ownership and operation of its extensive facilities can continue as at present. Private industry simply desires the right to own and operate its own facilities, subject to appropriate regulation in the interest of national security, health, and safety. This would afford industry an opportunity to attract the necessary investors' dollars. It is in this way, too, that most effective development of nuclear energy, as a resource to supplement coal, gas, and oil, can be achieved for the continuing benefit of the public.

If I might take another second, sir, I would like to identify the members of the committee. I think it would serve to emphasize the very real interest that the institute takes in the atomic-development program. There are 12 members.

Mr. J. B. Black, president of the Pacific Gas & Electric Co., San Francisco.

Mr. Walker Cisler, president of the Detroit Edison Co., Detroit.

Mr. G. M. Gadsby, president, Utah Power & Light Co., Salt Lake City, Utah.

Mr. Allen S. King, executive vice president, Northern States Power Co., Minneapolis.

Mr. E. L. Lindseth, president, Cleveland Electric Illuminating Co., Cleveland, Ohio.

Mr. J. W. McAfee, president, Union Electric Co. of Missouri, St. Louis.

Mr. C. B. McManus, president, the Southern Co., Atlanta, Ga.

Mr. I. L. Moore, president, New England Electric System, Boston.

Mr. R. G. Rincliffe, president, Philadelphia Electric Co., Philadelphia, Pa.

Mr. H. R. Searing, president, Consolidated Edison Co., of New York.

Mr. Philip Sporn, president, American Gas & Electric Co., and I serve as chairman and as stated, I am president of Middle South Utilities, Inc.

Chairman COLE. Thank you, Mr. Dixon.

Mr. Holifield, do you have any questions?

Representative HOLIFIELD. I will say this, Mr. Dixon: That your three recommendations are all right, with this exception, that you make general recommendations which do not deal specifically with the problem the committee has to deal with, particularly I want to address that to No. 2 in which you say, "Deal fairly with patent rights and incentives for new developments."

Then I would ask you if you have studied section 11, the patent and invention provision of the act, and if you would tell us in what ways that is not fair and in what ways you would like to have it changed so it would be fair.

Mr. DIXON. Mr. Holifield, I think that your suggestion is quite a fair one that these are quite general. I think the position I find myself in today, of representing a very large segment of the industry, almost makes that essential.

A number of our groups, our investor-owned companies, have appeared before this committee. I have in mind when Mr. Cisler appeared. I believe he accompanied his testimony with a rather detailed analysis of the act and the various sections which he and his group felt deserved attention. He of course was speaking specifically for the companies definitely involved.

I just question whether in all wisdom at this rather early stage of development the industry, as an industry, should be too specific.

Representative HOLIFIELD. I can see that you are taking a very fair and reasonable position insofar as you have been authorized to appear before the committee. However, I would ask you to consider further more specific changes in the act, because when it comes time for the committee to sit down and draft legislation we are going to want all the help we can get, particularly from gentlemen of your standing in the industry. If you do have specific ideas as to changes in the act, that would fit your industry into this new development in an equitable way, we would like to have those specific suggestions.

Mr. DIXON. Just in general, of course, the utility industry as an industry has no deep traditional feeling toward patents. Offhand, I can't think of a utility company that of itself owns a patent. We are deeply concerned that the manufacturers are protected, the people who provide us with materials and supplies, because we find that when they develop a process they make it available, they want to sell it. If it will help us to generate electricity cheaper, if we can provide better service, we have a very great concern that the equipment manufacturers have every incentive to do those things. We certainly would like to see changes made to promote that status for the manufacturers, particularly to provide normal incentives for individuals.

If I might make a suggestion—I don't know the procedures of this committee—it occurs to me that our committee might well serve a useful function if we had an opportunity to review suggested drafts of changes. I think we might be a means of correlating ideas and these rather diverse opinions. I think you have observed among the utility companies which have appeared here, that they have rather wide and diverse opinions as to how development should proceed at this stage, and we think that is a healthy thing. We think the more fertile minds at work, the more rapidly we will get better answers. As chairman of this committee I certainly would welcome the opportunity to try to do that work and to try to get our overall notions and suggestions at the time when perhaps your legislation is taking form.

Representative HOLIFIELD. The statement has been made repeatedly that the McMahon Act as it now exists is not adequate for the situation, that it should be changed. Of course, we feel that if that be true, the people who are advocating the changes in the act must have come to that conclusion as a result of their study of the present act. If we are wrong in that, if they are just saying to change this without knowing what they are talking about, then their advocacy is subject to some further scrutiny on our part.

Mr. DIXON. Addressing myself to our first point, we feel very strongly there must be changes if as an industry we are to attract private capital. Building a powerplant today, even under the conven-

tional methods, is an expensive program. I think none of us would build an expensive central power station without an assured source of fuel or without assured ownership. We couldn't finance it. We are a strictly regulated industry. The price of our product is controlled. Our profits are limited. Traditionally we have had to raise virtually all our new capital in competition with other seekers of capital. We have had to pay out a fair amount of dividends to attract that capital. So retained earnings do not provide a source of venture capital, if you wish to call it that, that might be devoted to this purpose.

If we are to finance development work, if we are to finance the construction of atomic-energy plants, there must be assurance that we will have a supply of fuel, and that we will have ownership. We must give normal assurances to our potential investors.

Mr. HOLIFIELD. Does any of your group at this time obtain electric energy from Federal projects at the bus bar?

Mr. DIXON. I would think yes, sir. Usually when you are in the neighborhood of other power sources you interchange power. On balance we sell and have sold very large amounts—speaking for my own company—we have sold very large amounts of power to the TVA in order to permit the expansion at Oak Ridge. We put in very, very large amounts of firm power over many months. At offpeak hours they have surplus and we take some capacity from them.

Representative HOLIFIELD. The reason I brought that up was to explore your insistence on your No. 1 provision that it would be necessary for industry to own the source of materials. They do not own the TVA, and yet they use the power that comes from the TVA.

Mr. DIXON. What we use is surplus or dump power. We wouldn't rely on that kind of power to provide for our own loads. We have our base powerplants.

Representative HOLIFIELD. You might not in that particular area. There are plants, such as the Southern California Edison Co., that buy their power from Hoover Dam. They supplement it with steam power, it is true.

Mr. DIXON. As I understand the McMahon Act, sir, the AEC could not legally enter into a long-term fuel contract. As I understand it, they may lease it, but it is subject to recall at any time. When it would take in our case a minimum of 3 years to replace a power source, I doubt that we could afford to rely on that rather indefinite source of energy.

Representative HOLIFIELD. Yes. As long as the power of immediate recapture for national-security purposes is there, you could not proceed. I can see that. I concede that point. However, the very nature of this material, having the dual purpose of being, on the one hand, energy for civilian use and on the other hand, energy for a bomb, puts it in a class by itself, and the question occurs whether the Government can make a firm contract with you to furnish you fissionable materials without a recapture clause in case of national emergency. That problem is involved.

Mr. DIXON. I recognize that. It is because that problem is there that utilities are building very, very large numbers of conventional steam powerplants today. Atomic power is not a dependable energy source yet. There may come a time when it is. To attract investors' dollars for what would appear to be a dependable source of power we would need some changes in the rules. As yet it isn't in that stage.

Representative HOLIFIELD. That presupposes that we can change the rules to where you can have assurance of a long-term supply of fuel at a reasonable price.

Mr. DIXON. That is my point, sir. We think that would be a very great aid in attracting investor dollars. We think private capital can aid this program materially.

Representative HOLIFIELD. That is a matter of policy and wisdom that the committee must exercise in drawing legislation.

Mr. DIXON. Yes, sir; and again I say that is among the reasons that my approach of necessity has been general. We are feeling our way. We think it is perfectly wonderful that so many of our companies are attacking this problem. We think the great diversity of opinions among our fellows is a wonderful thing. It is different approaches, it is different theories which ultimately will come up with the right answer. Pending the time when the right answer, if there is a single right answer, evolves, we would like to see many, many more companies participate. We would like to see every conceivable approach followed. We think it is just in that stage right now.

To the extent that we as a committee can coordinate ideas and be of value to your committee, we certainly would like to do that.

Mr. HOLIFIELD. Thank you very much for your testimony.

Chairman COLE. That is quite right, Mr. Dixon. Our committee has been pressed for time because the Senate members of the committee are now engaged in a hearing on the nomination of Mr. Joseph Campbell to the Commission, and those of us who have remained are anxious to go over and participate in that hearing.

Apropos of the suggestion which you made that your committee might do well to review any proposed draft of changes in the legislation, I would urge that you go one step backward and undertake to formulate such a draft rather than wait for someone else to formulate it and you just review it. I think your institute would be a very proper group through which utility companies could concentrate their efforts in formulating suggested changes in legislation. We have asked many of the individual companies which have appeared to do that. In order to avoid having scores of different suggestions, I think it might be very well and appropriate that that effort on the part of the various utility companies were concentrated in your committee.

With that in mind, we will close the hearing today with the expectation that we may have some affirmative product of your effort within the next few months.

Mr. DIXON. I will guarantee, Mr. Chairman, we will move heaven and earth to do anything that will help this committee. If it is doable, we will do it.

Chairman COLE. You can be very helpful, I am sure.

Mr. DIXON. We will give you everything we have. We deeply appreciate the opportunity of being here today.

Chairman COLE. Thank you, Mr. Dixon.

The next meeting will be Wednesday afternoon in this room, when we will hear former United States Patent Commissioner Casper Ooms and also Senator Malone, of Nevada, and Mr. Oscar Ruebhausen, representing the New York Bar Association.

(Whereupon, at 4:35 p. m., Monday, July 20, 1953, the committee was recessed, to reconvene Wednesday, at 2 p. m., July 22, 1953.)

ATOMIC POWER DEVELOPMENT AND PRIVATE ENTERPRISE

WEDNESDAY, JULY 22, 1953

CONGRESS OF THE UNITED STATES,
JOINT COMMITTEE ON ATOMIC ENERGY,
Washington, D. C.

The joint committee met at 2 p. m., pursuant to recess, in room 318 of the Senate Office Building, Hon. Carl Hinshaw, presiding.

Present: Representative Hinshaw (presiding), Senator Pastore, Representatives Van Zandt, and Holifield.

Professional staff members present: Corbin C. Allardice, executive director; and Walter A. Hamilton of the professional staff of the joint committee.

Representative HINSHAW. The meeting will come to order.

The purpose of the meeting is to hear testimony on some problems relating to the definition of a Federal policy on atomic-power development and private enterprise.

Today we are to hear Senator George Malone, of Nevada, who, for over a year, has shown active interest among various groups to encourage the selection of Eureka, Nev., as the site of the first, or one of the first, atomic powerplants. This interest was stimulated at least in part by the efforts of the AEC to locate a suitable site for possible construction of an experimental atomic powerplant in a high power-cost area. There have never been firm plans within the Commission for such a plant, but several studies have been conducted in preparation for the possibility that this might prove to be a feasible step in development of commercial economic atomic power. Only last week the AEC announced the grant of a \$50,000 study contract to Walter Kidde Nuclear Laboratories, Inc., to explore suitable atomic powerplant designs for such use. The committee invited the Atomic Power Utilization Committee of Reno, Nev., to submit a statement of its findings and views for the record.

We have a letter from the Governor of Nevada, the Honorable Charles H. Russell. I believe that that is the same gentleman who was formerly a Member of the House of Representatives.

Senator MALONE. Formerly a Member of the Congress from the State of Nevada.

Representative HINSHAW. In the letter, he discusses an ideal site for such an experimental powerplant in Eureka County, Nev. Attached thereto is a letter addressed to him by the chairman in reply, and then another letter from the chairman of the Atomic Power Utilization Committee of Reno, Nev., Mr. Alfred Merritt Smith, submitting certain views and enclosures for these hearings.

This material, in part at least, will be made a part of the record.

(The material referred to follows:)

THE STATE OF NEVADA,
EXECUTIVE CHAMBER,
Carson City, July 3, 1953.

Congressman W. STERLING COLE,

*Chairman, Joint Congressional Committee on Atomic Energy,
House Office Building, Washington, D. C.*

DEAR REPRESENTATIVE COLE: AS you know, the State of Nevada has been a proving ground for the Atomic Energy Commission's tests on the explosive power of nuclear fusion.

There is need, too, that Nevada share further in the program of atomic development.

The field which we in Nevada think should be explored in our State is that of atomic power for commercial use.

An ideal site, we all believe, for such atomic-power experiments is located in Eureka County. That county is in the central section of the State. It is a section rich in mining possibilities which require cheap power for development.

The location of an atomic powerplant in the Eureka area would aid not only the State of Nevada, but the entire Nation, for it would result in vastly increased production of critically needed materials, such as tungsten.

It is my sincere hope that you will give every consideration toward the selection of Eureka as a site for the proposed atomic powerplant.

With every best personal wish.

Sincerely yours,

CHARLES H. RUSSELL, *Governor.*

JULY 10, 1953.

HON. CHARLES H. RUSSELL,

Governor, State of Nevada,

Executive Chamber, Carson City, Nev.

DEAR GOVERNOR RUSSELL: Your letter of July 3 was most persuasive and logical. I want to thank you for calling to my attention the possibilities which the State of Nevada affords as a location for atomic-power experiments.

The weapons-testing program conducted by the Atomic Energy Commission in Nevada has been one of the most dramatic and important contributions to American security in recent years. The privilege afforded to the Nation and the patience shown by the people of your State put the rest of us in their debt.

The promise which increased supply of low-cost power holds out for Eureka County certainly makes your quest worthwhile. The reports on this and other high cost power areas in the country which have been filed with the joint committee by the Federal Power Commission bear out your observations.

The Atomic Energy Commission is exclusively and completely responsible under the Atomic Energy Act of 1946 for the administration of the atomic-energy programs authorized by the Congress. The Commission has informed the joint committee that it has and will continue to give every possible consideration to Eureka County as a location for an experimental atomic powerplant in the event that it should determine at any time in the future to undertake construction of such a plant. No such decision has yet been made.

I am also informed that one of the most difficult aspects in the location of experimental atomic powerplants is the fact that such plants are not expected to provide firm electric power for commercial application. To require them to do so would so seriously limit the designers as to make the plants virtually useless from an experimental standpoint.

Your letter, along with those I have received from both organizations and individuals in Nevada, is being forwarded to the Atomic Energy Commission with a request for reexamination of the entire problem. I shall be happy to forward the Commission's reply to you as soon as it is received.

Sincerely yours,

STERLING COLE, *Chairman.*

JULY 23, 1953.

UNITED STATES ATOMIC ENERGY COMMISSION,
 Washington 25, D. C.
 (Attention of Mr. Lewis L. Strauss, Chairman.)

GENTLEMEN: In the course of the joint committee hearings on some of the problems incident to definition of a Federal policy on atomic-power development, we have received correspondence and statements from various individuals and groups urging the selection of Eureka County, Nev., as a site for an experimental atomic powerplant.

A copy of a letter from the atomic power utilization committee, of Reno, Nev., is attached for your information. I believe it is quite possible the enclosures noted in their letter have also been made available to the Atomic Energy Commission.

I understand there has been a review of this matter within the Commission. It would be helpful to the committee if that review could be summed up in some concise form and provided to us.

An unclassified reply available in at least several copies would be appreciated in order that we may pass it on to Governor Russell of Nevada and the atomic power utilization committee.

Sincerely yours,

STERLING COLE, *Chairman.*

UNITED STATES ATOMIC ENERGY COMMISSION,
 Washington 25, D. C., August 11, 1953.

HON. STERLING COLE,
 Chairman, Joint Committee on Atomic Energy,
 Congress of the United States, Washington 25, D. C.

DEAR MR. COLE: In response to your request of July 23, 1953, the following summary outlines the present situation in connection with the location of a nuclear package powerplant in the Eureka, Nev., area:

A. COST OF POWER GENERATION AND MARKET STUDIES

1. Surveys and studies have been made by the Atomic Energy Commission, the Federal Power Commission, and the Department of the Interior with respect to the market for electric power in the Eureka region and the cost of providing power, both from conventional and nuclear sources.

2. It is estimated from these studies that—

a. At 10 mills per kilowatt-hour cost, the demand for power by 1960 would approximate 30,000 kilowatts at 60-percent load factor.

b. From 10 to 15 mills per kilowatt-hour the demand would fall off gradually; above 15 mills it would drop rapidly.

c. By construction of a transmission line from contiguous areas such as Twin Falls, Idaho; Summit, Calif.; and Salt Lake City, Utah, the cost of power delivered to Eureka is estimated to range from 10 to 13.1 mills per kilowatt-hour.

d. Power of the required magnitude and load factor would cost from 20 to 25 mills from reactor sources of the small size needed, assuming present technology.

B. FACTORS AFFECTING LOCATION OF PACKAGE POWERPLANT

1. *Economic feasibility*

From the above discussion it would appear that, considering cost of power generation only, it would not be practical at this time to locate a nuclear powerplant in Eureka. Studies made of other high-power-cost areas in the United States result in the same conclusions.

2. *Experimental reactor*

The selection of a site for an experimental reactor need not, of course, be based on an economic argument. The Commission will consider the merits of the

Eureka area in any site selection it may make but notes that the location of existing Commission facilities plays an important role in determining the most valuable location for any new facility from the point of view of research and development.

3. Other factors

Admittedly, there are other considerations which could influence the selection of an otherwise uneconomic site, such as reclamation, or special (noneconomic) mineral stockpiling incentives. These considerations do not appear to fall within the primary responsibilities of the Atomic Energy Commission. Nonetheless, we shall (in selecting sites) attempt to take these factors into account.

I shall be glad to furnish you with more detailed information in regard to this matter if you so desire.

Sincerely yours,

LEWIS L. STRAUSS, *Chairman.*

ATOMIC POWER UTILIZATION COMMITTEE,
Reno, Nev., July 13, 1953.

HON. W. STERLING COLE,
*Chairman, Joint Committee on Atomic Energy,
Washington, D. C.*

DEAR CONGRESSMAN COLE: I have your letter of July 8, 1953, inviting the local Atomic Power Utilization Committee to submit any statement of their views on atomic-power-development problems for inclusion in the record of the open hearings to be soon published. The Nevada Atomic Power Utilization Committee has a membership of 247, all of whom are leaders in Nevada. Its board of directors are men exceptionally well informed in the mining and engineering profession, and I think it would be very informative to your committee if one or more of them could personally appear at the hearing to make a statement and answer questions. As you state, however, the remaining time is short and none would wish to incur loss of time and expense of a journey to Washington without positive assurance of being heard before the adjournment of Congress.

I submit the following enclosures for inclusion in the record of the hearings or such portions of them as may seem advisable:

1. Atomic Power Utilization Committee, organization proceedings.
2. Report as to feasibility of construction of atomic reactor at Eureka, Nev.; July 25, 1952.
3. Report on present and potential electric power markets for proposed dual-purpose atomic reactor near Eureka, Nev.; September 30, 1952.
4. Nuclear-power effect upon the mining industry. An address before the American Mining Congress, Denver, Colo., by Senator George W. Malone; September 25, 1952. [Not printed.]
5. Transcript of the testimony of Dr. Lawrence R. Hafstad, Director of Reactor Development, Atomic Energy Commission, at Henderson, Nev.; October 10 and 11, 1952.

Our committee greatly appreciates the opportunity given us to present the case for atomic-power development in Nevada.

I further suggest that you communicate with Senator George W. Malone who is exceptionally well informed on the resources of Nevada. He is a lifetime engineer and maintains an office in Reno which is my headquarters. He is greatly interested in the possibility of developing many of Nevada's remotely located resources in both mining and agriculture, and he might well appear before your committee with a statement if the limited time will permit.

Most sincerely,

ALFRED MERRITT SMITH, *Chairman.*

(The following are excerpts from the documents noted:)

ATOMIC POWER UTILIZATION COMMITTEE—ORGANIZATION PROCEEDINGS

The committee was organized at Reno, Nev., on July 1, 1952, upon the suggestion of Dr. Lawrence R. Hafstad, Director of Reactor Development, United States Atomic Energy Commission, who came to Nevada upon the request of Senator George W. Malone for a preliminary examination of the Eureka mining district as a site for the construction of a reactor to supply electric energy to the mining industry while primarily engaged in the production of plutonium for the Govern-

ment. It is proposed to install a reactor of sufficient capacity to supply the power needs of all the various mines of the Eureka mining district, and also power for pumping ground water for irrigation in several desert valleys located within economic electric transmission distance.

PURPOSES

1. To prepare a feasibility report on the Eureka project, setting forth comparative costs with those of diesel-electric and hydroelectric power.

2. To disseminate information throughout the State in regard to atomic energy, and its use in various industries. This will be done by lectures to service clubs and other civic groups and by the distribution of unclassified and unrestricted literature supplied by the Atomic Energy Commission and affiliates.

3. To arouse the interest of the mining industry and owners of mines located in areas of difficult and remote accessibility in the use of atomic reactors to solve their power problems.

4. To promote educational programs in high schools in order to spread general information regarding nuclear energy physics, chemistry and technology, in the belief that such knowledge will do much for the future development and welfare of our citizens.

5. To actively support the program that has been initiated at the University of Nevada for the beneficiation of low grade uranium ores; to promote the adoption of additional studies covering effects of radioactivity on plant, animal, and human life and in the special fields of medicine, therapeutics, the conditioning and preservation of foods, and of procedures to prevent or neutralize any deleterious effects that may be created.

ORGANIZATION

Present at a dinner meeting in Reno, Nev., on July 1, which had been called by Senator George W. Malone, were a number of leading men in engineering, mining, financial, legal, and educational fields. With Senator Malone acting as moderator, these men organized as a general committee for an investigation of the possibilities of use of atomic energy as a source of power in Nevada. A chairman and a board of directors was elected, consisting of the following men: Alfred Merritt Smith, E. M., Nevada State engineer, 1935-51, chairman; Roy A. Hardy, E. M., Wingfield mining interests, manager, Getchell mine, etc. George W. Mitchell, E. M., managing director, Eureka Mining Corp., Ltd., Eureka, Nev.

Joseph E. Moose, Ph. D., chief of chemistry department, University of Nevada; Stanley G. Palmer, D. Sc., dean, College of Engineering, University of Nevada; Vernon E. Scheid, Ph. D., dean and director, Mackay School of Mines, University of Nevada

The directors were requested by Dr. Hafstad to proceed rapidly with the preparation of a feasibility report concerning the proposed construction of an atomic reactor by AEC at Eureka, Nev., upon or near the property of the Eureka Corp., Ltd., to generate electric power for dewatering the Richmond-Eureka mine in order to permit recovery of large bodies of valuable lead-zinc ores now urgently required in the national economy; and for the operation and development of other mines in the Eureka mining district, and for pumping ground water in the several adjacent arid valleys for irrigation.

Dr. Hafstad stated that a new reactor would definitely be constructed by AEC somewhere in the United States as soon as possible for the manufacture of plutonium; that electric energy would be a byproduct which would be sold as profitably as possible as a credit to the cost of the plutonium.

Each of the directors will be cleared by the Atomic Energy Commission in order to receive restricted information, particularly as to data and costs of reactor construction and operation.

The directors were further instructed to contact operators in all fields of private work and invite them to become members of the Atomic Power Utilization Committee, and participate in discussions.

The membership will be composed of persons who are active in State affairs and in the advancement of industry, including those engaged in professional work, especially in education. Meetings will be held, at which speakers who are specialists will appear. Lectures and panel discussions will be arranged. The more highly technical features of the subject will be avoided. The great advantages of peacetime utilization of this great force in science, industry, and

commerce will be described and discussed in the light of present widespread developments. The phenomenally rapid and dramatic progress in nuclear energy use has gone ahead of public information and education on the subject. An essential part of the committee program will be the spreading of knowledge regarding atomic energy, destined soon to become of major importance to the welfare of mankind, and vital to the economic development of mining and agriculture in the arid Western States.

REPORT AS TO FEASIBILITY OF CONSTRUCTING AN ATOMIC REACTOR AT
EUREKA, NEV.—JULY 25, 1952

* * * * *

While exploring the industrial field for an initial site, the Eureka, Nev., area was brought to the attention of AEC and a preliminary examination was made by Dr. Lawrence R. Hafstad, Director, Division of Reactor Development, during July 1952. At that time a group of mine operators, and interested engineers met with him in Reno, Nev., following his return from Eureka. Dr. Hafstad suggested that the group organize and submit a report to AEC on the apparent advantages and feasibility of the Eureka site. The group thereupon organized as the Atomic Power Utilization Committee, and the following were selected as the board of directors:

Alfred Merritt Smith, E. M., Nevada State engineer, 1935-51, chairman
Roy A. Hardy, E. M., Wingfield mining interests, manager, Getchell Mine, etc.
George W. Mitchell, E. M., vice president and managing director, Eureka Corp., Ltd., Eureka, Nev.

Joseph E. Moore, Ph. D., chief of chemistry department, University of Nevada
Stanley G. Palmer, D. Sc., dean, College of Engineering, University of Nevada
Vernon E. Schied, Ph. D., dean and director, Mackay School of Mines, University of Nevada

The board was instructed to prepare a report on the feasibility of the Eureka mining district for a reactor site without delay and submit it to AEC for consideration. This report is in compliance with the committee's directive.

ECONOMIC ASPECTS

Location

The mining district and the town of Eureka are located somewhat east of the geographical center of the State of Nevada. The town has a population of about 700 and is the county seat of Eureka County, Nev. It is 3 miles distant from the principal working site of the Richmond Eureka mine of the Eureka Corp., Ltd., the suggested location for the reactor.

The district is without railroad service. The nearest railroad connection is the Nevada Northern Railway at Ely, Nev., 77 miles east. Another outlet to the main east-west lines of the Southern & Western Pacific Railroads is 85 miles north via State Highway 20. Eureka is on United States Highway 50—a first-class, paved, 2-lane highway extending east and west through the State and passing through Reno, Austin, Eureka, Ely, and Salt Lake City. A paved two-lane highway connects Eureka with the properties of the Eureka Corp. Telephone lines of the Bell Telephone Co. connect the town with outlying communities. A 5,000-foot gravel airstrip adjacent to the town provides facilities for light- to medium-sized aircraft.

A map prepared by the Federal Power Commission is attached to this report, showing the remote location and complete absence of electric power transmission lines. The elevation of the town is approximately 6,500 feet, the mine 7,000 feet, and the terrain in general is desert with sagebrush covered valleys, lying between rough mountains.

* * * * *

History

In Eureka were found the first important lead-silver mines in the United States. At one time Eureka controlled the lead market of the world. The district was discovered in 1865, but the high lead content of the ore prohibited milling, and the district did not become an important producer until about 1870, shortly after smelting was introduced. In 1881, a heavy flow of water was encountered in the Eureka Consolidated shaft at 765 feet, and despite the installation of a large steam pumping plant the shaft was flooded in 1882. Leasers continued to operate intermittently, but in 1890 the Richmond smelter closed, and the Eureka smelter

also closed in 1891. Since then the district has been inactive as a substantial producer, although from time to time shipments of ores from deposits near the surface continue to be made. A concise history of the district up to 1923 is contained in Mining Districts and Mineral Resources of Nevada, by Francis Church Lincoln, available at the Mackay School of Mines, University of Nevada, Reno, Nev.

Since 1923 the outlook for Eureka District took an upward turn, although there has been little change in production. The United States Smelting, Refining & Mining Co., 75 Federal Street, Boston, Mass., acquired a controlling interest in the Richmond-Eureka Mining Co., which owned the important Richmond and Eureka mines, and leased them to the Eureka Corp., Ltd. To date the Eureka Corp. has expended \$7 million in efforts to reach large and valuable bodies of ore discovered by themselves and explored jointly with the United States Bureau of Mines at depth by a diamond core drilling campaign. The corporation now plans to spend about \$8 million additional in order to get into production.

* * * * *

Summarizing the feasibility features mentioned herein

1. The location is within a great desert area, the nearest population center being Ely, Nev., 77 miles distant.
2. Although the location is remote it is reached by paved main-line highways and has good telephone and telegraph connections.
3. The Eureka district is one of the most attractive potential gold-silver-lead-zinc producing areas of the United States. Recent development of a large body of ore in one mine alone apparently will justify the installation of a dual-purpose reactor to supply power.
4. Diesel-electric power, the only power presently available, costs 3 cents per kilowatt-hour. The AEC could furnish power for much less, and yet obtain a rate far in excess of what could be paid by large commercial firms in populous centers.
5. Disposal of radioactive wastes from the reactor should be a minor problem because of favorable location.
6. The financial backing of Eureka Corp. is strong and it would make a long-term agreement.
7. The Eureka Corp. has facilities for construction, operation, and management of a reactor powerplant, and a 6,000-kilowatt powerplant ready for immediate operation.
8. Initial experimentation could be carried on without interference, and all State agencies would cooperate to the fullest extent.

* * * * *

ATOMIC POWER UTILIZATION COMMITTEE,
 ALFRED MERRITT SMITH, *Chairman*.
 ROY A. HARDY.
 GEORGE W. MITCHELL.
 JOS. E. MOOSE.
 STANLEY G. PALMER.
 VERNON E. SCHIED.

REPORT ON PRESENT AND POTENTIAL ELECTRIC POWER MARKETS FOR PROPOSED DUAL-PURPOSE ATOMIC REACTOR NEAR EUREKA, NEV.—SEPTEMBER 30, 1952

PURPOSE OF REPORT

Business and professional men living in the Eureka, Nev., mining district are very much interested in the possibility of the Atomic Energy Commission constructing an atomic reactor there for the double purpose of manufacturing plutonium and generating electric power. A feasibility report had been requested by Dr. Lawrence Hafstad, and such a report had been prepared and submitted by the Nevada Atomic Power Utilization Committee, organized for that purpose.

The people of Eureka were of the belief that the report was not sufficiently comprehensive in that more detail was necessary, and that the resources had been underestimated. It was suggested that a local subcommittee be organized to cover the subject more completely by a supplemental report. Accordingly a subcommittee was appointed by the Atomic Power Utilization Committee, and Charles A. McKay of Eureka was designated as chairman. The committee has

diligently assembled much information and has endeavored to present it in the following paper. The committee hopes that it will lead to the selection of Eureka, Nev., as the site of the first large-scale commercial power generating reactor.

* * * * *

CONCLUSIONS

Numerous mines contributing copper, zinc, lead, and tungsten required for national defense are within this area. They need more and cheaper power for economical production and expansion.

A vast acreage of arable land can be developed by pumping of the available groundwater. Local citizens state they are ready to take up some 6,000 acres as soon as an atomic reactor is assured. This initial influx of settlers will probably be followed by hundreds of others as soon as facilities are ready. Pumping will be necessary on all of the land.

The subcommittee was surprised to find the resources of the area much greater than they had previously surmised, and are convinced that a detailed survey of such resources and their economic value to the project is more than justified and should be undertaken by the AEC immediately. All State agencies will gladly assist.

Our investigation indicates that 30,000 kilowatts will be required to satisfy present and potential power requirements within a radius of 75 miles.

* * * * *

CENTRAL NEVADA SUBCOMMITTEE OF THE ATOMIC POWER UTILIZATION COMMITTEE,

Charles A. McKay, Chairman, Eureka, Nev.; E. B. Crane, Owner, Santa Clara Mine, Eureka, Nev.; Charles Damele, Chairman, Board of County Commissioners, Eureka; Bert Acree, County Recorder and Treasurer, Austin, Nev.; LeRoy Casady, Garage Owner, Austin, Nev.; P. P. Hoover, President, White Pine Power District No. 9, Ely, Nev.; Kathryn E. McKay, Vice Chairman, Eureka County Republicans, Eureka; Alfred Merritt Smith, Chairman, Atomic Power Utilization Committee, Reno, Nev.

* * * * *

EXCERPT FROM TESTIMONY OF DR. LAWRENCE R. HAFSTAD, DIRECTOR OF REACTOR DEVELOPMENT, ATOMIC ENERGY COMMISSION, HENDERSON, NEV.—OCTOBER 10-11, 1952

* * * * *

Dr. HAFSTAD. There is another point which I think should be stressed in a hearing of this kind, while the cost on the busbar can be very low, the cost of transmission is the big element in any electric power project. We were discussing only the cost of transmission for electric power. I don't think it is generally realized the extent to which your transmission costs enter into the cost which the consumer has to pay for his electric power. This suggests that in areas remote from either big hydro installations or local coal and oil supplies, it might be cheaper to truck in a pound of uranium or something of that kind, and run on that instead of hauling in many tons of coal or oil or building an expensive transmission line. This is another way of emphasizing the fact that uranium will probably begin to compete first in high-power cost areas.

Senator MALONE. You find those places mostly in wide stretches of desert and mountainous areas where there is no concentrated demand for power, such as those in San Francisco, Los Angeles, Las Vegas, or Reno. Where the mining industry and the pumping of water and all development depends on low-cost power, but where there is no load sufficient to justify a long transmission line?

Dr. HAFSTAD. The thing that you bring out there—that is something which those of us who have been in the atomic-energy business for a long time feel to be true. The mining industry often operating in the most peculiar places you can imagine, the most remote areas, would be one of the first to cash in on the unique advantages of atomic power. So, it is not a surprise to us at all that regions such as the intermountain States out here should be very much interested in atomic power.

Senator MALONE. Now, of course, you remember when I first discovered you, you had been discovered by many other people no doubt, but I discovered you

for myself, I was trying to find someone who was interested in the examination of just such areas. I remember my first remarks to you, not knowing you were quite as interested as you have been, I tried to explain to you that the mountainous areas, eight States between the Rocky Mountains and the Sierra Nevada, had very little power available, and some States like Nevada have no fuel, no oil, or no gas. In isolated areas where it is 150 miles to the next town and that town very small, the population depending entirely on mining operations, livestock, and limited agriculture, that there were many areas of potential greatness. I mentioned a few to you at that time, one of them being Eureka, Nev. I stated to you that I thought it was worthy of an examination since there was an estimated 12,000 gallons per minute of water to pump 2,500 feet to make available \$100 million to \$150 million worth of lead and zinc which are strategic metals wanted very badly by the Government and where there were around 8,000 kilowatts of diesel-electric power installed costing about 3 cents per kilowatt-hour to operate which has been shut down because of the high cost. I requested you to examine at least that one area and I believe as a result we did set a chain of thinking in motion as you have just described, where wide undeveloped areas might be first to benefit from nuclear power.

* * * * *

I have a statement from the chairman which I think should be read into the record at this stage. It is a letter from Chairman Dean to me. "Dear Mr. Hafstad: I am glad to learn that you will have an opportunity next week to explore with the members of the Public Works Committee of the Senate some of the problems which face the Commission in its endeavor to secure useful power from atomic energy. There has been little question in the Commission's mind that in high-cost-fuel areas reactors might appropriately supply power. I hope, however, that you will be quite frank with the committee in explaining some of the difficulties, including the legislative changes, that will be required before we can induce private enterprise to come in and participate with risk capital in the construction of such power units."

* * * * *

Representative HINSHAW. Now, Senator Malone, we shall be very happy to hear from you.

**STATEMENT OF HON. GEORGE W. MALONE, A UNITED STATES
SENATOR FROM THE STATE OF NEVADA**

Senator MALONE. Chairman Hinshaw, I am glad to see you. I did not realize you were a member of the Commission. I am glad you are.

Representative HINSHAW. I am not. I am a member of the committee. We differentiate between the Commission and the committee.

Senator MALONE. I stand corrected. I know about that. You are from the House, that is part of the committee, of 10 members, I believe.

Representative HINSHAW. There are 9 members from the House and 9 members from the Senate. We are honored to be within your portals.

Senator MALONE. With reference to the report that you have just referred to, from A. M. Smith. Mr. Smith is a former State engineer of Nevada and is very familiar with the entire area.

First, Mr. Chairman. I would like to say that I became interested in this particular problem of the location of the first commercial powerplant, after talking to the members of the Atomic Energy Commission; chiefly to the Chairman, and to Dr. Hafstad, who is the technician in direct charge of that particular activity.

First, I was interested in the whole problem of atomic energy for civilian uses.

Naturally, there has been a tremendous amount of money expended in the field for national defense, and that was pretty well taken care of. That is to say, there is nothing very much that I could contribute to it.

Representative HINSHAW. Well, I would like to say, Senator that after experiencing the shocks that come from atomic explosions in the State of Nevada, those that have been conducted in the State of Nevada, if you fellows still want atomic-energy experiments, even though of a different nature, my compliments to you.

Senator MALONE. I will say, Mr. Chairman, that I became interested in this matter, and we are intensely interested in it. It is, of course, of great importance to select the most feasible site, wherever that may be, for the first commercial plant. I consider it one of the greatest of discoveries, and it may have more effect on the future of this Nation and the world, and it could very well have as much effect, or more than any of the discoveries in the past. They built the pyramids, and someone discovered the wheel, and they won wars by that method, through the chariots. Someone discovered gunpowder and then one man could disperse a whole tribe. Then came the steam engine, but it did not come all at once. It took about 75 years to get it on wheels after they discovered steam would move certain parts of a vessel or container. Then electricity took a long time, from the time Ben Franklin experimented with the kite until Edison came along and made it practical.

This one discovery, in my humble opinion, can change the course of history more than any of the others. I say that after a considerable study, not in reference to the military at all, but in reference to civilian uses. That is the reason I am so greatly concerned that we lose little time in what you might call an experimental plant or a pilot plant, which in my judgment should be constructed by the Government, because there is considerable discussion as to the method to be used and there are many things to be learned in constructing the first plant.

After these decisions are made and the first plant constructed—I believe it should be constructed by the Government, for the same reason that, it being an experimental plant, they being in entire charge of it, then, they could change and adopt whatever improvements or changes in design they wished to as they go along and would not be beholden to any other agencies. And then, after the first pilot plant is made to work—and there is no question in my mind but that it will work—it will be up to the Congress, I believe, to work out ways and means for a licensing process to private outfits, not that the Government would stay in the business, but that it would be like the experimental rubber plants. My own committee, the Interior and Insular Affairs Committee, had several, what we call, pilot plants running; like petroleum fuels from oil shale, petroleum fuels from coal. The chairman is no doubt familiar with the Government plant for zirconium and various other very important experiments and formulas that are being turned into practical use. The Government only goes far enough, or at least that is the general practice, and that is what I favor, to show the practical aspects, and then it turns them over to a private outfit under appropriate jurisdiction.

Nevada is the scene of not only the trial runs on the atomic bombs and various other military aspects in the atomic-energy field, but it may be known, though perhaps not generally known, that at the University of Nevada, School of Mines, which has been one of the outstanding mining schools of the Nation for 40 years, we have a project sponsored by the Atomic Energy Commission on new and im-

proved methods of beneficiating uranium ores. Of course, you know, Mr. Chairman, the difference between country rock and ore is many times just a proper method of beneficiating it. Like the copper ore in the country. It required 7 or 8 percent copper to be commercially feasible. Then some fellow, by the name of Colonel Jackling, came up out of a laboratory a good many years ago with a process that made one-half of 1 percent of copper feasible. And in the country, over in Butte, Mont., and in Salt Lake City, it turned that country rock into copper ore. One of the largest copper areas in the world is there.

Now, we have uranium ore in Nevada. There is a tremendous amount in Colorado and Utah and on the plateaus.

There is no question about it. It is just a question of grade.

It is my firm belief that the United States, right in that particular area, may become self-sufficient in uranium ore for the production of their needs, and certainly in the Western Hemisphere. I have little doubt that in Canada it is in sight now. We can produce the ores. But a new and improved method of beneficiating these ores will bring great improvement, and that is going on at the University of Nevada right now.

There was another project recently placed in the university on radiation dust. This has little to do with the powerplant, but I want to show that the State of Nevada is really trying to help in this whole situation.

Radiation dust, as the chairman remembers, was dust that settled down on Rochester, N. Y., and no one knows just what bad effect this radiation dust does have.

Representative HINSHAW. I take it, Senator, that a little bit of Nevada settled on Rochester, N. Y., in that case.

Senator MALONE. That is just about right. And maybe a little bit of some other State that went into the manufacture of the bomb itself.

At least, this radiation dust settled there and settled other places. A good deal of this is classified information. But we do not know yet the effect of radiation dust on plant and animal life.

In the Tennessee plant, outside of the plant, on the farm, they are running experiments now on various animals. I have visited that farm, and it does not look very good.

So I merely mention, Mr. Chairman, that Nevada is interested in this whole problem. Of course, we are the most sparsely settled State in the Union, sixth largest, 600 miles long, 400 miles wide. There is a lot of area there.

Then we come to the matter of: Why a commercial plant? We have read, no doubt the chairman has, that many learned gentlemen have said that feasible commercial power may be 10, 15, 20, 25 years away. I listened to those stories for a long time. But I come from an area, Mr. Chairman, where there are wide distances, in the mountains and the deserts, where you might drive 50 miles for breakfast. We are not talking about a thickly settled area.

Now, in these areas are large deposits of minerals. And that applies to the northern area and the eastern area of the chairman's own State, California. But there are eight States between the Rocky Mountains and the Sierra Nevada Mountains, all mountain and desert States. It is just a matter of degree, starting with Arizona, New Mexico, and ending with Montana and Wyoming, Colorado on the east, Idaho,

Nevada. Those States are just about alike, with the exception of the latitude; and the elevation determines the rainfall, and it is all dry desert and mountain area, except where you dam the water in the rivers and have irrigation projects, which is another job, and a very small percentage of the area of these States will ever be cultivated, because the water is just not there.

Now, in my opinion, in my humble opinion—I have been in the engineering business for 30 years, all over the western States. The chairman may remember that I was consulting engineer on the Central Valley project, your Shasta and San Joaquin Dam, and on your Los Angeles Flood Control District. I am entirely familiar with all of the country out there. It is my opinion that since feasibility is a relative thing, a relative term, it will be in those areas that you will first find feasible the generation of nuclear energy power, commercial power. Certainly it would not be near Hoover Dam, where power sells for 2 mills a kilowatt-hour at the switchboard. It would not be in Los Angeles, where oil and gas power would be around $3\frac{1}{2}$ or 4 mills a kilowatt-hour. It would not be in the coal areas back here, where they can generate power for about the same amount, $3\frac{1}{2}$ or 4 mills a kilowatt-hour. It certainly would not be in the Tennessee Valley, nor would it not be up in Washington near Grand Coulee. But when you get away from these areas, 50 to 100 miles, you cannot run a transmission line 100 miles for 20,000 kilowatts of power.

When they asked me about it, after we had discussed the relative feasibility aspects, I said, "I will mention 1 town, 1 place, Eureka, Nev., in about the center of our State. There are many other areas where they are now trying to mine there with power that costs 2 cents or $2\frac{1}{2}$ cents a kilowatt-hour. They have built 7,000 or 8,000 kilowatts of diesel power. It is very expensive power. We haul the diesel fuel from your State of California 600 or 700 miles, and in the wintertime it is pretty near impossible to get it in there. So when you are talking about a cent and a half, or 2 cents or $2\frac{1}{2}$ cents per kilowatt-hour for electric energy, it is my opinion, Mr. Chairman, that you are pretty close to feasibility now in the uranium energy field. There would have been a greater chance of feasibility on a byproduct, plutonium.

Now there seems to be a greater supply of plutonium, and maybe that source of revenue is not so valuable now. But the first site, the first feasibility, will be in the desert and the mountain areas, and wherever there is a sufficient load for a feasible size reactor.

Now, let me say something about the surveys that were made here by Mr. A. M. Smith—we call him "Tom" Smith—former State engineer of Nevada, the man who followed me as State engineer of Nevada. Tom Smith was a mining engineer before he took this job, worked for me before he did take it. He has made a survey of the area, two surveys, as a matter of fact, a secondary survey not only to determine the amount of power in that area that would be contributory to the load now, but what would probably be available if it were known that the energy was going to be available within certain brackets at a certain price.

So it is thought, there, that there would be a load of anywhere from 20,000 to 30,000 kilowatts, which would be a reasonably sized power-plant. There could be determined, of course, from a plant of that kind, the most feasible method of constructing a reactor—there are

three main methods—and also learn something about it as they go along. They will learn a good deal from the first commercial reactor.

Now, I think, after discussing this matter over a period of a couple of years with the Atomic Energy Commission—I have been cleared for all of the information, confidential information, so without discussing the matter, I have seen most of the plants, most of the installations, like Long Island and Oak Ridge, and I am keeping a very close track of the atomic-energy-powered submarine. It is a great thing which in my opinion has revolutionized the whole submarine business. You can stay under water for 6 months. It will be something that will change the whole complexion of what submarines can do.

Now, the same thing can be done in reactors. I look forward to the time. It won't all come at once. I am not saying to you, Mr. Chairman, that this atomic power is going to displace a lot of large projects in this country. I do not think it will. Because it will be a long time in coming, perhaps the time of their amortization period. But it will provide power where there is now no power; that is, power at a feasible price.

One of the reasons I mentioned Eureka, when they asked me about it: The estimate there is that there is about \$150 million worth of lead and zinc at the bottom of a 2,500-foot shaft, but you have to pump 12,500 to 15,000 gallons of water a minute to make it available. Therefore, the load is there. That is a base load. Then you have the seven or eight thousand kilowatts of power already installed, the diesel power, that could be used as standby in case it was necessary to close the plant down. And no doubt it will be, in experimental runs.

So it just seemed to be one of the most feasible sites that could be mentioned.

The Bureau of Reclamation, I think, of the Department of the Interior, I think, made a survey of certain power areas, and I think more or less centered on the Eureka site. At least, the mountain and desert areas were considered the areas where it would first really become feasible.

Now, Mr. Chairman, I have no further statement. I have a short prepared statement I would like to offer for the record. I would like also to have the privilege of reorganizing and coordinating any statements I have made in your record.

Representative HINSHAW. We will be pleased to have your statement, Senator, and of course you have the courtesies of the committee. (The statement referred to follows:)

STATEMENT OF SENATOR GEORGE MALONE

Let me thank you, Congressman Cole, and members of your committee, for giving me this opportunity to appear before you. On July 13 a letter was written to this committee by A. M. Smith, of Reno, chairman of the Nevada Atomic Power Utilization Committee.

Five reports were included in Mr. Smith's letter. Those reports told of the formation of the Nevada committee and of the committee's efforts in inducing the Atomic Energy Commission to build a reactor power project in Nevada.

You have those reports on file and they will be included in your printed record. I realize you have volumes of material before you but I hope all of you will have a chance to study these reports. They show that the Nevada site selected for proposed construction of such an atomic powerplant is highly feasible.

The Atomic Energy Commission is fully alive to the possibilities of commercial-power development through the construction of atomic reactors to make fissionable materials for bombs and at the same time use the heat of the reaction to generate electric power for commercial industrial uses, and the Commission has intensively investigated this field for about 2 years.

Four major power companies, each allied with a great chemical or industrial company, have joined them in these studies. In July of last year the AEC stated that at least one of these groups was ready to cooperate on the construction of a power reactor.

I suggested to the AEC that a sounder procedure would be to build the first pilot-plant reactor near Eureka in central Nevada, a remote but important mining area, where the 3-cent per kilowatt-hour power cost has prevented mining and irrigation development and where there is a large initial permanent load at once available, and sufficient installed diesel standby power to make it a safe experiment in operation.

Gentlemen, the time has come for the construction of such a plant. The wide stretches of mountains and deserts in Nevada, remote from the low-cost fuel and hydroelectric-power areas, are a natural for the location of the contemplated nuclear energy power pilot plant.

All of you, I am sure, are acquainted with Dr. Lawrence R. Hafstad of the Atomic Energy Commission. Dr. Hafstad is the Director of Reactor Development—the man who builds these powerplants.

I have the highest regard for Dr. Hafstad, professionally and personally. I have known Dr. Hafstad for several years and know that he is vitally interested in the Eureka site as a possible location for a reactor power project. He is very familiar with the area and knows the situation firsthand.

In a letter recently, Dr. Hafstad informed me, and I quote: "It would appear, therefore, that construction of a power reactor project capable of producing 30,000 kilowatts of power could be justified at the present time only as a pilot plant or experimental unit contributing to our knowledge of the technology and ultimate cost of atomic power. In selecting a site for such a reactor a number of considerations besides power costs in the area, including proximity to the development laboratory, will necessarily have to be taken into account."

Gentlemen, the Nevada Atomic Power Utilization Committee—backed by chambers of commerce and individuals throughout Nevada—stand ready to work hand in hand with the Atomic Energy Commission in any way so as to bring favorable consideration of the Nevada location.

Nevada, where the AEC has its testing grounds and at whose university two research programs currently are under way, is the natural location for such a reactor.

Out of the entire eight States located within the intermountain area, my State of Nevada is the most rugged and thinly populated. Eureka, Nev., is one of the most remote among all these vast mountain and desert areas considering the availability of waterpower or fuel to produce steam power.

These vast areas include the largest potential production of the vital strategic and critical minerals so necessary to our domestic economy and absolutely necessary to our very existence as a nation. The effect of commercial atomic power upon the mining industry will be of almost incalculable value.

As to feasibility, feasibility is a relative term. I have been in the engineering business for 30 years and know that feasibility is a relative term and depends on a number of factors and conditions. It may be that nuclear-produced electric power within areas now served by low-cost hydroelectric and steam electric power is several years away, but within these vast and isolated power-starved desert and mountain areas, the time is here now.

The Government should build the first pilot plant just as it has built the pilot plants to determine the practicability of producing petroleum fuels from oil shale and from coal in an emergency. When the first plant has thoroughly proven the practicability of such production, private capital should then be encouraged to actively enter the field.

If such power is feasible in Eureka, Nev., then similar plants can be constructed anywhere under proper competitive conditions and will be the answer to the Mountain States' 100-year prayer for the development of their resources, including mining, irrigation, and industry in their mountain areas.

I would like to urge members of this committee to consider the construction of such a plant, preferably in a high-power-cost area such as we have in the intermountain regions. Governmental agencies tend to move slowly and with extreme caution, except when spurred by dire necessity or fear. The War De-

partment did not wait to eliminate all the bugs from the atomic bomb before exploding it on Japan.

We are now ready to build an atomic-power reactor. Several small plants have operated successfully. One had a capacity of 100 kilowatts, so 20,000 should be easy and 500,000 is certainly coming.

The public has paid for the development of this new source of power and delivery should not be delayed. I am confident this type of reactor can be built now. It is feasible in high cost power areas. I feel that it would be an unnecessary burden on the taxpayers and an imposition on the miners and ranchers of the West to wait longer for the practical application.

We are spending billions of dollars abroad. The time is here to spend a few millions to build peacetime power reactors at places where there is every facility for its safe and profitable operation and where a crying economic need exists. Gentlemen, all great inventions that changed the course of history were crude at first. They had to be improved by public use.

The wheel, gun powder, the first steam engine, the cotton gin, grain reaper, locomotive, radio, automobile, telephone, all represented inventions that have changed the world. Application of atomic energy to peacetime development can be the greatest single factor to better this world of ours.

I would like to impress upon members of this committee that commercial nuclear power is feasible in the high power cost mountain and desert areas now.

Every time a plant is built, something new will be learned to reduce the cost of production. I would like to emphasize the time is here now for the AEC to construct a nuclear power pilot plant where power can be sold at a profit and simultaneously create profitable mining, irrigation, and industrial operations. I am convinced that the location we have under study in Nevada is the logical spot to commence construction. Let's not delay any longer.

Again, let me thank you, Congressman Cole, and members of this committee for giving me the opportunity of appearing before you here today. Your committee is a vital one and I wish you every success in this important undertaking.

Thank you very much.

Representative HINSHAW. We thank you very much for your presentation, and we certainly feel that Nevada has been an unusual host on several occasions.

And again I say that, being still interested, in spite of those occasions, is a great compliment to your State.

Senator MALONE. I might say in that connection that we are interested. You already have your installations there, and we still have some of these areas that are active, where they set aside areas that are active, where they set aside areas for practice bombing in that north-central Nevada area. There are certain advantages there for the Atomic Energy Commission and the Atomic Energy Committee, in my opinion.

One of them is that they do not have such wide diversified interest, and being a small State in population and wealth, they are interested in developments.

Now, of course, this does take out a certain amount of area in rangelands, in the atomic experimental area. Nevertheless, it is an area that is not highly productive. And the people of Nevada made up their minds that it was all right.

In such an action as the construction of a reactor, like in Eureka, or any of the areas there—I am sure that the mining areas, the mountain and desert areas, will be the feasible areas—you have a State that is intensely interested in the whole practical advancement of not only the military aspects but the commercial aspects. They are really more interested in the commercial aspects.

You have a letter from the Governor. There are 160,000 people in 110,000 square miles. It means that in anything you do there, the whole State is behind you. I think you all realize that that is an

item. Because if you started to construct something in any State or any community and the people objected to it, it would make it very uncomfortable. I do not believe you would ever find that in the State of Nevada, because they welcome development.

Another factor I want to mention to you is your defense, the safety factor. Most of your atomic-energy brains right at the moment, at least a year ago when I investigated it, are within submarine shooting distance of either coast, like your Cal-Tech, your University of California, your Massachusetts Tech; and it will become an item in case we really have any trouble with anyone, and we are talking about it all the time.

On the other hand, anything you have between those two ranges of mountains, the Sierra Nevada Mountains on the west, which form quite a lot of boundary between California and Nevada, and the Rocky Mountains on the east, eight States in there, is surely well located. And I think increasingly you will determine through your studies that the more of your laboratories and your experiments you can get in between those mountains, where you have a secondary defense, the better.

You will remember that when the Japs bombarded Alaska I went up there for the Senate Military Affairs Committee and made the report. If they had not finished the Japanese, which they apparently did not in some ways, they could have taken Alaska and gone down the coast, and the Sierra Nevada Mountains might have been our frontlines.

So you need some of your brains—and I am talking about atomic-energy brains, which are not common at all—in between the Sierra Nevadas and the Rocky Mountain Range.

I expect most all of you folks have been to these plants—Oak Ridge, Long Island. The men who are doing these jobs are not men of the age of your chairman or the junior Senator from Nevada. They are from 25 to 40 years old. A lot of them look like kids. But they are experts in the nuclear-energy field. And that is a field in itself. We are not going to become experts in that field. We do not have time.

So those are the kind you need, and you need a laboratory, one or more, whatever is necessary, in that intermountain area. I am talking about this reactor now, the safety of it, and these experiments that are going on at the University of Nevada that I mentioned, the experiments of the effect of radiation dust on animal and plant life, water, and soil, and the new and improved methods of beneficiation of uranium ore. All of that is going on there now.

And I urge you just to consider that safety factor along with the rest of it.

Mr. Chairman, I want to thank you for the opportunity of visiting with you.

Representative HINSHAW. Thank you very much, Senator. It has been a pleasure to have you before us.

Senator MALONE. Thank you.

Representative HINSHAW. Is Mr. Casper W. Ooms here?

Mr. OOMS. Here.

Representative HINSHAW. Mr. Ooms is well known as a former United States Commissioner of Patents. Mr. Casper W. Ooms has long been recognized as a leading patent authority. Since April

1949 he has served as the Chairman of the Atomic Energy Commission's Patent Compensation Board, as well as a member of its Patent Advisory Panel, and has had a particularly active interest in the workings of the patent portion of the act, section 11. Mr. Ooms addressed the Fifth Summer Institute of the Phoenix memorial project at the University of Michigan in June 1952. That symposium was devoted to some of the industrial and legal problems arising in connection with peacetime utilization of atomic energy. His lecture appears in the published transcript of the Summer Institute.

We are particularly pleased to have you, Mr. Ooms, and I expect that you will make a valuable contribution to our thinking.

STATEMENT OF CASPER W. OOMS, FORMER UNITED STATES PATENT COMMISSIONER, AND CHAIRMAN OF THE AEC PATENT COMPENSATION BOARD

Mr. Ooms. Thank you, Mr. Chairman and gentlemen.

My name is Casper W. Ooms. I am an attorney with an office in Chicago. For the past 25 years I have specialized in patent problems and the trial of patent cases. From 1945 to 1947 I was United States Commissioner of Patents. Since the creation of a Patent Advisory Panel of the Atomic Energy Commission, I have been a member of that panel, and since the creation of the Patent Compensation Board of the Atomic Energy Commission, I have been its Chairman.

I am appearing here at the invitation of the committee and presenting only my own personal views.

Inasmuch as there is no bill before this committee to which I can address myself, I plan to make a brief statement with respect to the patent provisions of the Atomic Energy Act of 1946 and then, if the members of the committee desire, answer such questions as they may ask.

I have been interested in the Atomic Energy Act since its passage, have attempted to keep informed on the patent activities under the act, and have written a few articles on the subject.

In my opinion, the patent provisions in section 11 of the Atomic Energy Act, directed as they were to a program which contemplated a continuing Government monopoly in the field of atomic energy, have fairly well served their purpose without any serious impact either upon the program or upon the patent system. Considering the other formidable aspects of this entire subject, the patent question has been, I think, given more weight and created more controversy than it warrants. There is, however, a sincere concern expressed by industry and by many responsible critics of the program with respect to the patent provisions of the act, and any legislation must necessarily give heed to that concern and attempt to meet the problem to insure the widest possible participation by civilian industry in the program.

As I have said, in my opinion, the patent provisions of the act have served their purpose and have been without any substantial adverse effect. Now, however, that the Government monopoly in the production and utilization of atomic energy is to be surrendered and industry drawn into the program, every incentive and encourage-

ment must be given to enlist that participation. The patent provisions must be modified and atomic energy brought within the normal operations of the patent system to the fullest extent that that is now possible. The patent system has been an integral factor in American industrial enterprise since the creation of this Government. Whatever its shortcomings, its contribution to our industrial progress has been substantial if not immeasurable. Its effect upon the techniques in the field of atomic energy should be substantial.

This does not mean, however, that all departures from the conventional patent system must be eliminated from atomic energy legislation. We have, on the one hand, the substantial concern by industry for the protection of the patent system upon the contributions it makes to this technology. We have, on the other hand, a widely expressed fear, that, inasmuch as participation in the development of civilian atomic energy applications cannot be universal because of the limitations of necessary materials, the scarcity of competent technical men, and inevitable security problems, the select group that may be enlisted in the early stages of this work may derive an unconscionable advantage and actually secure a monopolistic position that will embarrass the program forever.

The temptation to exaggerate this latter aspect is great. How real the threat is cannot be demonstrated, but as long as the possibility exists or as long as there is real concern that it may arise, this legislation should take account of that possibility and provide against it.

In brief, what I propose is that the patent section of the act be modified to eliminate, except as to military weapons, the prohibitions with respect to patenting certain inventions in this field. I would maintain the reporting provisions and the exemption from patent interference of research activities. I would also prescribe a restricted and tightened up provision for making the inventions, where necessary to effectuate the policies and purposes of this legislation, available by licensing to others than the inventors. I have redrawn section 11 (c) (1-2) to accomplish that and I am attaching to this statement that revised section.

This provision would probably make unnecessary any provision in the act with respect to the acquisition of patents of others by the Atomic Energy Commission, although I would leave undisturbed the provisions with respect to the award system created under the act and the Patent Compensation Board to hear claims for compensation and awards.

With respect to eliminating prohibitions of patenting certain inventions now found in section 11 (a) (1-2) of the act of 1946, I would adopt the amendments proposed in the bill of Congressman Van Zandt, H. R. 4687.

There are certain other saving clauses with respect to these changes in the act that would be necessary in view of the changes in section 11 (a) (1-2) and suggestions for these are found on pages 8 and 9 of the draft submitted by Karl Cohen, who testified before this committee.

The draft of the licensing provision which I am presenting is merely suggestive, and I call attention to the fact that it is distinguished from the earlier section 11 (c) in that there is no automatic licensing even though the Commission declares the patent affected with "the public interest," but that each applicant for a license must demonstrate separately that the license is necessary to effectuate the policies and

purposes of the act. This restriction is maintained to make the invocation of this licensing power an exception and an infrequently used device. It is intended to guard against the fear that the inventor who is willing to devote his resources to making developments in this field would be compelled to share his contributions with his competitors and to insure that he will be required to give licenses only in the extreme and infrequent situation where that is necessary to accomplish the designs of this legislation.

It should also be observed that it is not contemplated that this procedure is intended to be a permanent exception to our patent system. All legislation in this field is necessarily tentative. Some explanation should be made, however, that this provision is designed merely as an interim measure during the transitional period when general participation in the program is not feasible.

I realize that there will be a great deal of discussion before this committee on the patent phases, and no doubt some better expedient than that which I have suggested may be contrived. I have no particular affection for this form of language or licensing device. I have no use whatsoever for a general compulsory licensing scheme. I do think, however, that the special considerations which are involved in liberating atomic energy from a Government monopoly and domesticating it for general industrial use dictate that some exceptions to conventional patent protection may still have to be invoked.

Representative HINSHAW. Mr. Ooms, we will include in your statement the proposed amendment of section 11 (c) of the act, immediately following your statement.

(The material referred to follows:)

ATOMIC ENERGY ACT OF 1946—PROPOSED AMENDMENT OF SECTION 11 (c)

PATENTS AND INVENTIONS

(42 U. S. C. 1811)

SEC. 11. * * *

(c) Nonmilitary Utilization—

(1) The Commission may declare any patent to be affected with the public interest if (A) the invention or discovery covered by the patent produces, utilizes, or is essential in the production or utilization of fissionable material or atomic energy; and (B) the licensing of such invention or discovery under this subsection is necessary to effectuate the policies and purposes of this Act.

(2) Whenever any patent has been declared, pursuant to paragraph (1), to be affected with the public interest—

(A) The Commission is hereby licensed to use the invention or discovery covered by such patent in performing any of its powers under this Act; and

(B) Any person may apply to the Commission for a license to use the invention or discovery covered by such patent, and the Commission may grant such license if it finds that the granting of such license is necessary to effectuate the policies and purposes of this Act. The owner of the patent shall be entitled to a reasonable royalty fee for any use of an invention or discovery licensed by this subsection. Such royalty fee and the terms of the license may be agreed upon by such owner and the licensee, or in the absence of such agreement shall be determined by the Commission.

(3) * * * (no change).

Representative HINSHAW. I wish to thank you very gratefully for this contribution.

Are there any questions?

Representative HOLIFIELD. Mr. Chairman, I would like to ask a few questions.

Representative HINSHAW. Mr. Holifield.

Representative HOLIFIELD. Mr. Ooms, your statement is going to be very valuable to the committee, particularly in view of your background of knowledge on this subject, and it is obvious that upon such a short scrutiny of it, there may be many points in it which we cannot at this time question you on, because of our own lack of knowledge of their implications.

However, I was pleased to note that your statement is quite judicious, in that you recognize that we are dealing with a problem which is not a normal industrial problem. I think that is expressed in several places in your statement.

Also I am interested in the statement that you made that up until this time you do not believe that the patent provisions in section 11 has had an adverse effect upon the development of atomic energy under the purposes of the act.

Now, down at the bottom of the first page, you say that there is a widely expressed fear that a select group may be enlisted in the early stages of this work and that they may derive an unconscionable advantage and actually secure a monopolistic position that will embarrass the program forever.

It is true that some of us do have that fear. I would like to ask you why we should give any restrictive patent rights during this comparatively short interim period and during the time when all of the technology that has been accumulated over the past 7 years is nearing fruition, when there is a comparatively short length of time to go until we get to the point envisaged by the act where it has practical industrial value? Why should any restrictive patents be given during this interim period?

Mr. OOMS. I wonder, Mr. Holifield, whether we can say with any assurance that it is going to be a short period?

Representative HOLIFIELD. I do not think we can. But I think it is generally conceded by the testimony that is before us that energy can be produced at this time within a range of 2 or 3 times the cost of conventional power, the average cost of conventional power. And if that be true, and we have had some very strong testimony on that point, then it would indicate that in many parts of the world it is already possible, where power costs are high, to almost compete with the cost of presently produced power.

Mr. OOMS. To answer your question, the objective that I think every industrial witness that has appeared here has expressed is a desire to get into this on a normal industrial basis. And I think we must recognize that this is not a normal industrial problem. If it were, I would say, "Forget all special regulations. Just throw it under the regular patent system."

But here we have a system where, as I have gathered rather hurriedly from the testimony of the witnesses that have appeared here in the last month, I find none of them saying that there is likely to be any one way to do anything in this program. I think the people who know most about reactors have said there are great numbers of designs and alternatives for each one of these. And there is one thing that our patent system has done: We think, most frequently, of the restrictive aspects of it—but that has a blessing to it, too, in that

if you give an inventor a patent upon one way of doing something, if other people want to compete with him, they have to devise an equally good way to do it. The patent system works what some of the authorities call a compulsory diversification. And in this field, it is just as necessary as any place else, that we put as many people with as many different approaches to this thing at work upon it as we can, considering all the other limitations, such as materials and security and everything else.

I think if we say, "None of you will have the benefit of your research in it," we may put all of them in a position where they will say, "Let the Atomic Energy Commission or the big people in the world do the experimental work, and then we will come in 5 years from now."

I say that that might have an adverse effect upon the program. And the reason why I suggest this one licensing procedure to be used in extremities is because if the case ever does arise where a patent is issued to somebody on a technique in this field that is so unique that no substitute can be found for it, then the Commission shall have the power, under this section 11 (c), to make it available to other people. But I think to do that generally, with everything that is devised in this program, may have a dampening effect upon the approach of industry. I do not think you will get as many people trying to contrive new ways of applying atomic energy if you make everything that is learned immediately available without cost to everybody involved in the program.

I think there is an advantage in the restrictions, in that you compel people to apply themselves to diverse approaches and alternative methods.

That is the way it has worked in the patent system, and I think it will work that way here. But we still, by this provision of section 11 (c) would prevent anybody from ever getting such a restrictive hold on any particular technique that it would embarrass the program.

Representative HOLIFIELD. I think that is a wise suggestion. Because if we assume, as an example, and I am not using the correct numbers, that there are 5 different types of reactors in prospect, and assume that 5 study groups go into this program, and there are going to be, of necessity, a limited number go in, because of the amount of funds necessary and other complications, such as adequately trained personnel, assuming that 5 go into it, suppose out of the 5 types of reactor development, there is a reactor development which is so outstandingly successful that it almost nullifies the value of the other reactors. Now, it would seem to me that if that does occur, it has occurred because of the tremendous amount of free technology which is now available to these study groups, which has been paid for with tax moneys.

Therefore, it would seem to me that an ordinary type of patent which would allow that particular group to restrict the use of that type of a reactor from all the rest of American industry and American political subdivisions would be highly undesirable, and it would certainly not fulfill the purpose of the act, which is to strengthen free competition. It would be just the opposite; it would limit free competition. And it would limit the benefits of it being obtained by the masses of the American people.

So it seems to me that you have touched upon a very important point there, and I think you have wisely suggested that somewhere

in the changes in the patent laws, there be an escape clause there which would allow, upon reasonable determination by a competent patent award board, a finding that such a type of drastic or radical improvement would not become restricted and restrained from general use.

I think you have wisely suggested that, and it has not been suggested before, incidentally.

Mr. OOMS. Well, it was in the original act.

Representative HOLIFIELD. Yes, it is in the original act. And that is one of the things that has bothered me, that in what we believe to be a relatively short interim period between the status where we are now and the final accomplishment, someone should be allowed to come in and skim the cream off this whole development through a restrictive patent.

I think if Congress allows that, they would be defaulting on their duty to the taxpayer, personally.

Mr. OOMS. Mr. Holifield, I do not think it could occur with the kind of act which I contemplate here, and with this single provision for preventing just that thing.

Representative HOLIFIELD. What do you mean on page 2, third paragraph, by the adopting of amendments in Congressman Van Zandt's bill? What is your general thought on that?

Mr. OOMS. You will recall, Mr. Holifield, that in the original act there were prohibitions against the patenting of inventions for the production of fissionable material, and the utilization of fissionable material or atomic energy for a military weapon. That was prohibited. Obviously, the prohibition was innocuous there, because nobody could own production facilities. No one could own any uranium at that time.

Now that you are, if the legislation which everybody envisages does occur, going to permit facilities for the production of fissionable material and atomic energy, a patent should likewise be permitted in that field. There would remain the patenting restrictions as to military weapons.

Representative HOLIFIELD. You think that should be maintained, do you not?

Mr. OOMS. I do.

As a general proposition, I have a quarrel with a great many of my brothers as to whether you should permit any patents on military weapons. Because as distinguished from an invention, a patent is merely the power to exclude somebody from using something.

Representative HOLIFIELD. That is right.

Mr. OOMS. And, obviously, your enemies are the people you want to stop using military weapons, and not your friends, and you really don't need patents on military weapons. But as long as the provision is here, it has certain side values, such as reducing the opportunities for leakage, secrecy, things of that kind; so that I think the provision should be retained with respect to military weapons but nothing else.

Representative HOLIFIELD. Getting back to our previous line of inquiry, do you believe that the redrawn section 11 (c) (1) and (2), as submitted here, would effectively protect the Government in making available by licensing to others than the inventors these very important patents that we spoke of?

Mr. OOMS. I think it would. I think it would furnish adequate protection to the people, to the patent owner, to the patent owner's

competitors. I think it would meet precisely the problem which you put your finger on in the first place.

Representative HOLIFIELD. I notice that as to the restrictions with respect to the award system created under the act, and the Patent Compensation Board to hear claims for compensation awards, you leave that untouched. And I am wondering, on that point, if it would not be better to have a separate patent compensation board acting independently of the Atomic Energy Commission, rather than under the domination of a Commission, which, of necessity, is interested more in other things? And I am wondering if this is not a matter of such importance that it would justify a special board appointed by the President and confirmed by the Senate, of men that are highly qualified in the field of patent technology and background of patent law and so forth, and also with the public interest involved in that Board.

Mr. Ooms. I think everything should be done to maintain the independence of the Board.

I always fear, as I am sure you must, the creation of board upon board. Having sat on that Board continuously since it was created in 1949, I can say we have had complete independence. In fact, when the regulations were drawn, at the suggestion of the Patent Advisory Panel, a provision was put in there that the decision of the Board would be final and could not even be disturbed by the Commission. There has not been any kind of dominance of that Board by the Commission.

Representative HOLIFIELD. I did not mean to infer that there had been. I recognize that the arrangement has been very satisfactory to date. But I was thinking of the future. Because, as a matter of fact, your Board has not had to function on the scale that it will have to function on in the future, nor in as wide a field, with possibly as many applications for patents. It being up to now a restricted field, my opinion would be that you have not had to function as broadly as you will in the future.

Mr. Ooms. That is correct. We have had, I think, only a dozen applications before us, some of them of great difficulty, some of them extremely simple. And there isn't any doubt that as this program expands and you get civilian participation, the functions of the Board, if one is retained under the legislation, would be enlarged very substantially.

Representative HOLIFIELD. Are they subject to tenure of office by the will of the Commission?

Mr. Ooms. Yes, under the statute they have to be employees of the Commission. I don't think any of them are paid. We are all serving without compensation. We are WAE, as I think the civil service phrase is. We are Government employees to that extent. We could be, I think, dismissed by the Commission at any time.

Representative HOLIFIELD. Looking forward into this function in a larger field, do you not think this is going to be a matter of enough importance to require a permanent board acting independently, with membership with standard terms, just as we have on other quasi-judicial boards, quasi-regulatory boards?

Mr. Ooms. I would think so, but I think I would be cautious about assuming that it is going to be immediately a board with any large burdens. I think it will start out quite modestly.

Representative HOLIFIELD. But in the changing of the act, I think if we do change the act, I think we want to do a good job and draft as nearly as possible a pretty strong and competent act. And certainly this field is a field that cannot be ignored and should be given a great deal of thought and a great deal of wisdom in the drafting.

Mr. OOMS. I agree with you. I would hate to have anybody think that I was suggesting it to preserve this free job I have.

Representative HOLIFIELD. Even though the applications come gradually at first, I can foresee the time when they might come very fast, or when one particular application might be of such tremendous importance that it would more than justify having a very carefully appointed statutory board.

Mr. OOMS. We have one before us now which I think has a problem in it which is as great as any that have come before the courts of this country.

Representative HOLIFIELD. That is indicative of what I am concerned with.

Mr. OOMS. I think we have the men to take care of it. We have an attorney, a technical man, and a great industrial expert, and every time the Board has sat all have participated, and nothing has happened that hasn't been unanimously decided upon, and we have had no serious criticism of any kind.

Representative HOLIFIELD. I am sure that is true.

Now, as a member of the committee, I confess that I am not as well informed on the work of your Board as I should be. And I do not believe any other member of the committee is as well informed as he should be. And the reason we are not is that we know the action has been very limited up to date, and we have had, of course, complete confidence in the members of the Commission and in the members of your Advisory Board. But looking forward to a different situation, I think it behooves us to find out what you have done, how many patents you have granted, how you have arrived at an agreement upon compensation.

Mr. OOMS. That has been summarized up to June of last year in that article of mine to which the chairman referred.

Representative HOLIFIELD. Yes.

Mr. OOMS. There has been very little activity since then. We have had a couple of hearings, and there has been one case settled, and we have two cases pending before us at the present time.

Representative HOLIFIELD. Are the criteria that you make your decisions on publicly available?

Mr. OOMS. Yes; we have written an opinion in every case, Mr. Holifield.

Representative HOLIFIELD. You have rendered a written opinion, and your reasons therefor are a matter of record, I suppose?

Mr. OOMS. Yes, sir; and copies of them are available from the Atomic Energy Commission.

Representative HINSHAW. You mean they are available to the public?

Mr. OOMS. Yes. We have thus far not been required to classify anything.

There have been some of the applications and documents that have been under classification for short periods, but we have expressed ourselves quite early as making freely available to the public everything that could safely be made available to the public in those proceedings.

Representative HOLIFIELD. Now, that is another point. In the granting of these patents by the Board, they face an abnormal situation, in that in some instances they are not allowed to be publicized as would normal patent data, because of their military application; dual applications, I mean, both for civilian purposes and for military purposes.

Mr. OOMS. Of course, the Patent Office still handles the function of issuing the patents. All we pass on is the values of those that have been condemned by the act. I think there has been only one that has been actually vitiated by the act. And we pass upon applications for awards for making inventions which are no longer patentable under the act.

We did contemplate that we would have a great many problems of security; and in the case in which that did arise, the case was, fortunately, settled, so that we did not have to meet the problem of just how to handle it.

Representative HOLIFIELD. Now, just a minute. You said it was fortunately settled. You mean it was settled by compromise and by agreement with the inventor?

Mr. OOMS. The inventor and his counsel and the Atomic Energy Commission and its counsel.

Representative HOLIFIELD. And did that involve military application as well as civilian application.

Mr. OOMS. Oh, yes.

Representative HOLIFIELD. All right. That is the kind of an invention that I am thinking of, an important invention which will be used in reactor machinery or reactor processes and chemical processes, which might be of tremendous civilian use and also might be of a great deal of use to our enemies in a military way.

Now, if we are going to go into the field of widespread industrial application, is it not true that we are going to widen the field of security risk a great deal, if these gadgets and processes become available on a wide scale among many different users of reactors?

Mr. OOMS. Undoubtedly. The security problem is one in which I haven't indulged myself any further than to be sure that everything we did was amply protected by the security authorities of the Commission. But there isn't any question that the moment you expand the activities, you do increase that risk. That has to be taken care of. And I fear it will be a very serious embarrassment to the program, as long as security is a necessary aspect of it.

But I don't think that you can go into a civilian industry without taking on that additional burden.

Representative HOLIFIELD. Well, I am inclined to agree with you on that, and that is one of the reasons why I have been a little slow in wanting to jump into this thing and turn everything loose. Because I have not yet been able in my own mind—maybe it is lack of knowledge—to differentiate between civilian and military application on most of these principles that are involved. I have not been able to draw the line.

And I notice you have handled this very considerately, because here is another instance here in the last paragraph, where you say that "some exceptions to conventional patent protection may still have to be invoked." That is along the line of your testimony.

Mr. Ooms. I think that is unavoidable at this stage of this project. I would hate to think that that is a permanent problem. But I think the broader our industrial participation becomes, the less need there will be for exceptional treatment.

Representative HOLIFIELD. Now, I notice you referred to Mr. Cohen's statement on pages 8 and 9.

Will you give in your own words what that means to you?

Mr. Ooms. Mr. Cohen, when he appeared here, presented as part of his statement a redraft of the act, and I did examine the patent provisions of that redraft, because he had gone very thoroughly into this whole thing. And he did what the Van Zandt bill would do, and eliminated the prohibitions in paragraph 11 (a), and also with respect to military weapons, which neither the Van Zandt bill or my proposals disturb. And then he tried to recreate the situation as if these prohibitions had never existed. He put into his draft of the act a number of saving clauses, that would take the man, for example, who had filed an application with the Patent Office since 1946—

Representative HOLIFIELD. It would be retroactive?

Mr. Ooms. That is right. Yes.

He would give that man an opportunity to recapture a patent which was prohibited by the old act. And I think that would be a good thing to do. His saving clauses are very well drawn in that respect, with one exception. Of course, I can load this down with detail, but I think the detail can more properly come into an actual draft of the statute. And that is that he made the revival of these applications which the Patent Office had denied, automatic. I think it should require some action on the part of the holder of the patent application which had been denied before the revival took place.

Representative HOLIFIELD. They should certainly be screened from a security standpoint first. It certainly should not be made automatic without screening for security, evaluation of worth, and claim to private ownership.

Mr. Ooms. Everything in the Patent Office is screened for security.

Representative HOLIFIELD. Yes, I realize it is. But I mean the passage of the act itself should not make such items automatically patentable.

Mr. Ooms. No. That is something that can be taken care of when you get to the details of the draft.

Representative HOLIFIELD. In writing the legislation.

Mr. Ooms. Yes, sir.

Representative HOLIFIELD. And I notice in section 4, here, Mr. Cohen retains the judicial review of the Board, the action of the Commission or the Board.

Mr. Ooms. He went a little further, Mr. Holifield. As it now stands, the Patent Compensation Board makes a full record, and any review of it is upon the record made before that Board. He goes a little further.

Representative HOLIFIELD. And that review is by the Commission?

Mr. Ooms. What is that?

Representative HOLIFIELD. And that review is by the Commission?

Mr. Ooms. No, the Commission has no power; the Patent Compensation Board makes the decision, and under the regulations of the Commission with respect to that Board, the Commission has no power over that decision.

Representative HOLIFIELD. I see.

Mr. OOMS. That was intended to give this Board as complete independence, which you mentioned before, as possible.

Then, if a man is dissatisfied with the treatment that he has received at the hands of the Board, he may take the case to the Court of Appeals of the District of Columbia.

Now, Mr. Cohen's amendment would provide that when he took his case for review he would go to the district court and be permitted to put in additional evidence. Whether that is desirable or not is a matter on which lawyers will debate at great length. But as we have tried to conduct this Board, we have given each side—including the Commission, which does not really take an adverse position but presents very fully its views, and the applicant—every opportunity to bring before that Board every fact and consideration which they think important. We have completely eliminated any technical requirements, to the extent that they were not necessary, merely for orderly procedure.

The result is that the records that we have had before that board have been so full that I doubt whether any man could really add much to them. But another board might treat it differently.

Representative HOLIFIELD. Who are the other members of your board, sir?

Mr. OOMS. John V. L. Hogan, of New York, the famous radio inventor and consultant, and Mr. Isaac Harter, formerly chairman of the board of Babcock and Wilcox, who have been in various parts of the atomic-energy program since its beginning. He is a man well known in the high-temperature field and has been on the industrial advisory panel of the Commission and has served the Commission in other ways. He is our industrial member.

Mr. Hogan is our technical man. And I happen to be an attorney.

Representative HOLIFIELD. I hope your board will give further study to this matter between the time that you now appear and future consideration of legislative drafts, and that you will give to the committee the benefit of your background of knowledge.

Mr. OOMS. After you have the record as far as your joint committee does take it, I would like to review it with that in mind and submit a draft of the proposed patent section of the new act, and if I can be of any further help to the committee I shall be glad to be available.

Representative HOLIFIELD. I appreciate your testimony very much. Thank you.

Representative HINSHAW. Senator Pastore?

Senator PASTORE. Mr. Ooms, I was not here when you started your testimony. I have been trying to catch up by reading it while you were being questioned by Mr. Holifield.

I direct your attention now to the last 2 paragraphs on page 1 of your manuscript. And I think very aptly you bring out the two points of views; that is, with reference to the fears on the part of industry, that they would not invest their money, their private capital, unless they are given certain concessions on patent rights, and the fear of the public, generally, that if we have a select group that comes in at the beginning and derives all of these benefits to the disadvantage of other people, that would not be fair, either.

Now, you say, in your last paragraph on page 1:

The temptation to exaggerate this latter aspect is great. How real the threat is cannot be demonstrated.

Now, that is true. As far as the ultimate proof is concerned, we could not demonstrate it here this afternoon. But, from your experience in this whole field, and your work in the patent rights, in your opinion how real is that fear?

Mr. OOMS. The fear that some one inventor may get a dominating patent?

Senator PASTORE. Well, not some one; but that this whole field will be opened up to a great exploration of patent rights that will develop into great assets on the part of a select group, to the exclusion of all American business.

Mr. OOMS. I don't envision that the fear is substantial. But I think that we know so little about this whole field of atomic energy today that for anybody to be pontifical about it is going to be dangerous. And so I would say that as long as that fear exists, as long as the possibility seems to be that there is such a real danger, we should provide for it in the legislation.

Senator PASTORE. And all this, of course, is predicated upon the fact that the money that will be invested is exclusively private money?

Mr. OOMS. I wonder whether anybody has ever proposed that it all would be exclusively private money?

Senator PASTORE. Well, now, this is what I mean: How much are you going to liberalize these patent rights to people, when there is a partnership arrangement, where public money and private money is being used in conjunction, one with the other? Certainly you are not going to give private investors exclusive patent rights when part of the money that is being used in this project is public money too?

Mr. OOMS. We have never done it. As long as there has been contracting with any of the Government services, I think that they have required that the Government get part of the patent rights, if not all of them.

Senator PASTORE. And you would allow that to be done through negotiations?

Mr. OOMS. Yes, that is done through contract today, and I don't think anything in that act will interfere with that administrative feature of the whole program. But it is very difficult to sit here today and say there never will be any great invention or any great group of inventions that will not create an island in this field, and that those on the island will not have a greatly preferred position.

I think a lot of people are tempted to say that; they think that we do know a great deal about the field now.

Senator PASTORE. And the power to decide that will be left up to this Board that you speak of?

Mr. OOMS. To decide whether the patent is one such that it should be opened to licensing, yes. You must put it somewhere.

Senator PASTORE. And you feel it is rather significant that that can be determined?

Mr. OOMS. Yes. I think it can be.

Senator PASTORE. I say that in view of the statement that you have already made, that sometimes the granting of these patent rights is an encouragement rather than a discouragement; it encourages other people to find other ways and methods of doing the same thing.

Mr. OOMS. That is right.

Senator PASTORE. And I wonder at what point we can determine that that cannot be done.

Mr. OOMS. I think each one of those cases is going to have to be met on its own facts. I have, in the 25 years I have been in this business, seen only 1 or 2 patents for which no immediate alternative was available. There have been a couple. But in every field, as the progress develops, a patent that may seem to be dominating today may be obsolete 3 years from now.

Senator PASTORE. And you feel that all this field of atomic energy or the exploration of atomic energy for industrial use would not be any different from the cases you have experienced?

Mr. OOMS. No different in that respect.

Senator PASTORE. That is all I want to ask.

Representative HINSHAW. Are there any other questions?

If not, Mr. Ooms, I may say that up to this time your contribution made in the summer session, a transcript of which I have before me, the Summer Institute, that is, of the University of Michigan Law School, has certainly been almost the "Bible" in reference to the patent situation. We hope that others will now take an interest in it and join you in your thinking, or present different thoughts, as the case may be, to the end that a wholesome policy may be finally established by the Government in respect to the patents in this field.

We thank you very much for your presentation and for coming down here again to meet with us.

Mr. OOMS. Thank you, Mr. Chairman.

Representative HINSHAW. Now, is Mr. Ruebhausen here?

Mr. Ruebhausen, as chairman of the committee on atomic energy of the Association of the Bar of the City of New York, has been active in discussions on some of the problems involved in getting industrial participation in atomic-power development. He has spoken particularly strongly—both at the National Industrial Conference Board conference in October 1952 and at the American Power Association Forum in March 1953—about the need for changes in the act. The particular revisions which he has advocated which concern atomic-power development relate to declassification of industrially useful nonweapon data, ownership of both plants and materials, and allowance for private patents. Mr. Ruebhausen has proposed the appointment of a special Presidential commission of inquiry to review operations to date under the act.

Mr. Ruebhausen, we are particularly pleased that you have come down here from New York, and we are delighted to hear you.

STATEMENT OF OSCAR M. RUEBHAUSEN, CHAIRMAN, SPECIAL COMMITTEE ON ATOMIC ENERGY, THE ASSOCIATION OF THE BAR OF THE CITY OF NEW YORK

Mr. RUEBHAUSEN. Mr. Chairman and members of the committee, I am pleased to be here. I have a statement that I would like to read, if I may, sir.

My name is Oscar M. Ruebhausen. I am a lawyer and, currently, I am the chairman of the special committee on atomic energy of the Association of the Bar of the City of New York. It is in that capacity that I have been asked to appear at this hearing.

At the outset, I think I should tell you something about our bar association's special committee.

We are a group of lawyers first appointed as a committee more than 4 years ago by the late Robert P. Patterson, who was then the president of our association. Judge Patterson saw in the atom a challenge to lawyers as technicians and, more importantly, as citizens. He recognized that the process of assimilating atomic energy effectively and constructively into the fabric of a free society was certain to be difficult and he wished our bar association to assist in the process.

It was also hoped that our special committee, by vigorous attention to atomic problems but without seeking access to any restricted data, might help to make up for the very disturbing lack of any real public debate on atomic matters.

In October 1949 we filed our first report as a special committee. Bethuel M. Webster, who is now the president of our association, was then our committee chairman. We commented in that report on the fact that the policies of secrecy and monopoly made it inevitable that the Nation's atomic program would be conducted without the wholesome effects of real public accountability and without the stimulus of public understanding and constructive debate. We saw a real challenge in putting atomic energy fully to work for the national well-being. Our report then continued:

In the face of challenges so fundamental, citizen groups, of which the bar is one, should take vigorous leadership in working out a constructive response. The objectives of such leadership should be at least fourfold:

First, the development of the fullest possible public understanding of atomic energy and its implications;

Second, * * * an evaluation of the extent to which secrecy and monopoly are now, or will continue to be, desirable and necessary;

Third, to the extent that secrecy or monopoly are wise and essential, the development of mechanisms which will in part make up for the free interplay of democratic forces which is now denied to atomic energy; and

Fourth, * * * the isolation and resolution * * * of technical legal problems which are within the particular professional competence of lawyers to study and resolve.

In the past 4 years we have made progress on each of these 4 fronts. We have, I think, begun to acquire perspective about the atom. It has been for us a salutary experience.

I shall not, unless you wish it, describe the steps taken by our special committee toward the four objectives recited in our first report. But, with your permission, I will turn to the matter which is of more immediate concern today, namely, the definition of Federal policy on industrial atomic power development.

As a preliminary comment, I should report that the problems surrounding greater industrial participation in atomic development are still under consideration by our special committee. We have reached no final conclusions. We do not yet have a formal committee report to file with you. When our own studies of this problem are further advanced and when we have had the benefit of the thinking developed by the joint committee through these important hearings, we hope you will give our special committee another opportunity to appear before you and to submit detailed suggestions for action.

Pending formal committee action, accordingly, the views expressed by me must be made on my own responsibility. Those views are in a very real sense, however, a product of the deliberations of our special committee.

I would like to make three observations.

First, I believe the time has come for a full reexamination of the Atomic Energy Act of 1946, of the assumptions to which it gave expression, and of the policies which it put into effect.

Second, I believe that the secrecy complex has wrongly dominated the national approach to atomic problems, that secrecy—which is a negative policy at best—has been mistakenly relied upon to achieve affirmative objectives, and that the role of secrecy in atomic matters should, in the imperative national interest, be reduced.

Third, I believe that the reasons which led to the establishment of a Government atomic monopoly in 1946 are no longer compelling and that those provisions of the law which created that monopoly should be amended.

Let me comment briefly on each of these three points.

The need for a full review of atomic policy: The suggestion that there should be a full reexamination of our basic atomic law is not a new thought. In fact it was first expressed in the McMahon Act which itself acknowledged that the legislation must “necessarily be subject to revision from time to time.” It was echoed also by Senator Millikin early in 1947 when he reminded the AEC that it was the intention of the Congress to restore to private enterprise as soon as it was safe to do so the extraordinary grants of power embodied in the McMahon Act.

Nearly 7 years have passed, however, since the McMahon Act was passed. During all that period there has been no attempt at a public reevaluation of our national atomic policies until the joint committee opened these hearings. I am pleased that the Congress has taken this most important step and I am grateful for the opportunity to participate.

The reasons why a reexamination of our atomic law and atomic policy is particularly timely might be summarized as follows:

1. The act was adopted by a nation largely ignorant of the new force with which it must come to terms. The act therefore was a temporary expedient, although a wise one. It was designed, you might say, to hold the status quo pending a greater knowledge and a fuller understanding of all the factors involved.

2. Seven years of aggressive administration by the AEC have opened up new vistas and new problems. They have also brought the atom into perspective as a fixture of modern life. This new understanding and new knowledge should be drawn upon not only to test the wisdom of the policies to which we are now committed but to move forward affirmatively and with confidence to the realization of the goals expressed in the McMahon Act. We cannot afford to persevere without question in policies which were grounded on the tentative assumptions of 1946.

3. Responsible men who have been closely associated with the atomic enterprise have asserted that the atomic policies embedded in the McMahon Act are wrong, that they are hurting our military progress, our economic development, and our welfare as a nation. When men like Lilienthal, Oppenheimer, and Dean—to whom the Nation is deeply indebted for their dedicated and outstanding service—when such men urge that we are on the wrong path, we owe it to ourselves to hear them out.

For some time I have felt that a real contribution could be made to the construction of new and affirmative atomic policies if public hearings by the joint committee were supplemented by a high level, nonpartisan study of our atomic program by men of unimpeachable competence and objectivity. To this end I once proposed that the President of the United States create a special Commission of citizens to review the Government's stewardship of the atom during the past decade and to recommend desirable revisions in our atomic policies and the controlling law. I still think that proposal has merit. Such a Presidential Commission made up of leading citizens, scientists, and industrialists who have not previously had any responsibility for the administration of our atomic affairs could bring a much-needed fresh point of view to our atomic problems. It would be a partial substitute, moreover, for the public opinion and the public debate on atomic affairs which has failed to develop as it would have were it not for secrecy.

As matters now stand there is only one group in this entire country today that has in its possession all of the pertinent facts relating to our atomic-energy program. That group is the AEC itself. While the AEC enjoys, and deserves, the full confidence of the American people, the definition of the proper atomic policies for the Nation is a matter of exceeding importance. It is not only sound, but necessary, that the judgment and testimony of the AEC be supplemented with that of independent and objective private citizens who have full access to all the facts. I know of no such private citizens, today. There could be informed private citizens of this type, however, if the President would empanel a special citizens' Commission to ascertain the facts, if he would grant to it the funds for an adequate staff and request a report in time for action at the next session of Congress.

Representative HINSHAW. Mr. Ruebhausen, I might suggest to you that this committee is such a body.

Mr. RUEBHAUSEN. It is, sir. And the point I had in mind about it not having all the facts is that I understood in self-restraint it had asked that some of the facts not be revealed to it; and, secondly, while the full daily flow of information would reach the Commission, this committee would not have the responsibility for the knowledge that the AEC had.

Representative HINSHAW. Well, I think that that time has long passed.

Mr. RUEBHAUSEN. I had not appreciated that, sir.

Well, I will amend my statement to that effect.

Representative HINSHAW. We are conducting such an investigation at this time.

Mr. RUEBHAUSEN. That is correct, sir, and it is a very worthwhile thing and one which I should think the Nation would be proud to have done. There is nothing more important than to try to reevaluate the premises on which we have been proceeding. We may come out with the same conclusions, but I think it would be a healthy thing to look into the premises that we have been operating on.

Now, a word about secrecy. Secrecy in government is the very antithesis of democracy. The basic tenet of our democracy is, as Judge Learned Hand has said, that "the right conclusions are more likely to be gathered out of a multitude of tongues than through any kind of authoritative selection." This is the principle on which

we have staked our all as a nation—yet it is a principle from which we have departed in the case of nuclear fission.

In the name of security we have fenced off and marked "For the AEC only" an entire science, a wholly new industry, and a large and steadily expanding Government operation. We would not have dreamed of indulging in such a fundamental departure from principle for anything other than nuclear physics. We don't do it for electronics, or for chemistry, or for the aircraft industry. Yet each of them is as inextricably involved in our security as is the atom. Why then have we done this to the atom? Atomic secrecy is, I think, the special price we are paying for the fright and the shock with which the phenomenon of fission clouded our thinking in 1945. The price is exorbitant because it subordinates a fundamental principle of democracy to a concept of temporary military expediency.

Representative HOLIFIELD. Could I stop you for just a minute, Mr. Ruebhausen? You are making some statements there which I would like you to explain a little bit.

Do you mean to say that now you have no compunction at all about revealing everything that we know about atomic fission?

Mr. RUEBHAUSEN. No, sir.

Representative HOLIFIELD. Well, how far would you go? We have got the Atomic Energy Commission, a group of representative men, who have been studying this and have been periodically making known to the public everything that they felt was safe from a military standpoint. We have had periodic declassifications of a great deal of information.

Now, with all fairness, I do not think you can put electronics or chemistry or the aircraft industry into the same compartment as that into which you put atomic fission.

Mr. RUEBHAUSEN. No; I don't think you can, sir; but my point is this: With atomic energy the whole attitude has been that it is primarily and paramountly a military weapon. That certainly was true back in 1946, but—

Representative HOLIFIELD. Now, on that point, our objective has been, since the forming of the AEC, to achieve military stature. That has been the primary objective. It is the primary objective of the act. It remains the primary objective at this point, because we have no lack of conventional power. We have plenty of conventional power, and will have for four or five hundred years. It is desirable. We want to explore it. We want to obtain it, from the standpoint of acquisition of another source of power. But there is no driving necessity on it like there has been in the last 7 years upon the acquiring of a strong military stature.

And so it is not a matter that has been idly decided upon or negligently approached. It has been a deliberate policy, a considered policy, by the President, by the Congress, and by everyone else concerned with it, to get ourselves into a position of military strength as quickly as possible.

These other things, that are secondary in importance, can come later.

Mr. RUEBHAUSEN. And I wouldn't take away from that paramount objective, sir.

In answer to your first question, as to where you draw the line, that is a most crucial and difficult question on which I am not prepared to answer. I can't answer it.

Representative HOLIFIELD. You have made the statement here that "the price is exorbitant because it subordinates a fundamental principle of democracy to a concept of temporary military expediency."

Mr. RUEBHAUSEN. Yes, sir.

Representative HOLIFIELD. Of course, I do not believe that is true.

Mr. RUEBHAUSEN. Well, in terms of principle, I feel confident, myself, that the lasting progress of this country can only come if the administration of our Government is open and free and information is free. Secrecy has a place, and a most important place. And I would certainly say without qualification that anything pertaining to a military weapon should be secret.

Now, the crucial question is, and it is one I think you asked Mr. Ooms before: Are you satisfied that there is anything involved in atomic energy that does not pertain to a military weapon?

I can't answer that. I don't have the facts.

Representative HOLIFIELD. Then the price that we have paid, in terms of secrecy or in terms of subordinating a fundamental principle, may not have been exorbitant. It may be a necessary price.

Mr. RUEBHAUSEN. If it is necessary, it is not exorbitant, sir.

Representative HOLIFIELD. You may proceed.

Mr. RUEBHAUSEN. Moreover, it seems to me we have been confusing secrecy with security. Secrecy can, it is true, in many situations, contribute to security. But secrecy, applied wholesale as an affirmative instrument of policy, will ultimately defeat security. Secrecy badly impedes our own progress as a Nation; and yet real security lies only in our dynamic and continuous development, on all fronts, at a rate faster than that of any other nation. Our main effort, therefore, should be directed to creating the conditions under which maximum progress is possible. Pervasive secrecy is not one of these conditions.

There is a place, and a necessary one, for secrecy. But secrecy should be the exception, not the rule. Certainly all atomic military gadgetry, weapons, and plans should be secret and remain so as long as there is any clear advantage in it—but I do not think secrecy should extend much further.

There is, I think, another and fundamental reason why the present policy of atomic secrecy should be changed. I have grave doubts about the present situation under which access to atomic knowledge is confined to the relatively few who are AEC contractors or subcontractors. I question the fairness and hence the propriety of a system by which the United States Government opens an area of such fruitful and limitless possibilities as nuclear fission to less than all of its citizens. This is not said critically of the AEC for in this regard the AEC has consciously endeavored to mitigate the consequences imposed upon it by the law. Nor is it said critically of those companies which, not without sacrifice, have taken on AEC contracts.

It is, however, a fact that rich advantages beckon for those who have access to this new frontier of science and industry. Accordingly, while there are several possible courses of action, only one seems to me to be sound. The alternatives are three: Either first, the new frontier should be closed to all except Government officials—and that would, I think, be the height of folly—or second, the frontier should be opened, as it is now, to a selected group of corporations chosen by the Government, or third, the frontier should be opened to all citizens alike. The latter course, alone, is in keeping with the traditions

and principles which have given us our strength and vitality as a Nation.

A more limited application of secrecy in atomic affairs would have other advantages as well. It would be more manageable; it would cost less both in dollars and in the time of the scientists and administrators responsible for the success of our atomic program. If there were fewer so-called secrets to keep I think we could also expect to be more successful in keeping them.

Let us assume we can agree that the area of secrecy should be reduced. How then do we define the matters that should remain secret? How do we determine in advance which data, if released, would, on balance, be hurtful to our security? How can we decide when data long held secret need no longer be so confined? Such questions are by no means easy. Nor do I think they can be conclusively answered in advance by legislation. In the last analysis, within standards established by the Congress, the final decisions on secrecy must be left for administrative discretion.

But there is one specific suggestion I would like to make. Under the present law the conception of secret, or restricted, atomic data is extremely broad. It includes not only military data but also all data concerning the production of fissionable material and, indeed, the use of fissionable material in the production of power. Today, in effect, all data in the atomic field is "born secret"—and it stays secret until the Commission can meet the almost impossible burden of proving that its release will not adversely affect the common defense and security.

I think it clear that this approach should be reversed. I would urge that the law be revised so that all atomic data will be "born free," as it were, except for data falling within certain specific categories defined by the Congress—such as data related to the manufacture or use of atomic weapons—and except for data which the AEC affirmatively determines cannot be published without adversely affecting the common defense and security. Under such a proposal data concerning the use of fissionable material in the production of power, for example, would become public unless the AEC found positive reasons for holding it secret.

This proposal may seem like a minor change in the law; but I believe it could have a powerful effect on lifting the withering hand of secrecy from our atomic progress. Any amendment putting such a change into effect, however, should involve two other features: first, the amendment should before it becomes effective grant a sufficient interval of time, say 6 months, to the AEC to review all classified data and to determine affirmatively what portions of it would adversely affect our security if published; and second, the amendment should contain a clear statement of the standards to be applied by the AEC in determining the limited types of information which must still be held in secrecy. I would urge, moreover, that such standards should not be materially different from the classification standards now applied to any other national activity which has military significance.

In conclusion, I should like to say just a word about the atomic monopoly.

I am satisfied that the present atomic monopoly is unnecessary and undesirable. It is unnecessary because the reasons which dictated

the establishment of a monopoly in 1946 do not have a persuasive force today. Moreover, I do not believe that a monopoly, no matter how able or enlightened, is the best instrumentality for the achievement of the atomic progress which is desired by, and assuredly due to, the American people.

The job of developing vigorously our atomic potential for the safety and welfare of the Nation is, simply, too important, too big and too varied to entrust to any single group. Such a job should be entrusted, under Government guidance and regulation, to the multitude of talents that make up American industry, American management, and the American professions. No monopoly can ever command the versatility, the daring, or the willingness to fail which is characteristic of the free-enterprise system.

Our job as a Nation is to convert the potentialities of atomic energy into the greatest good, for the greatest number in the shortest possible time. There is nothing in American history, experience, or philosophy which indicates that a monopoly will do that job. We can, however, look with confidence to what might be accomplished if the full vigor and ingenuity of this country are turned loose on atomic matters. While under a system such as ours we can never tell in advance from what quarter progress will come, we can be certain that progress will surely be made. As long as men are free, ideas are open, and the successful are rewarded, this will continue to be so.

I urge, accordingly, that the McMahon Act be revised so as to put an end to the Government monopoly, so as to permit the private ownership and use of fissionable materials and so as to permit the private ownership and use of production facilities. Any such amendment of the act will clearly be a complicated task. In order to begin thinking through some of the difficult problems involved, an associate of mine, Robert B. von Mehren, and I, collaborated in preparing a manuscript. This manuscript was designed in part as a working tool for our special committee. As our writing progressed, however, we thought our studies might make a useful contribution if published. We were pleased that the editors of the Harvard Law Review agreed in this and in June published our manuscript under the title, "The Atomic Energy Act and the Private Production of Atomic Power." I refer to this article because in it you will find my present thoughts on a number of the detailed problems which will be involved in any amendment of the McMahon Act along the lines I have suggested today.

I repeat the hope that our special committee will have an opportunity to report to you more fully next year on any proposed changes either in atomic policies or the basic legislation.

In the meantime, for myself and on behalf of our special committee, I thank you for the opportunity to appear today, and I appreciate your courtesy in hearing my statement.

Representative HINSHAW. Mr. Ruebhausen, we are very pleased to have had you and certainly will accept your comments for study.

There are perhaps a few points in it that might be challenged.

You seem to think that the information that is classified by the Atomic Energy Commission is only in the hands of the Government and a few corporations.

I would like to point out to you that 28 universities, in conjunction with the University of Chicago, are engaged in a very important

project in DuPage County and the adjoining Cook County; that 9 universities are engaged in conjunction with the Brookhaven Laboratories; at least 30 are working in conjunction with the Oak Ridge Laboratories; and then there is the University of California in the Los Alamos Laboratories and the Radiation Laboratory, at Berkeley; and also the activities at Livermore, Calif.; and that some 150 universities and 25 hospitals are engaged by the Commission in doing research on various subjects; and that about 75 percent of the scientists who are at all competent on matters of this sort or even matters related to it are engaged in the project or have been engaged in the project.

So that it is not confined to a few corporations, nor is it confined to the Government. Many persons have been employed by the Government from time to time that are now in the universities, and the universities themselves have contributed greatly to the Government. This, I think my colleagues will agree with me, has been a great public undertaking.

Representative VAN ZANDT. Mr. Chairman, is it not true that there is a standing invitation to universities and individuals to contact the AEC for the purpose of joining study groups?

Representative HINSHAW. I think that is true. While there has been a very strong degree of secrecy surrounding the work, the problems of secrecy and the problems of security have been met only by a widespread demand that those who are engaged in the project in one way or another keep their mouths shut. That means that a lot of people have had to keep their mouths shut, and it means that a great many security officers are engaged in seeing to it that only those people who can successfully keep their mouths shut are engaged in the project.

Representative HOLIFIELD. It might interest you, Mr. Ruebhausen, to know that some 15,000 corporations have participated in atomic-energy work, and close to a half million people have been given security check by the FBI and the Civil Service Commission for participation in the program.

Mr. RUEBHAUSEN. Those are all impressive totals, and I think the Commission should be congratulated that it has been able to bring that about.

Representative HINSHAW. It has been a monumental task, I might say, for the security officers. And the fact that the information has been so well held even by so many people is a compliment to the American scientists and the American workers who have joined in the project.

Mr. RUEBHAUSEN. I think my only point, sir, is that 15,000 corporations or even a half a million people, large as those totals are, are really only just a small part of the latent talent that is in this country. We can't tell whether it will be a 22-year old in his own laboratory in Iowa or whether it will be a director of research in one of our major organizations who will produce progress. I think our Nation can gain if there is the fullest access to such scientific knowledge and such technology as can be released without compromising genuine military applications.

Representative HINSHAW. Well, there have been a great many volumes of facts released by the Atomic Energy Commission in its declassification work. There have been several sessions of declassification, that have produced many volumes of material. And I am sure that declassification is a thing that takes place constantly, not over a

period of any 6 months or a year, because a new quantity of classifiable material appears every day, that in turn must be studied for declassification.

Representative VAN ZANDT. Mr. Chairman, in the field of newspapers, radio, and magazines we have a lot of individuals posing as scientists in the field of atomic energy.

Representative HINSHAW. Why, certainly. And many of the newswriters are far ahead of most of us in the business.

Well, I only make those comments because perhaps as a lawyer you are a little far from scientific magazines, and so forth. You no doubt read the law journals. But being an engineer, myself, I read the scientific publications, not the law journals. And in the scientific publications there is a great deal of declassified atomic energy material.

Mr. RUEBHAUSEN. I am sure there has been more that has been declassified than the Commission has gotten credit for. And I understand also, that most of what might be called basic science has been declassified; but that when you get into the area of technology, including the technology on breeder reactors, that has not been declassified to the extent that would make possible private progress.

Representative HINSHAW. Well, I think that your committee would find it very interesting to discuss this subject with those of the Commission whose responsibility it is to decide the questions of classification or declassification.

We thank you for your presentation. We thank you for coming down to give us this information and the viewpoint of your committee. The fact that we would argue with you at all is an indication that we have been interested in your remarks.

Mr. RUEBHAUSEN. Thank you very much.

Representative HINSHAW. The next meeting will be tomorrow afternoon at 2, I am informed; and we will have, at that time, representatives of the National Association of Manufacturers, the Congress of Industrial Organizations, and the American Federation of Labor.

(Whereupon, at 3:55 p. m., Wednesday, July 22, 1953, the hearing was recessed until 2 p. m., Thursday, July 23, 1953.)

ATOMIC POWER DEVELOPMENT AND PRIVATE ENTERPRISE

THURSDAY, JULY 23, 1953

CONGRESS OF THE UNITED STATES,
JOINT COMMITTEE ON ATOMIC ENERGY,
Washington, D. C.

The joint committee met at 2:15 p. m., pursuant to recess, in room 318, Senate Office Building, Hon. W. Sterling Cole (chairman) presiding.

Present: Representative Cole (chairman), Senator Pastore, and Representatives Patterson, Holifield, and Price.

Professional staff members present: Corbin C. Allardice, executive director; and Walter A. Hamilton of the professional staff of the joint committee.

Chairman COLE. The meeting will come to order.

First, I apologize for the delay in starting the meeting. There was an important vote over in the House which prevented starting the meeting earlier.

I understand that the witnesses scheduled for today have important engagements, and that some of them have expressed a desire to rearrange the schedule of appearance of the witnesses. Ordinarily we try to accommodate the witnesses as much as possible to meet their personal commitments and conveniences, but I find if we were to rearrange the order of appearance today it would involve disarranging and inconveniencing other witnesses for today. So it has been determined to continue with the schedule as originally planned.

The first witness in that order is the representative of the American Federation of Labor, our former House colleague, Mr. Andrew J. Biemiller, whom we welcome this afternoon as the spokesman for the A. F. of L.

STATEMENT OF ANDREW J. BIEMILLER, MEMBER OF THE NATIONAL LEGISLATIVE COMMITTEE OF THE AMERICAN FEDERATION OF LABOR

Mr. BIEMILLER. Thank you, Mr. Chairman.

Mr. Chairman and members of the committee, my name is Andrew J. Biemiller. I appear today in behalf of the American Federation of Labor, which comprises a membership of more than 8 million persons in the organized labor movement. I am a member of the national legislative committee of the A. F. of L.

We wish to commend this committee for the public-spirited and nonpartisan attitude it has manifested toward a subject of the greatest national importance and for the conscientious discharge of its duties in exercising surveillance over the activities of the Atomic Energy

Commission. The comprehensive public hearing which you are now holding on the industrial possibilities of atomic power should serve to clarify the complex issues involved and to stimulate further public thinking on the matter. In view of the large public investments made in the atomic energy program to date and of the urgent need to keep this country in the forefront of this new field of endeavor, the clarification of issues afforded by these hearings is greatly to be desired.

It is our understanding that the committee is not addressing itself at this time to specific legislation, but is bringing together the views of various individuals and agencies, public and private, to assist the committee in formulating amendments to atomic energy legislation at a future date. It has been reported that the Atomic Energy Commission prepared a specific draft of new legislation but that the Bureau of the Budget has not as yet cleared those legislative proposals as being in accord with the program of the President. Therefore, my statement will not be directed to specific points of legislation but will consider some of the broader policy implications of atomic power development.

First let me read to you an official statement of the American Federation of Labor adopted last year. The executive council of the A. F. of L. in its report to the 1952 convention said:

Atomic energy itself and technology arising out of nuclear fission must remain in the public domain. While development of private investment and enterprise for civilian use of atomic energy should be encouraged, such use of it by private enterprise should be strictly competitive. Private monopoly in any phase or segment of the atomic-energy industry is intolerable. Yet even now monopolistic aggregates are already building up, not only around fringes of this public program, but within it. Monopoly of engineering skill and scientific technology is no less dangerous than monopoly of private capital. No private corporation should be permitted to accumulate materials, equipment, or skill of this industry for its own exclusive use or to arrogate to itself the power derived from their exclusive possession.

The convention concurred in the report of the executive council and made the following official comment:

On the great strides our country is making in the development of atomic energy depends the security of our Nation and the winning of peace for freemen. We are also just beginning to realize the new dream of putting atomic energy in the service of human welfare in biology, medicine, and as a source of productive power. Labor must assert its leadership in making sure that the broad public interest is fully served in the future developments of atomic policy.

Mr. Chairman, the American Federation of Labor is concerned with atomic-energy development not only because of its direct and vital bearing upon the organized labor movement but because we represent a broad segment of the American community interested in the welfare of our country. As citizens and taxpayers, as well as workers, our membership has contributed its share in developing the atomic-energy program for national defense and security. We have a stake, as do all other Americans, in this program. When and if the atomic resources, made possible by the expenditure of billions of dollars from the National Treasury, are devoted to atomic power and other industrial purposes, we would expect, and indeed insist, that the benefits of this huge public investment be widely shared rather than closely held by a favored few.

In furtherance of the public interest and to protect the public stake in atomic-energy development, we suggest that in the formulation of any new legislation there should be included an explicit declaration of congressional intent that atomic power be produced and distributed

so as to serve the national welfare. In making this declaration of intent, it would seem wise for the Congress to lay down certain guiding principles such as are found in Federal statutes relating to hydroelectric development. For example, the Flood Control Act of 1944 recites, in the case of power produced at certain Federal dams, that such power be distributed "in such manner as to encourage the most widespread use thereof at the lowest possible rate to consumers consistent with sound business principles * * *." Without arguing the extent to which statutes governing the production and distribution of hydroelectric power or other forms of energy are applicable in the atomic field, we wish to emphasize, Mr. Chairman, that the public interest in atomic-power development merits a congressional declaration to that effect which includes defined objectives of national policy.

In implementing this declaration, it should be made clear in the statute that public as well as private agencies will have full opportunity to produce and distribute atomic power and that the Atomic Energy Commission itself, or some other appropriate Federal agency, will undertake to produce atomic power for its own use, for use by other Government agencies, or for industrial and domestic consumption in areas deficient in energy supplies. While the American Federation of Labor is anxious to see private initiative and enterprise participate more actively in atomic power development, we believe it would be a mistake to abandon or curtail Government activities in the expectation that private industry can take over the whole job. Atomic power should be viewed as a national objective. The technical problems yet to be solved, the heavy costs for producing facilities that must be incurred, the strong competitive position of other power sources, all indicate that the achievement of this objective must rest on a broader base than profit-making opportunities. The role of Government in atomic power development dare not be shelved.

In drafting new legislation to promote the peacetime uses of atomic energy and the development of atomic power, careful consideration must be given also to the impact of these uses on established industries and occupations. We recognize, of course, that atomic power will not be developed overnight and that immediate radical transformations of the present economic structure are not necessarily to be anticipated. Nevertheless, it is wise policy to pay heed to the changes that may take place in order to avoid economic hardship and dislocation in the future.

The Congress, in drafting the original legislation, known as the McMahon Act, was alert to this problem. In section 7 of the act certain procedures were laid down for congressional review of specific proposals for industrial uses of atomic energy because of the complex and difficult problems that would be presented. The special Senate committee which prepared the original legislation, while expressing its desire "to promote the use of atomic energy in all possible fields for peacetime purposes," also stated:

The committee is aware, nonetheless, that the sudden introduction of certain devices utilizing the power released by nuclear fission might precipitate profound economic disorganization. Great industrial installations, representing nationwide investments, employing many thousands of workers, might be rendered obsolete.

Furthermore, devices utilizing atomic energy, if widely used, would so multiply potential hazards to national health and safety that even careful Government regulation would fail to provide adequate safeguards (79th Cong., 2d sess., S. Rept. No. 1211, pp. 21, 22).

Accordingly the original legislation in section 7 provided for licensing the manufacture and use of atomic energy devices; for reporting to Congress on the social, economic, and other effects of the industrial application of atomic energy; and for submitting to the Congress, 90 days in advance, any specific licensing action. It is apparent from the context of these provisions in section 7 that the Congress intended the Atomic Energy Commission to report on the overall industrial application of atomic energy prior to, or at least simultaneous with, submission of a report on specific licensing. This interpretation is borne out by the following statement in the report of the special Senate committee explaining the original legislation:

No license for manufacture or use may be issued until the Commission has made a report to the Congress stating all the facts with "respect to the use of such devices, the Commission's estimate of the social, political, economic, and international effects of such use, and the Commission's recommendations for necessary or desirable supplemental legislation" (79th Cong., 2d sess., S. Rept. 1211, p. 21).

We believe the Congress should adhere to its original purpose in requiring reports from the Atomic Energy Commission on the industrial impact of atomic power before licensing any given company in this field. If the Commission is authorized to go ahead and license atomic-power operations on its own, without reporting to Congress under section 7, the best that Congress could expect is a report in the future, after the social and economic consequences of atomic-power use have been felt, not before, as intended in the original act. Thus the specific purpose of Congress to prescribe procedures for an orderly transition to atomic power, to minimize or prevent undue economic dislocation, would be vitiated.

In connection with the above-discussed licensing activities, section 7 of the Atomic Energy Act also provides:

Where activities under any license might serve to maintain or to foster the growth of monopoly, restraint of trade, unlawful competition, or other trade position inimical to the entry of new, freely competitive enterprises in the field, the Commission is authorized and directed to refuse to issue such license or to establish such conditions to prevent these results as the Commission, in consultation with the Attorney General, may determine. The Commission shall report promptly to the Attorney General any information it may have with respect to any utilization of fissionable material or atomic energy which appears to have these results.

We believe that the Congress should not relieve the Atomic Energy Commission of its positive obligation to prevent or discourage monopoly in the field of atomic power. It is not enough to rely simply on the antitrust laws and to "pass the buck" to the Antitrust Division of the Department of Justice. Although these laws have an important function in limiting the monopolistic tendencies of big business, the protracted and cumbersome procedures for determining whether the antitrust laws have been violated in a given case may not work very well in the completely new field of atomic power.

The antitrust lawyers, working in an intricate maze of judicial decisions, are accustomed to thinking in terms of degrees of market control and percentages of production accounted for by established firms. In the case of atomic power, which breaks new ground and contains no precedents for evaluating industrial controls, it would seem more appropriate for the Atomic Energy Commission to maintain its original responsibility through its licensing powers to prevent the growth of monopoly in atomic energy. No proposals should be

entertained which would weaken the positive mandate in the Atomic Energy Act to strengthen free competition in private enterprise.

By the same token, extreme care should be exercised to prevent the acquisition of restrictive patent privileges which might serve to choke off the growth of this promising new field of enterprise. The need for vigilance in this respect is especially acute, for a limited number of firms, as present or previous contractors with the Atomic Energy Commission, have a virtual monopoly of technical skills and know-how in the atomic-energy program. It would be unwise and inequitable for a few firms to exploit a technical advantage acquired through the use of public funds and property by acquiring exclusive patent privileges for future development. Admittedly the problems of assessing equities in this field are delicate and difficult, but we urge the committee not to tie the hands of the Atomic Energy Commission in patent matters, so that all newcomers in the atomic-energy industry can be assured equal opportunity to gain a foothold and to develop.

At its last convention the American Federation of Labor officially paid tribute to the late Senator McMahon for bringing representatives of economic groups into consultation with the joint committee. We believe that they have a great contribution to make. The advisory panel appointed by Senator McMahon performed a very useful public service on certain specific problems. We believe that this technique should be revived and the services of representatives of economic groups utilized on the broad problems confronting the committee. They can be of particular value on these complicated problems of patents and licensing with their far-reaching implications. They can also be helpful in evaluating the social and economic impact of new uses of atomic energy.

We are aware that various proposals have been made to give atomic power a financial and economic boost by Government guaranties to buy plutonium from private companies undertaking to produce power. In view of the fact that the Nation has large hydroelectric resources still undeveloped and coal or other fuels in relative abundance, a serious policy question arises whether atomic power should be accelerated by subsidy incentives to private industry. It is our view that private enterprise in atomic power should be self-supporting and independent. The permanent position of an atomic-power industry in the American economy can only be assured when that power can pay its own way. In the meantime we believe that the Government should proceed expeditiously under present legislation to design and build reactors for submarines, ships, and airplanes, and for production of power in special areas lacking access to power and in plutonium plants already owned by the Government. The technical lessons to be learned in these Government-financed developments can be utilized by private industry in working to bring atomic power to the level of economic feasibility.

Finally, Mr. Chairman, I want to direct attention to certain matters of immediate and very direct concern to organized labor. As the members of this committee well know, labor relations in the atomic-energy program have not always been of the happiest. This vast new field of endeavor was launched in wartime under military auspices when the Manhattan District was organized by the Army engineers. The stringent secrecy requirements, so necessary at the outset in producing the atomic bomb, have placed heavy obstacles in the way of

collective bargaining and the normal routine of union-sponsored activities. The American Federation of Labor gave all-out cooperation in working for continuous, uninterrupted production on atomic projects. We voluntarily waived many collective-bargaining rights and cooperated fully with a necessarily strict security program. We recognize that in a weapons program this strict security is essential.

From the very start the Manhattan Engineer District selected large industrial concerns to operate the atomic-energy program. This practice was continued by the Atomic Energy Commission, although the duties and responsibilities vested in the Commission by the Congress did not necessarily require it as a matter of law. American industry and labor, with the help of scientists, engineers, and administrators, have done an outstanding job in atomic energy. However, one unfortunate aspect of the contractor method of performance has been the management-oriented position of the Atomic Energy Commission. That legacy of the Manhattan Engineer District, acquired by the Commission, is still in evidence.

It is to be noted that the membership of the Atomic Energy Commission, drawn mainly from the professions of law, Government, and business, has never included anyone from the ranks of organized labor. Corporation lawyers, investment bankers, and Government bureaucrats are supposed, somehow, to have a greater aptitude in the administration of atomic-energy affairs than labor-union officers. We believe that within the ranks of organized labor there are many talented and public-minded administrators who could perform a useful service on the Atomic Energy Commission.

We appreciate, Mr. Chairman, the continuing need for rigorous security controls in the military phases of atomic energy. However, it is our position that in the same measure as private industry is permitted to participate in atomic power and related enterprises, American labor should be allowed to engage in collective bargaining and other normal union pursuits. We do not intend to see the requirement of secrecy and security controls become a weapon in the hands of employers to curtail union-labor activities while extracting a profit from the atom. The situation is difficult and awkward enough when private firms act as contracting agents of the Government in an armaments program. When they go out on their own in the atomic field, the imbalance in their favor must be corrected.

The American Federation of Labor favors across-the-table bargaining by management and labor, without any Government interference. We recognize the exceptional security requirements of the atomic field and are willing to discuss the security problem which will remain when private enterprise engages in work in the atomic field. But we go on record as stating our belief that as free private enterprise enters the field we expect labor to be free to carry on normal collective-bargaining activities. In this connection the committee might well consider the establishment by statute of a labor-management advisory committee to the Atomic Energy Commission to assist in formulating administrative policies and procedures that will facilitate amicable relations and orderly progress in atomic-energy development.

We thank the chairman and members of the committee for this opportunity to present the views of the American Federation of Labor on atomic power, and again assure you of our willingness to consult

at any time with the committee or the Commission to help make a reality of the great potential blessings which atomic energy can bring to the American people.

Chairman COLE. Thank you, Mr. Biemiller.

Any questions, Senator?

Senator PASTORE. No.

Chairman COLE. Mr. Holifield?

Representative HOLIFIELD. Mr. Chairman, unfortunately I arrived late and did not get to hear the full statement of our former colleague, Mr. Biemiller, but I would like to comment on one thought which he has advocated near the bottom of page 4, where he makes the statement that it is his position that in the same measure as private industry is permitted to participate in atomic power and related enterprises, American labor should be allowed to engage in collective bargaining and other normal union pursuits.

This is bringing a new thought to the committee. In times gone by we have had more or less Government pressure, let us say, on the workers in these atomic-energy plants because of the fact that they were engaged in producing implements of defense at the time that we first needed them during the war, and then for preparation during this cold-war period. It is true that normal union-management relations have not obtained.

Mr. BIEMILLER. That is correct.

Representative HOLIFIELD. You make the statement that as private enterprise is allowed into the field, so shall labor be allowed into the field on an equal basis, and the resumption of normal collective bargaining between labor and such management as is allowed into the field shall take place.

Mr. BIEMILLER. So far as is consistent with the security of the country and, as we state, we would be very happy to sit down and discuss that problem, but it is our feeling that as private enterprise is allowed more and more into this field, it is obvious that some decision has been made that security problems are not as acute as they have previously been. To the extent that they are not, we would assume that we would then be permitted to resume full collective-bargaining procedures.

There have been many instances in the past where we have waived many aspects of our normal collective bargaining procedures. There have even been cases where a settlement at one installation was automatically put into effect at another installation, without consultation of any sort.

It is that kind of thing which we would certainly resent if atomic power were to become to any large extent a field for free private enterprise.

Representative HOLIFIELD. I notice you also advocate the establishment by statute of a labor-management advisory committee to the Atomic Energy Commission to assist in formulating administrative policies and procedures. Just what do you have in mind? What kind of commission would you have in mind there?

Mr. BIEMILLER. It is a two-fold suggestion, actually. First of all, to try to evaluate the problem of security as atomic power is utilized by private industry, and to reach an agreement on that matter so that we would not be faced with the problem that we have had in some

instances in the past, or at least we think we have had, of security regulations being used as a club against union members.

Secondly, as I stated in another part of this testimony, we believe that labor-union officials as well as management officials have a great contribution to make in evaluating the problems of licensing, the problems of patents, the problems of possible social and economic impact of the widespread use of atomic energy. We think the advice of the various economic groups, not just labor but also management and other economic groups, should be sought by this committee and by the Commission in meeting those problems.

It is the sort of thing, as I am sure you know, Congressman, that worked effectively during World War II in much of the War Production Board and the War Manpower Commission. We feel it is another way of getting the grass roots cooperation of the citizens of this country in developing this program, which to date has been entirely at their expense and in which they have a tremendous investment.

Representative HOLIFIELD. This, of course, does not set any precedent, as far as having advisory boards and consultative boards in the statute, because there are advisory boards at the present time.

Mr. BIEMILLER. That is correct.

Representative HOLIFIELD. There are boards at the present time, which are operating without compensation in most instances.

Mr. BIEMILLER. Incidentally, that is not a problem at all. I wasn't necessarily suggesting employing people, as far as this committee is concerned. I am sure our people would be glad to cooperate without compensation.

Representative HOLIFIELD. On page 2 you bring back to our minds the admonition that the Commission has had a duty imposed upon it by the original statute of preparing a report to the Congress and to the President prior to, or simultaneous with, submitting a draft of legislation. You are aware, of course, that they have submitted a draft of legislation which has not been made public. They submitted an explanatory statement on that legislation which has been made public.

Mr. BIEMILLER. Which we have read.

Representative HOLIFIELD. Which you have read.

You are also aware that they did not present an accompanying report upon the social, economic, political, and international impact of this new legislation.

Mr. BIEMILLER. We believe such a report should be made, and that this provision of the McMahon Act should be retained in any possible revision of the act.

Representative HOLIFIELD. The only excuse for not presenting that report was that the time of practical value application had not arrived, which was called for in the act, and therefore they did not have to make the report.

Notwithstanding the fact that that time of industrial application had not arrived, they went ahead and advocated legislation, thereby bypassing, in my opinion, one of their responsibilities. What comments do you have upon that?

Mr. BIEMILLER. Obviously, as a member of the committee, you are in a better position to make that judgment than we are as citizens observing it, but certainly our conclusion would be the same as yours,

that the report should have been made if they are coming in, as we know they are, with some concrete legislative suggestions. From the summary which we have seen of those legislative suggestions, which has been made available by the Commission, it would appear to us that they are getting into a realm of some far-reaching social and economic implications, part of which we discussed in this testimony. We think the report should have been made.

Representative HOLIFIELD. As a matter of fact, their summary of their policy statement and their legislative intent indicated that this was a far-reaching and basic change in the act; and notwithstanding that fact, they failed to provide this committee and the Congress and the President with the analysis called for in the legislation. I think particularly that part of your statement is very valuable because, as one member of the committee, I believe that they should not evade or shift the responsibility which the Congress has placed upon them prior to the advocating of basic changes in the act.

Chairman COLE. Mr. Price?

Representative PRICE. No questions.

Chairman COLE. Mr. Biemiller, in connection with your statement where you refer to labor relations in the atomic program, on page 4, you say that they have not "always been of the happiest." From my observation of the program, there has been a minimum of labor unrest and dissatisfaction in this atomic-energy business. What unrest and disturbances or dissatisfactions have occurred, it appears to me, are in those areas where the full interplay of labor-management relationships and bargaining responsibilities have prevailed, principally in the construction phase of various plants; but in the operation of the plants themselves, there has been almost a complete absence of labor dissatisfaction or unrest, which can be taken either as an expression of great restraint on the part of the individual working people, or as an indication of full and adequate and fair treatment by the Commission through its contractors, or perhaps a combination of both.

At any rate, I think that the people engaged in the production phase of the atomic-energy program are entitled to a good, generous pat on the back for the work they have done, continuing to report for duty, and not suspending for a moment any of the important operations which are so vital to our national security. I think they have done a splendid job.

Mr. BIEMILLER. Mr. Chairman, I appreciate very much your remarks in that respect. As you know, a very large percentage of the workers in the plants are organized in A. F. of L. unions. We, too, feel that we have shown restraint and have cooperated in many matters.

I think, though, that in your statement you are underscoring the point that I am making. In the plants themselves, where the weapons program is under way, where we recognize the need for a stringent security, we have been willing to waive certain matters, and we have tried to cooperate in every way possible. In certain phases of the construction program, where the worker may not realize the security implications, there has been unrest in several areas. You know of these, as this committee, on a couple of occasions that I am aware of, has investigated some of these problems.

Likewise, I think the role of the Atomic Energy Commission's special panel on labor relations has been fruitful in some instances.

However, we do know that these problems are there, that they exist, particularly as the program becomes one of more private enterprise.

Chairman COLE. If there are no further questions, thank you very much, Mr. Biemiller, for your appearance and your statement.

Mr. BIEMILLER. Thank you very much.

Chairman COLE. The next witness is a representative of the Congress of Industrial Organizations, Mr. Ben Sigal. If he has his associate, Mr. Elwood Swisher, with him, he may come forward also.

We will be very glad to hear your statement, Mr. Sigal.

STATEMENT OF BENJAMIN C. SIGAL, REPRESENTING THE CONGRESS OF INDUSTRIAL ORGANIZATIONS

Mr. SIGAL. Mr. Chairman, my name is Benjamin C. Sigal. I am appearing today in place of James B. Carey, secretary-treasurer of the Congress of Industrial Organizations, who is unavoidably detained in Europe in connection with the World Congress of the International Confederation of Free Trade Unions which recently completed its third conference in Stockholm, Sweden.

I should add that I am general counsel of two international unions which represent employees in the atomic-energy industry, namely, the International Union of Electrical, Radio, and Machine Workers, CIO, and the Gas, Coke, and Chemical Workers of America, CIO.

Mr. Swisher, president of the gas, coke, and chemical workers, is here with me, and will make some remarks after I have completed my statement.

Chairman COLE. Very well.

Mr. SIGAL. The CIO appreciates this opportunity to participate in public discussions before this committee regarding the question of amending the Atomic Energy Act in order to permit the private ownership of fissionable materials and the facilities for producing them. The CIO has taken an active interest in the problems relating to the production and use of atomic energy from the time they became a matter of public discussion. We participated actively in the discussions which preceded the passage of the Atomic Energy Act of 1946. We were in full accord with the policy of that act vesting ownership of fissionable materials, patents, and production facilities in the people of the United States. It is, therefore, a matter of deep concern to us that concerted efforts are now being made to alter in fundamental respects the wise policy now incorporated in that act.

In order to place this discussion in the proper perspective, we think there are two fundamental questions to be answered: First, does the Atomic Energy Act in its present form permit the development of the industrial use of atomic energy at a satisfactory rate? Secondly, will the ownership of fissionable materials by private interests bring about faster development of the industrial use of atomic energy while at the same time adequately protecting the public interest?

Objectives of the Atomic Energy Act:

What is the reason for the policy set forth in the present act?

There can be no doubt that the overriding consideration of Congress at the time the act was adopted was that of security. The reasons for establishing a complete Federal monopoly of fissionable materials in order to achieve "the paramount objective of assuring the common defense and security" is effectively set forth in the report of the Senate

special committee which recommended adoption of the McMahon-Douglas bill, which subsequently became the Atomic Energy Act. This report stated in part that—

From the start of its deliberations the committee has been convinced that an absolute Government monopoly of production of fissionable materials is indispensable to effective domestic control of atomic energy. A number of factors point unmistakably in this direction:

1. Fissionable material is the principal ingredient of the atomic bomb. Thus, to permit private manufacture of fissionable material would be to permit private manufacture of material of enormous destructive potentialities.

2. The production of fissionable material is attended by serious hazards to public health and safety. The responsibility for minimizing these hazards is clearly a Government function.

3. The future production of fissionable material is closely interrelated with the possibility of achieving effective and reciprocal international safeguards against the use of atomic weapons. It is undesirable, therefore, to permit private development in an area which may soon be placed under Government control by reason of international agreements.

4. The production of fissionable material is technologically in its infancy; unforeseen and unforeseeable factors may play a great part in its development. To permit decontrol and decentralization of this activity, and weaken continuing Government supervision, would be contrary to the principle of prudent stewardship demanded of the Government by considerations of national defense and national welfare.

5. The technology of fissionable material production teaches that even a slight interruption in the manufacturing process may occasion great loss and damage to the entire operation. Government control is more likely to assure continuity of operation than is private control.

In our opinion, any persons proposing a change in the law which would permit the ownership of fissionable materials and the production of atomic energy to be placed in the hands of private interests, have an obligation and a burden to show that conditions have so changed since the adoption of this act that the foregoing factors are no longer of such controlling importance as they were at that time. I will discuss some of these factors in greater detail below.

The act states, in part, in its declaration of policy, that—

It is reasonable to anticipate * * * that tapping this new source of energy will cause profound changes in our present way of life. Accordingly, it is hereby declared to be the policy of the people of the United States that, subject at all times to the paramount objective of assuring the common defense and security, the development and utilization of atomic energy shall, so far as practicable, be directed toward improving the public welfare, increasing the standard of living, strengthening free competition in private enterprise, and promoting world peace.

Certainly these objectives are as fundamental and paramount as they ever were. The burden is upon those who would amend the act to demonstrate that their proposals would achieve these objectives more effectively than the present law would permit. In our opinion, they have not made, nor can they make, such a demonstration.

In setting the groundwork for this discussion, one other statutory provision must be examined. The framers of the act looked forward to the time when industrial use of atomic energy would be feasible, and they therefore established a procedure through which such uses could be promoted under proper safeguards. Section 7 (b) of the act provides:

(b) REPORT TO CONGRESS.—Whenever in its opinion any industrial, commercial, or other nonmilitary use of fissionable material or atomic energy has been sufficiently developed to be of practical value, the Commission shall prepare a report to the President stating all the facts with respect to such use, the Commission's estimate of the social, political, economic, and international effects

of such use and the Commission's recommendations for necessary or desirable supplemental legislation. The President shall then transmit this report to the Congress together with his recommendations. No license for any manufacture, production, export, or use shall be issued by the Commission under this section until after (1) a report with respect to such manufacture, production, export, or use has been filed with the Congress; and (2) a period of 90 days in which the Congress was in session has elapsed after the report has been so filed. In computing such period of 90 days, there shall be excluded the days on which either House is not in session because of an adjournment of more than 3 days.

If amendments to the act of the nature proposed are desirable, the procedures set forth in section 7 (b) should be observed. They have not been observed, and it is therefore necessary to determine whether or not there is any justification for this failure.

PRODUCTION RECORD OF AEC

There seems to be little question that, generally speaking, the production record of the Atomic Energy Commission has been noteworthy, despite the enormous complexity of the problems with which it has been faced. One qualified witness, Mr. J. Robert Oppenheimer, Chairman of the AEC General Advisory Committee, told the members of this joint committee in 1949 that—

When the Commission took over (from the Manhattan District) the future of the whole enterprise was uncertain, the continuity of production of fissionable materials was far from assured, the design and development of improved weapons was nearly stagnant. In each of these respects the picture has radically changed. Better weapons have been developed and tested, the production of materials has been substantially increased and assured, and a sound and forward-looking program has been established.

The Commission's own semiannual reports reveal that during the first 2 years of its existence it increased the output of fissionable materials with the facilities built by the Manhattan District, while at the same time it improved these facilities and built additional production capacity. By 1948, this building program became, according to the Commission, "the greatest single construction project in peacetime history."

By 1949 this construction of constantly more productive facilities had been going on at an accelerated pace, which has continued up to the present time. The reports reveal that each year the amount of fissionable material produced has exceeded amounts produced during previous similar periods.

In its Thirteenth Semiannual Report, issued in January 1953, the Commission reported that the second half of 1952 had witnessed "the crystallization of important lines of exploration, research, and development that began earlier in the decade."

As a result of new uranium discoveries and the development of improved processes for extracting it from low-grade sources, large additional authorizations for production of fissionable materials and weapons were made. The development of reactors for the output of power resulted in more accelerated progress than in any other half-year of the previous decade. Assembly was substantially complete on one prototype reactor for submarine propulsion and work began on the prototype reactor to power the submarine. A contract to supply atomic power for a large naval vessel, such as an aircraft carrier, was entered into. Work began on testing facilities for nuclear power plants for aircraft.

Outside of the military application of atomic energy great strides have been made with radioactive isotopes, which are making startling contributions in medicine, agriculture, and industry.

In short, although criticism may be leveled at some aspects of the Commission's record—and we shall make some ourselves—we think there is no reasonable basis for asserting that the act, in its present form, does not permit the widest possible development of the potentialities of atomic energy. Why, then, the concerted drive for substantial amendments to the act?

PROPOSALS FOR AMENDMENT

One of the major proponents of a change in the act is the Atomic Energy Commission itself. The Commission has declared in substance that, while it recognizes its responsibility to continue research and development in the field of nuclear power, it proposes that interim legislation be adopted to permit ownership and operation of nuclear power facilities by private interests, to permit sale or lease of fissionable materials, and to grant more liberal patent rights than are presently granted to private persons. The Commission declares that it is the objective of this policy to promote development of nuclear plants which are economically independent of Government commitments to purchase plutonium for military weapons. All this is proposed on the ground of providing reasonable incentives to encourage wider participation in power reactor development. The Commission states, however, that since atomic power has not yet been developed to the point of economic use, the time is not yet at hand for the report called for in section 7 (b) of the Atomic Energy Act.

In our opinion, this proposal, with the justification offered for it, fails to reflect that degree of candor we have a right to expect from a governmental body charged with so heavy a responsibility as that carried by the Atomic Energy Commission. It has not stated why it cannot carry on the research and development of nuclear power as well as or better than private industry. It has offered no evidence that there is any private group now prepared to develop nuclear plants which are economically independent of Government commitments to purchase weapons-grade plutonium. Nowhere has the Commission shown specific justification for turning over to private interests, by way of "more liberal patent rights" as well as in other ways, a substantial part of the fruit of the \$12 billion investment made by the American people in atomic-energy development. So far as we know, the Commission has failed to give any consideration to the social, political, and international effects of its proposals, while its discussion of the economic effects is extremely vague and hypothetical. In short, the Commission has failed utterly to make out a case justifying amendments of the act at the present time which would permit the private ownership of fissionable materials and private production of atomic energy.

In our opinion these proposals of AEC stem not so much from new developments of a significant nature as from an apparently fixed intention of the Commission to turn over to private industry the production of atomic power. This intention was foreshadowed by the Commission's abandonment early in 1950 of the only major industrial-power project it had started. A public statement of what

some or all of the Commissioners were thinking was revealed in a speech made by Commissioner Pike to the National Association of Manufacturers on December 8, 1950. That, you remember, was prior to the time that the industrial teams really began their surveys. Mr. Pike said, in part:

We will probably have to ask for a change in this act. We will have to get the opinion of Congress, and to get the Congress to form an opinion there will have to be some testimony from industry, I take it—from the direct companies that will want to take an interest in power from atomic energy.

I think it is fair to say that for us, as Commissioners, to go up to Congress and say we want to take the bars down on large operative powerplants—and remember, any plant large enough to make any appreciable amount of power almost by its own nature will make appreciable amounts of plutonium—I expect the boys would say, “You fellows are always coming up here trying to give things away to the Russians.” Of course, this is not quite a fair statement, but I don’t think that fairness in committee hearings is outstanding. That is what the boys might say, but—those of you who are interested—if you will come up or send somebody (and I would say preferably not a lawyer, but somebody who is actually going to have his nose rubbed in paying for the cost of this thing and is interested in the results) if you go up and talk industry language to these gentlemen you will probably carry the day. Put it this way: You will have a great deal better chance of carrying the day than if you leave it to us who have to be in contact with these people all the time. We have, let us say over the last 3 or 4 years, developed certain little frictions between ourselves which show up at times, when they don’t see quite eye to eye with us.

That was the advice of Commissioner Pike almost 3 years ago to members of private industry as to how to handle the Congress.

Most of those who support the proposed amendments attempt to create the impression that if private industry were permitted to participate in the atomic energy program on the basis of private ownership of facilities and materials, privately owned power reactors would spring up as soon as they could be built. This is certainly not the case. I think the record made before this committee shows that not a single person or group indicated a willingness to invest enough money to build and operate a full-scale reactor for the production of atomic energy power. In every case, it was stipulated that the Federal Government should put up the bulk of the money involved for either a pilot plant or a full-scale plant, would actively participate in research and development, and would guarantee these brave entrepreneurs against any loss. Finally, putting a frosting on the cake, these free enterprisers want the benefit of the patents which they would be able to develop after acquiring all the knowledge available from the Atomic Energy Commission. Is this the kind of private enterprise on which our Nation has been built? Certainly no one can reasonably claim that this is what Congress had in mind when it declared, in the act, that atomic energy should be utilized and developed, among other things, to strengthen “free competition in private enterprise.”

The witnesses who discussed the types of power reactors they favor fall into two groups, namely, those who propose dual-purpose reactors and those who propose single-purpose reactors. The first would produce both power and plutonium, and the second would produce power only. So far as we are aware, all of the industrial groups represented based their proposals on the construction of a dual-purpose reactor. These proposals will require that the Government commit itself to buying the plutonium produced.

On the technical aspects of this problem, we will not venture an opinion. However, this committee is aware that the principal technical research experts who testified do not consider the dual-purpose reactor feasible for the economic production of atomic power. They point out, further, that a full-scale atomic powerplant would cost no less than \$75 million, and closer to \$100 million. No industrial group has indicated that it is prepared to provide sums of this magnitude.

The proposal to permit private participation in the construction and operation of dual-purpose reactors at the present time has been effectively criticized by an industrial leader familiar with the problem. Mr. Philip Sporn, president of the American Gas & Electric Service Corp., who served as chairman of the Advisory Committee on Cooperation between the electric power industry and the Atomic Energy Commission, and can scarcely be accused of bias against private industry, recently had the following to say, in part, on this problem:

* * * Power as a byproduct of plutonium could afford an exciting prospect for early development of nuclear energy on a substantial scale. But this statement of the situation should also make clear that such an operation is likely to remain exceptional—for the reason that it would have to be underwritten by a long-term Government guaranty of dubious soundness.

A few words are necessary to explain this conclusion. Feasibility in development along this route depends upon the availability of a continuing market for plutonium because the economics of the power is inextricably linked with sale of plutonium. So far as we can now tell a market for plutonium means a Government market for the metal to make stockpile bombs. If the market for plutonium ceases or contracts, the value of the power becomes questionable unless it has been guaranteed by a long-term Government underwriting which would persist regardless of the sale of the metal upon which the economics of the byproduct depends. The difficulty of assuring a permanent market for plutonium is evidenced by the recent statement of Chairman Dean of the Atomic Energy Commission that there will come a time when we can stop our urgent drive to make more and more atomic weapons and sit back, look at our stockpile, and say, "Now we have enough." * * *

* * * When we plan powerplants for commercial use economics requires that we think of them in terms of a useful life of 25, 30, or even 40 or more years. It is difficult, therefore, to think of byproduct nuclear powerplants being developed on other than the very exceptional basis of long-term Government commitment to buy the plutonium at a fixed price or otherwise to underwrite the project.

Whatever the value and the interest in proceeding with present developments of ideas of such plants, in the end, hope for nuclear energy as a more or less permanent economical source of power, must rest on the straight power reactor and the breeder reactor. And the optimism of recent months, however justified, has not grown particularly out of any spectacular developments in relation to such reactors. As to them, while we are certainly ahead of the point where we stood when people were saying, several years ago, that it would be a matter of "decades" before we had economical power, there is no reason for believing that we are unexpectedly further ahead.

So that all of this gratifying experience, actual and in prospect, still leaves us quite far removed from a real solution to the problem of producing nuclear energy economically and of making it contribute significantly to satisfy our overall requirements for electric energy.

The foregoing opinions of Mr. Sporn parallel those of a number of witnesses who have appeared before this committee.

PRESENT PARTICIPATION OF PRIVATE INDUSTRY

One impression that may be obtained from some of the testimony of industry witnesses who have appeared before this committee is that

private industry has been, to a large extent, excluded from the atomic energy program. Nothing could be further from the truth. In the first place, section 4 (c) (1) of the act specifically provides for private ownership of "facilities which (A) are useful in the conduct of research and development activities in" all fields of scientific investigation relating to atomic energy, so long as they "do not, in the opinion of the Commission, have a potential production rate adequate to enable the operator of such facilities to produce within a reasonable period of time a sufficient quantity of fissionable material to produce an atomic bomb or any other atomic weapon." It is under that section that private laboratories have been established and have produced some fissionable material. Thus those who are interested in research and development may own their own production facilities and may operate them to make fissionable material in the course of their work. The basic limitation is that they cannot produce within a reasonable period of time enough fissionable material to produce an atomic weapon. So far as we know, the Atomic Energy Commission has not yet found it necessary to restrict normal private laboratory operations. In the light of this provision it is evident that those who seek an amendment to the act desire the right to produce fissionable materials in sufficient quantities in a reasonable time to make atomic weapons.

More significant in this connection is the fact that practically all atomic-energy facilities are now operated by private industry. At the present time all fissionable material, except for small amounts produced in private research, is today manufactured for the Atomic Energy Commission by a few large companies operating under contract with the AEC. Not a single major facility is operated by the AEC itself. Indeed, this manufacture is concentrated in the hands of only a few firms like General Electric Co., Du Pont, Union Carbide, and Monsanto. It certainly cannot be said that private industry is barred from acquiring all the available know-how to produce fissionable material.

Indeed, the CIO is firmly of the opinion that the AEC should never have begun this process of delegating its production responsibility. We believe that the public welfare demands public operation, as well as public ownership, of the atomic energy industry.

Certainly those who believe that private industry should participate as fully as possible can scarcely complain about the policy that the AEC has followed in that regard. What sweeter arrangement, from the point of view of private industry, could have been provided, within the barest limits of common decency, than for the Federal Government to take all the risk, spend fantastic sums of money, and at the same time give private industry the benefit of all the know-how that has been acquired as a result of taking that risk and making that investment.

But it is said, this is not really private enterprise, because ownership remains in the hands of the Government, management fees allowed to the operating corporations are not adequate incentives, and there is no real inducement to pioneer in this field. What is it then that the proponents of change desire? Do they want to take any risks? Certainly not. Every proposal to build a reactor providing commercial quantities of power is conditioned upon ample subsidies from the Government. Do they want to build with their own funds reactors large enough to supply power? Certainly not. Every proposal is

conditioned on the Government providing all or the major part of the money necessary to build these plants. Do they want to provide power in a free market on a competitive basis? Certainly not. They all agree that cannot be done now, and probably not for at least another 10 years. Are they willing, despite the demand for huge Government subsidies, to accept compulsory licensing of all atomic-energy patents to qualified applicants, and thus perhaps save the appearance of free competition? Certainly not. Those industry representatives who were candid indicated that they would insist on an unrestricted right to license; that is, their unrestricted right to license or to refuse to license.

Only one conclusion can reasonably be derived from an examination of the record. That is that a few corporations desire to get in on the ground floor before atomic power on a competitive basis has actually been produced, so as to prepare the way for the creation of a huge private monopoly to substitute for the present public monopoly. They want the present prohibition against private ownership of patents in the atomic energy field lifted so that they can get sufficient control to enable them to dominate the entire industry. This would be comparatively easy, because of the vast amounts of money required to build reactors for production purposes. The creation of such a monopoly is a consummation devoutly to be resisted.

As to the effect on national defense, we cannot enter into an extended discussion of this aspect of the problem since we are without the vital secret information necessary for an informed judgment about it. We can, however, offer certain reflections upon it.

If it is true, as has been authoritatively stated, that the facilities now in operation, plus those authorized, can produce enough atomic weapons for our defense, then there can be no justification for permitting the construction, under private control, of additional facilities for the production of fissionable materials intended for atomic weapons. Aside from the fact that this would be putting into the hands of private industry materials of fantastic destructive potentialities, it would require that the Government obligate itself to buy enormously expensive fissionable materials for which it had no use. It would mean that we would have to continue the manufacture of atomic weapons even if we had attained what our military officials deemed to be a sufficient stockpile.

On the other hand, if the present and projected production facilities of the Government will not be sufficient to provide enough atomic weapons, then it would be highly irresponsible to expect to obtain the needed additional materials from private manufacturers. We say "irresponsible" because it appears to be the consensus that the amount of plutonium which could be obtained in the near future from those reactors which may possibly be built under private auspices is highly indeterminate and uncertain. If it is known now that the present and projected production facilities are not sufficient to provide the needed atomic weapons for our defense, then it would be utterly inexcusable if authorizations are not now made to construct them. The obligation and the power to determine how much plutonium should be produced, and the rate of its production, for military purposes must at all times remain a governmental prerogative.

We recognize that persons in high authority do not entirely agree with us. On this point, the Congressional Record of June 2, 1953,

reported that representatives of the Joint Chiefs of Staff discussed with the joint committee, in executive session, the effects of the development of atomic power upon the military use of fissionable materials. These representatives of the Joint Chiefs of Staff recommended that any legislative changes to further atomic power development should include adequate safeguards to protect military claims upon fissionable materials, and concurred in the view that development of atomic power by private enterprise would be beneficial to the military services and to the national security. The nature of the safeguards they proposed was not revealed.

However, these representatives stated further that in the event private enterprise did not undertake rapid development of atomic power, it was the view of the Joint Chiefs of Staff that the Government should continue to push ahead in this field.

Inasmuch as the record before the committee establishes, in our opinion, that private industry is not ready or able to undertake the rapid development of atomic power, the net effect of the recommendations of the Joint Chiefs of Staff would seem to rebut any claim that the act must be amended now. Those recommendations recognize that the Government can push ahead in this field and, under the circumstances, should do so without delay.

On the effect on world peace: One of the objectives of the Atomic Energy Act is that the development and utilization of atomic energy shall be directed toward promoting world peace. Almost before the dust of the Hiroshima bomb had been dissipated, efforts were begun to outlaw the atomic bomb. The United States took a leading part in these endeavors. It participated actively in developing the United Nations plan for control of the bomb. This plan provides for effective prohibition of the manufacture, possession, and use of atomic weapons, and, at the same time, would promote the development of atomic energy for peaceful purposes only. In addition to providing for an international system of inspection, it provides for international ownership of source and fissionable materials and international ownership, operation, and management of facilities making or using materials in quantities sufficient for weapon purposes. President Eisenhower has only recently emphasized the willingness of the United States to enter into agreements providing for "the international control of atomic energy to promote its use for peaceful purposes only, and to ensure the prohibition of atomic weapons."

In order for the United States to be ready at any time to enter into international agreements under the United Nations plan, it must have complete control over fissionable materials and production facilities. If this Government should adopt a policy which would permit private industry to own and produce fissionable materials in substantial quantities, it will thereby give notice to the world that we have retreated from our determination to abolish atomic weapons by international agreement. When we give private industry a stake in the continued production of fissionable materials for military purposes, we give it, to that extent, a measure of control over our efforts to abolish the atomic bomb. Such action would indeed be a great disservice to world peace.

The public investment: There is one other consideration to which little explicit attention has been paid by administration and industry witnesses. The people of the United States have already invested,

or committed, \$12 billion in the atomic-energy industry. All of that has been done in a dozen years, more or less. It can certainly be anticipated that additional sums in great amounts will be spent by the Federal Government on this industry.

Consider the immensity of this investment in relation to present common stock equities in private industry, equities which have been built up over scores of years. As of the first quarter of 1953, stockholders' equities in all manufacturing industries in the Nation were valued at \$106 billion, less than 9 times the Government's investment in the atomic energy industry; for the same period the equities in the electrical-machinery industry were valued at \$5.1 billion; in the chemical and allied industries \$9.7 billion. The entire equity in the electric-power industry was valued, as of December 31, 1952, at \$11.4 billion. With the possible exception of the petroleum refining industry, the production of atomic energy is by far the greatest industry in the United States. The combined common-stock equity of the five major corporations operating in the atomic-energy field, namely, General Electric Co., E. I. du Pont de Nemours & Co., Union Carbide & Carbon Corp., Westinghouse Electric Corp., and Monsanto Electric Co., is \$3.6 billion. These comparisons provide a yardstick of a sort to give some appreciation of the staggering size of the public's stake in the atomic energy industry, solely from a monetary point of view.

As a result of these expenditures, the Government has acquired, not only a stockpile of atomic bombs, but also a great body of knowledge—scientific, technical, and engineering—concerning the production of atomic energy. A basic issue raised by these hearings is whether that knowledge will be used entirely in the public interest, or whether any significant part of it will be used for private profit and the possible development of a powerful monopoly.

The answer is clear to us, and we think it should be clear to Congress as steward of the interest of all the people of this country. We think it intolerable that a patrimony of such great value should be given away without even the pretense of a mess of pottage in return. In addition, the proposals made by the industry representatives to this committee constitute the most extraordinary looking of an anticipated gift horse in the mouth. The prospective donees would not be satisfied merely with receiving the gift, but they insist on an indefinite continuance of gifts to support the original one. It may be that, in the present climate of opinion, many people have become somewhat insensitive to the enormity of the giveaway programs which have been initiated by the Federal Government within the past few months. Those actions, however, should not dull us to the fact that if such a program is carried over into the atomic-energy industry, it will eventually have a social, political, and economic impact far beyond that of any action of a similar nature heretofore contemplated.

The potential multi-billion-dollar giveaway of atomic know-how, reinforced by patent rights, contemplated by industry representatives who have appeared before this committee, may dwarf the combined value of all previous and other proposed giveaways of our country's national resources.

There is, of course, no accurate way of assessing how many tens of billions of dollars this know-how represents—nor how much additional money from the American taxpayer will be necessary to enable private industry to exploit fully these advantages. It is a virtual

certainly, however, that the possible future value of these acquisitions, which private industry wishes to monopolize, would make the tidelands oil giveaway look like a bargain-basement transaction.

To summarize our viewpoint on this matter, we think the questions raised by the proposals pending before the joint committee must be answered as follows:

1. The Atomic Energy Act in its present form permits the fullest possible development of atomic energy for industrial use.

2. The private ownership of fissionable materials, and the facilities to produce them in substantial quantities, will not bring about a faster development of atomic energy for industrial purposes than the AEC can achieve.

3. The interests of national defense will not be promoted now, any more than they would have been in 1946, by permitting the private manufacture of matter having the enormous destructive potentialities of fissionable material.

4. The possibility of achieving effective and reciprocal international safeguards against the use of atomic weapons would be reduced if private development of fissionable material in substantial quantities were permitted.

5. Since private industry would require large subsidies and guaranties against loss, in order to engage in the building and operation of full-scale power reactors, it is economically not feasible to embark on a program of private development of such reactors.

6. The conditions under which private industry generally is willing to engage in such a program, particularly the liberalization of patent privileges, would promote the creation of a giant private monopoly, and defeat the objective of the Atomic Energy Act to strengthen free competition in private enterprise.

7. The vast public investment already made in the atomic-energy industry requires that power reactors be owned and operated by the Government, so that the people of this country will not be denied what is potentially one of the major fruits of their tremendous expenditures.

We have several recommendations on this whole problem. We think the course to be followed is clear. First, the proposals for amendment of the Atomic Energy Act along the lines suggested by the AEC, and all similar proposals, should be rejected in their entirety. Second, the Atomic Energy Commission should proceed without delay to build full-scale nuclear reactors for power purposes only.

One of the areas in which the Commission may be properly criticized vigorously is its failure to build nuclear-power reactors sufficiently large to produce substantial amounts of power. It has the available know-how. It recognizes the need for research and development of such reactors. It has, or can get, the necessary funds.

The amount of electric power used by the Commission's facilities is enormous. Published figures indicate that they use approximately 21½ percent of the total amount of electric power produced in this country. It is obvious that the AEC could use all the power that it could produce from its own reactors. In the course of building such reactors the necessary experience will be acquired, and arrival of the time when atomic power can be produced at competitive prices will be hastened. Indeed, in view of the Commission's desire to turn over the production of power to private industry, the Commission will have

a strong inducement to produce electric power from a nuclear reactor at competitive prices at the earliest possible moment.

The AEC has declared that "as a Nation we should not delay the development of this great potential source of energy for constructive purposes" and that it believes "the attainment of economically competitive nuclear power to be a goal of national importance." In the light of these statements, if the Commission fails to proceed now with the construction of nuclear-power reactors it will be derelict in the performance of its duties.

Chairman COLE. Thank you, Mr. Sigal.

Senator, do you have any questions?

Senator PASTORE. No questions.

Chairman COLE. Mr. Holifield?

Representative HOLIFIELD. I will pass at this time.

Representative PRICE. No questions.

Representative PATTERSON. No questions.

Chairman COLE. Then we will hear from Mr. Swisher.

Representative HOLIFIELD. If you are passing to Mr. Swisher at this time, I would like to say that your statement has been very thoughtfully prepared and certainly presents to this committee a very definite viewpoint. You have been, if I might say, brutally frank, and the challenge which is represented by your statement on many different problems here in which you have not minced words, is certainly a challenge which this committee intends to meet, and to meet the responsibilities which are enjoined upon us by law.

Mr. SIGAL. We think that blunt language is required, Congressman, because of the enormous importance of this problem. The question should not be discussed in circuitous language so that the meaning may be obscured.

Representative HOLIFIELD. I am glad to see on page 6, where you quote Mr. Sumner Pike's speech, that he gave to the National Association of Manufacturers advice on how to get what they want out of Congress, and I hope when the representative comes before us he utilizes those methods.

Chairman COLE. Mr. Swisher.

STATEMENT OF ELWOOD D. SWISHER, INTERNATIONAL PRESIDENT, UNITED GAS, COKE, AND CHEMICAL WORKERS OF AMERICA, CIO

Mr. SWISHER. My name is Elwood Swisher. I am president of the United Gas, Coke, and Chemical Workers of America, CIO.

Our union represents thousands of workers employed in the atomic energy program by contractors for the Atomic Energy Commission. Our organization is most closely involved in the day-to-day operations of this vast enterprise. We adhere to the policy enunciated by Mr. Sigal in behalf of national CIO who has preceded me. We have been designated as the collective bargaining agent for some of the most fundamental units involved in the process of preparing uranium for the atom bomb program.

Our experiences with the contractors and with the Atomic Energy Commission have not been of the most cordial relationship, but we have made collective bargaining work. We have had, and continue to have, serious differences with the whole method of operation of this

program; but we have sought to look beyond the immediate collective bargaining needs of our members, and have discussed and debated at great length the problems posed by the developments in this industry. Following the most extensive discussion, the executive board of our organization adopted a statement of policy on atomic energy in Detroit, Mich., January 16, 1953. Pertinent excerpts follow:

Regarding Government control, we say:

Wise men in Government saw that atomic energy was too powerful and possessed potentials too great to let a few men or a few companies get control of it.

For that reason, the development of atomic energy was placed in the hands of a Government-controlled commission with the idea of spreading the potential benefits of atomic energy over the Nation for the benefit of all the people.

On security:

Of equal importance to the economic and political implications of private control of atomic energy is that of personal security. Public ownership of atomic energy is vital so that security of the individual worker in the industry can be safeguarded.

A straw in the wind to show what can and may happen is the manner in which AEC has turned over the employment of workers by the private companies under contract to develop atomic energy. The company hires the worker, it decides whether or not he is a good security risk and it can employ lie detectors, the use of which this union vigorously opposed and the wide use of which has been abolished, and a diabolical espionage system to spy on the worker. His every word and action is under suspicion in many instances. If private industry got control of atomic energy, this same system could be developed into a thought-control program which would not be concerned merely with national security, but could be used as a union-busting device. This would set the stage for a Fascist state with atomic energy as the vital core.

On the question of labor relations:

Another practice which has been very annoying and expensive to the UGCCWA has been that of deliberate stalling by the companies on atomic plant grievances. This has meant that such cases have gone to arbitration where the union must pay half the costs. The irony of this situation is that our members pay their share of arbitration costs through their union dues, and they help pay the company's share through taxes, inasmuch as the Government pays the company for operating the plant. This is double taxation and insult is added to injury because the worker helps to pay the cost of the company's fight against the worker's best interests. Only American big business could figure out a steal like that and get away with it.

I also might say to the members of the committee that this also applies to negotiations and the exploration of contracts as well as wage reopeners. The Government is paying the company's lost time and the union is paying the union's lost time out of their union dues.

On the question of fooling the public and the Congress, our position was:

The campaign in regard to atomic energy will be twofold, as we said before, (1) to sell the public on the idea that AEC has failed to do its job, has wasted public money, and that atomic energy should be turned over to private concerns, and (2) to do a similar selling job on Capitol Hill.

On protecting the public interest:

This union, therefore, serves notice that it will vigorously oppose any moves to weaken, cripple, or sabotage the Atomic Energy Act of 1946 including any effort to change the law so the financiers and industrialists can lay hold of the facilities and materials used in producing nuclear energy.

The United Gas, Coke, and Chemical Workers hereby calls on President Dwight D. Eisenhower to use the full power and prestige of his office to prevent a grab of atomic energy by private interests, and we urge the Members of the Congress similarly to defend the rights of the people in respect to public ownership of

atomic power and energy, and to strengthen the Atomic Energy Act, rather than weaken it.

This union also suggests that the Congress appropriate additional funds for atomic research for peaceful purposes which would benefit the public, rather than concentrating on the development of atomic energy as a destructive force.

This union urges the Congress of Industrial Organizations and its affiliates representing more than 6 million Americans to join in the fight to keep atomic energy in the hands of the people.

This policy statement was adopted prior to the calling of these hearings, which were so directly suggested in the remarks of Commissioner Pike almost 3 years ago.

We did not have the advantage in January as we do now of knowing how thin the basis has been for the tremendous ballyhoo campaign which has been waged to sell the concept that only private enterprise can complete the process of developing atomic energy for civilian use.

Now that this committee is developing the facts, now that those who have had any contribution to make have had an opportunity to appear before this committee, it is clear that the whole ballyhoo campaign has very little essence to it. It is clear that the possibilities of immediate atomic power have been greatly exaggerated for self-serving ends. It is clear that no industrial combine is prepared to initiate and finance the construction of an atomic power reactor without Federal subsidy or guaranties against risk.

Most fundamental of all is the fact that we have achieved the present state of knowledge in this whole field of atomic energy only through the expenditure of vast sums of public funds. No better program for increasing the benefits from atomic energy, nor for reducing the costs of the operations could be arranged than for the AEC to build power-producing reactors to meet part of their own power needs.

It is my understanding such a program was initiated in Oak Ridge, and discontinued. Later the experiments were conducted at the Knolls Laboratory, Schenectady, N. Y. Three years ago this program was canceled. I have never understood why. Just in the past few days the Congress has been discussing how to meet the power needs of the Tennessee Valley.

Gentlemen, one method would be to have the Atomic Energy Commission substitute power produced from atomic energy for some of the power now purchased from the TVA. Everybody would benefit. The AEC would have completed the first large-scale power reactor. The AEC would control part of its own power source. The TVA would have available for industrial expansion in the Tennessee Valley a substantial block of power. Industry and the community would benefit.

To meet the power needs of the gaseous diffusion plant in Pike County, Ohio, for which over \$2 billion have been appropriated, the Congress has already amended the law to provide cancellation costs which might total \$100 million. If this substantial obligation can be assumed by the Government on the basis of a possible cancellation, it seems to me that the wiser investment would have provided for the completion of a second power reactor to produce part of this electric power needed directly by the Commission itself. Thus the hazardous adventure by the Ohio Valley Electric Corp., which is composed of more than 14 utility companies, would have been substantially reduced.

Likewise in the Hanford plant, production of some of its electric power needs directly by the AEC would make available to that expanding region portions of public power now used by the Commission. Every argument for the earliest completion of this power program seems to require that it be achieved by direct Government completion of at least the first power reactor.

We have had some experience with the shortcomings of the present system of operation of the AEC. We know as human beings the difficulties of dealing with the AEC. The members of this committee know of our efforts to establish normal community life in the areas where AEC operates. More than money, material, and training are involved in this program. Hundreds of thousands of human beings are directly affected by the policy attitudes of the Atomic Energy Commission. We know the difficulty of dealing with that group. One of your own colleagues recently said (Congressional Record, June 17, 1953, p. 6911) :

Let me say that I spent a year working for the Atomic Energy Commission and I find that I cannot rely on anything the Atomic Energy Commission tells me, because everything they have done has been wound up in a cloak of secrecy and security, and behind the cloak are some things that would certainly amaze and disgust you gentlemen of this Congress.

We do not wonder, then, at the difficulties which we have had attempting to establish normal community life in such areas as Oak Ridge, since the Commission, using security, is able to bamboozle the public, misrepresent the facts to Congress, and pose as virtuous angels in the reams of publicity which they pour onto the American people. But we who work in the plants know the Commission's shortcomings. We know nevertheless the need for maintaining primary focus on the public interest. We do not want the American people to suffer from a transfer to a pseudo private enterprise but in reality to a tight-fisted monopoly.

On the same day that the Congress took steps to grant authority to President Eisenhower to extend FHA mortgage terms to 30 years, the first 25 families who were being permitted an opportunity to build their own homes in Oak Ridge were offered mortgage terms by the new bank in Oak Ridge.

Gentlemen, a private banking monopoly offered to loan 25 families money which is deposited by thousands of our members, 50 percent of the cost of the home, \$6,000 on a \$12,000 house, to be repaid in 5 years at 6-percent interest.

In contrast, under the GI bill, these 25 families, many of whom are veterans, are entitled to form a section 213 cooperative, secure a 95-percent loan, make a down payment of \$600 instead of \$6,000, and make monthly payments of \$57.80, for interest and principal, instead of \$116 per month. Is this the kind of private enterprise which is being advocated for the control of atomic power production?

Representing the workers who have contributed to the safety of this country by making what might be thousands of bombs, we protest this ballyhoo campaign, we urge this committee to reject it, and hope you will instruct the Commission to remove power reactor projects from the bottom of the priority list and place them instead on an equal footing with the weapons programs.

Chairman COLE. Thank you, Mr. Swisher.

Are there any questions?

Representative HOLIFIELD. This matter that you brought in here at the last is certainly news to us. Is this the Government-owned houses at Oak Ridge which Congress authorized the Atomic Energy Commission to sell to the occupants?

Mr. SWISHER. No. This is the start of a new program. They are allowing families to lease, on a 55-year basis, I believe, property to build their own homes on. The houses already built are not affected by this program.

Representative HOLIFIELD. Do you mean the AEC is allowing them to come in and lease a piece of ground?

Mr. SWISHER. That is right.

Representative HOLIFIELD. But there is no provision for financing the houses?

Mr. SWISHER. None. They are having considerable difficulty.

Representative HOLIFIELD. What about the houses that are built, which the Congress authorized them to sell?

Mr. SWISHER. I might say there had never been anything concrete on that until last night. I see that a bill—

Chairman COLE. Mr. Swisher—if the gentleman will defer—that subject is somewhat foreign to our meeting today, and I hope we will not get into a prolonged discussion of it.

Representative HOLIFIELD. I do not intend to. I just wondered about this statement here.

Mr. SWISHER. I would like to say, Mr. Chairman, if you will permit me, this housing situation is of vital concern at the present time in Oak Ridge.

Chairman COLE. I realize that, but this is not the time or place to discuss it.

Mr. SWISHER. I recognize I am possibly out of order, but I would like to make the plea that the necessity of it warrants, I think, special consideration of the committee, whether today or at a special session or something on that order, to bring to the committee's attention some of the ramifications that may, shall we say, erupt down there over the question of rent increase.

Chairman COLE. The Member of Congress in the House from that district, Mr. Baker, has introduced a bill to authorize the Commission to sell Government-built houses to the workers with a formula for determining the price. That bill will be considered by the House as quickly as possible.

Representative HOLIFIELD. I assume this is the bill just handed to me by a member of the staff. I see that a bill by Mr. Baker of Tennessee has been introduced. It has been referred to our committee. So on that basis, I will withhold my questions, because the chairman is right, it is out of order at this time to discuss that, because it has nothing to do with atomic power.

Chairman COLE. If there are no further questions, thank you very much, gentlemen, for your statements.

Mr. SWISHER. Thank you, gentlemen.

Chairman COLE. Our concluding witnesses are Dr. Guy Suits, vice president of General Electric Co., who will appear for and in behalf of the National Association of Manufacturers, and Mr. William Steiger, who is vice chairman of the National Association of Manufacturers Patents Committee.

Are you Dr. Suits?

Dr. SUITS. Yes.

Chairman COLE. Are you going to speak first, Dr. Suits?

Dr. SUITS. Yes, sir.

Chairman COLE. First let me express my regret at not being able to accommodate you to better advantage this afternoon.

Dr. SUITS. Thank you very much.

**STATEMENT OF DR. C. G. SUITS, CHAIRMAN, SUBCOMMITTEE ON
ATOMIC ENERGY OF THE COMMITTEE ON RESEARCH OF THE
NATIONAL ASSOCIATION OF MANUFACTURERS**

Dr. SUITS. Mr. Chairman and members of the committee, my name is C. G. Suits. I am vice president and director of research of the General Electric Co., and chairman of the Subcommittee on Atomic Energy of the Committee on Research of the National Association of Manufacturers, and I am speaking today for that association.

The NAM is a voluntary organization of more than 19,500 manufacturers, 83 percent of whose members have less than 500 employees each. As you may know, the National Association of Manufacturers, as a cross-section of American industry, includes in its membership a host of manufacturing companies, both large and small, that are participating in many phases of the country's atomic energy program. In some cases the company's role is that of a supplier of conventional industrial equipment required in the operation of AEC plants. In other cases our members are contractors to the AEC, or to its contractors, for the development and production of the many special materials and components which are required by the vast AEC activity concerned with the military applications of atomic energy. Finally, some members of the National Association of Manufacturers are major contractors of the AEC for the operation of its largest research, development and production facilities. In this category of major contractors to the AEC, the NAM includes some 70 companies in its membership. In all of the above categories, there are over 1,000 participating companies in the National Association of Manufacturers.

Thus the National Association of Manufacturers is in an excellent position to present a point of view which reflects the many diversified interests of industry in the future legal, patent, and competitive framework of atomic power development.

My own company is engaged in the operation of the Hanford Works, the Knolls Atomic Power Laboratory, and the aircraft nuclear propulsion project. It was my responsibility to plan, build, staff, and initially operate the Knolls Atomic Power Laboratory, which has since grown to a separate operating division of the company, and I have had an opportunity to observe intimately the postwar operation of the Hanford Works. The large participation of American industry, as in the case of my own company, in the work of the AEC, is motivated primarily by the hope that from knowledge gained in the military applications of atomic energy will come a future industry based on atomic power.

The shape of atomic powerplants to come has been the subject of speculation and prediction on the part of many of the people who have participated in these hearings. If the choice between helium-cooled reactors, light-water- or heavy-water-cooled reactors, and

liquid-metal-cooled reactors, is still in some doubt, and if there remain some unresolved questions concerning natural or enriched fuel and a homogeneous versus a heterogeneous core design as well as the choice of neutron spectrum, there should be no reasonable doubt that cheap atomic power is not just around the corner. Carbonaceous fuels are so cheap and abundant that their contribution to the cost of electricity in present-day plants is generally much less than the contribution of plant investment and operation.

For this reason the saving in the cost of the fuel required in conventional plants, although an ultimate possibility in atomic powerplants, does not present an immediate objective of vital consequence. Hence, the problem of building an atomic powerplant which will compete economically with a powerplant burning conventional fuel reduces to the problem of designing and building a nuclear boiler which will compete in investment and operation expense with a conventional steam boiler. This nuclear boiler, or nuclear reactor, is presently encrusted with stainless steels, semirare metals, and expensive alloys, and is surrounded with complex associated gear, and is the most expensive part of the atomic powerplant. One must anticipate that a vast program of research, engineering investigation, and pilot plant construction and operation extending many years into the future and costing hundreds of millions of dollars will be required before the goal of economical atomic power can be said to be in sight.

If this be true, as I believe, it is pertinent to ask why any changes in the Atomic Energy Act should be contemplated at this time. I think a persuasive answer can be given to this question. First, in spite of the great technical difficulty and exceptional cost of developing economical atomic powerplants, our most capable scientists and engineers believe that this goal is ultimately attainable. Second, the great rate at which we are using up fossil fuels, and particularly the great rate at which this usage is increasing each decade, indicates that, although our fuel supplies will last well into the future, we will probably begin to experience a fuel shortage within the life span of people now living.

Third, the experience of industry in designing, building, and operating the great American power systems must be brought to bear upon this problem if the project is to succeed ultimately.

There is every indication that industry is willing and anxious to participate to an increasing extent in the development of atomic power. If private capital is to be invested in this great enterprise, some of the provisions of the present Atomic Energy Act pertaining to ownership, patent, legal, and competitive matters should be revised. The Atomic Energy Act of 1946 was the result of careful and thoughtful deliberations on the problems imposed by the advent of atomic energy, primarily with respect to its military applications. The nonmilitary uses of atomic energy were foreseen, but not provided for specifically in the act. If the great resources of our free enterprise system are to play a responsible role in this development, some of the elements of complete government monopoly must be changed in recognition of this participation. We believe that changes may be made in the act which will greatly encourage the participation of private industry without in any way compromising "the paramount objective of assuring the common defense and security." For example, under the present act the ownership of all fissionable material is vested in the Government.

We believe that with proper provisions for licensing by the Government and under security regulations established by the Government, private ownership of fissionable materials should be permitted.

Furthermore, under such conditions of security a licensee should not be limited in the amount of fissionable material which he may own. We believe that the Government should also license private industry to manufacture and use equipment or facilities for nonmilitary applications of fissionable materials which may be developed by private industry, and with private capital should be allowed to grow and progress in a competitive framework. Consistent with this objective, a licensee should not be required to make available to all others information which he has developed by the expenditure of his own capital.

Since substantial investments may ultimately be involved, the provisions of the amended act should not permit the capricious or arbitrary cancellation of such licenses, providing, of course, that the licensee is not in violation of regulations concerning health, safety, or national security.

The patent provisions of the Atomic Energy Act of 1946 are very special and clearly did not provide for the participation of competitive industry in atomic energy developments except as a contractor of the Government. Upon this question Mr. W. A. Steiger of the NAM committee on patents will comment in detail.

A brief summary of the principles which the NAM believes should be incorporated in any law relating to atomic energy follows:

The first and foremost objective should be to assure the common defense and security of the United States.

Subject to the above, we believe the following principles should be embodied:

(1) The law should be directed toward the development and utilization of atomic energy, to improve the public welfare, increase the standard of living, strengthen free competition in private enterprise, and promote world peace.

(2) The Government should control the development and manufacture of military weapons employing fissionable materials.

(3) An agency of the Government should be empowered to permit ownership of fissionable materials by operators of facilities of a nonmilitary nature licensed by the Government and operating under safety and security regulations established by the Government.

(4) There should be no limitation on the amount of fissionable material which the Government may sell or distribute to a licensee for nonmilitary use after military needs have been met.

(5) The Government agency should be empowered to license applicants to develop, manufacture, use, or own apparatus or facilities for industrial, commercial, or other nonmilitary uses wherein fissionable material is used or produced.

(6) No person should be required, as a condition of his license, to provide the Government agency with technical information and data, except as may be reasonably necessary to administer health, safety, or national security laws or regulations.

(7) No license granted by the Government should be terminable by the Government except for deliberate violation by the licensee of health, safety, or national security regulations established by the Government.

(8) All patentable inventions relating to the field of atomic energy should be patentable by the inventor under the patent laws of the United States subject to the procedures followed on other items of national defense.

(9) That, in contracts granted by the Government to private contractors, the patent clauses in such contracts should conform to the practice prevailing in the armed services procurement regulation for products of a nonatomic nature.

Mr. Chairman, I would like to suggest, if I may, that Mr. Steiger present his testimony, which is contiguous to my own.

Chairman COLE. Very well, unless some member—

Representative HOLIFIELD. You mean before questioning occurs?

Dr. SUITS. Yes, if you please, because I suspect that some of the questions may bear upon the testimony of both of us.

Chairman COLE. We will hear from Mr. Steiger now.

STATEMENT OF WILLIAM A. STEIGER, VICE CHAIRMAN, COMMITTEE ON PATENTS, NATIONAL ASSOCIATION OF MANUFACTURERS

Mr. STEIGER. Mr. Chairman and members of the committee, my name is William A. Steiger. I am vice chairman of the committee on patents of the National Association of Manufacturers, and I am speaking for that association.

The National Association of Manufacturers has adopted a statement of principles, including two principles relating to patents in the atomic-energy field, which principles have been referred to by Dr. Suits. These principles are in accord with our American patent system which was established when our Constitution delegated power to the Congress to authorize the granting of patents. Since the first Congress, this country of ours has been blessed with patent laws which have stimulated individuals and corporations to invest their time and money in the creation of new or better products. As President Lincoln said:

The patent system added the fuel of interest to the fire of genius.

In the words of the National Patent Planning Commission, appointed by the late President Roosevelt:

Our patent system has contributed to the achievement of the highest standard of living that any nation has ever enjoyed.

Now, in view of the proven success of our patent system, do we need a different patent law for atomic energy than for radar, jet engines, or clothes-washing machines?

SECURITY

Well, first of all, there is the question of security. I wish to repeat what Dr. Suits has said: that NAM believes that security is paramount and that all other considerations are secondary. However, we have this very same question of security in nonatomic weapons and many other national defense items of a classified nature. We already have the Espionage Act, we have provisions in title 35 of the United States Code on Patents—sections 181–188—prohibiting the issuance of any patent detrimental to national security, and we have the armed services procurement regulations on classified contracts.

Under existing law, an inventor may file a patent application in the United States Patent Office but that patent application cannot issue as a patent if, in the opinion of the Government authorities, its issuance would be detrimental to national security. Such a patent application remains in secrecy in the Patent Office until such time as the Government authorities declassify it. However, when the patent issues, it is the prerogative of the inventor to exploit his patent in the normal commercial way. The security laws with respect to patents generally have proven adequate, so where is the necessity for a different law with respect to patents in the atomic field?

Just suppose we had one security law for guns, another for electronics, another for jet engines. The result would be utter confusion. So it appears to us that the security aspects are already taken care of by existing legislation.

The next question is: What inventions should be patentable?

The Atomic Energy Act provides that many inventions relating to atomic energy cannot be patented. Furthermore, patents granted on inventions useful in both the atomic and nonatomic fields have no force or effect in the atomic field. The act also provides that the Government might, if it sees fit, compensate inventors who have been denied their patent rights.

We say that Congress should make all such inventions patentable, if they meet the existing statutory requirements and thus afford the inventor an opportunity to seek his reward in the normal way. This is the democratic way. No offer of reward by any Government agency in lieu of a patent will ever provide a satisfactory inducement for substantial investment of private risk capital. No man or group of men, either in industry or in government, can appraise the potential value of an invention for the next 17 years with any degree of accuracy.

Next we come to ownership of patents.

The present act prevents ownership of patents on certain activities in the atomic field. NAM believes that, subject to existing security regulations, any inventor should have the right to apply for and own patents in any phase of the atomic field. This is in accordance with our established patent laws and in accordance with the practices prevailing on other items of national defense which affect national security. However, with respect to atomic weapons, NAM believes that the Government should control their development and manufacture, but if someone should, with his own resources, invent something which is of importance to the military, that invention should be patentable by him subject again, of course, to existing security regulations. The committee should keep in mind that we already have on the statute books a law—act of June 25, 1948 (28 U. S. Code 1498)—whereby the owner of a patent cannot prevent the Government from utilizing his invention, the owner's only remedy being a suit for damages for patent infringement in the United States Court of Claims.

The present Atomic Energy Act also provides that any invention which utilizes or is essential in the utilization of fissionable material or atomic energy may be declared affected with the public interest, whereupon the Commission is licensed and the owner of the patent is required to license others, the owner of the patent being entitled to a reasonable royalty. This provision, of course, is directed to inventions made at the individual's expense and is generally known as compulsory licensing.

This means that, until the present act is amended or superseded, any patented invention is available to anyone in the discretion of the Commission. Legislation for general compulsory licensing of patents has been proposed many times and considered by committees of Congress. However, no such law has ever been enacted. The reason for not enacting such a law is that it lessens the value of patents and the incentive to invent, and has been opposed always by small manufacturers. Many small manufacturers owe their existence to their patent position, and it is unquestionably true that such a law,

whether it be in atomic energy or applicable generally, is in favor of the manufacturer who does not spend money on new developments. Compulsory licensing eliminates the need for making new inventions, since it does not make it necessary to carry on research and development in order to avoid the patents of a competitor. Atomic energy will develop at the fastest rate if privately owned patents prohibit the copying of the work of others, and require original development by each company in the field.

From now on, it is not likely that any individual or company can monopolize atomic power by a basic patent, as the basic information has already been published or is in the control of the Commission. The advances in the art from now on will be confined to improvement inventions, such as those for increasing efficiency and reducing cost. If private industry is encouraged through the vehicle of normal patent practice to contribute its own money in this effort, more inventions will be made, the art will advance at a more rapid rate, and Government participation and expense should ultimately become less. Different manufacturers will assume different approaches to the problem, and there will ultimately emerge competitive systems different in detailed aspects, one from the other, with each manufacturer probably having some patent protection on his specific contribution, each manufacturer striving to have the lowest cost and each manufacturer contending that his system is the best. Private ownership of patents within the framework of the antitrust laws has, historically, never had a tendency to impede the advancement of an art or to restrict competition. This is free enterprise with its resultant benefits to the public. It is a proven system. It has been successful in all other arts; why should it not work in atomic power? NAM believes, therefore, that the time has come when no manufacturer can monopolize this art through patents and, therefore, that this compulsory licensing provision of the present act should be terminated.

The next question is patent provisions of contracts between the Government and private contractors.

First, let us take the case where the Government finances the development.

Under the armed-services procurement regulations, it has been the prevailing practice for the armed services to grant research or development contracts with a provision that the contractor grant the Government a royalty-free, nonexclusive license under any patent covering inventions made in the course of performing the work under the contract. With this type of patent provision, the armed services have been highly successful in attracting the most competent people in industry to undertake their research and development problems, many of a classified nature.

It should be remembered that there is little or no profit motive in such contracts. Leaving aside patriotic responsibility, such contracts are attractive to the manufacturer only because they may increase his technical knowledge and because he may obtain patents of value in the non-Government field. Because of these inducements, it is generally agreed that the armed services have been very successful in attracting the most competent people to assume these contracts, with consequent saving in cost to the taxpayer and with a material decrease in the time required to attain the objective. It is recommended, there-

fore, that in granting research and development contracts, as distinguished from supply contracts—contracts for standard commercial supplies—the Government follow this same proven procedure in the atomic-energy field. It has worked successfully in many projects of a highly classified nature, and it is, therefore, urged that this policy be adopted by the Commission in its future contracts of this nature. NAM fails to see any real difference between Government contracts pertaining to atomic energy and those dealing with other items of national defense. Both may be subject to top security classification and both involve expenditure of public funds for research and development, and, therefore both should be treated in the same manner.

Now we have the other problem where the contractor himself finances the development.

As stated heretofore, NAM believes that, if an individual or manufacturer, with his own money, invents or develops in the atomic field, he should, subject to security regulations, own the patents covering the same in no different way than if he invested time and money in the nonatomic field. However, if such a manufacturer should obtain technical or scientific assistance from the Government, he should, as consideration for such assistance, be required to grant to the Government a royalty-free, nonexclusive license under any invention made in the course of his work on the project. The licenses granted would give the Government all of the patent rights it requires or can possibly use, and such a policy would stimulate private endeavor in this field.

Summing up the patent aspects, NAM believes that, in the future, patent procedure should be in accordance with established patent practice and established security and procurement regulations of the armed services; that is:

(a) All patent activities should be subject to existing security regulations;

(b) Every invention meeting the prevailing statutory provisions of our patent laws should be patentable;

(c) Where an invention is made without direct assistance from the Government, either financial or scientific, the inventor should be entitled to complete ownership of the patent;

(d) Where the Government finances a research or development project, the contractor should own the patents subject to a free, non-exclusive license to the Government for governmental purposes; and

(e) Where a manufacturer or individual spends his own time and money in research or development but requests and obtains technical or scientific assistance from the Government, he should be required to grant to the Government a free, nonexclusive license for governmental purposes.

In addition to this report, I would just like to add a personal comment at this time, and that is, I think as far as the present Atomic Energy Act is concerned in its patent aspects, those patent aspects have been to date very ably administered by the Atomic Energy Commission.

In conclusion, I would like to thank the committee for giving the NAM an opportunity to present its views. We appreciate it very much.

Chairman COLE. Do the members have any questions of either of these gentlemen? Mr. Holifield?

Representative HOLIFIELD. Dr. Suits, I would like to address a question, on page 5 of your statement. You state there that the Government should control the development and manufacture of military weapons employing fissionable material, but you do not say that they should control the fissionable material which makes those weapons explosive and destructive.

Is that your meaning? Do you mean to restrict control of the development and manufacture of military weapons, without giving the same control to the Government on the fissionable materials which make them a weapon?

Dr. SUITS. I am not certain I understand your question, Mr. Holifield.

Representative HOLIFIELD. Let us go over it again. This is paragraph No. 2, on page 5:

The Government should control the development and manufacture of military weapons employing fissionable materials.

Let us make it very simple. Let us compare it to a gun and to the bullet or the cartridge in the gun. You advocate that the Government shall control the gun, but shall not control the cartridge that goes in it; is that right?

Dr. SUITS. What we advocate is that fissionable materials should be made subject to private ownership under proper conditions of security and safety.

Representative HOLIFIELD. But not with Government control?

Dr. SUITS. Without Government control except in matters pertaining to security and safety.

Representative HOLIFIELD. I just want to know what you mean.

In section (4) you say:

There should be no limitation on the amount of fissionable material which the Government may sell or distribute to a licensee for nonmilitary use after military needs have been met.

Do you mean by that that there should not be a fair allocation of the available surplus to industrial users after the military needs have been met?

Dr. SUITS. No. What we mean is that the limitation embodied in the present act which would make it impossible to acquire enough fissionable material to run a reactor, should be removed.

Representative HOLIFIELD. But replacement materials or the original materials would, of course, be subject to fair allocation by the Government?

Dr. SUITS. Certainly.

Representative HOLIFIELD. So you do not mean that a limitation should be applied in that sense.

Dr. SUITS. No. That is right.

Representative HOLIFIELD. No. (6):

No persons should be required, as a condition of his license, to provide the Government agency with technical information and data, except as may be reasonably necessary to administer health, safety, or national security laws or regulations.

Recognizing the fact that any patent that might be obtained or any information that might be developed from this point onward rests

on the great body of technical information, the use of machinery and processes which have been developed at Government expense, you yet feel that there is no obligation on the part of any person who uses all that great body of information to give to the Government knowledge which he may develop, even for national defense?

Dr. SUITS. Yes; that is exactly the way I feel.

Let me explain it in these terms: The \$12 billion investment which has been made in the atomic establishment has been made for the purpose of developing the military position and acquiring a stockpile of atomic bombs, and, in our feeling, has been well spent. The by-product technology and scientific knowledge that we are concerned with here may have an application to the development of atomic power-plants, and the improvements and inventions based on developments which have been made by the Government, if they are developed with private funds and private investment, we feel the title to those inventions should rest with the individuals or companies who make the investment.

Representative HOLIFIELD. Then you are taking the position that the Government, which has paid for this investment with tax money, shall derive no other benefit out of this project except that of the military. In other words, correlated with the development of military weapons, there also has been developed knowledge which is of benefit in the field of health, biology, and public power; and the Government should give all of that freely away at this time without any obligation on the part of the favored few who receive it to pass such information on to the people?

Dr. SUITS. Let me give you the analogy of this situation which is found in present practice of the Government when contracting with industry for research and development.

If an industrial firm at present undertakes a development contract for the Government, it receives, as Mr. Steiger has indicated, the right to the nonmilitary or nongovernmental uses of any resulting inventions, and the Government receives a free license for governmental applications. Such contracts take no cognizance whatever of the know-how that may have been developed by the industrial contractor prior to this contract.

Representative HOLIFIELD. But he developed that at his own expense.

Dr. SUITS. That is right, but he gets no credit for that. We think that situation is entirely analogous to the situation here. The individual company has developed that knowledge for previous purposes, and has put it to use in a regular line of products which presumably justified the development in the first instance.

In the case of the atomic field, we think that the military applications of atomic energy have been the justification of the Government's investment, and that the byproduct knowledge must be greatly expanded and further developed before it has application to atomic power; to the extent that private investment furthers that development, the private company should have title to the resulting patents.

Representative HOLIFIELD. Your position, if I understand it, then, is that all knowledge and technical information that has been developed, outside that of military application, shall now be made available to those who have the funds to participate—and there must of necessity be a limited number in the power field particularly, because of the amount of money necessary to build these reactors—that all this

information should be given to these people without any obligation on their part to the Government to recompense, either through payment for that information or through obligation to transfer resultant benefits which there may be, to the people who paid for the original basic store of knowledge?

Dr. SUITS. Let me give this additional explanation. One can imagine that in the future development of atomic power there will be requests upon Government laboratories for additional information and data and reports.

Representative HOLIFIELD. That is another subject. Let us confine ourselves to my question, please.

Dr. SUITS. We feel that such additional burdens that may be placed on governmental laboratories could properly be paid for and charged for at cost.

Representative HOLIFIELD. But why should you not pay for the past burdens that have been put upon laboratories?

Dr. SUITS. Because we feel that the past burden has been already paid for in the military development, and that the public has been the beneficiary in the atomic weapons stockpile.

Representative HOLIFIELD. Of course, that would be true in the future; any future burdens paid for by the Government would probably inure to the military protection of the people.

Dr. SUITS. Yes.

Representative HOLIFIELD. In the same way. I suppose you would want those passed on to the industrial users on the same basis, without any recompense to the Government.

Dr. SUITS. Only to the extent to which they have been paid for by private investment. If they have been developed for governmental purposes, the Government should make the first and primary use of them.

Representative HOLIFIELD. Why do you draw the line between the knowledge which has been produced to the present time, and knowledge which may be produced in the future from governmental expenditures?

Dr. SUITS. I draw no such line.

Representative HOLIFIELD. Then you are ready to pay for this incidental knowledge or byproduct knowledge obtained in the past? You are ready now to go in and pay the Government for that, are you?

Dr. SUITS. Only to the extent to which a proper burden is imposed upon Government laboratories for requests for additional specific information.

Representative HOLIFIELD. But the information which already has been obtained, the processes, the metallurgical development, and all that sort of thing—you want that free at this time?

Dr. SUITS. I think they should be made available to those citizens who have it in their power to put it to use for the ultimate benefit of the country.

Representative HOLIFIELD. I just wanted to know where you stood on it.

In No. (7), you say:

No license granted by the Government should be terminable by the Government except for deliberate violation by the licensee of health, safety, or national security regulations established by the Government.

Would you preclude that license from termination by the Government for emergency military use in case it were necessary to have the product of that factory?

Dr. SUITS. No. I think a military emergency would be an over-riding consideration.

Representative HOLIFIELD. Mr. Steiger, in your statement, at the bottom of page 2 and the top of page 3, you say:

Just suppose we had one security law for guns, another for electronics, another for jet engines. The result would be utter confusion. So it appears to us that the security aspects are already taken care of by existing legislation.

Do you mean by that that there is no basic factor or consideration in your mind between, let us say, a machinegun and a power or a gadget that is as destructive, potentially or actually destructive, as the atomic bomb?

Mr. STEIGER. Yes, Congressman. Of course, I am talking only of the patent aspects.

Representative HOLIFIELD. You want the same principles of patent to apply to a force as destructive as the atomic bomb as you would to a revolver?

Mr. STEIGER. No. In other words, we have developments today for national defense which are in the top security classification. Those inventions are handled under our existing security laws. So far as all of us know, the security laws have been adequate to protect those highly classified developments. There are just as highly classified or just as important from the classification standpoint and from the security standpoint as atomic energy. They have been protected through the existing security laws, so far as we know.

Representative HOLIFIELD. Would you say any of these inventions are as capable of mass destruction as atomic weapons are capable of?

Mr. STEIGER. That is a difficult question to answer, Congressman. You take the radar-sighting equipment for the bomb, take the airplane which has to deliver the bomb, the jet engines that drive the airplane. Wouldn't you consider that many of those things were as important as the bomb from the national defense standpoint?

Representative HOLIFIELD. No; I would not consider them so, from the standpoint of security. We know every country in the world has airplanes. We know that every country in the world—I am speaking now of the larger countries—has jet planes. We know they have radar. But there are areas within the atomic field which we believe as yet have not been entered by other countries. Maybe we are wrong. Certainly we should consider that point in the releasing of information and making known to the public information on that, on anything which has to do with the production of atomic weapons. In other words, it seems to me that it should be in a field pretty much by itself because of its degree of destructiveness, and that we must consider it more carefully than we would some of these other industrial secrets which we know are known to other countries.

Mr. STEIGER. I see your viewpoint. I think we all agree we want the best security we can get.

Representative HOLIFIELD. The same question on page 5. You speak there of compulsory licensing of patents. It has been proposed many times, and you say that no such law has ever been enacted. My same line of reasoning would be, is not this an unusual case? The develop-

ment of the atomic bomb, with its tremendous destructive power, is such an unusual case, and the difficulty of dividing or compartmentalizing the civilian type of information from the military type of information, and the difficulty of handling the material on the one hand for a reactor and on the other hand for a bomb—in other words, because of the duality of its use, it seems that we have an unusual case here, just as unusual today as it was in 1946 when we made some unusual patent legislation.

Mr. STEIGER. It always has been opposed by small manufacturers, because small manufacturers make specialty items.

Representative HOLIFIELD. I realize that, sir, and in my own heart I have opposed it, too. But I am looking at this with my knowledge of the importance of the matter which we are handling. To ask for compulsory patenting on a vacuum sweeper or any of the other normal gadgets we use in civilian life, is one thing. But to ask for compulsory licensing on a new development which can be used for a duality of purposes, it seems to me other factors enter into it.

Mr. STEIGER. I am sympathetic with you on your previous question, but on this, of course, it doesn't involve security. If you have compulsory licensing you won't have the amount of inventing. We all have a tendency to copy the other fellow if we can do it, so we won't invent our own or better ones. We would all have the same kind of washing machine or the same kind of automobile.

Representative HOLIFIELD. Let us consider that for a minute. There are two kinds of benefits that may come from patents. One benefit is that of a monopoly use or restricted use of what you patent, and that is the practice throughout industry. The other is the royalty income that is involved by cross-licensing and bringing it to the people as a whole by a multitude of manufacturers using that patent and paying a royalty for it, but at the same time spreading throughout our Nation a widespread base of free competition in the manufacturing of articles which may or may not depend upon this particular new invention.

So you have royalties in either case, but in one case you have a restricted right to use solely that patent, which gives a monopoly advantage to the owner and user; and in the other case you have a widespread use of it for the benefit of society, but still retaining ample royalty rights on it, a reasonable royalty right on it, so the inventor is compensated and repaid for his contribution to the advance of the particular technology.

It seems to me that that type of licensing, because of the fact that it is based on billions of dollars' worth of tax moneys expended by all of the people, would be an equitable way of transferring some of that basic investment, equity investment, you might call it, to the people in as widespread a manner as possible, and at the same time protect the right of free enterprise to receive compensation for their initiative and their inventive genius.

Mr. STEIGER. I see your viewpoint. Of course, under those conditions you have less inventing, less development and research.

Representative HOLIFIELD. That is a statement on your part which I may or may not accept. You may be right on it. I am not sure. We do have an equity here which has been established, something very unusual which has been established in a new scientific field which the Congress has to consider.

At the bottom of page 5 you predict that there will be no basic improvements or that there is little likelihood of it, and I question your ability or my ability to predict that within the next year there may not be a startling and radical new development in the field of reactor development which may make atomic power half the cost of the average cost of conventional power. That may occur within a year. We cannot say.

The development in this new field has been so rapid that I think you or I, either one, could not predict that such a thing will not occur. If it does occur, and if one company has the individual right or restricted use of that, then, again, you see we are not guarding the public interest.

Mr. STEIGER. Congressman, we are going through the first power system, and, of course, we found nothing basic or fundamental.

Representative HOLIFIELD. That is something that, of course, neither one of us can tell.

Mr. STEIGER. Of course, the records are in the Atomic Energy Commission files, which contains all of the patent disclosures made to date.

Representative HOLIFIELD. I notice on page 7, at the top, that you recognize the right of the Government to a royalty-free use of any patents which have been developed by Government expense.

Mr. STEIGER. Yes.

Representative HOLIFIELD. Of course, there have been other compensatory factors involved in this development, which has given to industry know-how, organizational and scientific knowledge which they did not have before, which by the very nature of it, not being exclusively adaptable to atomic energy—I am speaking now of the field of development of pumps and certain very high-tolerance machinery, new metals which have other uses, and so forth—that knowledge is available to industry. So they have had compensation in addition to their satisfaction from doing their patriotic duty.

Dr. SUITS. I would like to comment on that, if I may. I think there have been relatively few examples of byproducts of atomic-energy developments which have had other uses. I recall few, if any.

Representative HOLIFIELD. You feel that the chemical processes and the high-tolerance processes, the development of zirconium and other metals, bringing them down from extremely high cost to low cost, has no commercial application at all?

Dr. SUITS. That is certainly true up to the present.

Representative HOLIFIELD. You see no benefit that will accrue from that type of thing in the future?

Dr. SUITS. It is conceivable that there will be such a benefit, but it is surprising that to date in spite of the great expenditures in research and development in the specialized field of atomic science and engineering, there has been none.

Representative HOLIFIELD. I think private industry has done a magnificent job under the AEC, Government contracting with private industry, and my hat is certainly off to them for the job they have done in this great development.

I can hardly conceive that out of the tremendous amount of money that has been spent on metallurgical and chemical research and development that there are not appreciable advantages which will accrue to our country.

Dr. SUTTS. Mr. Holifield, of course that was part of the motivation of contractors of the AEC, but I can say for certain that as far as the industrial area in which my acquaintance lies they have been almost no nonmilitary applications of atomic technology. I do not know of a single application which has come as a byproduct of research and development in this area in my company.

For example, you mention the development of high-purity zirconium. But the primary interest in the metal, in fact, the sole interest, as far as I know, is in atomic reactors. Even the reduction in cost that you refer to is still a reduction which only puts it in the class of rare metals, and not commercial alloys and metallic materials. So I think one has to say in honesty that the great developments of atomic technology have been almost solely applicable to the field of specialized atomic processes and equipment.

Representative HOLIFIELD. This committee has been informed that radioactive isotopes have been used and are being used by industry in quite a number of fields, in the detection of flaws, concealed articles, and that sort of thing. Is that true?

Dr. SUTTS. That is true, but the fact is that the principal application of isotopes has not been to industrial processes, but has been primarily to research. Isotopes have been a valuable research tool, but even there the primary use has been in the fields of biology and medicine. There it has been very important.

In industrial research isotopes have been of very minor importance, and in industrial process and manufacturing applications, almost of negligible importance.

Representative HOLIFIELD. Thank you, sir, for your appearance here today and your statement.

Chairman COLE. Mr. Price.

Representative PRICE. Mr. Chairman, I have just one question: I would like to get down to the fundamental reason for these hearings. In the statement of policy issued by the Commission they say this:

We believe the attainment of an economically competitive nuclear power to be a goal of national importance. It would be a major setback to the position of this country and the world to allow its present leadership in nuclear power development to pass out of its hands.

In your statement on page 3 you say this:

One must anticipate that a vast program of research, engineering investigation, and pilot-plant construction and operation extending many years into the future and costing hundreds of millions of dollars will be required before the goal of economical atomic power can be said to be in sight.

That has been the gist of much of the testimony here, which would indicate a great financial burden on industry if it attempts to do this job alone.

In view of the fact that it is of great importance to us to hold pre-eminence in the development of nuclear power, does the NAM have any recommendation as to what the Commission should do?

Dr. SUTTS. This is a broader question than I think we are prepared to comment on today, but I would be glad to say the following:

It seems to me that there should not be doubt at this point—no one in industry is prepared to propose that private industry can now undertake the atomic power development in its entirety. That is out of the question.

Representative PRICE. That is the gist of most of the testimony before the committee.

Dr. SUITS. It seems to me that what we should contemplate is that there will be an increasing participation on the part of private industry in the development of atomic power and that the participation will increase as the goal comes nearer to fruition. Atomic power is not now economic. It is our hope that someday it will become economic and that progressively, as an investment of stockholders' money can be justified, increasing funds will be available for that purpose. But to encourage such private investment we feel that here should be a framework of free enterprise.

Representative PRICE. Do you feel that it is too early at this time for the AEC to divorce itself and let industry go it alone?

Dr. SUITS. Yes; I think it is definitely too early for that.

Representative PRICE. Do you think it would be wise on the part of the Commission to sponsor a pilot plant?

Dr. SUITS. I think the Commission should sponsor not only one but many pilot plants. Some pilot plants can be built in small size and for moderate expenditures that will answer many important questions, such as the feasibility of a process, the durability of a material, the feasibility of a type of control. Those things can be answered by small pilot plants costing from a few to \$10 million or \$20 million.

Other questions on this problem of economic atomic power will require the building of very large plants. The real inventorying of the performance of a very large reactor will finally be required before a real answer can be given to the question of its economy.

Representative PRICE. You think until that real answer comes the Commission and industry should continue on a cooperative basis and work together?

Dr. SUITS. I think they should continue on a cooperative basis and work together, but there should be provision made in the law—and now is not too early—to recognize private investment, in addition to present provisions for contracting with the AEC for development at its expense.

Representative PRICE. The Commission has encouraged private investment to come into the program?

Dr. SUITS. Right.

Representative PRICE. That is all I have, Mr. Chairman.

Chairman COLE. Mr. Steiger, for how long has the life of a patent been fixed at 17 years?

Mr. STEIGER. I can't answer. It has been fixed ever since I can remember. I don't know just what the original grant was. I think the original grant was less than that. There has been considerable debate in the past. In some inventions 17 years is too short and in some it is too long, but on the average 17 years seems to have been a happy period.

Chairman COLE. I realize that has been the yardstick which has been used for a great many years, but I had hoped that you might give us a brief history of the law of the patents with respect to the duration of an exclusive right.

Mr. STEIGER. I am sorry I cannot do that. I can say that in most foreign systems it is not always 17 years, but always approximately that. In other words, it has been found by foreign countries that that is approximately correct.

Chairman COLE. I wish you would comment on this: How far wrong am I in this line of thinking? That the goal of patent laws has always been to make an invention available for public use without payment of royalty, just as soon as possible consistent with preservation of the spirit of incentive.

Mr. STEIGER. The fundamental inducement of our patent system has been that a patent is more or less a contract between the Government and the inventor. In consideration for the inventor's disclosing his invention to the public, the Government gives him the right to prevent others from making, using, or selling it for 17 years.

Chairman COLE. That is predicated upon the basic principle that knowledge is not a private monopoly.

Mr. STEIGER. That is right.

Chairman COLE. That it must be shared and made available to anybody who wants to take advantage of it.

Mr. STEIGER. Yes.

Chairman COLE. Now, there are various ways that can be achieved. I would like to have my colleague hear this line of thinking because he was not here at another meeting where I explored this thought. To repeat myself:

Mr. Steiger has agreed that the objective of our patent laws has been to make available for public use as early as our economics will allow the the use of any patentable idea.

Mr. STEIGER. Public knowledge.

Chairman COLE. Public knowledge and public use of it.

When I say public use, I mean any individual can pick up that idea and adapt it to his own use for his own purpose and to his own profit without payment of royalty to anyone.

Representative HOLIFIELD. At the end of the 17-year period.

Chairman COLE. The goal is for everybody to use your idea just as soon as he can.

Mr. STEIGER. No.

Chairman COLE. That is the goal. That is the objective. Experience has found that it is wiser to allow a monopoly in the hands of the individual inventor for a reasonable period of time in order to provide the incentive to—

Mr. STEIGER. Disclose his ideas.

Chairman COLE. To disclose his idea.

Then, too, by giving an exclusive monopolistic right to one inventor you require other people who are denied the use of that to go out and find an alternative, which makes for progress.

Mr. STEIGER. And frequently the second one is better.

Chairman COLE. At any rate, the ultimate goal is to make available this knowledge by all the public, individuals, as quickly as possible.

Mr. STEIGER. That is right.

Chairman COLE. That is achieved by cutting off the monopoly any private inventor has at the end of 17 years.

Mr. STEIGER. That is right.

Chairman COLE. After that, it is public property.

Mr. STEIGER. That is right.

Chairman COLE. But there are other ways that goal might be accomplished and accelerated. One is that the Government through public funds might buy the invention and release it for public use.

Mr. STEIGER. Yes.

Chairman COLE. Another is if the inventor refuses to sell the Government can confiscate it if it feels that it is in the public interest that that should be made available. Or still another course is that the Government with its own funds might hire scientists and inventors to develop these ideas on their own.

Mr. STEIGER. Yes.

Chairman COLE. As soon as those ideas have been learned, then they become public property.

Mr. STEIGER. Yes.

Chairman COLE. It occurs to me that that same reasoning can be applied to the knowledge and the art of atomic energy that has been developed under Government auspices, with Government funds, up to this time. That is, all we have done is to accelerate the time when the public might use it. If that is the goal of the patent system, then I see no reason to argue that because public funds have been used in learning this information, therefore the Public Treasury should be compensated for the use of it by the payment of a royalty on the part of the user, because the purpose of this atomic program outside of the military aspect has been to gain this information as quickly as possible.

For the same reasoning, it cannot be argued with persuasive force, that since public funds were used to invent and develop an idea, therefore any subsequent improvements on that idea made by a private person should immediately become public property, or at least subject to compulsory cross licensing.

Mr. STEIGER. I think that is right, Mr. Chairman, because when a patent issues, copies of it are purchased by all people who are interested in that art. If it is a washing-machine patent, everybody in the washing-machine art buys a copy of that patent. They look at that patent and frequently say it is a pretty good idea, but here is a better way of doing it. So that is one way it stimulates invention.

One idea superimposed upon the other. That is the way the arts progress as a rule until eventually the present model bears little resemblance to its original counterpart. It has resulted from a series of inventions, one superimposed on the other, step by step.

Representative HOLIFIELD. Mr. Chairman, may I say I am not quite sure that I understand exactly what the chairman has enunciated as the principle, but I would like to comment that there is nothing particularly sacred in the time of 17 years which runs for a basic patent.

Mr. STEIGER. No.

Representative HOLIFIELD. I think it is the custom and is accepted and has been found to be workable and all that. However, my contention is that in this instance we are concerned with a new development, many of the basic principles of which have been established and brought to the present far-advanced point of development by the expenditure of Government money. Therefore, we are in a little different position than Henry Ford was when he was out in his garage working on one of the first automobiles. We are in a little different position and therefore it may be that a certain type of change in patent legislation may be equitable in the public interest at this time.

I am not sure what that might be.

I call to your attention, however, that there is a quite widely accepted principle of wide cross licensing today in industry, which heretofore did not exist. The history of patents, I believe, will show that in

times gone by the monopoly use of a certain device was considered to be more valuable to the owner than a widespread licensing and a quick collection of royalties from a great many sources, but there has been a gradual inclination on the part of inventors—and maybe this is the law of self-preservation because they feel that they should get as much in royalties as possible before a competitor invents something which will make their invention obsolete.

Maybe that is the kind of society we are evolving into, where ideas come so thick and fast and development is so fast that the old idea of restricted use is not any longer as valuable as it was in the past.

I am exploring in my own mind the peculiar background of this case and wondering if new ideas could not be equitably compensated for on the basis of an evaluation of reasonable royalty by an independent board, such as the board which now functions in atomic energy, the patent advisory board, but with the provision that once that company was given a patent and a reasonable royalty for the use of it, compulsory cross licensing should be made available to all segments of American industry and all municipal and State political subdivisions that might be interested in the power field.

Mr. STEIGER. Congressman, you are right that in this country there is a tremendous amount of licensing by companies.

Representative HOLIFIELD. Cross licensing?

Mr. STEIGER. Or just straight licensing. Of course, that is for two reasons: In the first place, when somebody comes to you for a license, they are behind you. You are ahead of them. You license them and then get something better, is the motto.

Chairman COLE. The day may come when you might be behind him, though.

Mr. STEIGER. That is right. You might have to go back to that fellow and get a license because he may be smart some day, too, and make a very good invention. So there is a great tendency in this country as distinguished from foreign countries for corporations to license each other. Frequently in that case a company will invent something and have a patent protection on it and will not license for a few years at the start. He wants to get his invention seated. He wants the public to know that that was his contribution. Then after it is seated in the public mind that a certain company pioneered the thing, they will license all competition at a reasonable royalty. Manufacturers don't believe in Government boards setting royalties. A manufacturer is scared to death of that. He wants to sit across the table from his competitor and battle it back and forth and settle on same royalty.

Representative HOLIFIELD. That is right. It is that line of thinking which I have been gradually developing in my own mind, with full regard for the fact that I think there should be a just compensation for new ideas. That is the American way and I think that should be followed.

One of the staff brought to my attention that if the synthetic-rubber plants had been sold 6 or 8 years ago they would have been worth a great deal more than they are today because the Goodrich Co. recently announced they have a new process which costs only one-sixth as much as the Government's synthetic-rubber plant process.

There is an indication of what I mean, of how quickly our technology is increasing and developing. I do not know the answer, I might say, but I am seeking one.

Mr. STEIGER. Yes.

Dr. SUITS. Mr. Holifield, may I comment on that same question because it seems to me that it bears on a question you raised earlier, namely, the equity of turning over to private industry knowledge which has been gained by the Government in the atomic-energy development. As you have indicated, this \$12 billion that we think of has depreciated. It depreciates daily. Not only do the manufacturing plants depreciate, as is well known, but the technical knowledge depreciates. The knowledge that we gained 5 years ago in many cases is now outmoded by recent knowledge. Although there is a great equity here in technical knowledge and know-how and scientific data, it is much less than one commonly believes, and the developments that are going to take place in the next 10 years will be probably comparable to everything that has happened in the past in the atomic era. So the real value of this technical knowledge and know-how is, I feel, much less than commonly believed. Much of it is already in the public domain. Despite security considerations, a tremendous amount of valuable data has already been released.

Representative HOLIFIELD. I think this committee wants as much of that information released as is possible, keeping in mind national security. In fact, I think the Atomic Energy Commission at this time should reevaluate their whole body of information and make available as much of it as can be done safely or as much, even, as we have knowledge that other countries, such as France and England, have, because I am sure that what they have is available to the Soviets in one way or another.

Chairman COLE. Let me ask what your opinion is regarding a provision that might be in the law which would require any inventor in the atomic field to surrender to the Government their foreign rights on that patent.

Mr. STEIGER. I think we have to have a provision like that, Mr. Chairman, as long as we keep the information in this country.

Chairman COLE. I am thinking of the economic end of the thing as well as the military phase.

Mr. STEIGER. I returned from England not long ago and the British manufacturer, of course, feels that he has been sort of left out of the program over there. He gives great credit, and we do, too, to how the Commission has operated in this country so that manufacturers have been in on the thing and learned something and have acquired some experience. Of course, the foreign manufacturer would like to have access to some of that information some day.

Chairman COLE. Would such a limitation as that, which is to deny the foreign use of a patent, still provide sufficient incentive for the genius of this country to experiment?

Mr. STEIGER. Yes, I would say so, because if he can get a United States patent and he has hopes of recovering something from that United States patent, that is his main objective, that is his main source of revenue. He could be denied his foreign rights, and I do not think it would affect the incentive one iota.

Chairman COLE. It occurs to me that that idea might provide the Government with some degree of recompense for the investment which

has been made in the program up to now and might have some appeal to those who feel that the Government should derive some recompense from it. But it also has a further aspect, that it would strengthen the hand of our Government in dealing with foreign governments, and also we must remember that any improvement or refinement in this process of splitting the atom has a direct benefit and value in manufacturing weapons and materials. So as this information is developed in this country and eventually goes abroad, we are indirectly improving the war potential of the foreign countries of the world.

So it is highly important that our Government retain a high degree of control on foreign uses of those improvements.

Mr. STEIGER. You see, Mr. Chairman, we have a law today on the books that if you file a patent application in the United States, no corresponding application can be filed in any foreign country without a license from the Commissioner of Patents. We have a law like that today, aside from atomic energy.

Representative HOLIFIELD. I am not going into detail on this subject of foreign patents, but we have a rather sordid story of some of the dealings between the German firms and some of our big United States firms in the exchange of patents and the restriction of patents by restrictive patent agreements to prevent, for instance, the use of synthetic rubber in the United States, to prevent the manufacturer of aspirin, and so forth.

There are a few other international patent agreements that we could go into in great detail and talk about, which were highly in the interest of the individual business firms both in Germany and in the United States, but proved not to be in the interest of the American people when war came.

So there is this international consideration involved, particularly when we are dealing with a weapon potential that can destroy a city the size of Washington with a very limited application of such weapons.

Dr. SUITS. Mr. Cole, there is one point that I would like to comment on with reference to your question of foreign patents. One of the objectives of filing a foreign patent application is, not to make provision for the manufacture of the patented device in the foreign country, but to prevent impediments to its sale in the foreign country. If the United States patent application is not filed in the foreign country, it may be filed and reissued in the name of a foreigner, who could then prevent the sale of the patented article in the foreign country. Since atomic equipment presumably would not be offered for foreign sale, this reason for filing foreign patents would not exist.

Representative HOLIFIELD. May I ask the question, if that is filed in the foreign country, are not the drawings and specifications made available to that foreign country?

Dr. SUITS. Yes.

Representative HOLIFIELD. Then from the standpoint of security we have defeated our purpose.

Dr. SUITS. Surely. I am not supporting the suggestion of foreign patent filing. I am pointing out that inherent in the atomic-power development, one of the principal reasons for filing a foreign patent application does not exist. In other words, since we presumably do not intend to sell atomic-power equipment to foreign countries, we don't have to protect the market by taking out foreign patents.

Representative HOLIFIELD. And it would be dangerous to do so if it happened to be related to military production of weapons or fissionable material.

Chairman COLE. How would you deal with a situation where an inventor discovers a very valuable idea but fails to file for a patent?

Mr. STEIGER. Of course that is a situation which you are always going to have, Mr. Chairman.

Chairman COLE. Tell me, how common is that; how prevalent is it?

Mr. STEIGER. It is not very prevalent.

Chairman COLE. Would you say it is very rare?

Mr. STEIGER. Yes. That is, usually a man who makes a worthwhile invention knows of our patent system and he would usually try to get a patent in the first place. Usually that is his incentive in working on the thing. Usually he doesn't get just an idea. He has to do some work on it. He has to make drawings and think about it. Usually all through that he is hoping to get a new idea for which he can get a patent. So we say let him apply and get a patent because when he sends that patent application to the Patent Office under our existing law the Government can put that under secrecy if it affects national security. The idea is to encourage him to send it in. The only other way to do, he can make a report to the Atomic Energy Commission today. He can file a report with the Commission, and he is supposed to do that if it affects national defense, but he might not know that.

Chairman COLE. I had in mind more competition among companies, where one company conceives an idea but in order to withhold it from competitors or anybody else, he won't even file for it; a situation referred to as a trade secret.

Mr. STEIGER. There is very little of that in this country on apparatus.

Chairman COLE. At any rate, that problem would be no more aggravated by relaxing the patent provisions of the law as to atomic energy than exists today. It would not be any worse.

Mr. STEIGER. No. Some people even today try to keep things in secrecy instead of applying for a patent. Some people today in industry try to keep processes and formulas and so forth secret, but I think there is a small amount of that compared with the number of people who apply for a patent.

Chairman COLE. There is one other point I wanted to clarify in my own mind, Mr. Steiger. You said the present practice is that the Government has the right to use an invention derived through the use of public funds royalty-free. That means that the Government may license another company to manufacture a product for the Government without the requirement of that company having to pay a royalty?

Mr. STEIGER. I said two things, Mr. Chairman. One is, if I own a patent and the Government wants to use my patent, it can go right ahead and use my patent or it can have it manufactured and made for it and I cannot stop the Government and I cannot stop that manufacturer.

My only redress would be to sue the Government in the United States Court of Claims for patent infringement and try to get some damages out of it. That is where I made the invention and had nothing to do with the Government. It is my own patent. The Government decides it needs it so it goes ahead and uses it. I cannot stop it. That is No. 1.

No. 2 is in these development contracts of the armed services the contractor grants the Government a nonexclusive license for the Government to make it itself or the Government can go out and have anybody make it for it.

Representative HOLIFIELD. Mr. Chairman, I would just like to bring up a point that came to my personal attention recently. A man invented a device which is being used by the Navy. He invented it and filed for a patent on it. The Navy wanted this device manufactured in quantities of thousands. It is strictly a defense item. Before they would give this plant a contract they made that man give the right to manufacture to other sources. In other words, they would not confine themselves to one source, on the very good argument, I thought, that in case of hostilities if that one plant was bombed, they would have no other source. They just the same as blackjacked that individual into making that process available to several other people to use, and then they tried to beat him out of his original contract for the manufacture of these items.

This occurred in my own district, and a small manufacturer was the man involved. When you go to dealing with the Government on patents it is pretty tough. I know that.

Chairman COLE. Any further questions?

Thank you very much, gentlemen.

The next meeting of the committee on this subject will be Monday, when we will hear representatives of Sylvania Electric Co., the NACA, the Research and Development Board of the Department of Defense, the Engineers Joint Council, and the Institute of Radio Engineers.

I might at this time announce that Mr. Strauss, the Chairman of the Commission, will appear on this subject on August 3.

The meeting is adjourned.

(Whereupon, at 5 p. m., Thursday, July 23, 1953, the committee was recessed, to reconvene Monday, July 27, 1953.)

ATOMIC POWER DEVELOPMENT AND PRIVATE ENTERPRISE

MONDAY, JULY 27, 1953

CONGRESS OF THE UNITED STATES,
JOINT COMMITTEE ON ATOMIC ENERGY,
Washington, D. C.

The joint committee met at 2 p. m., pursuant to recess, in the Old Supreme Court room, the Capitol, Hon. W. Sterling Cole (chairman of the joint committee) presiding.

Present: Representatives Cole, Van Zandt, Patterson, and Holifield.

Professional staff members present: Corbin C. Allardice, executive director; Wayne P. Brobeck and Walter A. Hamilton of the professional staff of the joint committee.

Chairman COLE. The meeting will come to order.

The first witness this afternoon will be Mr. Walter Kingston. Will Mr. Kingston come to the witness table?

Mr. Kingston is the director of the atomic energy division of Sylvania Electric Products Co. This company requested an opportunity early last spring to present its views on atomic-power-development problems before the joint committee. Their letter, in part, said:

Our work for the Atomic Energy Commission over the past several years has been concentrated on developing, for production, new and advanced types of nuclear fuels and components for the atomic-energy program. One of the major reasons why we are actively interested in such a program is our earnest hope and belief that the way will soon be clear for our company to produce and sell, on a competitive open market, nuclear fuels and components. We believe that this is but one of many important phases of the atomic-energy program which might be opened to industrial participation on a competitive basis, and which, at the same time, might stimulate and expedite the atomic-energy program for this country as a whole.

Mr. Kingston, we welcome you, this afternoon, to amplify in any way you wish the contents of that letter and the thinking of your division and your company on the problem facing this committee. You may proceed in your own way.

**STATEMENT OF WALTER E. KINGSTON, GENERAL MANAGER,
ATOMIC ENERGY DIVISION, SYLVANIA ELECTRIC PRODUCTS,
INC., BAYSIDE, N. Y.**

Mr. KINGSTON. Thank you, sir.

Gentlemen, my presentation will be brief and, I hope, to the point.

My name is Walter Kingston, and I am general manager of Sylvania's atomic energy division, an outgrowth of Sylvania's metallurgical laboratories, with which I have been associated for the past 23 years. During this year, the metallurgical laboratories have been active in carrying out research and development in the fields of physi-

cal metallurgy and physical chemistry, with special emphasis on improvement in quality, reduction in cost, and new product development. These activities have been primarily associated with the products manufactured by Sylvania Electric Products, Inc., including certain Government defense requirements.

Some 7 years ago, our laboratories became involved, in a modest way, in research and development on certain metals, alloys, and compounds, which were of interest to the Atomic Energy Commission. Throughout this period, our participation in atomic-energy programs has increased markedly, and our base of operations widened considerably. Actually, for the past 5 years, our efforts have been chiefly concentrated on the design, development, and construction of fuel elements of many types, as well as other nuclear reactor components, for use with practically all types of reactors in use or being considered. It could be truly stated that we have become nuclear component specialists, and are probably the largest single group in this country exclusively involved in such work.

From the beginning, it was apparent to us that there was a real opportunity for an industrial engineering group to demonstrate to the Commission that sound engineering principles, applied within the framework of aggressive industrial thinking and application, could pay dividends in improved devices or products, and lower cost of such products, in the fields of reactor components, in the same way that similar principles have been applied to other fields in which the Atomic Energy Commission and its contractors are involved. We believe we have been successful, in a modest way, in attaining these objectives.

With the above in mind, and as a result of serious study and deliberation on the part of our management, we have evolved the following philosophy of operation:

(1) That fuel elements and reactor components were an important and critical part of any reactor, whether it be for defense or civilian use.

(2) That such components could be effectively manufactured by an industrial organization using its own capital, and sold to the Government or authorized private industry at a unit, competitive price.

(3) That, by bringing to bear on such operations the democratic principle of profit or loss, the results would certainly show up as a lower cost, higher quality, competitive product.

(4) That, in order to bring this situation about, the industrial organization would have to be in a position to purchase certain raw materials from the Government or private sources, and to obtain certain patent protection. This would require revisions or amendments of the McMahon Act or Atomic Energy Act of 1946.

Since the attitude of the Atomic Energy Commission has always been to encourage increased participation of industry in its programs, it was understandable that our operational philosophy was of interest to them, although it was obvious that certain factors could only apply as a result of modification of the Atomic Energy Act.

On the basis that there was a real need for industrial participation of this kind, and the feeling that an important opportunity would exist for an industry which could "produce the goods," Sylvania's management, about 18 months ago, decided to establish an Atomic Energy Division, whose objectives were to work with the Commis-

sion and other authorized industries toward the previously outlined goals.

To date, Sylvania has invested between \$3 million and \$4 million of capital in this venture, chiefly in building and plant facilities, as well as working capital. Up to this time, substantially all of our activities have been devoted to research, engineering, and pilot plant manufacture under contract to the Atomic Energy Commission and its contractors. It is our definite objective that, when a given type of fuel element, or other reactor component, has been demonstrated to be of value, and the requirements established, Sylvania will be in a position to invest capital to set up and operate manufacturing plants to produce such fuel elements or reactor components at unit, competitive prices, taking all the normal risks of manufacture. Obviously, there would have to be certain guaranties insofar as volume or number of components is concerned. Otherwise, large capital investments could be obsoleted overnight by changes in reactor design, requirements, et cetera.

Eventually, when the need has developed, Sylvania's Atomic Energy Division expects to be in a position to contribute to the requirements of industrial nuclear power generation. Until that time arises, we are cooperating with Government approval, by using Sylvania's funds, with the various industrial groups operating in this field. It is our firm conviction that, if atomic energy is to be made attractive for non-defense purposes, and indeed if we are to utilize it to best advantage for purposes of defense, it must be made considerably less costly. It is our strong opinion that private industry, aggressively competing in such programs, risking its own capital and that of its stockholders, with the profit incentive or loss deterrent, will do much to bring atomic energy and its products and byproducts much closer to earth economically. There is no reason why such participation could not be carried out within any framework of security or accountability established by the Atomic Energy Commission.

In order for industry to participate effectively in such a program, certain fundamental changes must be made in the Atomic Energy Act of 1946. In our opinion, there are two major modifications required. These are:

1. The Atomic Energy Act should be changed to permit licensed private ownership and operation of plants for the recovery, manufacture, and sale, to Government-licensed reactor owners or operators, of nuclear fuels and components containing source or fissionable material. The act must also permit licensed fuel or component manufacturers—who are not necessarily reactor owners or operators—to buy source and fissionable materials from either the Government itself or from private sources which have been licensed to sell such raw materials.

2. The Atomic Energy Act should make provision whereby inventions and discoveries, arising from activities sponsored with private capital, shall remain, by patent, the property of the sponsoring party. The law should provide for an irrevocable license to the United States Government on any patentable invention or discovery where such license is required by the Government for the national security. In order that organizations who have been a part of the atomic energy program for the past several years do not gain an unfair advantage over those companies wishing to enter the field when the act is changed,

it is suggested that a 1- or 2-year interim period be provided in the act whereby a license to all patentable discoveries and inventions is made available to the Government which, in turn, can sublicense qualified firms wishing to enter the field during the interim period. After the 1- or 2-year interim period, standard patent law should apply.

Thank you.

Chairman COLE. Thank you, Mr. Kingston. You have given us some new suggestions and thoughts on this subject.

First, I want to make sure that I understand just what your testimony was with respect to the amount of capital that Sylvania has already spent in this venture, in this field.

You indicated that the company had spent between 3 and 4 million dollars of capital; does that mean that that represents an expenditure of Sylvania funds?

Mr. KINGSTON. Yes.

Chairman COLE. Entirely?

Mr. KINGSTON. Yes.

Chairman COLE. It is my recollection that there has been no other company that has invested as much of its own funds in these studies as your company has apparently spent.

Mr. KINGSTON. I think that is my recollection, too.

Chairman COLE. Now, how much has been spent by your company through arrangements with the Commission?

Mr. KINGSTON. I can only give you an approximate figure, but I would say that it is in the range of 4 to 6 million dollars.

Chairman COLE. Has that been by a direct arrangement with the Commission?

Mr. KINGSTON. That is under subcontract to the Commission.

Chairman COLE. Subcontract?

Mr. KINGSTON. Well, subcontract to the Commission's contractors.

Chairman COLE. Do you have a single contractor, or are you a subcontractor to several of the Commission's contractors?

Mr. KINGSTON. The latter is true. We contract directly with the Commission, and also we subcontract with certain of the Commission's contractors.

Chairman COLE. What has been the nature of your direct contract with the Commission?

Mr. KINGSTON. You mean in terms of the nature of the work?

Chairman COLE. The nature of the work and the dollar cost of it.

Mr. KINGSTON. Substantially all of the major part of the figure that I gave you is under direct contract to the Commission.

Chairman COLE. You did not give me any figure.

Mr. KINGSTON. I said between—

Chairman COLE. Six and seven million dollars? Oh, that figure. Most of that figure was a direct contract with the Commission?

Mr. KINGSTON. A direct contract with the Commission.

Chairman COLE. And the nature of the work was what?

Mr. KINGSTON. Research and development in the area of fuel elements and materials involved.

Chairman COLE. What do you mean when you use the expression "fuel elements"?

Mr. KINGSTON. Well, the fuel element in a reactor is that portion containing the fissionable materials.

Chairman COLE. I still do not understand the nature of your study. Was it for the purpose of devising combinations, devising ways in which the fissionable material might be mixed with some other element or commodity, to the point where it can be burned more efficiently?

Mr. KINGSTON. That is correct, and also from the standpoint of costs, lower costs, more effective designs, and so forth.

Chairman COLE. Where has this operation been carried on?

Mr. KINGSTON. This has been carried on in two locations, both located in eastern Long Island, Bayside, Long Island, and Hicksville, Long Island.

Chairman COLE. Has Sylvania actually made a pilot reactor for the Commission?

Mr. KINGSTON. Not a pilot reactor. They have a pilot plant, in which pilot operations on fuel elements are being carried out.

Representative VAN ZANDT. Where is that plant?

Mr. KINGSTON. At Hicksville.

Chairman COLE. You say obviously there would have to be certain guaranties insofar as volume of components is concerned.

Would you amplify that in order that we may understand just what you meant?

Mr. KINGSTON. Yes, I would be glad to.

By "guaranties," here, I mean guaranties in terms of numbers.

Chairman COLE. Numbers of what?

Mr. KINGSTON. Numbers of components. If a manufacturer is asked to quote on 1,000 new type spark plugs for a car, he obviously might give one figure. If we were quoting on a hundred thousand spark plugs, he could give a figure which could, of course, be considerably lower; or if he were quoting on 10 spark plugs, the figure would have to be very high because of the capital investment that would be required in this case to make new kinds of spark plugs, assuming that the spark plugs could not be made by conventional techniques.

Chairman COLE. Then you mean that the conventional practice would have to be followed by the Government in solociting bids from any company that might manufacture the particular item the Government wanted?

Mr. KINGSTON. That is correct.

Chairman COLE. And that is the extent of the guaranty that you had in mind?

Mr. KINGSTON. That is all.

Chairman COLE. In your first item of recommendation, on page 5, you indicate that the law should be changed to permit licensed fuel or component manufacturers to buy source or fissionable materials from either the Government itself or from private sources which have been licensed to sell such raw materials.

I take it from that, then, that you do not fear that there would be any undue advantage or competition by continuing the Government in the business of making fuel elements and having those available to any licensed purchaser?

Mr. KINGSTON. Well, I believe that certainly the Government should buy such components on a competitive basis, considering all qualified manufacturers. If the Government itself could make such a product at a lower cost, or a higher quality, or both, than any industrial organizations, naturally, the Government should carry the work out itself.

However, one of the points that I believe is important here is that on this basis, if a private enterprise was to purchase such materials from the Government and incorporate them into fuels, it would not only have to do so at a unit competitive cost, but any losses of materials would naturally result in a loss to the manufacturing organization. And when one deals with materials that are of considerable inherent value, such a loss deterrent would unquestionably, or should unquestionably, result in a lower cost, higher efficiency, higher quality operation and product.

Chairman COLE. This particular sentence to which I directed your attention anticipates that the users of fissionable material will have two sources to get it, either from the Government or from private producers of the fissionable material.

Now, from that, I take it that you do not fear that there would be any danger from competition on the part of the Government with those private people who make the fissionable material?

Mr. KINGSTON. Well, frankly, I am not qualified to give an opinion on that particular aspect. I have no studied it.

The raw material I was referring to here was not fissionable material as produced in a reactor. What I, rather, referred to here was the source material, as produced in mines and refined.

Chairman COLE. Are there other questions of Mr. Kingston that the members of the committee may wish to ask?

Representative HOLIFIELD. Mr. Kingston, as to this three or four million dollar investment, which I believe you stated is chiefly in building and plant facilities, was that invested under a certificate of necessity, in view of the fact that you were handling this six or seven million dollar contract with the Atomic Energy Commission?

Mr. KINGSTON. We did obtain certificates of necessity.

Representative HOLIFIELD. Does that allow you amortization in 5 years?

Mr. KINGSTON. It does from a tax standpoint only.

Representative HOLIFIELD. And charging that amortization up to the expense of operations?

Mr. KINGSTON. Rapid amortization is not charged as an expense to the contract.

Representative HOLIFIELD. The amortization of plant cost, I asked, was it allowed in the computation of profits? The amortization of the cost of building these buildings was allowed in your accounting, 20 percent of it per year, if it was on a 5-year amortization basis, and most certificates of necessity carry that.

Mr. KINGSTON. The rapid amortization of plant was only allowed from a tax standpoint. Contract operations are charged standard depreciation only.

Representative HOLIFIELD. So actually the Government was charged for that three or four million dollars?

Mr. KINGSTON. The Government was charged only normal depreciation on the capital investments involved. Rapid amortization as allowed by certificates of necessity applied only for tax purposes. Actually, the certificates were not 100 percent, even for tax purposes.

Representative HOLIFIELD. What was it?

Mr. KINGSTON. One was of 60 and one of 75.

Representative HOLIFIELD. On a 5-year amortization period?

Mr. KINGSTON. That is correct, sir.

Representative HOLIFIELD. So that cuts down your net capital investment?

Mr. KINGSTON. As I see this, the rapid amortization allowed for tax purposes by the certificates of necessity does not cut down our capital investment.

Representative HOLIFIELD. Now, in the second recommendation you made, you suggested that 1- or 2-year interim period be provided in the act, in which all patentable inventions or discoveries are made available to the Government.

Did you refer to those patentable inventions and discoveries that had been made up to date?

Mr. KINGSTON. Oh, no; just those that would be made.

Representative HOLIFIELD. In this interim period?

Mr. KINGSTON. This refers only to those that are made from the period of the change in the act, and made with private capital, or under private sponsorship.

Representative HOLIFIELD. Well, here is what you say:

In order that organizations which have been a part of the atomic-energy program for the past several years do not gain an unfair advantage over those companies wishing to enter the field when the act is changed, it is suggested that a 1- or 2-year interim period be provided in the act whereby a license to all patentable discoveries and inventions is made available to the Government, who in turn, can sublicense qualified firms wishing to enter the field during the interim period. After the 1- or 2-year interim period, standard patent law should apply.

Now, seeking the meaning of that, do you mean to say that just those licenses which are taken out in this 2-year interim period shall be made available to the Government? Or is the license to all patentable discoveries and inventions made prior to the 2-year period also to be made available, through the Government, to those who wish to participate?

Mr. KINGSTON. The latter.

Chairman COLE. You mean both of them?

Mr. KINGSTON. Both of them.

Chairman COLE. You mean the licenses that have been developed over the last 10 or 15 years shall be available for public use without royalty, and in addition those patents which might develop in the next 2 years after the law has been changed?

Mr. KINGSTON. Yes.

Representative HOLIFIELD. That is the point I wanted to make, because I wanted to clear that up.

If that be true, you say they shall be made available to qualified firms wishing to enter the field during the interim period. Let us assume that we set the period 1954 and 1955 as the interim period, and let us assume that in that period 10 firms enter the field. Now, if firms who are not yet financially able wish to enter the field in 1956, they would not have access to this information which has been made available to that favored few that have participated, or signified their willingness to participate, in the interim period; is that true?

Is that what you mean?

Mr. KINGSTON. No; I mean that this information should be made available to all firms who had a logical and reasonable interest in such a program.

Representative HOLIFIELD. Does that mean during this interim period? Or from now on?

Mr. KINGSTON. I would say from now on.

Representative HOLIFIELD. I see what you mean. In other words, you would not confine access to that information only to those companies that were able to participate in the interim period, but you would make it available to any company that wanted to come into the program in the future?

Mr. KINGSTON. I would say so, as long as they had a realistic interest.

Representative HOLIFIELD. Providing they could qualify?

Mr. KINGSTON. From all standpoints, including security, of course.

Representative HOLIFIELD. Yes. And then, after that interim period, you say standard patent law should apply. That would be on future developments?

Mr. KINGSTON. That is correct.

Representative HOLIFIELD. That is all, Mr. Chairman.

Chairman COLE. Of course, your suggestion might cause an inventor to withhold applying for a patent until the 2 years had expired, and then make application for it, so that he could get a permanent patent.

Mr. KINGSTON. I would be afraid he might suffer if he would hold up. With the aggressive competition which I would envisage along these lines, I am quite sure that it would be quite dangerous to hold up over a long period of time.

Chairman COLE. That is true.

Mr. KINGSTON. Otherwise the inventor might find that his invention had been anticipated by someone else.

Chairman COLE. Mr. Van Zandt?

Representative VAN ZANDT. Mr. Kingston, I am impressed, as are the other members of the committee, with the fact that Sylvania was actually at work in setting up this development some years ago, and the fact that you have spent \$3 million or \$4 million.

How many people do you employ on that project at the present time?

Mr. KINGSTON. On the order of 430, sir.

Representative VAN ZANDT. Have you any scientists working for you?

Mr. KINGSTON. Yes; roughly 40 percent would be highly qualified scientists; in many cases specialists in their field.

Representative VAN ZANDT. Are these specialists you refer to recently acquired employees?

Mr. KINGSTON. No. Many of these we brought along from our parent organization.

Representative VAN ZANDT. They have grown up with this new division of Sylvania?

Mr. KINGSTON. That is right.

Representative VAN ZANDT. Are you actually in the process of manufacturing component parts?

Mr. KINGSTON. Yes; we are, sir.

Representative VAN ZANDT. That is, on a pilot-plant basis?

Mr. KINGSTON. On a pilot-plant scale.

Representative VAN ZANDT. Have you had any inquiries from industry in general, who are interested in building reactors?

Mr. KINGSTON. Well, groups in the public-utility field have approached us, and we are working together with them, with the Government's consent.

Representative VAN ZANDT. You have in mind those utilities who are members of study groups?

Mr. KINGSTON. Yes.

Representative VAN ZANDT. In your opinion, how far off are we from actually building a reactor?

Mr. KINGSTON. A power reactor?

Representative VAN ZANDT. Yes.

Mr. KINGSTON. First of all, I am not qualified to answer that.

Representative VAN ZANDT. I mean in your opinion.

Mr. KINGSTON. My own opinion would be certainly between 5 and 10 years.

Representative VAN ZANDT. Have you any ideas as to the cost?

Mr. KINGSTON. Well, I have heard many figures. I am not qualified, sir, on that.

Representative VAN ZANDT. We, too, have had figures ranging from \$50 million to \$100 million or more.

Mr. KINGSTON. Well, I would say this: With the present cost of making component parts, the cost I would think would be quite high. But I am sure that all of these costs can be lowered considerably, and will be.

Representative VAN ZANDT. That is all, Mr. Chairman.

Chairman COLE. With reference to the 3 or 4 million you say your company has invested of its own funds in plant construction, are those plants usable only for studies and research and inquiries in the nuclear field, or are they also adaptable or usable in other areas of interest to the Sylvania Co.?

Mr. KINGSTON. I think I can answer that question best by pointing out that a metallurgical group of this size is far too large for the activities that Sylvania normally carries out. We would not have built these buildings or set up the working capital that is involved if it was not for the atomic-energy operations.

Chairman COLE. So that the interest in the atomic field was what prompted you to make this expenditure?

Mr. KINGSTON. Yes, sir.

Chairman COLE. But in doing so, you realized that your company could take advantage of other lessons that might be learned, which would be usable by the company in a field other than the nuclear field?

Mr. KINGSTON. Well, of course, there are always certain byproducts from any program of research and development, but in this particular case, since our parent company's interests are primarily in the electronic and lighting industries, it is not easy to see the tie-in, there, with such byproducts. It is conceivable, of course.

Let me put it this way. If something should happen tomorrow with the result that there was no more work of this type, we would be forced to dispose of the buildings.

Chairman COLE. If there are no further questions, Mr. Kingston, thank you for coming down, and especially for the suggestions which you have made as to one possible method of handling a phase of this problem that is very bothersome to the committee; and I refer to the 1- or 2-year free period of inventions.

Thank you very much, Mr. Kingston.

Mr. KINGSTON. Thank you, gentlemen.

Chairman COLE. The next witness is Dr. Walker, who is a personal friend and neighbor of our colleague on the committee, Mr. Van Zandt, and I will ask Mr. Van Zandt to introduce Dr. Walker.

Representative VAN ZANDT. Dr. Eric Walker, dean, School of Engineering, Pennsylvania State College, will be our next witness.

Pennsylvania State College is among those universities and colleges which have begun active plans for construction of atomic reactors as research tools for the use of their students and faculties. In addition to discussing the prospects and problems involved in this venture, Dr. Walker has also followed closely the work of the nuclear science group of the Institute of Radio Engineers. A member of that group, Dr. William Breazeale, also of Pennsylvania State College, is with Dr. Walker this afternoon. The Institute of Radio Engineers is a professional society which abstains from anything remotely resembling lobbying. Drs. Walker and Breazeale have been invited to testify on their own work, and it is, of course, understood that they are not representing, but only reflecting the views of the organizations with which they are associated.

Pennsylvania State College entered into a no-fund contract with the Atomic Energy Commission last year to design a research reactor. The board of trustees appropriated \$250,000 for the project. The modified swimming pool reactor which it is estimated can be built for this amount is based on a reactor at Oak Ridge. The Pennsylvania State design is due to come up for safety review this September.

Dr. Walker, in addition to being dean of the School of Engineering at Pennsylvania State College, has been involved for many years with research work in the Department of Defense, and many of the weapons that we employ today in warfare, represent some thinking and engineering ability of Dr. Walker.

Doctor, we are pleased to have you here this afternoon, and you may now proceed with your statement.

STATEMENT OF DR. ERIC WALKER, DEAN, SCHOOL OF ENGINEERING, THE PENNSYLVANIA STATE COLLEGE

Dr. WALKER. Thank you.

Mr. Cole, I have given the committee a written statement, but I think I can save your time and that of Mr. Holifield and Mr. Van Zandt if I extemporize on that and thus avoid repeating some of the things which the previous speaker said. So if it is satisfactory to you, I will deviate from the written statement and just talk what I have to say.

Chairman COLE. That is agreeable with us, so long as you do not omit any thought of importance that you have contained in your statement.

Dr. WALKER. I will try not to. I think I have the notes covered.

I am speaking to you this afternoon not only as dean of engineering at the Pennsylvania State College, but also as chairman of the Engineering College Research Council. This is a council consisting in membership of about 100 engineering colleges, all of whom are accredited by the Engineers Council for professional development, and all of whom do research in the field of engineering.

Therefore, I should like to speak to you as a representative of engineering education, primarily.

In this country traditionally we have looked to the engineering schools and colleges to provide engineers. If industry wants engineers, it goes to the engineering schools to get them. If the Government needs engineers, it goes to the engineering schools to get them. And this year the military is taking just about half of our graduate engineers.

I do not need to tell you gentlemen anything about the shortage of engineers in this country. It is estimated we need about 40,000 a year.

A couple of years after World War II, we graduated 50,000 engineering students per year. Then the number started to go down to 38,000, 26,000, this year about 23,000, and next year we will produce about 19,000 engineering graduates in this country.

There was a little newspaper article the other day that said the Russians were turning out 50,000 engineers this year.

The reasons for this I do not think are important to this committee, but the point I want to make is that we are going to have a tough time getting engineers, not only for our normal peacetime lives, but also for anything we do in the atomic-energy field; that we must start right at the college educating atomic-energy engineers. Industry is going to need them, the Government is going to need them, and the military is going to need them.

Now, in addition to the overall shortage of engineers, what is not known generally is that in some fields the shortage is a loss worse than in others. And this is because you cannot persuade the young men to go into some fields.

The railroads complain to us continually: "You don't teach railroad engineering. Where can we get our railroad engineers?" And the public utilities complain that they do not get the best men anymore.

Well, to engineering educators, the reason for this is fairly obvious. We do not teach these things in the schools because the boys do not want them, and the reason they do not want them is that they do not find them interesting. There is no way that they can go into the laboratory and actually do railway engineering or do utility engineering. They can go into the laboratory and try out their ideas in radio engineering and in many other fields of engineering, and so they go into these fields. And although Mr. Kingston, from Sylvania, would say there is a shortage of radio engineers, I will say there is a much greater shortage in the utility fields.

Now, what are we to teach in atomic-energy engineering, if we are to get the boys to go into it? We have to allow them to be creative. This is what we say engineering is, that "We give you a chance to create something the people want." And so in some way we must get atomic-engineering laboratories in our colleges. A few colleges are beginning to worry about this and wonder how to get atomic-engineering laboratories.

From the figures you people deal in, money figures, you know that this is pretty expensive. Yet most of our colleges operate on a shoestring. We do not get support from the Federal Government for education in any great degree. Many of us do not want it. We get along with our tuition, our endowments, our State funds, and anything else we can get.

For instance, at Pennsylvania State, we hope to build a nuclear reactor, to use as the basis for our atomic engineering education, for a quarter of a million dollars. Why a quarter of a million dollars? This is all I dare ask the board of trustees to give me. My board of trustees is made up of a group of farmers and small-business men, and they have to worry about where the college gets its money. I asked them for a quarter of a million dollars to set up an atomic-engineering laboratory, and they responded enthusiastically.

The farmers said: "Here is a chance for us to get something new in farming."

The coal miners, the small-business men, did not know what atomic energy might give them, but they thought the college might help them out if we did this.

So we are trying to build, as Mr. Van Zandt says, a nuclear reactor to be used for educational purposes for students in their senior year, the graduate year, on \$250,000.

We have reached the point in this building of having my own staff draw up the designs.

Dr. Brazeale, who is here with me, is in charge of the nuclear design. We are ready to build the electronic equipment that is needed. But now the board asks me this question: "If you build it, are you going to get the fissionable material to run it with?" And we have asked the Atomic Energy Commission: "If we do these things, will you loan us the fissionable material to put in this reactor to make it a workable laboratory instrument?"

If the Atomic Energy Commission says "Yes," then we will build it. If they say "No," we cannot build it. If they say "maybe," it is a matter of whether I dare stick my neck out far enough to have the college risk its money on this building, and then perhaps have it sit there when we get through.

Representative HOLIFIELD. At that point, may I ask if it is a matter of primary importance whether you own that material, or whether it is put in your care under a lease basis, a use basis?

Dr. WALKER. I do not think it is of any importance, Mr. Holifield, just so long as we can have it.

Representative HOLIFIELD. Under the research section of the act, private laboratories are allowed to do research and development up to a certain point. Now, that is where the material becomes in such quantities that it is available for making a bomb. And I submit that, of course, without going into security matters, that may have changed as the years have gone by. So that I can certainly see your point, that that section of the act needs looking into.

Dr. WALKER. Yes, that is one of the problems that we have before us. And what we would like to see is a revision of the act which would allow us to have enough material to run this reactor the way we had intended to run it.

There are 1 or 2 other recommendations I would like to make:

One is this business of declassification. If the colleges are to teach nuclear engineering, we must have a body of declassified information to teach from. I do not think we need to know anything about what goes in a bomb, or how you make a bomb. All this military information can be segregated, but there is still a great deal of material which is still classified that I personally do not think needs to be classified.

People know it anyway. They can figure it out anyway. A careful study has to be made to find out what additional atomic-energy literature and knowledge can be declassified and taught in the ordinary engineering schools.

I have already mentioned the release of sufficient material to make this thing work. The third thing I wish to mention is the subject of patents, which the previous speaker mentioned.

Representative HOLIFIELD. Excuse me, please.

Mr. Chairman, beginning on page 4, paragraph 1, I would like to have Dr. Walker take that in his formal presentation so that we can have a little chance to discuss it, paragraph by paragraph.

Dr. WALKER. Beginning at the top of the page?

Representative HOLIFIELD. No; at No. 1, there.

Chairman COLE. Where you refer to the specific suggestions for modifying the act.

Dr. WALKER. Would you like me to read that?

Chairman COLE. Yes; I think you had better start there.

Dr. WALKER. We would like to recommend some declassification.

The suggestion has already been made that the act be amended to separate weapons information from reactor information and that the latter be declassified to a much greater degree than it is now. At present, only information relative to low-power research reactors is declassified. In other words, we can teach little about power reactors and it is evident these are becoming the most important branch of the business.

The question of release of classified technical information always balances the cost of allowing potential enemies to have the information against the advantage of permitting a more widespread attack on technical problems in our own country. In my opinion, the advantages of declassifying information relative to power reactors far outweighs the disadvantages.

Representative VAN ZANDT. Doctor, in that suggestion do you have in mind making this information available to the student body, who would use the facilities of this laboratory?

Dr. WALKER. That is correct, to the students who take courses in nuclear engineering.

Representative VAN ZANDT. You feel that the chance you take with the individual student or the group of students in disseminating this information and the possibility of it reaching the enemy is something that cannot be compared with the good we can get out of it?

Dr. WALKER. Yes; and I am always emphasizing the fact that reactor technology has little to do with the making of wars.

Representative HOLIFIELD. The fact that plutonium can be made in reactors is of no particular significance to you?

Dr. WALKER. In what way, Mr. Holifield?

Representative HOLIFIELD. Well, you made the statement that reactor technology had little relation to weapons, notwithstanding the fact that reactors make plutonium, which is the heart of the weapon. So if we make available to the student body, which means making available to everybody—

Dr. WALKER. That is right.

Representative HOLIFIELD. Nuclear technology in reactors, in the high-speed reactors, we are thereby making known to the world

information as to how to more efficiently produce plutonium; are we not?

Dr. WALKER. That is correct.

Representative HOLIFIELD. That is where the problem comes in, of separating this information from the civilian reactor use to the military use. That is where that line of demarkation becomes very difficult.

Dr. WALKER. And it requires the wisdom of Solomon to find it, too.

Representative VAN ZANDT. Doctor, does it not mean that if a decision is not favorable, the country will be denied a reservoir of trained specialists in this field?

Dr. WALKER. Yes; I think what we are thinking of primarily is: What is going to happen 20 years from now? Where are you to get the people to run this thing? And if atomic energy is to become a big part of American life, we have to train the men and women to run it 20 years from now.

Representative HOLIFIELD. I am certainly sympathetic to that viewpoint. I am just wondering how we can do it with the security problems involved.

Dr. WALKER. Dr. Breazeale and I and quite a few others, as you know, do have access to this information, and it is our opinion that a pretty clear-cut line can be drawn. It might be debatable at times. We make some mistakes. But I think we do more good than the mistakes we make.

Chairman COLE. You may proceed with your second item.

Dr. WALKER. I wanted to say something about patents.

Now, this is not a big thing to the colleges, because very few colleges get much income from patents. We do have contracts with the Federal Government, nearly all colleges do, through the military, in which we agree to give the Government a royalty-free license on any invention we shall make.

As you know, this is not the condition when we deal with the Atomic Energy Commission.

Now, we have with the Atomic Energy Commission a no-cost contract. In other words, the Commission gives us no money. This is a mechanism by which we will present our designs to the Commission, get their approval, and later ask for the loan of material. Nevertheless, we had to sign this patent agreement, which I would like to read, because it is quite irksome to us and I am sure would be irksome to other colleges that had similar no-cost agreements.

Whenever any invention or discovery is made or conceived by the contractor or its employees in the course of the work under this contract, the contractor shall furnish the Commission with complete information thereon; and the Commission shall have the sole power to determine whether or not and where a patent application shall be filed, and to determine the disposition of the title to and rights under any application or patent that may result. The judgment of the Commission on these matters shall be accepted as final; and the contractor, for itself and for its employees, agrees that the inventor or inventors will execute all documents and do all things necessary or proper to carry out the judgment of the Commission.

No claim for pecuniary award or compensation under the provisions of the Atomic Energy Act of 1946 shall be asserted by the contractor or its employees with respect to any invention or discovery made or conceived in the course of any of the work under this contract.

The point I want to make is that this is a dreadfully one-sided agreement in which we, without receiving any recompense under this contract, agree to give up for patent purposes any ideas whatever.

There is some question as to what is meant by "in the course of work under this contract." Since the contract carries no money, is anybody doing any work under it? But I think we would have to say that if we sign this agreement, which we have done in good faith, we will have to deliver up any idea that comes along. This is hardly in keeping with the whole idea that a man should be able to be recompensed for the results of his work. If a man comes up with a brilliant idea he should not be forced to give it up for nothing at all.

So I would strongly suggest that something be done to liberalize this patent agreement, especially in cases where there are no-cost contracts.

Representative VAN ZANDT. Doctor, Pennsylvania State College is involved in a lot of work for the Department of Defense. How does the provision of this contract compare with the contracts you have with the Department of Defense regarding production?

Dr. WALKER. We agree to give the Department a royalty-free non-divisible, nontransferrable license to manufacture. In other words, we cannot hold up the Government for royalties on work done for them. But the college can still own the patent. And if there were any profits coming from it, or any rewards coming from it, the college could receive that reward.

Representative VAN ZANDT. Do you not handle top-secret information in the field of weapons?

Dr. WALKER. Yes, we do.

Representative VAN ZANDT. Do you permit your student body to become part of your effort in this defense field?

Dr. WALKER. In classified contracts?

Representative VAN ZANDT. Yes.

Dr. WALKER. Not in general. But there are occasions when we take seniors who are getting near to graduation, and we put them through the proper security clearances, because we are expecting them to go to work for us after they graduate. And it takes about 6 months to get a security clearance.

Representative VAN ZANDT. In other words, you train your own employees?

Dr. WALKER. We manage to get some of the best men that way, Mr. Van Zandt.

Representative HOLIFIELD. It speaks well for your training.

Dr. WALKER. There is one more point I wish to make, and this does not have to do so much with the act itself as with the administration of the act.

I mentioned once before that colleges really are shoestring operations; that we do not have sales offices, and we do not have Washington representatives, and we do not have people who can go around and expedite things, such as is necessary and useful in business.

We have to do things by letter instead of by phone. And we find it much more difficult to do business with the Atomic Energy Commission than we do with some other Government organizations.

When we do work, let us say, with the Bureau of Ordnance of the Navy, we expect to go through a routine very similar to that an industrial organization would use, because this is more of a development and engineering type of work and has little to do with research. But when we are doing research, we do it, as I say, on a shoestring. We are used to trying to do everything ourselves, and we are not used to having to do all the expediting that seems to be necessary.

To cite an example, if we want to communicate with the Atomic Energy Commission, we deal through the New York office. This is 200 miles from State college. The New York office writes to Washington, which is 180 miles from State College. The Washington office might write to Oak Ridge. And we have to wait considerable time not knowing what the status of our request is or where we stand. And we cannot send someone down to find out.

The Navy and the Army and Air Force have found a way out of this difficulty by setting up special groups to deal with colleges. The Office of Naval Research of the Navy has been a pioneer in this regard. They know that college contracts are small, that you do things differently in colleges; that you often do things in a very unbusinesslike way in colleges, because professors just are not very businesslike in general. And it would be extremely desirable, if the colleges are to get into engineering education in the atomic energy field that instead of seemingly blocking us the Commission would do something to help us get started. This has nothing to do with the act itself, but merely the administration of the act.

Representative HOLIFIELD. You are, in effect, suggesting that an expediter be given the job by the Commission of liaison with the colleges to "get on with the job" so that he can call on the colleges and make the necessary arrangements, and shortcuts, so that you would not have to go through all the redtape that is involved.

Dr. WALKER. That is correct, sir.

Representative HOLIFIELD. And is that the method which the Navy, Army, and Air Force follow?

Dr. WALKER. In some respects.

Admiral Bolster, who is the Chief of the Office of Naval Research, is sitting in the back of the room, and he can tell you better than I. But we can tell you full well that someone will drop around from the Office of Naval Research and see what we are doing on the projects and listen to what we have to say and make helpful suggestions. In other words, we feel it is a sort of partnership. And we would like to have a partnership with the Atomic Energy Commission.

Representative HOLIFIELD. I think that is a valuable suggestion on administrative procedure. I do not know that the committee is aware of this difference that you brought out.

Dr. WALKER. I think, Mr. Chairman, I have covered everything I have in the written statement.

Chairman COLE. Would you mind taking just a minute, Doctor, to tell us the benefit of your observations, as to the reasons why the supply of the annual crop of engineers in this country has dropped approximately 50 percent in the last 5 years?

Dr. WALKER. Yes. I must restrain myself on this, because this is very close to my heart.

It is my impression that the supply of engineers is not going to come up to our needs for many, many years, and the reasons are something like this: Engineering is getting to be much more difficult than it used to be, science is going ahead by leaps and bounds, and therefore we have to call upon a higher-intelligence-quotient person. In other words, instead of dipping so deeply into the population, we have to take just the bright boys. And I claim that I can tell at the end of a freshman year whether a man is going to be a good engineer, because I just ask what is his intelligence quotient. If it is 120, he

might make it. This means he is in the upper 10 percent of the population, you see. He has to be good in mathematics, English, and physics, and not many boys are good in these three things.

And then, lastly, he must want to be an engineer. This means he wants to be, not his grandfather or his uncle.

We have done some arithmetic on this, and we find that there are only about 160,000 boys graduating each year who fulfill these first four requirements. Now, of this 160,000, about half of them do not want to go to college anyway. This cuts you to 80,000. About half of those who want to go to college cannot afford it. This cuts you to 40,000. And out of this 40,000, we engineers want all of them. The ministry, the law, the medical profession, all want this same type of boy. And so we just do not have 50,000 young boys coming out every year who can be engineers. Obviously we have to find some way out of this dilemma. And I think it is going to mean that we will start not only training engineers, the creative people who are to come up with the new ideas of what people want, but we have to train a whole body of technicians to back up the engineers and do the work which many engineers are called upon to do, which really is below their highest skill.

What it means, Mr. Cole, is that we have to be very, very careful in our use of this talented manpower. And coming back to atomic energy, if atomic energy is going to get its share, we as educators and you people in Congress have to work hard to make sure that we do get our share for atomic engineering.

Chairman COLE. With reference to the fact that Russia is graduating, did you say, 50,000 a year, you do not mean that those 50,000 are all highly skilled, highly qualified, 120 IQ people?

Dr. WALKER. I would doubt it, Mr. Cole. But we do know they have more people to start with. They have a bigger basic population than we have.

Chairman COLE. Are there any further questions of Dr. Walker?

Representative VAN ZANDT. Doctor, how far along are you with the reactor?

Dr. WALKER. We have all the engineering designs completed for the building, the electronic equipment, the reactor itself. We have sent a report to the Atomic Energy Commission, which is now, I believe, before the Safeguard Committee, and we are awaiting word. And this word we hope will be "Yes; if you build this we will loan you the necessary material." And until we get that word, we cannot move much further.

Representative VAN ZANDT. If you get something affirmative from the AEC from the safety standpoint, what is your target date as to completion?

Dr. WALKER. We would let the contract to build within a month of getting word from the AEC, and would probably be tuning the reactor up within 10 months.

Representative VAN ZANDT. If your planning worked out to the point where the building is complete and the reactor is functioning, what would be the size of your classes?

Dr. WALKER. We do not know. Dr. Breazeale and I have talked about starting a pilot class of about 15 this coming fall. This would be 15 boys who would have to work with pencils alone. They would

have no laboratory to work in. I think we might move up to 30 or 40 engineers a year eventually.

Representative VAN ZANDT. You would increase progressively, would you not?

Dr. WALKER. As industry and the Government demanded such.

Representative VAN ZANDT. Say with 5 years of experience, then what would be the size of your class?

Dr. WALKER. I do not think it would be more than 50. I do not think we could find 50 bright boys who wanted this.

Representative VAN ZANDT. Would that 50 represent 1 year's production?

Dr. WALKER. One year's production; yes.

Representative VAN ZANDT. Since the Pennsylvania State College is located in the geographical center of Pennsylvania, is it not true that the benefits from the reactor will greatly assist the coal, chemical, and possibly other industries?

Dr. WALKER. Well, we have thought of coal, the oil industry, the farmers. I think many manufacturers would find use for tracer materials. And we might eventually go much further ahead.

I know one vice president of the Pennsylvania Railroad who calls me up occasionally and asks: "How are we coming on this nuclear energy business? When should the railroads be interested?"

Now, this may be a short time or it may be a long time. We have been in this only 10 years. Where we are going nobody can tell.

Representative VAN ZANDT. Is it not true that the success of your efforts at the Pennsylvania State College depends primarily upon declassification of classified information?

Dr. WALKER. Declassification and getting the loan of the material. If we do not get these two things, there is no point in our trying any more.

Representative VAN ZANDT. Is it not true that there is need for the establishment of a policy of administrative shortcuts?

Dr. WALKER. That is right.

Chairman COLE. Thank you, Dr. Walker.

Our next witness is the president of the Engineers Joint Council, Joint Council, Mr. R. J. S. Pigott.

Mr. Pigott is here to give us the views of the Engineers Joint Council, which includes many of the outstanding engineering societies of the country.

STATEMENT OF R. J. S. PIGOTT, PRESIDENT, ENGINEERS JOINT COUNCIL

Mr. PIGOTT. Engineers Joint Council was founded originally by the four largest, Mr. Chairman, the civil, the mining and metallurgical, the mechanical, and the electrical. It is now enlarged, and is growing rather rapidly, because it is one of the few organizations in which the engineers each devoted to a particular branch of engineering can pool their problems.

Chairman COLE. I have glanced quickly at your statement, and I note that you identify the composition of the council.

Mr. PIGOTT. You will find it is identified at the bottom of page 1, by title.

Chairman COLE. Go ahead.

Mr. PIGOTT. Should I read this to you?

I will brief it as much as I can.

Your own response to our letter of May 26, expressing interest in the establishment of policy in this connection, that is, the peacetime applications of atomic energy, has requested our recommendations be submitted in a prepared statement.

Now, since many of the achievements which will be necessary to bring atomic power to fruition are engineering in nature, engineers have a great interest in the development of policy which will permit them to be most effective. Engineers Joint Council differs from the individual societies in that it is an overall organization formed by leading national engineering societies representing the basic branches of the profession. Two of the council's objectives are appropriate to the problem you are now considering:

To advance the general welfare of mankind through the available resources and creative ability of the engineering profession;

To develop sound public policies respecting national and international affairs wherein the engineering profession can be helpful through the services of the members of the engineering profession.

There were something over a half-million engineers in the 1950 census, about 80 percent of whom were working in private industry, and most of the rest in Government.

Engineers Joint Council's principal recommendations have been developed by an atomic energy panel. This panel contains representatives selected by its member societies: American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers, American Water Works Association, American Institute of Electrical Engineers, the Society of Naval Architects and Marine Engineers, American Society for Engineering Education, and American Institute of Chemical Engineers. These representatives have used available channels within their respective societies to aid in consolidating the opinions of engineers and engineering groups informed in atomic energy matters. This statement has been approved by the executive committee of the council.

Where and how engineers get their work done is important. Almost all of us work in organizations and roughly 80 percent in private industry. The organizations referred to in what follows are industrial companies, universities, and nonprofit research groups. Activities referred to do not include contract operations for the Commission. If law permits and these organizations see attractive opportunities, they will provide conditions engineers find most essential to rapid and realistic progress. Facilities to test and prove, reduction of ideas to actual machinery, freedom to initiate and try, wide association and exchange of ideas and information with others—these are some of the conditions engineers treasure most highly. Engineers' greatest incentives are to be able to contribute to progress most effectively, and for that to get warranted recognition and pay.

Some provisions of the present law prevent or discourage organizations from providing such conditions for engineering progress. We believe the following principal recommendations will provide a framework within which engineers can become effective toward such objectives:

1. The law should provide for issuance of appropriate licenses under conditions defined later to organizations to develop, manufacture, own, and use facilities for producing or using heat and radiant energy from atomic fuels, together with production and sale of radioactive products such as atomic fuel produced therein.

2. A workable system of making source, fissionable, and feed materials available at a price to all licensed organizations is needed. It is doubtful that actual requests will become large soon enough to affect the Nation's defense requirements.

3. One of the traditional American incentives, patents, should be revitalized. This is one kind of incentive motivating individual engineers and engineering groups.

Such recommendations are basic to provide engineers with places in which to develop, for business to have the incentive to manufacture what they develop, for feed materials to be available to operate and prove equipment, so that results can be determined and then improved upon. Engineers are practical people. Their nature is to look ahead to results. You will seldom find engineers happy to develop formulas or drawings for which there appears no effective channel leading to end use.

The definition of "appropriate license" in recommendation No. 1 above is important. The administrative agency should be required to issue licenses to all who apply unless there are valid reasons preventing issuance. All licenses should be issued subject to regulations protecting the security of classified information and preventing the diversion or use of fissionable materials for unlawful purposes. It is possible that Federal regulations, establishing some safety codes and standards, may be required for the time being. However, as the atomic industry grows, safety codes and standards would normally be established through such channels as engineering societies, the American Standards Association, and others, and enforced by the States. The ASME boiler code is an example. Standards for safe radiation conditions are already being established by the National Committee for Radiation Protection. Practical procedures implementing standards are best established by operating organizations. Final responsibility for industrial-owned plant safety normally is the operator's and should not be assumed by the Government.

Licenses should be revocable only if organizations fail to comply with the law. The administrative agency should require such organizations to supply all information necessary to demonstrate compliance and may need to conduct inspections. Information beyond this should not be required. Maximum engineering advances will be obtained by establishing in the atomic energy field the normal freedom for an engineer to publish information or not as best suits his interest and that of his organization. Both interests are generally the same.

Freedom of choice to release information or not raises questions of security. But laying security aside for the moment, we wish to discuss with you the vital effect of such freedom on incentives and on the availability of engineering data.

The right to hold and use certain knowledge for a time is a vital incentive in competitive engineering achievement. Industrial applications of atomic energy will benefit the public sooner and better if the pattern of centralizing technical information in the present military phase is not carried over into the industrial phase. At the same

time the publication and general availability of the bulk of technical information to all who wish to use it is just as important to engineering progress. There are normal balances between published and retained information. Over the years in America, individuals and organizations have established balances appropriate to their lines of endeavor which have resulted in a rate of engineering progress equaled by no other system.

We have emphasized these two aspects of information, because at present neither retaining nor releasing can be done in the way and amount necessary for maximum progress. Present security implementation interferes with progress in both military and industrial atomic applications in a degree which we feel warrants reexamination of this problem by the Congress. The vital problem of national security is to weigh the gain to America's progress through the release of information versus the detrimental effect on the enemy's progress of not releasing it.

It was clearly the intent of the Congress to promise latitude in the present law toward obtaining the best balance. The Atomic Energy Act, Public Law 585, 79th Congress, states as follows concerning the control of information:

SEC. 10. (a) Policy: It shall be the policy of the Commission to control the dissemination of restricted data in such a manner as to assure the common defense and security. Consistent with such policy, the Commission shall be guided by the following principles:

(1) * * *

(2) That the dissemination of scientific and technical information relating to atomic energy should be permitted and encouraged so as to provide that free interchange of ideas and criticisms which is essential to scientific progress.

However, in defining "restricted data," the law states:

SEC. 10. (b) Restrictions: (1) The term "restricted data" as used in this section means all data concerning the manufacture or utilization of atomic weapons, the production of fissionable material or the use of fissionable material in the production of power but shall not include any data which the Commission from time to time determines may be published without adversely affecting the common defense and security.

In practice the effects of these two clauses are directly opposite.

The aggregate result is clear. The vast body of important atomic energy information is classified. As early as 1948 outstanding engineers examined the Government's atomic activities for AEC as the Industrial Advisory Group, chaired by James W. Parker. Their report emphasized the need of industry for more and better information and the loss to general industrial progress of classified technology. Representatives of engineers have contributed to work on declassification in the Advisory Committee on Industrial Information to AEC. This problem is so vital and the considerations so difficult to balance that we believe a thorough reexamination is imperative.

This statement is concluded with a few comments on the importance of the basic recommended changes in the law. The present law was conceived with excellent perception of the situation then facing this country and recognition of the special problems of atomic fission and materials. Basically, however, atomic energy problems differ from those in other fields only in degree and not in kind. We believe the public will benefit if the legal ground rules are changed toward those proven by experience as most productive while consistent with national security. We believe the changed ground rules proposed to encourage

engineering advance toward nonmilitary benefits are compatible with the Government's program. The development of sufficient weapons and atomic propulsion of ships and planes can proceed effectively through present contracting methods under either the present law or as modified, and each program will substantially benefit the other. An investigation of the effect of security has been suggested relative to both military and other progress; our other recommendations are relative to engineering progress under private auspices. We feel the recommendations are essential to a healthy atomic industry effectively utilizing the country's engineering talent.

Chairman COLE. Thank you, Mr. Pigott.

Are there any questions from members of the committee?

Apparently the committee has no questions to ask of you, Mr. Pigott. We are letting you off easy.

Mr. PIGOTT. I am very happy to be afforded this opportunity of telling you our views.

Chairman COLE. Some time ago it appeared advisable to members of the committee that the committee hear from the National Advisory Committee for Aeronautics with respect to the system which that agency has in dealing with patents. References were made from time to time during the testimony to the procedures of the NACA. So, at the suggestion of the Chair, the NACA has very kindly cooperated, and Dr. James Hootman, who handles the patent phase of NACA, has been scheduled to appear this afternoon. If he is in the room, I will ask that he come up to the witness table.

I appreciate your appearing this afternoon, Dr. Hootman.

STATEMENT OF JAMES A. HOOTMAN, TECHNICAL ASSISTANT TO THE DIRECTOR, NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

Dr. HOOTMAN. Thank you, sir.

Chairman COLE. You may proceed.

Dr. HOOTMAN. Mr. Chairman, my name is James A. Hootman, and I am appearing in response to the request of your letter of July 21 addressed to Dr. Hugh L. Dryden, Director of the National Advisory Committee for Aeronautics. I am a technical assistant to the Director, and have been with the NACA for 17 years, first as project engineer at our Langley Laboratory, and for the past 12 years as a member of the headquarters staff in Washington. I hold the master of science and doctor of philosophy degrees in physics.

I believe that you have stated the reason that the NACA was called upon, so I will pass over that part.

The National Advisory Committee for Aeronautics was created by act of Congress in 1915 to supervise and direct the scientific study of the problems of flight. From a modest beginning, it has grown with the growing importance of aeronautics to industry and to national defense until today it operates 3 major laboratories and two auxiliary flight research stations, employing in all somewhat more than 7,000 people. Some 2,000 of these are professional scientists and engineers.

Representative VAN ZANDT. May I interrupt there, Mr. Chairman?

Doctor, do you have any of these so-called tunnels on college campuses now that you operate, or are they strictly operated by the colleges?

Dr. HOOTMAN. They are operated by the colleges.

Representative VAN ZANDT. How many of them are there? Do you have any idea?

Dr. HOOTMAN. I wouldn't know offhand.

Within recent years there has been an increasing awareness on the part of NACA officials of the responsibilities of our agency with regard to the patentable inventions of our employees, and in 1944 a statement of policy in such matters was drawn up at NACA headquarters and approved by the chairman. Copies of this policy were made available to the laboratory heads, but the matter was given no publicity at that time because of the fear in some quarters that circulation of the policy among all employees would encourage them to be overly patent conscious, to the detriment of their work on basic problems.

The original policy statement was revised in 1949, and its essentials were thereafter incorporated in the information booklet handed each new employee when he came to work for the NACA. The 1944 and 1949 patent policy statements represented an attempt to state in simple terms the rights and privileges of the Government and of its employees as they existed under the law and decisions of the courts. If the idea upon which the patentable invention was based was integrally connected with work specifically assigned to the employee—that is, if it constituted the solution of either all or a part of a problem presented by the work to which he was assigned—and if it was deemed in the public interest to do so, a patent was to be obtained and the Government was to be entitled to all rights thereunder.

If the invention was conceived incidentally in the course of the inventor's regular or general employment, but was not integrally connected with work specifically assigned him, a patent was obtained at Government expense under the provisions of 35 United States Code 45 if deemed in the public interest to do so. In such case, the rights of the Government in the invention were fully protected by the retention of a nonexclusive, irrevocable, royalty-free license for manufacture and use for all governmental purposes. If the employee wished, he was permitted, on request to NACA headquarters, to patent the invention at his own expense through private counsel, this in no way altering his obligation to grant a license to the Government.

If it was found that the idea upon which the invention was based was outside the general scope of the employee's duties, and that he had not used Government time, facilities, or other Government employees in the development of the invention, he was permitted to take any action he deemed advisable. If, however, it was deemed in the public interest to do so, opportunity was offered the employee to have the invention patented at Government expense under the provisions of 35 United States Code 45, in return for a nonexclusive, irrevocable, royalty-free license.

Chairman COLE. Doctor, would you tell us just briefly what the provisions of 35 United States Code 45 are?

Dr. HOOTMAN. Under the provisions of that legislation, an employee of the Government has a patent obtained in his name at no expense to him. The Government pays the fees, prepares, files, and processes the application.

Chairman COLE. And, in return, the Government has the right to use that license without payment of royalty for its own direct use or for assignment to produce the item for Government use.

Dr. HOOTMAN. To produce the item for Government use; yes, sir.

Inasmuch as the NACA is an organization concerned primarily with fundamental research rather than with engineering development, assignment of an employee to invent is quite rare except within those groups which devise new instruments to be used in our own research programs. Consequently, almost all of the inventions of our employees fall within the second and third of the categories just described.

The NACA has never employed a staff of patent attorneys. In the early days of its existence, the number of patentable inventions its employees reported was quite small, and the practice developed of referring those few which were reported to the Army Air Corps or to the Bureau of Aeronautics, Navy Department, for patent action. This arrangement was logical because these were the services which stood to profit most by utilizing Government patent rights in their development and procurement contracts, thus reducing the necessary royalty payments to private concerns and individuals.

NACA policy has always required that our employees report through proper channels to NACA headquarters all of their inventions which they believed to be patentable. Disclosures made at the laboratories are forwarded to the headquarters office by the laboratory directors with their recommendations and with full information concerning the inventor's employment status and the circumstances under which the invention was made. NACA headquarters then reviews the case and decides whether or not patent protection will be sought, and how the rights in the invention will be divided between the Government and the employee. If it appears that the Government has rights in the invention and that these rights should be protected, a full disclosure is made to the Navy Department with a request that patent action be initiated. The Office of Naval Research thereupon takes over the responsibility of preparing, filing, and prosecuting the patent application.

The procedure up to this point is essentially the same today as it has been for the past 10 years; however, the creation of the Government Patents Board by the issuance of Executive Order 10096 on January 23, 1950, has established, in the person of the Chairman of the Board, an authority for the review of agency decisions concerning the disposition of rights of Government employees in their patentable inventions.

Chairman COLE. Now, let me ask, Doctor: Is that the Board of which Admiral Bolster is the Chairman?

Dr. HOOTMAN. No, sir.

Chairman COLE. Who is the Chairman?

Dr. HOOTMAN. The Chairman is Dr. Archie M. Palmer.

Chairman COLE. And who are the other members of the Board?

Dr. HOOTMAN. There are 10 agencies, sir; that have representation on the Board. I happen to be the member for NACA.

Representative VAN ZANDT. What is Dr. Palmer's background?

Dr. HOOTMAN. He has been with different branches of the Government, with the National Science Foundation, and is a former university president and a scientist.

Representative VAN ZANDT. Is he employed by Government today?

Dr. HOOTMAN. Yes, he is.

The Chairman of the Government Patents Board also acts as a referee in disputes regarding rights between agencies and their employees. The Executive order, which established a uniform patent policy for all branches of the Government, subject to specific exemption of the Atomic Energy Commission, specifies certain criteria to be observed in the disposition of the rights in employee inventions. These criteria, although notably different in their approach from those of the NACA policy of 1949, are not essentially different in fact as presently interpreted by the Chairman of the Government Patents Board. The Executive order and administrative orders issued by the Chairman under its authority, outline uniform procedure to be followed by all agencies. After a preliminary prior art search indicates that a device or process proposed by one of our employees is patentable, a report is made to the Chairman of the Board describing the invention, the circumstances under which it was made, and the decision of the NACA regarding the disposition of rights. The Chairman may concur in, or reverse this decision, and subsequent handling of the case will depend upon his ruling. Otherwise, the establishment of the Government Patents Board has had little effect upon our processing of the inventions of our employees.

Chairman COLE. Doctor, my recollection of the original charter creating the NACA tells me that it was a rather sketchy, ambiguous, indefinite kind of a beginning, and that there has been very little legislation, and Congress has done very little by way of passing laws affecting NACA.

You folks have just sort of grown up by yourself.

Your statement did not cover the situation where private companies used the facilities of Government laboratories under NACA sponsorship. What is the practice concerning patents flowing from such use as that?

Dr. HOOTMAN. Well, Mr. Cole, there is practically no use, no use that I can recall, of that type, made by private concerns, unless the private concerns are contractors of the Government, in which case the Government agency involved requests the NACA to do the research.

Then we are doing the work for the Air Force or the Bureau of Aeronautics, Navy Department, or one of the other branches of the Government.

Chairman COLE. Then the only time a private aircraft company, either engine or plane, can use NACA is if the private company is a contractor of the Government, and then in that case the contractor applies to NACA for NACA to make this study?

Dr. HOOTMAN. It does not work exactly that way, sir. The contractor, working with the Air Force, we will say, or the Bureau of Aeronautics, decides that certain experimental work is required in the development of his model. Then the Bureau of Aeronautics or the Air Force, as the case may be, will request certain specific research to be done by the NACA, which we will then perform.

Chairman COLE. And all of the work the NACA does is Government work.

Dr. HOOTMAN. It works out that way at present. Theoretically it is possible for a private concern or even a private individual to have work done by the NACA by paying the necessary cost of research. Actually, that has not been done for a long time.

Representative VAN ZANDT. Mr. Chairman?

Chairman COLE. Mr. Van Zandt.

Representative VAN ZANDT. Suppose that you have a model in a wind tunnel, and you experiment with it over a period of months. You develop a new feature, and you think it will be acceptable to commercial aviation. How will the information concerning this feature be disseminated to the industry itself?

Dr. HOOTMAN. The information would go to the particular branch of the Government for which the work was being done, if it were that type of research.

I should make it clear that a great deal of the research the NACA has done is basic research and is initiated by the Committee itself. It is initiated by the various committees and subcommittees working under the main NACA organization.

However, as to the work that we do specifically for the agencies, the information would go to the agency involved immediately, and it would also go to the manufacturer whose design was being investigated, and steps would be taken to protect it by patent if it were considered desirable. But the information would not be withheld in the slightest.

I might say that the NACA does have some research carried out under contract.

Mention was made by an earlier witness of that type of work. We have work done by universities which are equipped with special facilities and personnel capable of carrying out work that is necessary in the field of aeronautics. Research contracts are let for that type of work, and the clause in the contract relating to patents states that as to any patents obtained as a result of the contract, the Government will obtain a nonexclusive, irrevocable, royalty-free license under the patent.

Chairman COLE. I do not understand that, Doctor. If NACA makes a direct contract for conduct of research in a particular field for which the Government pays the expense, the patents that might result from that contract are treated as though the contractor had been an employee of the Government and had developed this patent incidental to his principal work. Is that correct? Why would not the patent that followed from that contract be owned exclusively by the Government?

Dr. HOOTMAN. That is a question that is a rather far-reaching one, sir. The practice of taking a license rather than title to the patent has been in effect, I think, within Government circles, for a long time; the theory being that when you let a contract, you buy services.

Now, if you should contract for the title to patents which might develop, you would necessarily expect to pay more than if you contracted merely for the free license, which is all the Government actually needs anyhow. That is one line of thinking.

Chairman COLE. But where an idea, an invention, is discovered by a direct employee of NACA, in the course of his work, the Government is given the exclusive license to that patent, is it not?

Dr. HOOTMAN. If the man was specifically assigned to that particular job, and he does it, then the Government takes title; yes, sir.

Chairman COLE. Now, if you contract for a laboratory to do that same sort of study, the Government does not get an exclusive title or license?

Dr. HOOTMAN. The terms of the contract would not be as specific in that case as the terms of the direct assignment of an employee. The contracts are not so specifically worded as that. If we should let a contract to develop a specific instrument, for example, it would be a good parallel to the case of assigning our own employee to developing an instrument or an improved process.

Chairman COLE. Well, we asked you to come down and explain your system, not to find fault with the system you have, so I will not argue with you about that.

Do you have any questions?

Representative VAN ZANDT. Doctor, can you tell us in dollars and cents what the NACA represents today in the way of investment?

Dr. HOOTMAN. Something like \$200 million, sir.

Representative VAN ZANDT. How long has it been in existence?

Dr. HOOTMAN. Since 1915.

Representative VAN ZANDT. How many employees do you have?

Dr. HOOTMAN. Just a little over 7,000 at present, of whom a little over 2,000 are actually research people.

Chairman COLE. On the question that Mr. Van Zandt has raised, the amount of Federal money invested in NACA is very interesting, because \$200 million represents a little less than half of what the Federal Government has invested in the atomic-energy research program.

Dr. HOOTMAN. They have made better time than the NACA did.

Chairman COLE. I think the record will show, and if not it should show, in the record of this hearing, that that part of the 10 or 12 billion dollars overall program of money spent by the Atomic Energy Commission which has been spent for research and development in the atomic-energy field related to reactors has been about five or six hundred million dollars.

Mr. Hamilton now tells me it is \$554 million on reactor research.

Representative HOLIFIELD. Now, who gets the benefit of that? All of the private and Government Air Force facilities?

Dr. HOOTMAN. That is correct. Our research results are reported very promptly to Government agencies and the industry, through several different types of publication.

Representative HOLIFIELD. What is the theory involved? That in the interest of the general welfare the Government is justified in spending this sum primarily for military use in aircraft, and secondarily from the standpoint of the aircraft transportation, manufacturing, and transportation service, to the people?

DR. HOOTMAN. Of course, for some years the emphasis has been on the development of higher performance military craft, and we feel that perhaps that is our chief function and means of serving the country.

However, there is very little that can be applied to military aircraft that cannot eventually be applied to civil aircraft as well.

Representative HOLIFIELD. So the Government has to a great extent, subsidized the development of the aircraft industry, not only through your service but also through the assistance in developing military-type aviation, which is also developing civilian-type aviation.

DR. HOOTMAN. It has at least provided the basis on which the aircraft industry can build and go forward.

Representative HOLIFIELD. I was rather amazed to find that you have about 7,000 people in your organization. That does not include the Civil Aeronautics Board, which operates all the weather stations and the airfield landing towers, and so forth.

DR. HOOTMAN. That is correct. They are under the Department of Commerce, and we are an independent agency.

Representative HOLIFIELD. That is an additional subsidy for private aircraft as well as for military aircraft, is it not?

DR. HOOTMAN. That is mostly operative, however, rather than research.

Representative HOLIFIELD. Regulatory and operative, is it not?

DR. HOOTMAN. I beg your pardon, sir?

Representative HOLIFIELD. I say that is in the field of both regulation and operation.

DR. HOOTMAN. Regulatory and operative; yes, sir.

Representative VAN ZANDT. What does the original charter of your group establish in the way of an objective for the Committee?

DR. HOOTMAN. The purpose for which the NACA was established was to investigate the problems of flight with a view to their practical solution. It was a pretty broad charter.

Chairman COLE. It could not have been very much broader.

DR. HOOTMAN. And it has broadened as time has gone on.

Chairman COLE. By the initiative of those responsible for running NACA and not by Congress, except that Congress provides the funds.

DR. HOOTMAN. That is probably pretty largely true. We find that we now have to examine such things as high temperature materials, which are needed in jet engines. This, of course, is one of many new problems which weren't even thought of even 15 years ago.

Chairman COLE. Thank you very much, Dr. Hootman, for coming up this afternoon.

Another group from whom the committee has sought counsel and information on the procedures to be followed dealing with patent phases of our military program, where Federal money is used to develop new ideas and inventions, is the Armed Services Patent Advisory Board, who are represented today by Admiral Bolster and General Brannon.

Admiral, I do not know whether you speak for the Board, as Chairman, or whether we will hear from General Brannon later.

General Brannon, do you have a statement?

STATEMENT OF ADM. CALVIN M. BOLSTER, CHIEF OF NAVAL RESEARCH, ACCOMPANIED BY MAJ. GEN. ERNEST M. BRANNON, JUDGE ADVOCATE GENERAL OF THE ARMY, AND COMDR. D. H. DICKEY, PATENT COUNSEL FOR THE NAVY

General BRANNON. No, sir.

Admiral BOLSTER. I have the only statement.

My name is Calvin M. Bolster, Chief of Naval Research. I have been asked to explain briefly some of the highlights of current patent policy of the Armed Forces. I would like to state that within the Navy patents come under the Chief of Naval Research due to their impact on our research and development programs. In the Army and the Air Force patent work is administered by the Judge Advocates General. Since I am not a patent lawyer, I have asked Maj. Gen. Ernest M. Brannon, Judge Advocate General of the Army, to accompany me here. I also have with me Comdr. D. H. Dickey, patent counsel for the Navy, to help answer any questions you may have.

In examining the current patent policy of the Armed Forces, it is necessary to realize that this policy is the result of a long and complicated history of recommendations, reports, and legal decisions, each of which has accumulatively affected the current interpretation of patent policy by the departments and the present Armed Forces procurement regulations insofar as patents are concerned. One important aspect of this historical background is that there has been repeatedly strong evidence that Government policy should, insofar as practicable, recognize the need for an incentive for industry and the public to work on military matters and to provide them with adequate patent protection where appropriate.

In order to understand our interest in patents and the necessity for a clear-cut patent policy it is desirable to explain what we are talking about. Actually, the whole need for patent policy arises over the recognition by the Government of the existence of private rights in what have legally been termed "proprietary items." Existence of the proprietary item has long been recognized and is actually covered in the Navy regulations. A proprietary item is defined as one in which the owner has a property right or interest, enabling him to exclude others from its use without consent or at least subject to such restrictions as he may place thereon. Such proprietary items have normally been divided into the following categories:

(a) Patents, which include machines, articles, substances, processes, and methods on which a patent is issued.

(b) Copyrights, which are normally issued on drawings of a scientific or technical nature, books, periodicals, musical compositions, maps, and so on.

(c) Trade secrets, which are secret processes peculiarly known only to the owner and on which a patent has not been issued. Others may produce this unpatented article but under the philosophy of trade secrets they do not have the right to use the drawings of the specific manufacturing equipment developed by the producer.

(d) Trademarks, trade names. These are primarily to protect the association of a product with its source of manufacture.

As would be expected, patents are, by far, the most important and the most troublesome type of proprietary items.

As I stated above, the Navy has long had a specific regulation with regard to such items. Last year the Army, Navy, and Air Force conducted a review of patent policy, and among other things recommended that all the services adopt the following regulation regarding proprietary items:

It is the policy of the armed services not knowingly to adopt or use or authorize the adoption or use for or on behalf of the Government of that in which another has a proprietary right or interest without authorization of the owner or unless such use has been authorized by the Secretary of the service adopting it, except that adoption or use without prior consent is authorized when the exigencies of the service so demand but in any such instance a full and complete report of all facts and circumstances relevant thereto shall be made promptly to the Secretary of the using service.

Actually the interest of the Armed Forces in patents and inventions is necessarily very great, and it is important that they be administered soundly because of their intimate relationship to our contracting problems. It could well be said that the lifeblood of the Armed Forces is invention, when this word is used in its broadest terms to mean anything that is new and useful and which will improve the efficiency of the services. However, it should be noted that the value resides primarily in the invention itself. On the other hand, industry is primarily interested in patentable inventions and in retaining their industrial know-how. Both the ownership of the patent itself and the retention of know-how are of great importance to industry in maintaining their competitive position.

In studying all of this material it becomes apparent that the Government obtains patents primarily to maintain a sound defensive position. I believe in no instance has the Government ever sued an infringer and certainly would not do so under present policies because, in accordance with a listing of Government-owned patents recently published by the Chairman of the Government Patents Board, such patents are free to all.

In summary, we may briefly state that the Government-industry philosophy is:

1. That the Government acquires patents primarily and solely for protective reasons.
2. The Government does not exploit patents.
3. The leaving of proprietary rights with contractors while assuring proper protection to the Government establishes incentive for Government contractors.
4. That additional sources for procurement should only be established when essential to meet Armed Forces needs.

Unless we are to get into a detailed legal discussion which is very involved, I believe for the purposes of this committee a very brief but concise statement of our policy regarding contracts would give you the clearest understanding of the current situation. These policies are, in fact, extremely simple and have as their primary philosophy the premise that the Government will normally obtain a royalty-free license for work performed when appropriate. However, in order to maintain the very necessary incentive to industry, the Government does not under Armed Forces policies acquire the complete rights of an invention, except under unusual circumstances.

With this introductory statement, our contracts may be grouped under three general types: (a) research and development; (b) a type

which involves supplies, including some research and development; and (c) an outright supply contract.

When the essential purpose of a contract is to conduct research and development or when research and development is to be accomplished in specific areas under a contract for supplies, our regulations require that the Government receive a royalty-free license under any invention, improvement or discovery—whether or not patentable—conceived or first actually reduced to practice in the performance of this contract.

When the essential purpose of a contract is to furnish supplies only, such royalty-free licenses are not normally required but are subject to acquisition through negotiation when appropriate. In all of this work the question of so-called background patents has always been a difficult one, and it should be noted that in general the granting of a license or title to the Government as a result of work performed under a research and development contract as outlined above does not necessarily or normally give the Government license under so-called background patents or inventions. Here again, this type of problem would normally be handled in the negotiation phase of the contract.

Lastly, the problem of providing patents for a classified project has always been a difficult one. This is normally handled by holding the patent application in a secret status for the duration of the Government's interest in protecting the classified nature of the material covered by the invention. Such a patent would normally only be permitted to issue after the security restrictions by the Department concerned had been removed.

The policy of the division of patent rights between the Armed Forces and their employees is in general that the Government obtains at least a free license and frequently obtains outright title to such inventions depending upon the circumstances under which this invention was made. These matters are all governed by the administration of Executive Order No. 10096.

And, in general, this is the same material that you covered with the last witness.

Chairman COLE. Executive Order No. 10096 is the one to which Dr. Hootman referred a while ago.

Admiral BOLSTER. Yes, sir.

Chairman COLE. Setting up what?

Admiral BOLSTER. The Government Patent Board.

Chairman COLE. General Brannon, do you have anything you want to add at this time to Admiral Bolster's statement?

General BRANNON. No, sir.

Chairman COLE. Are there any questions from members of the committee?

Representative HOLIFIELD. Mr. Chairman, on page 4, No. 4:

That additional sources for procurement should only be established when essential to meet Armed Forces needs.

Will you please elaborate on that?

Admiral BOLSTER. Yes, sir. This is essentially saying—and this came up essentially after the Korean incident began, when we were broadening the base rapidly—that you do not necessarily go out and hand somebody's drawing to somebody else to make an automobile or an airplane, the airplane industry being one of the most difficult,

unless the country really needs them. In other words, the generation of new sources of material of this type rests with the need, and is not done under other conditions.

Representative HOLIFIELD. I assume this applies only to the procurement of items which are needed? If an inventor develops a patentable item under his own financing, and it is an item which the Navy wishes to purchase, and he comes to the Navy to sell it to the Navy, and let us assume that the Navy wants to buy that article: Do they, in their negotiations with him, insist upon other sources manufacturing that same article?

Admiral BOLSTER. Not normally, no sir. If he has adequate facilities and is able to produce the item and has the patent rights on it, it normally would be procured from him, and he would receive a reasonable royalty from it. It only comes up when we have tremendous needs, and this one manufacturer can't produce enough of the item. Then you have to somehow get the other people in the act and have more made. And in that case, if he had the actual patent, he would probably have to license the other source to do it.

This is covering the cases where the Government has acquired the license.

Representative HOLIFIELD. I see. In other words, you would insist on him making that available so that you would have other sources, so that if something happened to his particular facility, others would be available?

Admiral BOLSTER. Yes, sir; we frequently have to do that. The Secretaries have that right.

Representative HOLIFIELD. Do you force him to give that right to other companies without recompense to him?

Admiral BOLSTER. No, sir; not normally.

Representative HOLIFIELD. If he has the patent applied for, how do you handle that, if it is the case of an item you want to buy where he has filed an application for a patent?

Admiral BOLSTER. Well, actually, these things are the subject of very long, drawn out negotiations. Frequently, if a man has a clear-cut patent, it is easy. If he hasn't, you sometimes, after much review, decide he doesn't have a good case. And then we might get into a suit. Some of these suits actually go to the Court of Claims. Up until recently we have had a Patent Royalty Adjustment Board, where, in cases where it looked that the Government had infringed on his patents, we could adjust this by mutual agreement.

I should let these lawyers talk about this sir. This is out of my field. But I have been working on it.

Representative HOLIFIELD. Would you care to add to that?

Commander DICKEY. The Patent Royalty Adjustment Board was used in cases where there were other parties involved, ordinarily where there was a license arrangement between a manufacturer and an inventor, if you want to say that. Where the manufacturer was to pay a certain royalty to the inventor, on the ordinary peacetime procurement, royalties were considered reasonable and proper. But when you suddenly stepped up procurement, royalties would go to an unconscionable height. A man getting \$40,000 a year royalty would suddenly be getting \$40,000 or \$45,000 a month royalty on the same item. That permitted us to review that and to issue a notice to cut

the percentage royalties back to what was considered a reasonable return on his investment or on his invention.

Representative HOLIFIELD. That is where a man has acquired a private patent; and let us assume that he is charging 50 cents royalty on an item. When he starts making it in great quantities, you can go in and force him to reduce that 50-cent royalty per item to a lower amount?

Commander DICKEY. That is right, sir.

Representative HOLIFIELD. Now, that is not true in civilian life. On what theory do you force that? That is, you just withhold the contract from him?

Commander DICKEY. No; ordinarily it arises primarily when there is a license agreement between two parties, the inventor and the manufacturer. We are buying from the manufacturer, who has to pay the royalties to the inventor. The inventor is really a third party, and our primary contract is with the manufacturer.

Then, under this Royalty Readjustment Act—which was not renewed on the 1st of July, so it no longer is applicable—we had the right to adjust the royalties which the manufacturer would pay to the inventor, to get him a proper return on his investment, but not an exaggerated return based on the stepped-up procurement.

Representative HOLIFIELD. I am not arguing the proposition. I am just trying to ascertain the facts. What you, in effect, did, then, was to say to the manufacturer: "We will not give you a contract in which you will have as an item of cost a royalty that high. You must obtain it for less"?

Commander DICKEY. Well, occasionally, sir. But it happened more frequently after the contract had been let earlier. In other words, there was a manufacturer who manufactured for us during peacetime, say up until the 1st of June, and he was still manufacturing for us in the stepped-up procurement.

And then is when we take a look at the royalties he is paying.

Representative HOLIFIELD. I cannot see where you would have the legal right, though, to force the manufacturer to pay a lesser royalty than that covered in his agreement with the inventor.

Commander DICKEY. Your Congress gave us that right, sir.

General BRANNON. It is essentially a matter of eminent domain. We could seize the patent, but in order that we might do it more quickly, the Congress authorized us to limit the payment we would make to the holder of a patent.

Representative HOLIFIELD. Are you speaking of items of defense, or common-use items?

Commander DICKEY. No; it is items of defense.

Representative HOLIFIELD. I certainly am not complaining about it, but I just was exploring the methods in which you work.

Chairman COLE. Any further questions?

If not, let me thank you, gentlemen, for coming down and giving us the benefit of your knowledge.

This concludes the hearings on this subject with one exception.

There is one further witness to appear before the committee, and that is Mr. Strauss, the new Chairman of the Commission, who is presently scheduled to appear before the committee on August 3, a week from today. It is possible that we may arrange, at the convenience of Mr. Strauss, to hear him at an earlier time.

In addition, the committee has invited other interested individuals, groups, organizations, and companies to submit statements of their views on this subject for inclusion in our published transcript. These statements will continue to be received over the next 2 weeks and will be made a part of the record insofar as possible.

If there are others whom we have not contacted, it is entirely through inadvertence.

Unsolicited statements of views will be welcomed up to the 10th of August, since it is our intention to provide ourselves, the Congress, and all interested parties with the maximum opportunity to examine these problems and familiarize themselves with the views concerning them.

The meeting will be adjourned with the understanding that the next hearing on the subject will be August 3, unless the Chair advises the committee of an earlier date.

(Whereupon, at 4:10 p. m., Monday, July 27, 1953, the hearing was recessed until Monday, August 3, 1953.)

ATOMIC POWER DEVELOPMENT AND PRIVATE ENTERPRISE

FRIDAY, JULY 31, 1953

CONGRESS OF THE UNITED STATES,
JOINT COMMITTEE ON ATOMIC ENERGY,
Washington, D. C.

The joint committee met at 2 p. m., pursuant to recess, in the Old Supreme Court room, the Capitol, Hon. W. Sterling Cole (chairman of the joint committee) presiding.

Present: Representative Cole, Senators Hickenlooper (vice chairman), Bricker, Edwin C. Johnson; and Representatives Hinshaw, Durham, Holifield, and Price.

Professional staff members present: Corbin C. Allardice, executive director; Walter A. Hamilton; and Wayne P. Brobeck.

Chairman COLE. The meeting will come to order. The Chair feels that it might be appropriate to take a very brief minute to give an inadequate expression of the feeling that is felt by the members of this committee and I am assured by not only the witnesses but by all the persons in attendance at this meeting, over our sadness in the death of Senator Robert A. Taft, who was probably one of the greatest statesmen in our lifetime and whose absence in the Halls of Congress and in the machinery of Government will be sorely missed, and who cannot be ever fully and adequately replaced. Some thought was given to canceling this meeting today in respect to the memory of this great person. But after consultation with the witnesses, and a feeling that it would be his wish, it has been determined that we should carry on.

Before calling on the witnesses who are scheduled to appear today, the Chair would like to refer to two letters which have been received from prominent persons in this field. One is from Dr. Kenneth Pitzer. The other is from Dr. Edward Teller, who is one of the outstanding, the most outstanding, nuclear physicist, a man of very great imagination, a man who has contributed as much as any other one person to the success of this Government in this important field. Both are very important letters and will be placed in the appendix.

(The letters referred to will be found on pp. 623 and 632, respectively.)

Chairman COLE. The witnesses to appear today are Mr. Lewis L. Strauss, the new Chairman of the Commission, and Mr. Campbell, I see, is with him, who is also a new member of the Commission.

STATEMENTS OF LEWIS L. STRAUSS, CHAIRMAN; JOSEPH CAMPBELL, COMMISSIONER; DR. HENRY D. SMYTH, COMMISSIONER; AND MARION BOYER, GENERAL MANAGER, UNITED STATES ATOMIC ENERGY COMMISSION

Chairman COLE. Whether it is the plan of the Chairman, Mr. Strauss, to speak alone for the Commission today, or to share the presentation with his colleagues on the Commission, Mr. Campbell, or his associates—

Mr. STRAUSS. Another gentleman and member of the Commission, Dr. Smyth, is also here with me, Mr. Chairman. In view of my novelty, I would appreciate it if I might have the privilege of calling on my colleagues and members of the staff.

Chairman COLE. Of course. If you wish, have them come up and surround you, or have them sit in back of you. The only reason the Chair did not recognize the presence of Dr. Smyth is that he had appeared with the Commission at the opening session of these hearings. Of course, he is welcome at all times, and we are glad to acknowledge his presence.

Mr. Strauss, this is the first time that you have appeared before the committee, certainly in open session, since your designation and acceptance of the chairmanship of the Commission.

Let me reiterate very briefly what was expressed at your first appearance as Chairman at the closed session. I bespoke the complete and implicit confidence that every member of this committee, irrespective of party or the House of Congress to which he belongs, has in you and your capacity.

When we first learned of your nomination, it was accepted with unrestrained and unreserved joy and delight. Having observed your work on the Commission during your previous service, we felt completely justified in having an implicit reliance upon your capacity to render an outstanding service to our country in this most important field. In some respects your nomination as Chairman eases some of the responsibilities of this committee to keep such a constant check over the Commission's operation. I do not mean by that expression to indicate that we have lacked confidence in your predecessors, but because of our personal acquaintance with you we feel very safe in the knowledge that the chairmanship of the Commission is in competent hands and extend to you a very cordial welcome today.

Representative DURHAM. Mr. Chairman, this is one time that I feel confident in having a Republican express my views fully.

Mr. STRAUSS. Mr. Chairman, I am naturally very proud to have those remarks on the record. I feel very humble in the face of these responsibilities, and I am grateful for that encouragement.

I also appreciated your remarks in connection with Senator Taft in opening this session. You know, I am sure, that the relationship between us was a close one that has existed over many years. His encouragement has meant a great deal to me, and I feel his death as a very profound personal loss.

With your permission, Mr. Chairman, I should like to limit my testimony at what I understand is the close of these hearings to a summation of the present position of the Atomic Energy Commission in respect to industrial power; is that your pleasure?

Chairman COLE. It is, sir.

Mr. STRAUSS. To the extent possible for me, consistent with the pre-occupation of operating as Chairman of the Commission, becoming reacquainted with its personnel, trying to settle recent work stoppages at Oak Ridge and Los Alamos, and other necessary diversions, I have been reading the testimony taken by your committee. It is already clear that the hearings have been of enormous value. The idea of staging them at this particular juncture is a fortunate one and a great deal of material and opinion has been elicited which warrants the careful study of the Commission.

To the extent that I came to my new responsibilities with certain more or less fixed ideas concerning the application of atomic energy to power, I would say that exposure even to those parts of the testimony which I have already read, and that is only a part of it, has shown me aspects of the case that had not previously been presented, and I go into the coming months with a much more open mind.

I am in general accord with the Commission's statement of power policy. However, as of this moment, I am not prepared to rule out the possibility of plants which are designed to produce weapons grade plutonium as a byproduct of power. I am aware that such plants might involve compromises in design which would qualify the usefulness of power cost derived from them. I am assured, however, that the Commission's power policy statement was not intended to preclude such dual-purpose plants as a possibility, so much as to emphasize the greater desirability of plants which are economically justified in terms of power production alone.

I would be glad at a later date, and in executive session, to discuss parts of this question more fully. With this reservation noted, it may be appropriate here at the close of the hearings to restate the Commission's position on nuclear power development. This position was adopted on the basis of three fundamental determinations:

First, that the weight of scientific and engineering opinion holds that the goal is attainable. Second, that industry has indicated interest, and demonstrated it by contributions of talent and money. And, third, that hydrocarbon fuels are a diminishing natural resource, and that steps should not be longer deferred in developing so great a new source of power with its promise of compactness and eventual cheapness as a factor in our national strength.

Upon these premises, the Commission formulated the following policy statement:

First, we believe the attainment of economically competitive nuclear power to be a goal of national importance. Reactor technology has progressed to the point where realization of this goal seems achievable in the foreseeable future if the Nation continues to support a strong development effort. It would be a major setback to the position of this country to allow its present leadership in the world in nuclear power development to pass out of its hands.

Second, accordingly, we recognize it as a responsibility of the Commission to continue research and development in this field and to promote the construction of experimental reactors which appear to contribute substantially to the power reactor art and constitute useful contributions to the design of economics.

Third, in addition, it is the conviction of the Commission that progress toward economic nuclear power can be further advanced

through participation in the development program by qualified and interested groups outside the Commission.

Fourth, we recognize the need for reasonable incentives to encourage wider participation in power reactor development, and propose the following moves to attain this end:

(a) Interim legislation to permit ownership and operation of nuclear power facilities by groups other than the Commission.

(b) Interim legislation to permit lease or sale of fissionable material under safeguards adequate to assure national security.

(c) Interim legislation which would permit owners of reactors to use and transfer fissionable and byproduct materials not purchased by the Commission subject to regulation by the Commission in the interest of security and public safety.

(d) The performance of such research and development work in Commission laboratories relevant to specific power projects as the Commission deems warranted in the national interest.

(e) More liberal patent rights than are presently granted to outside groups as may seem appropriate to the Commission and consistent with existing law.

(f) Consideration of a progressively adjusted code for safety, and exclusionary requirements as may appear reasonable in the light of operational experience with reactors. Competent State authorities will be encouraged to assume increasing responsibility for safety aspects of reactor operation. Financial responsibility associated with reactor operation will be assigned to the owners in keeping with normal industrial practice.

(g) Giving full recognition to the importance of reactor technology to our national security, a progressively liberalized information policy in the power reactor field as increasing activity justifies.

Paragraph 5: It is the objective of this policy to further the development of nuclear plants which are economically independent of Government commitments to purchase weapons-grade plutonium.

That is the paragraph to which I noted a minor reservation.

Paragraph 6: We view the next few years as a period of development, looking toward the realization of practical nuclear power. On this basis, we conclude that the time is not yet at hand for the report called for in section 7 (b) of the Atomic Energy Act of 1946, as amended.

I would hope, Mr. Chairman, by the end of this year that we will have been able to draft a series of proposed amendments to the act to give effect to this policy, to this policy statement. And by that date also, to carry them through the administrative procedures required to ascertain that they are compatible with the policy of the Government.

Difficulty in this area will be the modifications to be recommended in patent legislation. The spectrum of choice here lies all the way from complete Government monopoly at one extreme, to a return to our traditional free-enterprise system at the other.

We have the assistance of an advisory panel composed of experienced and public-spirited men, intimately familiar with the theory and the practice in this field, and as a Commission we are actively engaged in study and debate on this question. In the last analysis, of course, it will be settled in the legislative chambers on this floor. We will nevertheless present our best judgment to you.

I do not think that we should request or that you should consider amending the law to facilitate the development of industrial nuclear power in other respects without simultaneous action in the patent field.

Now, I realize that the statement of the Commission's present position is interim in character. It suggests many questions which have not before been raised, questions which derive from such considerations as the broad use or avoidance of subsidies, the demands of security, the problems of international cooperation, and the like.

For instance, if the Commission is to buy fissionable byproduct material, would the price be its weapon or its fuel value? How will the Commission select from among perhaps many applicants the contractors to build and operate reactors? Will the Commission attempt to recoup to the Government the cost of the fuel sold or leased, and, if so, what elements are to be included in that cost?

What kind of charge, if any, will the Commission make for the research and development work to be done in its laboratories? Will the Commission charge, and if so on what basis, for the chemical processing of the fuel elements that have been through the reactor cycle? Will industry or Government be expected to bear the cost of compliance with security regulations and with the Commission's safety regulations?

What are the minimum patent rights that would be required to insure industrial participation? What does the Commission mean in its statement of policy by the phrase, "More liberal patent rights than are presently granted"?

Should the patent-protection period be abbreviated? Should anyone have the right to exclude others from using an important invention in the nuclear-power field? What are the arguments pro and con for the outright sale or leasing of fuel elements?

Is a subsidy for atomic power comparable with the system by which the aviation industry was encouraged? What is the proper period in which to amortize the first power reactors?

These and many other questions come to my mind and no doubt to yours. I am hopeful that you will not ask me these questions or others like them this afternoon. Some are just not presently answerable. Some are not properly answerable by me after only 3 weeks on this job. Some have never as yet, so far as I know, engaged the Commission's attention although eventually they must do so.

My own general position, however, for whatever interest it may have for you, was pretty well forecast by a question addressed to me by Senator Vandenberg, I believe, in late 1946 or early 1947. I do not recall the verbatim question, but the general tenor of it was about this:

"Question: Will you tell this committee your general attitude toward the rather socialistic provisions of this act?"

"Answer: Well, Senator, I think that under conditions as they exist in the world, and until the military requirements for weapons are fully met, there is no way to administer a force so powerful and so little known other than as provided in the law. It is my hope that in our lifetimes conditions will improve to the point where atomic energy can be freed of Government monopoly and placed in the framework of American system of free, competitive enterprise."

These, as I said, are not the precise words of the query, nor the reply, but as nearly as I can recall them. Nothing has given me cause to alter the viewpoint then expressed.

Thank you, Mr. Chairman.

Chairman COLE. Thank you, Mr. Strauss.

As was to be expected, you have given a very clear and concise and cogent statement.

Do any members of the committee wish to raise a question to Mr. Strauss?

Representative HOLIFIELD. Mr. Chairman?

Chairman COLE. Mr. Holifield.

Representative HOLIFIELD. Mr. Strauss, I, too, want to express my satisfaction and pleasure in the fact that you are now back with the Atomic Energy Commission.

Mr. STRAUSS. Thank you, Mr. Holifield.

Representative HOLIFIELD. I have listened to your presentation carefully and I am going to refrain from asking many questions which are in my mind. I think you have probably read some of the transcripts of the hearing and you know the general line of questioning that is in my mind. I agree with you that I do not have the answer, and I do not expect you to have the answers on such short notice. There are one or two questions, however, that I want to ask you.

In presenting a future legislative draft, you would favor presenting it in the form of amendments to the basic Atomic Energy Act rather than in separate legislation; would you not?

Mr. STRAUSS. That would be my personal view, sir. I obviously could not commit my colleagues.

Representative HOLIFIELD. That is right. Now, I want to commend you for a statement where you said that simultaneous presentation of patent amendments with the other amendments would be in order.

Mr. STRAUSS. That is also my personal view. I think that my colleagues share that view.

Representative HOLIFIELD. I want to say that I certainly agree with that position also, and I am pleased to hear you make that statement.

The last question I think I shall ask you is this: Do you contemplate, prior to the submission of a legislative draft, the submission of a report to the President and the Congress as required in section 7 (b) ?

Mr. STRAUSS. Not at the present time, Mr. Holifield.

Representative HOLIFIELD. I would hope that you would consider that point. I believe that it is important. I believe that the presentation of drastic amendments to the act without taking into consideration some of those factors that 7 (b) enunciates in its request of the report to the President and to the Congress, would be unwise, in my opinion, and I hope you will study that point.

Mr. STRAUSS. May I say in answer to that question, Mr. Holifield, that that bridge had been crossed by my colleagues in the course of the preparation of the statement of policy which I read. I will familiarize myself with the arguments which are presented pro and con on the point. While I am inclined to believe that the decision that was reached was sound, as I stated, I have an open mind.

Representative HOLIFIELD. That is all, Mr. Chairman.

Chairman COLE. Are there any other questions?

Senator HICKENLOOPER. Mr. Chairman, I would like to ask Mr. Strauss to amplify the situation so far as the patent controversy is

concerned. As I understand it, I think, as we have appreciated for a number of years, the proper treatment of patent matters in inventions and development has always been a troublesome thing, that is, the preemption of patents by the Commission. Do you think that matter presents any insurmountable problems in connection with the enlargement of this field for private enterprise activities?

Mr. STRAUSS. No, Senator, I do not believe that the problem is insurmountable. I think it is very difficult. The extreme views on both ends of the spectrum are maintained with great tenacity and force by their proponents. I suspect that the answer will lie somewhere between them.

Senator HICKENLOOPER. Like the conference committee on the appropriation bills between the two Houses, about halfway between?

Mr. STRAUSS. Yes, sir. I would not want to commit myself to halfway.

Senator HICKENLOOPER. That is all, Mr. Chairman.

Chairman COLE. Are there any further questions? If not, the committee would like to express a word of welcome to the other new member of the Commission, Mr. Joseph Campbell, who of course, is not nearly as well known to us as Mr. Strauss is, but who is equally welcome, and who I am sure will bring to the Commission a fresh viewpoint and make a valuable contribution to the work of the Commission out of the wealth of his long and constructive experience. We welcome you today, sir.

Mr. Campbell, do you care to add anything to Mr. Strauss' statement, or to express your thoughts on this or any other subject?

Mr. CAMPBELL. Mr. Chairman, I am delighted to be with the Commission, particularly under our Chairman. I have been here long enough to realize how valuable your joint committee has been to the Government. In a few months I will probably know more about it. Thank you very much.

Chairman COLE. That concludes the witnesses, but before closing this last hearing on the public participation of atomic power, I think it appropriate to mention a press release made today by the Atomic Energy Commission.

The announcement states that payment has been approved of \$300,000 as compensation for the partial revocation of a patent granted to 7 atomic scientists in 1940. The patent is entitled "Process for the Production of Radioactive Substances."

The discovery involved in the patent was that radioactive isotopes of a number of elements can be produced by exposing the elements to neutrons which have been slowed down by passage through different types of moderating material.

The original ideas of this group of 7 scientists and the techniques they developed during their experimentation in Rome during 1934 which resulted in patent being granted in 1940, is truly basic to the production of atomic fuels and weapon materials, as well as to the operation of practically all reactors.

I make mention of this matter for two reasons:

Enrico Fermi, who was a member of this group, is now, and has been for a decade, one of the great contributors to advancement of the United States atomic-energy program. His theoretical contributions in the field of reactor design, in a large measure, assure him a prominent place in the annals of atomic energy.

The second reason why I mention this award is that it is the outstanding example of a patent disclosing basic discoveries in the field of atomic energy, which has been handled under the present United States patent law, and the patent provisions of the Atomic Energy Act.

Mr. Strauss' testimony today comprises the last of 14 open hearings before the Joint Committee on Atomic Energy on some of the problems incident to definition of a Federal policy on atomic-power development and private enterprise. In 6 weeks we have heard from over 50 individuals representing 46 separate companies, groups, organizations, and governmental bodies. In addition, we have invited 60 others to submit any comments, views, or statements they may care to make for inclusion in the record of these hearings. I would like to insert at this point a list of all those whom we have contacted in our quest for advice and assistance during this period and renew our invitation to all others who may care to do so to join in helping us explore the complex and vital problems.

(The list referred to follows:)

WITNESSES WHO HAVE TESTIFIED AT OPEN HEARINGS ON ATOMIC POWER
DEVELOPMENT POLICY

June 24

Gordon Dean, AEC Chairman
Lawrence Hafstad, AEC Reactor Director
James Beckerley, AEC Classification Director
John Bugher, AEC Director of Biology and Medicine
William Davidson, AEC Industrial Development

June 25

Robert LeBaron, assistant to the Secretary of Defense
Isador Rabi, Chairman, General Advisory Committee
Walter B. Smith, Under Secretary of State

June 29

Walter Williams, Under Secretary of Commerce
Douglas McKay, Secretary of the Interior
Dale Doty, Commissioner, Federal Power Commission

July 1

Walker Cisler, president, Detroit Edison Co.
Tyrone Gillespie, counsel, Dow Chemical Co.
Edwin Putzell, secretary, Monsanto Chemical Co.
Earle Mills, president, Foster Wheeler Co.
Fred Kellogg, president, Pioneer Services & Engineering Co.
Willis Gale, president, Commonwealth Edison Co.

July 6

Walter Zinn, director, Argonne National Laboratory
Alvin Weinberg, technical director, Oak Ridge National Laboratory
Chauncey Starr, atomic research department, North American Aviation Co.
Karl Cohen, vice president, Walter Kidde Nuclear Laboratories, Inc.
John Menke, president, Nuclear Development Associates, Inc.

July 9

Gwilym Price, president, Westinghouse Electric Co.
Charles Weaver, general manager, Atomic Power Division, Westinghouse Electric Corp.
Francis McCune, general manager, Atomic Products Division, General Electric Co.
Arnold Brown, vice president, American Machine & Foundry Co.
Eugene Wigner, physicist and professor, Princeton University

July 13

J. Lee Atwood, president, North American Aviation Co.
Robert Stevenson, vice president, Allis-Chalmers Manufacturing Co.

July 15

George Weil, atomic power consultant
 Clyde Ellis, National Rural Electric Cooperatives Association

July 16

Alfred Iddles, president, Babcock & Wilcox Co.
 L. R. Rowley, production Manager, National Lead Co.

July 20

Malcolm Ferguson, president, Bendix Aviation Co.
 Walter Raleigh, vice president, New England Council
 Samuel Morris, chairman, atomic power committee, American Public Power Association
 Edgar Dixon, chairman, atomic power committee, Edison Electric Institute

July 22

Senator George Malone (Nevada)
 Oscar Ruebhausen, New York City Bar Association
 Casper Ooms, patent consultant

July 23

Ben Sigal, Congress of Industrial Organizations
 Elwood Swisher, United Coke, Gas & Chemical Workers Union
 A. H. Biemiller, American Federation of Labor
 William Steiger, Westinghouse Electric Co. for NAM
 Guy Suits, General Electric Co. for NAM

July 27

Eric Walker, dean of engineering, Pennsylvania State College, for the Institute of Radio Engineers
 T. A. Marshall, secretary, Engineers Joint Council
 Walter Kingston, director, atomic energy, Sylvania Electric Co.
 Rear Adm. Calvin Bolster, Chief, Office of Naval Research
 Maj. Gen. Ernest M. Brannon, Army Judge Advocate General

July 31

Lewis Strauss, AEC chairman

INVITEES WHO HAVE DECLINED TO TESTIFY BUT HAVE SUBMITTED LETTERS OR STATEMENTS FOR THE RECORD

American Cyanamid Co.
 Bechtel Corp.
 Carbide & Carbon Chemical Co.
 Combustion Engineering—Superheater Co.
 E. I. du Pont de Nemours & Co.
 T. Keith Glennan, president, Case Institute of Technology
 Kaiser Engineers Co.
 David E. Lilienthal, former AEC Chairman
 Pacific Gas & Electric Co.
 Phillips Petroleum Co.
 Sumner T. Pike, former AEC Commissioner

COMPANIES, GROUPS, AND INDIVIDUALS INVITED TO SUBMIT STATEMENTS FOR THE RECORD

Aircraft Industries Association of America, Inc.
 American Gas & Electric Co.
 American Patent Law Association
 Atomic Committee of American Society of Mechanical Engineers
 Association of American Railroads
 Association of Railroad and Public Utility Commissions
 Atomic Power Utilization Committee, Reno, Nev.
 Dr. Manson Benedict, MIT
 Dr. Robert Blum, atomic power consultant
 California Research & Development Co.
 Dr. Edward Condon, Corning Glass Works

Consolidated Edison Co., of New York
 Cooperative League of America (Jerry Voorhis)
 Dr. Lee duBridge, president, California Institute of Technology
 Dr. John R. Dunning, dean of engineering, Columbia University
 Duquesne Light Co.
 Fairbanks, Morse & Co.
 Dr. Enrico Fermi, University of Chicago
 Gibbs & Cox, Inc.
 The Kuljian Corp.
 Dr. J. B. H. Kuper, Institute of Radio Engineers
 Dr. E. O. Lawrence, Radiation Laboratory, University of California
 Los Angeles County Board of Supervisors
 Dr. Edward McMillan, Radiation Laboratory, University of California
 University of Michigan Engineering Research Institute
 Minneapolis Honeywell Regulator Co.
 Dr. James Newman, attorney
 Nuclear Instrument & Chemical Corp.
 B. E. Proctor, MIT
 Dr. Kenneth Pitzer, dean of chemistry, University of California
 Public Affairs Institute (Leland Olds)
 Radioactive Products, Inc.
 Rand Corp., Santa Monica, Calif.
 Dr. Glenn T. Seaborg, University of California
 Carleton Shugg, general manager, Electric Boat Division, General Dynamics Co.
 South Carolina Electric & Gas Co.
 Standard Oil Development Co.
 Stanford Research Institute
 E. Blythe Stason, dean, University of Michigan Law School
 Dr. Edward Teller, Radiation Laboratory, University of California
 Tracerlab, Inc.
 Vitro Corp. of America
 United States Commissioner of Patents

COMPANIES, GROUPS, AND INDIVIDUALS WHO HAVE SUBMITTED UNSOLICITED LETTERS
 OR STATEMENTS FOR THE RECORD

Chamber of Commerce of the United States
 Chester L. Davis, patent attorney, Perry, Mo.

Chairman COLE. The opinions and conclusions which have been expressed have run the gamut from encouragement of all-out private atomic-power development on the one hand to allowing only Government development on the other. The opinions have been competently expressed so as to emphasize the particular peculiarities of each view.

A careful analysis of this testimony along with other information will be necessary as preparation for consideration of possible legislation on this subject next year. Such an analysis will be prepared before next January.

But some points of common agreement among our witnesses might well be noted now.

No one has indicated that any company, group, association, or individual is prepared at this time to undertake alone the entire investment which is necessary to develop and build a full-scale atomic powerplant.

Every witness has urged that the Atomic Energy Commission continue a vigorous reactor research and development program.

No one has suggested that private industry is ready today to finance all of the research and development still needed to make commercial atomic power a reality.

Everyone has noted the necessity for indefinite continuation of Federal regulation of atomic energy; national health, safety, welfare,

and—most important of all—defense and security will obviously require such regulation.

Ownership of fissionable material has been identified by our witnesses as less important than the opportunity to use fissionable material on clearly defined terms.

The patent problem is central to industrial participation and will have to be resolved before large private investment is likely to be forthcoming.

A strong plea has been made by almost every witness for a clear statement of Federal policy on atomic-power development and a clear outline of the plans and programs for its accomplishment; everyone needs such clear statements in order to plan efficiently and act wisely and with dispatch.

And finally, all of our witnesses have seemed to agree that atomic power is important to the future economy of the United States and of the entire world; the social, political, and economic importance of atomic-power development is generally recognized.

I have therefore addressed a request to the Commission today which, in part, is as follows:

1. Even though the Commission has concluded that the time has not yet arrived when "any industrial, commercial, or other nonmilitary uses of fissionable material of atomic energy has been sufficiently developed to be of practical value," as set forth in section 7 (b) of the act, it might, nevertheless, be of considerable assistance if the Commission were to prepare an estimate of the "social, political, economic, and international effects of such use" as now appear. This estimate would be helpful in our further consideration of the problems even though it is appreciate that such an estimate might be of an interim nature if the circumstances envisioned by the act have not, in fact, fully developed at this time.

2. There have been a substantial number of references by witnesses during our hearings to the indefiniteness of Commission plans for research and development in the field of atomic power components, pilot plants, and prototypes. It would seem appropriate that plans for Commission activity should be set forth in a concise manner so that all interested companies, groups, organizations, or individuals can henceforth have no doubt about the Federal program under the existing act. I have in mind here that a 3- to 5-year program consisting of specific research and development projects—perhaps including construction items—might be set forth so that others could adjust their plans accordingly. Even though appropriations are determined on a year-to-year basis, it should be possible to carry out planning and programing over a longer term.

The transcript of these hearings will be published within 2 or 3 weeks. All in all, we have some hard thinking to do before next January, when, it is hoped, we will resume open hearings on specific legislative proposals.

SENATOR HICKENLOOPER. Mr. Chairman, I want to say for the record that I want to congratulate Representative Cole, the chairman of this joint committee, for his foresight and his diligent attention to this subject in generating this series of hearings on this very important matter. There can be no question, as a result of these hearings, but what commercial power and, we hope, of course, competitive power, will be a most important factor in the years to come. At least up until the time of these hearings, whether or not that competitive power would be feasible or available within the foreseeable future has been very much in doubt in the public mind.

As far as I am concerned, it may not have been fully clarified in these hearings, but certainly the chairman has laid the basis for an understanding of the problem and has explored the various ways and means by which the private-enterprise system can participate. He

has, with enviable success, I think, secured the cooperation of private groups and public groups, and especially the cooperation of the Atomic Energy Commission in attempting to make these hearings a better picture of the problem, and lay the basis for work in this field which can go on in the future.

These hearings, I think, will go down as the first public exploration of a field which no doubt will, in the future, be of equal or greater importance to our economy and such as electricity, although comparisons are difficult at this time.

But I do want to sincerely congratulate the chairman on his foresight and in the breadth of the hearings which he has conducted and his patience, and success of these hearings, in the face of very difficult legislative situations on both sides of the Capitol during these weeks that he has labored with this problem.

Senator BRICKER. Mr. Chairman?

Chairman COLE. Senator Bricker.

Senator BRICKER. May I join with Senator Hickenlooper in my expression of appreciation, also, and may I ask a question as to how soon the chairman thinks that the record will be printed so it will be available for us for study.

Chairman COLE. Certainly by the 1st of September, and we hope sooner. We expect a digest of the hearings will be available, perhaps, for you to read after your Thanksgiving dinner.

Permit the Chair to express his appreciation for the generous statements of both Senators. Of course he cannot assume credit for the success of these hearings. The credit is due to the members of the committee themselves who have attended, as well as to the members of our staff who have worked so long and faithfully on this program. I would like, in particular, to make public acknowledgment of two staff individuals who have worked on this program; one, Dr. James G. Beckerley, the classification officer of the Commission, who was assigned by the Commission to sit at these hearings, day after day, in order to warn us in case we should invade a field involving security and sensitive information.

The hearings were started by us with some misgivings as to whether it would be possible to explore this very important field without necessarily invading some phases of the program which were colored with security implications. However, fortunately we have been able to conduct this entire series of hearings without a single instance of Dr. Beckerley being required to flag us down.

It is true that we did have a false alarm at our opening hearing, but that was not because we were approaching anything of a sensitive nature. Dr. Beckerley, thank you, very, very much for your faithful though perhaps tedious attendance to your assigned task.

Finally, I want to pay particular thanks and acknowledgment to the work that has been done on this entire venture, if I may call it that, by a member of our staff, Walter Hamilton, who has been engaged in this phase of our studies in the atomic reactor program for well over a year, studying reports, interviewing people, working day and night, traveling all over the country. If credit is due to any one individual for the success of these hearings, that credit should go to Walter Hamilton. I think he has done a splendid job and I want to make public acknowledgment of that.

Representative DURHAM. Mr. Chairman?

Chairman COLE. Mr. Durham.

Representative DURHAM. I want to also congratulate the chairman for the hearings now being closed. I think certainly it has been called to the attention of the country at large more fully. It has been explored here in the open, and I feel that the Commission, the committee, and all the country will gain a lot from the hearings which have been going on now for something like 6 or 8 weeks, as the chairman said, under very difficult circumstances. It required a lot of patience, when the temperature was around 90 degrees and above, to attend meetings all day long, morning and afternoon, and Mr. Cole has been very diligent. I congratulate him on the hearings.

Representative HOLIFIELD. Mr. Chairman?

Chairman COLE. Mr. Holifield.

Representative HOLIFIELD. Mr. Chairman, I just want to add my word of appreciation to the way these hearings have been conducted by you as chairman, and to express my own personal appreciation for the patience with which you have allowed me to question witnesses. I realize that I have indulged in more questioning, probably, than some of the others, but I thought it was a very important matter, and I have very strong views on these subjects. You have been at all times patient with me in my questioning, and you have handled the affairs of the committee with dignity and the way I think a congressional committee should be handled. I express my own personal commendation and appreciation.

The CHAIRMAN. It should be said that all of the questions which you raised, Mr. Holifield, were pertinent, penetrating, and entirely appropriate. So far as I can recall only in one instance, when you sought to inquire into the housing situation down at one of the plants, did I feel it necessary to get you back on the track. But all in all, your questions were entirely proper and appropriate, and very, very helpful.

Representative PRICE. Mr. Chairman, I join my colleagues, both from the House and Senate, in full support of the statements they have made here, in the matter of the conduct of the meetings, and the benefit the meetings have been to the atomic energy program and to the public at large.

Chairman COLE. The record is not complete unless it shows that this series of hearings during the last month or so represents the culmination of an effort started by the staff of the joint committee well over a year ago, under the guidance, at the suggestion, and under the leadership of Mr. Durham, who was then acting chairman of the committee. Credit should be given to him for his vision and for his efforts in getting the ball started in its momentum.

Mr. HOLIFIELD. Mr. Chairman, I ask that a copy of a resolution in the House of Representatives, sponsored by my colleague, Mr. Price, and me on this subject and a statement submitted by me, both of which were made a part of the Congressional Record on July 29, 1953, be made a part of this record.

Chairman COLE. Without objection it is so ordered.

As a member of the Joint Committee on Atomic Energy. I wish to call to the attention of the House membership the fact that our committee has held comprehensive hearings on a subject of vital national importance—the development of atomic power. These hearings commenced June 24 and continued to the close of the present session of Congress. In all, the committee met 26 times in closed and open sessions and heard more than 50 witnesses from all walks of

life, including business executives, labor representatives, Government administrators, university scientists, public and private power spokesmen, and others. The hearings will be printed shortly, and I believe the Members will find them instructive and interesting; they should make a valuable contribution to the clarification of the complex and difficult issues implicit in the development of atomic power.

Chairman Cole deserves commendation for the systematic and orderly manner in which these hearings were arranged and conducted. He has been always patient and fair and statesmanlike in his demeanor. The wide range of views presented to the committee and the extensive nature of the hearings bear testimony to his thoroughness and his desire to have the committee obtain a rounded picture of this phase of atomic-energy activities. I am sure that the other members of the committee share my appreciation of the chairman's good work. We have put in many long hours, despite the pressure of other congressional duties, to work with the chairman in making the hearings productive. I may say with a pardonable touch of pride that these public hearings of the Joint Committee on Atomic Energy are a model of committee action in enabling the Congress and the public to be informed on a matter of national and, indeed, worldwide concern.

For some time our committee has been interested in the prospects for atomic power development. The stage for the present hearings was set last summer when the then chairman, the Honorable Carl T. Durham, sent a letter, dated August 19, 1952, to Gordon Dean, Chairman of the Atomic Energy Commission, expressing the committee's interest in the atomic-power studies undertaken by a number of private industrial firms under Commission auspices. Chairman Durham also advised the Commission that he would propose a series of meetings on industrial participation in atomic-power development to be held by the joint committee in the next session of Congress that is, the first session of the 83d Congress. The Commission was requested to submit a written statement of its policy views on the subject.

By letter dated September 4, 1952, Mr. Dean acknowledge the chairman's request and indicated that policy discussions then in process within the Atomic Energy Commission might be crystalized for presentation to the committee at the beginning of the new year. In the meantime, toward the close of 1952, the staff of the joint committee made a survey of atomic-power prospects and problems, published as a joint committee print—December 1952—under the title "Atomic Power and Private Enterprise." The information brought together by the committee staff provided extremely useful background material for the present hearings.

Half of the new year passed before the Atomic Energy Commission got around to presenting the policy views requested by Chairman Durham in August of the preceding year. Along with a policy statement on atomic-power development the Commission finally submitted a proposed draft of new legislation designed to promote private investment in this field by conferring the right of private ownership of fissionable materials and atomic-power reactors and by making other basic changes in existing atomic-energy legislation. The legislative draft did not receive clearance from the Budget Bureau and so was considered only informally by the committee without being made public. However, the policy statement in support of the legislation was released and became a focal point of discussion in the hearings subsequently held. I want to make it clear that the committee did not direct its attention to specific legislation in the hearings but rather to the broad field of atomic-power problems and policies.

Prior to the time the Commission presented its policy statement and draft legislation, I had made a quite intensive study of this subject matter and I became convinced that basic changes in the Atomic Energy Act now would be premature and ill-advised. Although I favor the fullest possible participation by private enterprise in atomic-energy development, I am strongly opposed to any legislative course that would entail huge Government subsidies to private firms or restrict the participation, through patent devices or otherwise, to a small segment of industry. Since electrical power based on nuclear fission does not appear capable of competing in cost with power from conventional sources, such as coal and falling water, for some years to come, I took the position that the Government should proceed under existing legislation to develop atomic power reactors and advance reactor technology until private industry was willing and able to invest its own funds on an independent footing and to participate on the basis of equal opportunity for all.

On June 1, in an hour-long statement on the floor of this House, I set forth in detail my views with respect to atomic-power development and the role of private enterprise therein. Later, when the policy statement of the Atomic Energy Commission became available, I prepared a critical analysis of the Commission's views which I presented to the House on June 22. Gordon Dean, then Chairman of the Atomic Energy Commission, undertook to reply to my criticism in a letter to Chairman Cole, which is printed in the Congressional Record of June 30. Although Mr. Dean's statement did not address itself to all the points made in my criticism, I was happy to note his clarification of certain key issues and his assurance, for the Commission, that the atomic-energy program of the Government would not be curtailed or encroached upon by anything that private industry might undertake to do in this field.

My own understanding of atomic-power problems has been enlarged and improved by the present hearings. It is evident from the diversity of views presented that there is no simple and easy solution to these problems. Further studies by the Atomic Energy Commission and by our joint committee will be necessary before we arrive at the stage of formulating new legislation on atomic-power development. My initial view that new legislation is untimely has been confirmed. The Commission would seem well advised to proceed with an evaluation of the potential impact of atomic-power production on economic, social, political, and international arrangements, as contemplated in section 7 (b) of the Atomic Energy Act, as amended, and to report in due course to the joint committee. With the help of that report and our own studies and investigations, we will be able to judge more soundly the need for additional legislation in the future.

In the meantime it is imperative, and I believe the Congress is of one mind on that score, that American leadership in all phases of atomic-energy development be maintained. We have a great and growing stockpile of atomic weapons. We have pioneered new strategic and tactical uses of atomic armament. But we cannot be insensitive to the fact that the peoples of the world yearn for peace. We would enhance our position of world leadership by demonstrating our active interest in the peacetime uses of atomic energy and in the development of atomic power for human welfare. As Gen. Walter "Beetle" Smith, Under Secretary of State, testified before the joint committee:

"It is of paramount importance to our international relationships generally that the United States maintain and improve its leadership in atomic-energy development. It is important, therefore, that we press ahead with the development of nuclear power. There is every reason to believe we will be the first to have nuclear power if we are prepared to move with vigor in this direction. It would be very damaging to the position of the United States if another country were to be first in this field of endeavor. It would be especially damaging if the Soviet Union were to precede us in the development of atomic power. If this were to happen, the Soviet Union would cite their achievement as proof of their propaganda line that the United States is interested in atomic energy only for destructive purposes while the Soviets are interested in developing it for peaceful purposes.

"On the positive side, by being first to develop nuclear power we will have further demonstrated to all the world that we are intensely interested in the peaceful aspects of atomic energy with all its implications for the future of mankind. This achievement would provide additional and positive evidence of the humanitarian policies of this Government, and its desire to further the economic well-being of the free world."

I know that Chairman Cole and the other members of the committee have been very much concerned lest we lag behind the Soviet Union in atomic-power development. The chairman communicated his views to the Appropriations Committee of the House in urging that funds be earmarked for the Atomic Energy Commission to embark upon a specific power project. I take the recent action of the Appropriations Committee in providing some \$7 million for preliminary work in this field as indicative of the favorable sentiment of the Congress. However, in view of the rather uncertain language in the appropriation bill, I believe the Congress should register its positive interest in promoting the peacetime uses of atomic energy and the development of atomic power by adopting a joint resolution to this effect. I am introducing such a resolution today, the text of which will be presented at the conclusion of these remarks.

The adoption of this resolution will signify to the world that we are firm in our intention to put the atom to work for the welfare of mankind. It will serve

to clarify for the Atomic Energy Commission the intent of Congress in certain matters affecting atomic power which are within the Commission's area of responsibility. It will constitute a congressional endorsement of Gordon Dean's statement that private industrial interest in atomic power will not slow down the Government's program. And, finally, the resolution would obligate our committee to submit recommendations to the Congress, after complete study and investigation, for further legislative steps to be taken in this field.

A resolution embodying the sense of Congress on atomic power development is especially pertinent because there seems to be a belief prevailing in the Department of Defense and possibly the National Security Council that the Government can afford to relax its reactor programs on the supposition that private industry will take over the greater part of this work. It is clear enough from our hearings and from the industrial realities of the situation that private industry is not prepared to assume such responsibilities. We must take care not to let atomic power progress disappear in a gap of uncertainty between Government responsibility and private interest. In the present, relatively limited state of the art, the Government has no sound alternative but to forge ahead on all fronts in reactor technology.

Mr. Speaker, there is a widespread and growing demand for more public information about the atomic-energy program. Many persons believe that the release of authoritative information on the size and character of our atomic bomb stockpile will serve as a powerful deterrent to warlike adventures on the part of Soviet Russia. Also it is believed that publicizing official information about atomic activities in Russia will serve to bring home to our people the reality of the danger of Soviet atomic aggression and the importance of civilian defense measures. Scientists are anxious to remove the fetters on the free exchange of ideas in atomic science, and industrialists deem it essential to have readier and less restricted access to atomic data if private development is to take place.

Mr. Dean chose in his last press conference as Commission chairman to emphasize the importance of relaxing atomic secrecy restrictions. And just recently President Eisenhower agreed that such a course ought to be followed.

Although the President seemed to think that a relaxation of atomic secrecy depends on changes in the Atomic Energy Act, I believe that the Atomic Energy Commission has considerable latitude under existing law for making more information publicly available. Accordingly, my proposed resolution would direct the Commission to institute a positive program of declassifying information within the framework of the present act. This mandate would meet with the approval of private firms who are anxious to evaluate the possibilities of getting into this new field of endeavor.

If time does not permit action on this resolution in the present session, I trust the Members will give it earnest thought and be prepared to act upon it early in the next session.

For the convenience of the Members, I include the text of House Joint Resolution 317:

"House Joint Resolution 317

"Joint resolution to promote the peacetime application of atomic energy and the early development and practical use of atomic power

"Whereas the United States Government has invested \$12 billion to date in the development of atomic energy; and

"Whereas the primary objective of this investment has been to strengthen the national defense and security and to further the cause of freedom in the world; and

"Whereas the American leadership must be maintained in all phases of atomic-energy development; and

"Whereas it is fitting and timely that we demonstrate to the world at large our sincere interest and constant endeavor to develop the peacetime uses of atomic energy; and

"Whereas the technical feasibility of atomic-power production has been established in the course of reactor developments and operation for atomic armament; and

"Whereas the economic availability of atomic power for industrial and domestic consumption depends on further research, experimentation, and construction in the reactor field; and

"Whereas private industrial and utility firms have manifested an active interest in participating in the development of atomic power; and

"Whereas the interest and participation of private industry in atomic-power development will be furthered by the less restricted use and greater dissemination of scientific and technical information relating to atomic energy; and

"Whereas the potential production and use of atomic power present crucial issues of public policy which must be resolved in order that the public interest in atomic energy will be fully protected while participation by private enterprise is encouraged: Therefore be it

"Resolved, etc., That it is the sense of the Congress that the peacetime applications of atomic energy shall be vigorously promoted and that the Atomic Energy Commission shall proceed expeditiously to establish or advance reactor programs and all related work essential to the early development and practical use of atomic power, including the development and construction of reactors for submarine, aircraft carriers, and aircraft and for central station production of electricity; and be it further

"Resolved, That in pursuance of the policy prescribed in section 10 of the Atomic Energy Act of 1946, as amended, to permit and encourage the dissemination of scientific and technical information relating to atomic energy, the Atomic Energy Commission shall screen all restricted data within its control with a view to the early declassification and publication of the maximum amount of information useful for industrial and other purposes without adversely affecting the common defense and security, and shall take effective steps to continuously declassify and disseminate such information; and be it further

"Resolved, That before any new legislation is enacted in respect of atomic power development, the Atomic Energy Commission shall submit to the Congress in accord with section 7 (b) of the Atomic Energy Act of 1946, as amended, a report stating all the declassified facts with respect to atomic power use and the Commission's estimate of the social, political, economic, and international effects of such use and the Commission's recommendations for necessary or desirable supplemental legislation; and be it further

"Resolved, That the Joint Committee on Atomic Energy shall continue its studies and investigations and if deemed necessary shall hold further public hearings on the subject of atomic power development, such studies, investigations, and hearings to include but not necessarily be limited to

"(1) the feasibility of private ownership of source and fissionable materials, nuclear reactors, and processing facilities, with special attention to factors of military priority requirements, security controls, safety and health hazards, regional power needs, and international agreements;

"(2) the desirability of Government commitments to purchase plutonium as a condition of private investment in atomic power, with special attention to their subsidy implications and the economic future of atomic powerplants upon cessation of Government purchases;

"(3) the extent to which the Federal Government shall produce usable by-product power as contemplated in section 7 (d) of the Atomic Energy Act of 1946, as amended, in conjunction with the production of fissionable materials for atomic weapons;

"(4) the technical, economic, and accounting relationships between atomic power production and production of fissionable material for atomic weapons;

"(5) appropriate patent policies to encourage private investments in atomic power while preventing the growth of monopoly or restrictive arrangements;

"(6) appropriate policies to govern the production and distribution of atomic power in order that the benefits of such power shall be widely distributed and maximum revenues shall be returned to the Federal treasury;

"(7) the integration of atomic power policies and administration with other power activities of the Federal Government;

"(8) new problems in Federal-State and Federal-local relationships consequent upon the construction and operation of atomic power plants; and be it further

"Resolved, That upon the conclusion of these studies, investigations, and hearings the Joint Committee on Atomic Energy shall submit a report to the Congress and present recommendations for atomic power developments based upon its own findings and those submitted by the Atomic Energy Commission in accordance with section 7 (b) of the Atomic Energy Act of 1946, as amended."

If there is nothing further, the meeting will adjourn, with an expression of appreciation by the Chair to the members of the committee for their diligent attendance.

(Whereupon, at 3 p. m., Friday, July 31, 1953, the committee was adjourned.)

APPENDIX

The following statements and letters were received in response to specific invitations from the joint committee to the organizations and individuals listed on page 569. In order to publish the complete testimony as early as possible, it was necessary to establish a firm cutoff date beyond which letters and statements could not be accepted for publication at this time. Receipts subsequent to August 10, 1953, are available at the office of the Joint Committee on Atomic Energy. They will be published insofar as possible in connection with further hearings and reports dealing with atomic-power development. [Editor.]

STATEMENT BY CHARLES S. WILSON, CHAIRMAN, PATENT COMMITTEE, AIRCRAFT INDUSTRIES ASSOCIATION OF AMERICA, INC., JULY 22, 1953

Manifestly, it is now appropriate to rationalize the Atomic Energy Act of 1946 (42 U. S. C. secs. 1801 et seq.) and to consider amendments to liberalize this act to remove atomic energy from its ivory tower. To do so, will open the atomic-energy field to exploration and development by individuals and corporations in the exercise of traditional American competitive free enterprise. This would certainly encourage inventions in this field and their application to commercial purposes for the benefit of the general public. To that end, section 1811, relating to patents and inventions, should be amended.

Those portions of the act relating to—

- (a) Prohibition against granting of patents;
- (b) Compulsory licensing of patents; and
- (c) Right to condemn or requisition patents

have been found to be particularly objectionable and unduly restrictive, especially in view of other legislative enactments designed to protect and secure general military inventions and developments.

The deletion of section 1811 (a) production and military utilization (1) and (2); section 1811 (b) use of inventions for research; section 1811 (c) nonmilitary utilization and section 1811 (d) acquisition of patents, as well as the revision of section 1811 (e) compensation, awards, and royalties, would conform the patent provisions of the Atomic Energy Act of 1946 with the general patent law.

This action is recommended and requested for the following reasons:

PROHIBITION AGAINST PATENTS

The act in its present form prohibits the granting of patents covering inventions used solely in the production of fissionable material or the utilization of fissionable material or atomic energy for a military weapon. Thus, the Atomic Energy Act abrogates the basic patent laws of the United States.

There is now no need for prohibiting patents pertaining to fissionable material or atomic energy. The basic purpose of the Atomic Energy Act was to protect the national security. Aside from the Atomic Energy Act of 1946, national security with respect to classified information is protected by the Invention Secrecy Act of 1951 (Public Law 256, 82d Cong.), which delays the issuance of patents until the matter contained therein is declassified.

The United States Patent Office has also established a special division for the handling of classified subject matter, including inventions relating to atomic energy.

Rights of inventors should not be denied by prohibiting the granting of patents under the Atomic Energy Act. Inventors should have the opportunity of being rewarded for their inventions relating to atomic energy in the same manner as for other inventions, and patents should be granted for all inventions relating to atomic energy.

COMPULSORY LICENSING

The act also provides for compulsory licensing for the use of atomic energy for commercial purposes. This is repugnant to the United States patent system, and was not included in the Patent Codification Act (Public Law 593, 66 Stat. 792, ch. 950), effective January 1, 1953.

The grant contained in United States patents excludes others from making, using, or selling the patented invention, and has been regarded as a stimulant to invention. The issued patent frequently spurs others to greater activity in the field. The exclusive right of the patent encourages the investment of private capital without fear that others will encroach upon the market once it is established by the patent owner. This enables the patent owner to have the opportunity of being rewarded for the risks taken.

The compulsory licensing provisions of the Atomic Energy Act should be deleted.

RIGHT TO CONDEMN OR REQUISITION PATENTS

It is not necessary for the Government to acquire title to patents because it has the right to use patented inventions under the Act of 1910, as amended, 28 United States Code 1498. Placing power in the Commission to condemn, requisition, or take patents which the Commission believes should be administered by it cannot help but have the effect of destroying incentive to make inventions relating to atomic energy. Moreover, since these patents are issued no useful purpose would be served by their condemnation or requisition so far as national security is concerned. This provision of the act should be deleted.

II. Government policy with respect to rights in inventions should be clarified.

ALLOCATION OF PATENT RIGHTS IN RESEARCH AND DEVELOPMENT CONTRACTS

Present research and development contracts with the Commission provide that the Government has the sole right to allocate patent rights in inventions emanating from such contracts. A stated policy of leaving sole commercial rights with the developing contractor, subject to a nonexclusive, royalty-free license to the Government, would encourage research and development work in the atomic-energy field under Government sponsorship. The possibility of obtaining valuable commercial rights would encourage competent contractors to take low-profit research and development contracts.

The Atomic Energy Commission administers its research and development contracts insofar as patent rights in inventions and discoveries are concerned, somewhat differently than the Department of Defense. The Department of Defense leaves title to inventions with the developing contractor together with all commercial rights. This practice enables the benefits of the invention to be made available to the using public since it encourages the investment of private capital in the exploitation of the invention. If licenses were available to everyone, or the patent rights dedicated to the public, private capital may not be forthcoming to take the risk of marketing the new product covered by the invention.

The act should therefore be revised by including therein under declaration of policy as paragraph (c) under section 1, the following paragraph:

"(c) To insure that the development and utilization of atomic energy shall be directed toward improving the public welfare, increasing the standard of living, and strengthening free competition in private enterprise, it shall be the policy of the Government to acquire only a nonexclusive, royalty-free license for governmental purposes in inventions or discoveries emanating from federally sponsored research and development work."

III. General: The act provides for a Patent Compensation Board and the right for judicial review. These provisions, however, are believed to be more illusory than real. Inventors in the atomic-energy field should have the right to obtain patents according to the established laws and practices of the United States Patent Office and the right to exploit these patents under the laws of the United States as they existed prior to the Atomic Energy Act. Atomic energy should not be burdened with patent provisions which are untried in the United States and which are fundamentally contrary to our basic concept of patent law.

One of the more serious problems that has arisen in the administration of the patent provisions of the act is the practice of the Government taking title to inventions through the Atomic Energy Commission. This raises a legal question as to whether the Government (the granting agency of the temporary monopoly of the patent grant) can also be the holder of that monopoly. Without going into this very complicated matter, the problem can be eliminated by having the Government take only a nonexclusive, royalty-free license in inventions emanating from the Government-sponsored research and development. This course of action is recommended.

The arts and sciences have flourished under our patent laws. Industry has correspondingly flourished. No special patent laws were necessary to develop aeronautics, radio, television, electronics, and the many advances in the field of chemistry and other sciences. It is strongly urged that atomic-energy research and development would be encouraged by the changes recommended herein.

AMERICAN CYANAMID Co.,
New York 20, N. Y., July 9, 1953.

Hon. STERLING COLE,
Chairman, Joint Committee on Atomic Energy,
Washington, D. C.

DEAR MR. COLE: Answering your letter of July 2, we should like very much to cooperate with your committee in discussing the problems incident to the definition of Federal policy on industrial atomic power development; but it so happens that Dr. R. C. Swain, vice president, who is most familiar with our activities in the atomic-energy field, is away from the office this week on a trip from which he is not expected to return until early next week. You will appreciate, therefore, that it would not be practicable for us to prepare the unclassified statement in time for the hearing on July 16.

I shall bring this exchange of correspondence to the attention of Dr. Swain immediately upon his return, with the idea that he would communicate with you promptly. Perhaps you will agree that, under the circumstances, it would be better to postpone his appearance before your committee until a later date.

Very sincerely yours,

K. C. TOWE, *President.*

[Note: Dr. Swain was unable to prepare a statement before August 10, the closing date for receipt of comments.]

STATEMENT BY C. WILLARD HAYES, CHAIRMAN, COMMITTEE ON LAWS AND RULES,
AMERICAN PATENT LAW ASSOCIATION, JULY 31, 1953

The American Patent Law Association, which comprises over 1,400 lawyers engaged primarily in the practice of patent law throughout the United States, favors in principle revision of the Atomic Energy Act of 1946 to permit private ownership of facilities for production and utilization of fissionable materials for industrial purposes and to permit the acquisition of patent rights relating thereto.

The industrial development of the United States has taken place under a free-enterprise, competitive system which has depended upon our patent laws to protect and encourage private investment in research and development. This protection has been the cornerstone of the phenomenal advances made in this country in every field of science and the useful arts.

What may be termed the atomic-energy industry was born of war and by reason of military necessity was initiated by Government under conditions of utmost secrecy and rigid control. The exigencies of the world military and political situation prolonged the necessity for emphasis on the military aspects of nuclear fission under governmental sponsorship, and the public and industry have accepted this situation.

The authors of the Atomic Energy Act of 1946 recognized that future development of nuclear fission for peaceful purposes would require revision of the policies established during the war and postwar era, and the American Patent Law Association believes that the time has arrived for such revision so as to permit, within the limits of the requirements of national security, the entry of free enterprise into this field.

Complete governmental operation and control of any industry is foreign to the concepts of our free-enterprise, competitive system. Except for such controls as may be dictated by the requirements of the national security, it is believed that the realm of nuclear fission should not be an exception to this rule any longer or to any greater extent than is absolutely necessary to maintain that security.

There has been some concern expressed that the huge public expenditure already made would in some manner be jeopardized or lost by opening the field to private enterprise. However, it is our view that the more rapid advances and the broadening of the field of research which might be expected to ensue would be in the public interest and that the ultimate benefit to the public and the Nation would be far greater and achieved at less expense to the taxpayers than if the program were to be continued on the present basis of total governmental sponsorship.

As to the expressed fears of creation of monopoly by revision of the patent sections of the act to permit the private holding of patent rights in the field, it should be borne in mind that the basic concepts and procedures insofar as they are patentable are already known and subject to governmental ownership and control and therefore could not form the basis of any private patent monopoly. Once the field is opened to privately sponsored research and development, the fruits thereof should be protected by the patent laws in the same manner as in any other field, for the same reasons, namely "to promote the progress of science and the useful arts, * * *." (Constitution of the United States, art. 1, sec. 8.)

Accordingly, it is the view of the American Patent Law Association that the ultimate public interest will best be served by revision of the Atomic Energy Act of 1946 to effect the opening of the field of nuclear fission to research and development by private enterprise and by liberalization of the patent provisions of the act to permit the protection of future inventions in this field resulting therefrom.

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS,
New York 18, August 3, 1953.

MR. STERLING COLE,
Chairman, Joint Committee on Atomic Energy,
Congress of the United States, Washington, D. C.

DEAR MR. COLE: On behalf of this Society's Nuclear Energy Committee please accept our appreciation for your letter of July 24, giving the committee opportunity to present written comments on the problems incident to a broadening of the Federal policy on industrial atomic power development.

This society is a member body of the Engineers Joint Council and our Nuclear Energy Application Committee was represented on the panel of the Engineers Joint Council whose recommendations were presented to your committee by R. J. S. Pigott on July 27, 1953. Our committee joins whole-heartedly in the recommendations made by the panel of the Engineers Joint Council.

This society does have a real interest in the broader use in industry of atomic energy application because it will look upon such broadening as increased opportunity for the society to render service such as it has rendered for over 60 years through the development of industrial safety codes and test codes for various types of power apparatus.

We regret to note in your letter that it will not be possible to have action by the Congress on this problem in this session.

Yours very truly,

C. E. DAVIES, *Secretary.*

ASSOCIATION OF AMERICAN RAILROADS,
OPERATIONS AND MAINTENANCE DEPARTMENT,
Washington 6, D. C., July 30, 1953.

HON. W. STERLING COLE,
Chairman, Joint Committee on Atomic Energy,
Congress of the United States, Washington, D. C.

DEAR MR. COLE: Further in connection with our recent correspondence on the question of a Federal policy regarding industrial use of atomic power:

Careful consideration has been given the contents of your letter. We have a committee in this association which has been given the responsibility of investigating the possibilities of nuclear energy as a source of primary power for locomotives. This committee has been in existence such a short time it has

not yet had the opportunity to reach any decisions on the general design of equipment to be used. Manifestly, however, material capable of producing nuclear energy will be required if such a locomotive is to be used and release of this material by the Atomic Energy Commission will become necessary when the locomotive is built. We would not expect in the course of ordinary events that such a locomotive design would be completed before 10 years time elapse.

While, for industrial development, it will eventually become necessary to obtain the material for nuclear power we do not foresee at this time the necessity of making public any further information on the details of atomic energy. We believe we can satisfactorily progress our work by using unclassified material and having two or three qualified men cleared for access to such classified material relevant to this work which is released for industrial use.

The foregoing represents our thinking based upon the development period and the stage during which pilot experience on one or two locomotives would be obtained. If circumstances become such that more extensive use of this energy would be economical, such change in the status of this development may cause us to change our views relative to the laws pertaining to methods of handling this subject.

We wish to thank you and your committee for your thoughtfulness in bringing this matter to our attention and providing us with an opportunity to express our views.

Very truly yours,

J. H. AYDELOTT, *Vice President.*

STATEMENT OF EUGENE S. LOUGHLIN, PRESIDENT, NATIONAL ASSOCIATION OF RAILROAD AND UTILITIES COMMISSIONERS, AND CHAIRMAN, CONNECTICUT PUBLIC UTILITIES COMMISSION, JULY 27, 1953

My name is Eugene S. Loughlin. I am president of the National Association of Railroad and Utilities Commissioners and chairman of the public utilities commission of the State of Connecticut. This statement is made in my capacity as president of the national association and incorporates my opinions as member and chairman of a State regulatory authority.

The national association is composed of the regulatory authorities having jurisdiction over, among other utilities, the electric utilities in most of the 48 States and the District of Columbia and the Territories of Hawaii and Puerto Rico. It also numbers, among its members, four Federal regulatory authorities, including the Federal Power Commission and the Securities and Exchange Commission. The association, therefore, has a keen and vital interest in the subject which occupies your honorable committee. This interest will be briefly touched upon below and is sufficient, in my opinion and in the opinion of the association, to justify the association's careful attention to the subject of atomic power for electrical generation. Because of its importance, in my capacity as president of the national association, I recently caused to be formed a special committee on development and use of atomic power in the electric industry, which committee is composed of five members representing areas wherein the construction of reactor piles is under consideration. As soon as security clearance is given, it will be engaged in the exploratory stages of the problems which will confront it, some of which will be mentioned below and many more of which will appear in the course of the committee's study. It is the purpose of this committee to make its report to the association, which report, to the extent that security provisions allow, will be made public and, where classified information is contained, will be made available to this committee and to the Atomic Energy Commission and to such other places as are proper and necessary.

Since all authorities are now agreed that the generation of electricity from atomic power is possible and that only practical questions of cost stand in the way, the time has now arrived for evaluation of the practical aspects of this question of generating electricity from atomic reactors.

Before engaging in these practical questions, however, most of which are concerned with economics and costs, there are many subsidiary questions which must be answered. These are not entirely economic and appear only when the surface is scratched sufficiently deep that the essential nature of the electric-utility business is disclosed.

Up to the present time in the development of atomic power and the generation of electricity from such reactors as are used in the process of transmutation of fissionable materials, the problems have been chiefly scientific and

physical. The first serious effort to apply the fruits of this concentrated and strenuous period of development to industrial processes has come in the field of generation for electric energy for consumption by the general public. Undoubtedly, there are many other uses in the public interest to which this great development will be put in the future. As a matter of fact, however, the immediate problems before the Congress and the Atomic Energy Commission result from the fact that the only prospective large-scale application of atomic energy to date to purposes other than providing tools of war is in the field of generation of electricity.

Actually, this fortuitous circumstance is of considerable importance to the general welfare since the business of gearing and distributing electric energy has been the subject of active regulation in the public interest for a great many years. The risk, therefore, is minimized that the purposes will not be achieved which are so ably set forth in the Atomic Energy Act of 1946, wherein it is stated that the paramount objective of this country's atomic-energy policy shall be "assurance of common defense and security, the improving of public welfare, increasing the standard of living, strengthening free competition and private enterprise and promoting world peace."

Although it is greatly to the advantage of the general public that atomic power should find its first practical application in a regulated industry, some very important characteristics result which require extensive study and research in resolving them. These are the problems which I want to point out to you briefly and which the committee appointed by this association will deal with much more exhaustively and comprehensively.

The single most important factor this honorable committee should bear in mind in considering possibilities of changes in Federal policy toward atomic energy, insofar as it affects the use thereof by private enterprise in the generation of electric energy, stems from the fact that the electric-utility business (1) is a regulated industry; and (2) is of such a nature that in virtually every State in the Union it was deemed of sufficient public interest to be brought under regulation. In other words, unlike other industries, the electric-utility industry is affected with a public interest or, as stated by Mr. Justice Frankfurter, in the *Hope Natural Gas* case, "For our society, the needs that are met by public utilities are as truly public service as the traditional Government functions of police and justice. They are not less so when these services are rendered by private enterprise under governmental regulation."

A subsidiary question which stems from the above two considerations is a practical one and arises by virtue of the fact that many utilities are subject to State regulation alone, while others are subject to both State and Federal regulation by virtue of the provisions of article I, section 8 of the United States Constitution. My purpose here then is to discuss briefly some of the problems which, in the opinion of the association, must be constantly borne in mind by your honorable committee when it is considering the business with which it is now occupied.

This association is not concerned, for the purposes of this statement, in the answers to the scientific question whether one type of reactor is superior to another or whether the dual-purpose reactor, the so-called breeder reactor, is the answer to the cost question. We assume, however, that some variation of the breeder reactor, which has already been successful in producing small quantities of electric power at Arco, Idaho, will be used. This seems to provide the most practical answer to the cost question at the present time. If such a proposal is carried out, commissions and regulatory authorities generally will be confronted with the same problem which caused such difficulty with the Tennessee Valley Authority and other similar functions, namely a multiple-purpose joint-cost facility, with the necessity for allocation of plant and expenses to the various functions. This problem, however, does not appear to be one for legislative determination. The Congress may decide that it ought to fix by law the part of the cost of a dual-purpose reactor which should fairly be charged to the production of plutonium or other byproducts. But it appears to the association that the answers to such a question should be found in a forum of regulatory authorities rather than the legislature.

As a consequence of the possibility that dual-purpose reactors will be used, however, other problems do develop. For example, there is a question whether the United States Government should fix the price of plutonium or other byproducts, such as tritium, U-233, radiological warfare weapons, or radioactive isotopes. If so, how should these prices be fixed? Should the Federal Government guaranty the fixing of the price for this byproduct and what protection should and would be afforded utilities and investors if the present arms race, which seems the most practical source for consumption of plutonium, should slow down or end? Since

the selling point of the dual reactor results from the market for the byproduct created by the international situation, should the Congress consider extending a guaranty or some other protection against a change in the situation which would eliminate the market for the byproducts?

The subsidiary question, of course, of proper accounting for the revenue received from the sale of these byproducts should be properly left to the regulatory authorities.

In the same connection, a problem will immediately arise what to do with the outmoded equipment in the event the present type of reactor becomes obsolete, either entirely or in some part of its production process. Should it be written off as an expensive error or should it be perpetuated on the company's books, even though replaced? If it is to be written off, should the Federal Government bear all or part or any of the loss?

By reason of the emphasis on dual-purpose reactors, the risk arises that the electric-utility companies using such facilities will find their economic well-being keyed to sources outside of the utility business, such as the market for plutonium or other byproducts. Should some approach be adopted, such as charging against the Federal Government the entire cost allocated to byproduct production and the entire expense of so producing byproducts, thereby relieving the utility of any risk involved in a change in the market conditions for its byproducts, or is this a risk which should properly be borne by the utility as part of its research program?

By reason of the present monopoly on ownership of fissionable materials by the Federal Government, practically all proposals for the generation of electricity from atomic power contemplate the loan or lease of uranium or comparable fissionable material to the utility with title remaining in the Federal Government. Presumably, in the event of the need for this material by reasons of national emergency, the Federal Government could recapture or take possession of the material which had been used by the utility. Two questions of concern to this association arise from this contingency.

First, should the Federal Government extend a guaranty to the utility which will indemnify it against any such contingency which might destroy its ability to generate electricity, thereby impairing its financial status and earning capacity? A similar provision appears in S. 2239, 83d Congress, where privately owned utility companies provide energy to new gaseous-diffusion plants of the Atomic Energy Commission. They are indemnified against losses as a consequence of reduction in the consumption by these plants for a period of 25 years. The problems which utilities will have in attracting capital when the underlying earnings supporting the securities are subject to the contingencies of international disputes are such as practically to eliminate any possibility of large-scale financing for purposes of constructing atomic-energy electric-generating plants without some provision made for this difficulty. For the same reason, should customers of utilities be forced to bear the capital costs of experimentation and development when there is a chance that the whole productive heart of the plant will be repossessed?

Secondly, from the point of view of the regulatory authority, any possibility that generating facilities may be rendered inoperative by reason of repossession of atomic fuel by the Government is of serious concern since it raises the risk that the utility will be unable to render efficient and adequate public service. Should, therefore, a standby plant of sufficient capacity to provide the equivalent power to that supplied from the reactor generator be maintained at Government expense or should other facilities, such as elaborate transmission networks, be set up to provide for such a contingency? The economies from atomic-power electrical generation would largely disappear if utilities themselves would be required to set up their own standby plant.

It is respectfully urged that this honorable committee also bear in mind the possibilities of dual regulation by State or Federal agencies which can result from the introduction of atomic-power electric-generation plants. These can arise from several sources. For example, the extent of the control of the Atomic Energy Commission over the rate of output of the particular utility must be carefully evaluated since primary responsibility for plant capability rests with management and the control over the sufficiency of this capability has been vested in nearly all cases in State regulatory authorities. Will there be a possibility of conflict on these points?

Finally, what will be the position of State utilities and public-utilities commissions if the Government decides to let the United States itself and not private enterprise develop electricity from atomic power? Would not this place the

source of generation and, hence, the greatest item of cost, which is of fundamental concern in fixing reasonable rates, beyond the reach of State commissions? Moreover, what would be the effect on State laws which enable State commissions to order changes in plant, etc., to meet deficiencies and to prescribe safety regulations? Would power so generated have to be in such large blocks that it would have to be transmitted in interstate commerce to become economically practical, thereby subjecting the utility to dual regulation by State and Federal agencies?

These and many other more difficult questions will be carefully considered by the committee set up by this association during the next year. It is hoped that before a definitive statement of Federal policy concerning this subject is reached by your committee, it too will give careful, cautious consideration to them and that it will bear in mind and seek the opinion of the committee of this association established for that purpose.

The opportunity of making this statement is appreciated. No one is more keenly aware of the immeasurable benefits from lower costs and higher productivity which will result from the perfection of the process of generating electricity by atomic powers than are members of the National Association of Railroad and Utilities Commissioners. By the same token, however, no one is more anxious that the development be in the public interest in every sense. We are engaged in the study of the problem from the point of view of the regulator, therefore, to make certain to the best of our ability that the problems uniquely within the experience of men whose daily business it is to weigh the actions of utilities in the scale of public interest are thoroughly considered before final decisions are reached. We appreciate this chance to advise you of our plans and progress to date.

CALIFORNIA INSTITUTE OF TECHNOLOGY,
NORMAN BRIDGE LABORATORY OF PHYSICS,
Pasadena, Calif., July 31, 1953.

Hon. W. STERLING COLE,
Chairman, Joint Committee on Atomic Energy,
House Office Building, Washington, D. C.

DEAR MR. COLE: Thank you very much for your letter of July 24 and your invitation to send any unclassified comments on the general subject of a Federal policy on industrial atomic-power development.

Although I have been interested in this subject for several years, I do not have any unclassified comments to send to you at this time. It has been a long time since I have seen you and I hope some time to have the pleasure of calling on you in Washington.

My best wishes to you for the future.

Sincerely yours,

ROBERT F. BACHER.

BECHTEL CORP.,
San Francisco, July 17, 1953.

Mr. STERLING COLE,
Chairman, Joint Committee on Atomic Energy,
Congress of the United States, Washington, D. C.

DEAR MR. COLE: Reference: Your letter of June 24, subject, Federal policy on industrial atomic-power development.

During my absence, my associate, Mr. J. P. Yates, wired you that I was out of the country and that, upon my return, I would communicate with you in connection with this matter.

Our company, together with the Pacific Gas & Electric Co., is associated with several other companies who have been studying the development of nuclear energy for industrial-power purposes.

Mr. J. W. McAfee is chairman of this group and I understand that Mr. McAfee and Mr. Philip Sporn, president of the American Gas & Electric Service Corp., and Mr. Willis Gale, chairman of Commonwealth Edison Co., have all made statements to your committee which are generally representative of the views of their companies and to which we subscribe in general principles.

In view of this, it is my feeling that a statement from me would really be somewhat redundant and superfluous.

Furthermore, I would much prefer that Mr. McAfee, as chairman of the group with whom we are working, be considered spokesman for our company as part of that group, in this particular matter.

In view of the above, I will assume that it is not essential for me to come to Washington or to proceed further in this matter at this time.

Respectfully yours,

S. D. BECHTEL.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY,
DEPARTMENT OF CHEMICAL ENGINEERING,
Cambridge, Mass., August 7, 1953.

HON. W. STERLING COLE,

*Chairman, Joint Committee on Atomic Energy,
Congress of the United States, Washington, D. C.*

DEAR MR. COLE: I am happy to be able to reply to the questions regarding national atomic-power-development policy, which you raised in your letter of July 13. I think it is important that our policy in this field be reexamined because the production of useful power for nuclear fission has been postponed so much longer than was originally anticipated.

Historically, the development of commercial nuclear powerplants by the Atomic Energy Commission has been retarded because this development has had lower priority than production of fissionable material for atomic weapons and development of reactors for propulsion of military vehicles. In addition, a Government agency is inherently a less effective organization than a private company for undertaking a development in which reduction of costs is the primary problem. Such a development is best undertaken by a group which risks its own funds and is able to profit from the economies it effects. I believe that our national policy should be to remove the artificial restriction which now inhibits participation of private companies in the development of nuclear power. The private companies, themselves, would then be in the best position to determine if this were the time to push private development of atomic power for commercial use.

There appears to be greater interest in some foreign countries, notably England, than in the United States in the development of industrial atomic powerplants. This situation has its explanation in the fact that costs for the production of power from conventional fuel are higher in England than in the United States so that power from nuclear fission may well be economically justified in England, whereas it is not yet economic in the United States. I do not believe that this country should seek to obtain a position of leadership in the development of atomic powerplants, solely for the sake of being ahead of the rest of the world in this development. There are many processes which can be justified economically in other countries, which do not pay their own way in the United States, and nuclear power appears to be one of these at the present time.

The cost of electric power produced in atomic powerplants should be figured in the same economic terms as power from conventional steam plants such as are owned and operated by the private utility companies at the present time. The economic significance of atomic power can be properly assessed only if atomic powerplants are neither subsidized nor penalized relative to competing sources of power.

The security restrictions, under which development of nuclear reactors must necessarily proceed today, do retard the rate of development of atomic powerplants. This situation, although regrettable, cannot be avoided at the present time because of the troubled international situation, and because of the close ties between atomic powerplants and plants for the production of atomic weapons. The development and design of the reactor part of atomic powerplants must for the time being be restricted to individuals with proper security checks, as is now the case. Nevertheless, I believe that a useful step in liberalizing security provisions could safely be made by giving properly cleared individuals all relevant technical and economic information needed for intelligent development of nuclear reactors. At the present time, the administrative interpretation of the security provisions of the McMahon Act still results in undesirable compartmentalization of information, particularly the withholding from individuals not employed by the Atomic Energy Commission of information on costs of uranium and other fission materials, and the costs of building and operating Government-owned facilities for processing these materials. Private companies seeking to develop economic atomic powerplants should have all available information on the costs of related Government-controlled operations.

I should like to see a number of pilot-plant investigations made on promising types of nuclear reactors. The homogeneous reactor experiment, which is being conducted at the Oak Ridge National Laboratory, and the experimental breeder reactor, which is being tested by the Argonne National Laboratory, are examples of the type of undertaking which should be multiplied. There are a half-dozen other types of nuclear reactors for the production of useful power which cannot be evaluated properly at the present time for lack of pilot-plant experience, which would give us badly needed information on the life of equipment, cost of construction and operation, and efficiency of conversion of nuclear fuels to electric power. Private companies should be encouraged to do this pilot-plant work with their own funds. To this end, they should be permitted to take out and use such patents as might result from a privately financed pilot-plant program and to own full-scale atomic powerplants which might be built as a result of pilot-plant findings.

The statement of policy on nuclear power development recently issued by the Atomic Energy Commission outlines a number of desirable steps which should be taken to encourage wider participation of private companies in the development of nuclear power. I am in agreement with all of the measures proposed by the Atomic Energy Commission, except that their proposal to liberalize patent rights through a change of administrative policy on the part of the AEC rather than by revision of the Atomic Energy Act does not go far enough. I believe that the Atomic Energy Act should be revised to permit private companies to own patents on processes and equipment for the production of fissionable material or nuclear power. It is only in this way that private companies can be assured of an opportunity to profit from investment of their own time and personnel in experimental studies aimed at developing atomic powerplants. Diligence, ingenuity, and risk taking on the part of private companies have been responsible for the industrial greatness of the United States. There is every reason to believe that private industry, if given normal business incentives, will make a reality of atomic power as soon as it is economically competitive with power from conventional fuels.

Sincerely yours,

MANSON BENEDICT,
Professor of Nuclear Engineering.

STATEMENT BY MR. ROBERT BLUM TO THE JOINT COMMITTEE ON ATOMIC ENERGY,
AUGUST 10, 1953

(NOTE.—This statement constitutes exclusively my own personal view as an individual citizen. It does not represent the views of any other person or group either in or outside of the Government.)

In my previous work for the National Security Resources Board and other agencies, I have given extensive consideration to atomic energy and related national-security problems.

On the basis of that consideration and attendance at joint committee hearings, I wish to express my very sincere admiration for the magnificent performance of the joint committee.

I appreciate the opportunity given to me by the joint committee to "flag" problems and suggestions which may warrant further analysis.

In this statement I will attempt to suggest integrated consideration of—

I. National-security problems and national objectives which make it very important for the United States to move forward as rapidly as possible in providing world leadership on atomic development;

II. Policies relating to private participation, Government action, and foreign-relations problems which may be suitable to meet national-security problems and objectives;

III. Programing desirable to provide maximum actual progress; and

IV. Action by Congress and the President to increase the effectiveness of United States efforts to achieve world leadership.

Although I have had to base my own suggestions in sections II, III, and IV on my own appraisal of national-security needs, the joint committee will wish to look to the National Security Council for better guidance and for major decisions.

I. NATIONAL SECURITY PROBLEMS AND NATIONAL OBJECTIVES

(NOTE.—Although this statement is confined to atomic power development and cannot attempt to cover overall national-security problems, action on atomic-energy problems must be balanced and fitted in the whole range of overall national-security problems, policies, and programs.)

The United States superiority in atomic weapons and striking power has been a key factor helping to deter Soviet encroachment, and to avert full-scale war.

But within a few years Soviet Russia's strength (including atomic weapons and delivery capabilities) may be sufficient to devastate European and United States centers of population and strength.

Increasing Soviet atomic striking power increases enormously the difficulty and the urgency of national-security problems, and "telescopes" the time available to meet those problems.

The risks and difficulties to be faced must be given full consideration. Even though the United States and Soviet Russia are trying to avoid full-scale atomic war, it will be difficult to negotiate satisfactory peaceful solutions of major problems if the power and objectives of the Soviet Government do not change very significantly. The unpredictable reaction of the Soviet Government to intensified United States pressure, the impossibility of controlling chance development of many vast and complex problems arising in all parts of the world, the difficulties and chances of miscalculation involved in United States and Russian appraisal of one another's strength and intentions, and possible demands in either country to "hit first, before being hit" all increase seriously the risk of future catastrophe.

Accordingly, the United States must improve its intelligence, must improve its defensive measures, and must develop the most effective national-security action which it can devise. But no outcome or solution will be satisfactory other than peaceful resolution of difficulties without full-scale atomic war.

Although I believe that there is a real likelihood that war may be averted, and although I want to avoid discussion of military problems, I have noted above problems relating to increasing Soviet atomic striking power and contingent dangers, because they increase greatly the need for prompt development of strength, political unity, and effective nonmilitary action throughout the free world to cope with Soviet Russia by means short of war.

Accordingly, I believe it is imperative for the United States to go forward as rapidly as possible to provide both the deterrent of military strength and retaliatory power and vigorous pursuit of the wide range of national security policies and programs which might help to avert Soviet encroachment without war and lead to permanent peace and freedom.

Therefore, it is highly important to obtain the support of countries in Europe or elsewhere faced by encroachment or under the shadow of potential Soviet attack, the support of India and many other neutral or friendly nations, and the support of peoples within Soviet-dominated areas.

The extent of that support may be influenced significantly by the degree to which we develop world leadership in making peaceful uses of atomic energy available for the United States and the free world.

Failure of the United States to press forward vigorously on nonmilitary benefits from atomic energy would dissipate United States prestige and leadership, enable the Soviets to gain propaganda advantages from our concentration on weapons, and jeopardize support by our allies and neutral nations. If the United Kingdom or any other friendly nation were to take the lead (as is quite possible), the disadvantage to the United States would be even greater. If Soviet Russia developed atomic-power applications before the United States—even though small or high-cost—it would have a disastrous impact on United States leadership and bargaining power and the attitude of peoples throughout the world.

Accordingly, even though the United States economy can meet its own electric-power needs for decades to come from conventional (nonatomic) energy sources, there is an immediate and important national-security need for the United States to move forward as rapidly as possible without any loss of momentum to achieve world leadership in atomic-power development.

To be effective, the United States must achieve not only moderate-cost nuclear power first, but also provide a real opportunity for other nations to benefit from United States leadership.

II. POLICIES RELATING TO PRIVATE-INDUSTRY PARTICIPATION, GOVERNMENT ACTION, RELATIONS WITH OTHER COUNTRIES AND INTERNATIONAL-CONTROL PROBLEMS, AND FURTHER PUBLIC-POLICY CONSIDERATION

The key goal of atomic-development policies and programs is to provide maximum actual development to meet national-security problems and objectives.

As part of the democratic process of providing public understanding, public debate, and congressional resolution of issues, major interested groups are now being given an opportunity to present their views. However, although all participants wish to aid the Nation, some participants are quite naturally carrying into the atomic-development debate views which were forged in earlier internal battles over public and private power and other major domestic political issues.

It is hoped that all concerned will become increasingly aware of the need for resolving the problems of the various groups and interests in order to maximize forward progress on United States atomic-power leadership which may be of major importance in averting Soviet domination or war.

1. *Participation by private industry*

More widespread private-industry participation, benefit and competitive initiative could advance technological development.

Accordingly, development of nuclear power should not be confined to a Government monopoly (especially one faced with the impediments of secrecy and concentration on weapons problems) but instead should be open for private initiative and diversified competitive effort.

However, because private firms cannot raise capital unless warranted by prospective income—especially on untried and uncertain large-scale enterprises—only a very few groups are on the brink of providing sizable amounts of private capital. Moreover, considerable time may be required to resolve questions regarding the terms and conditions for private participation.

As a result private development may not be available in full swing for several years.

But if government and industry were to work together for the next 5 years they could make substantial research and development progress and could clear the way for future large-scale private development.

However, I do not believe the limited progress immediately obtainable from the proposed amendments to the act and the present prospects for application of private capital will be commensurate with the overwhelming national-security needs for maximum progress.

Greater immediate private participation should be obtained, not just from a few firms, but instead from the vast and manifold resources and capabilities of the great bulk of American industry.

The full scope of potential technological advance in electric power, chemical processing, metallurgical development, engineering and construction, isotope use and process control, electronic applications and instrumentation, equipment production, propulsion, etc., could significantly increase United States industrial strength and the opportunities for beneficial applications throughout the world. That would help to counter Soviet propaganda against United States capitalism by demonstrating that the United States Government and private enterprise could together provide major benefits for the rest of the world.

Therefore, it is not sufficient merely to amend the act to confer rights on private participants and to permit a few firms to provide an initial "trickle" of capital.

Instead, it is important to provide the real incentives of an actual market, a real opportunity to bid to do a job and a real chance to make a profit—in order to bring forth prompt private action. I believe that it is now possible to establish a real market for private industry work on development without sacrificing the public interest.

Specifically, I urge that a joint Government-industry program be established as outlined more fully in part III to call forth more widespread private participation and lead to greater progress.

Royalties or similar rewards may be justified to bring forth new resources and new efforts by private participants to achieve the new technical development necessary for national security but patent controls should not be used to exclude other potential future participants.

2. *Government action*

It would be unwise to rest our national security program for world leadership on an uncertain and unassured foundation of mere hopes for private capital,

or on good prospects for private capital at a time which would be too late to meet national security needs.

If private capital does not come forward promptly, preferences for private ownership, efforts to encourage private participation, or hopes for future participation should not delay progress. Instead the present Government-industry combination of Government financing, research in and outside of Government, and private construction and operation of facilities should carry the ball.

In fact, whether private capital comes forward or not, opportunities for joint Government-industry development at Hanford, Oak Ridge, Portsmouth, Argonne, Arco, GE's Knolls Laboratory, the Westinghouse projects near Pittsburgh, and other activities should be considered for their possible advantages of unified operation with other AEC activities and avoidance of extra expenditures for "exclusion areas."

Until private capital actually can carry the ball it should not oppose, but instead support, efforts and appropriations for combined Government-industry progress.

3. *Foreign relations and international control problems*

(a) *Uranium suppliers.*—It has been of the greatest possible importance to the United States and the free world (in deterring Soviet Russia) that the uranium supplies of the Belgian Congo have come to the United States instead of being made available to Soviet Russia. Presumably, the Belgians made Congo uranium available to the United States for the common interest in the defense of the free world.

In considering the desire of domestic United States private companies to own and use fissionable materials (and to seek patents) for private company objectives, the United States Government must take into account the very real need for full cooperation with the Belgian Government and producers in the Belgian Congo on their power-development programs and for continuation of mutually satisfactory arrangements relating to supply and use of uranium.

Similar consideration must be applied to other potentially important foreign sources of uranium or other radioactive materials.

Therefore, in drafting legislative provisions relating to United States private rights, care must be exercised to take into account the needs for foreign raw material suppliers.

(b) *International control of fissionable materials.*—The current impasse on international control because the Soviet Government has been unwilling to accept international inspection, etc., does not justify our playing ostrich by developing a United States atomic-power program which does not give adequate consideration to the terribly rapid United States and Soviet weapons buildup toward capacity for potential destruction and the importance of further consideration of international control.

The United States has consistently espoused the position in the United Nations that for international control it is essential to have international ownership of fissionable materials and facilities and effective international inspection.

The basic fact, which has not changed, is that diversion of fissionable materials in even relatively small quantities could, if undertaken by a potential enemy, be a serious threat to United States security.

Even though the time may not now be ripe for international control, we must not jeopardize in any way our ability to enter into an effective system for international control.

Private ownership of fissionable materials could contribute to potentially serious international difficulties. Although control of United States private operations may provide useful experience (although experience in leasing might be even more desirable) private ownership of fissionable materials in the United States may make it politically more difficult to compel centralized and foolproof control over Soviet fissionable materials. Moreover, Soviet Russia could gain propaganda advantages by charges that the United States has taken a hypocritical position in the United Nations of demanding international ownership at a time when we are providing for private ownership and diffused responsibility within the United States, and charges that we have sacrificed international control to private company profits.

Clearly, the ordinary rights of private ownership would, in fact, be very much abridged because the United States Government must control very extensively any private use of fissionable materials. However, ownership of fissionable materials actually may not even be an important factor in the limited goal of private demonstration of private operating success in obtaining nuclear power.

Accordingly, I believe the natural (and perhaps primarily ideological) urge of the private spokesmen for ownership of fissionable materials should be reconsidered by them, and should be subordinated to the very important national security considerations relating to international control.

(c) *Exchange of information to benefit the United States and development of peaceful uses by other friendly nations.*—Further Atomic Energy Commission declassification of reactor development information to aid United States private participation will also help foreign countries. Accordingly, the announcements of declassification should state that we mean to help other friendly nations advance their atomic-power programs. By doing so we may gain a small contribution to United States world leadership obtainable from United States recognition of the interests of other nations.

Other information may be downgraded for use by security-cleared individuals in United States private companies.

It may be unwise and impractical for the United States Government to provide information which remains classified to United States private companies and to maintain at the same time a complete iron curtain excluding uranium suppliers and friendly foreign nations from any information or benefits which would not jeopardize United States security. To do so may preclude United States use of foreign scientific analyses and may create antagonisms, the exact opposite of the United States need for even greater free world support and cooperation on proposals relating to international control of atomic weapons.

Accordingly, mutual exchange of information (subject to United States security controls) should be explored more fully.

(d) *Resulting need for concurrent action covering United States domestic activities and cooperation with other countries and international control.*—Further analysis of problems relating to other nations should be provided by NSC, AEC, or State before executive or legislative action is undertaken which might be detrimental to United States national security needs.

Changes in the act should take into account at one and the same time both United States domestic interests and United States security and foreign objectives. Failure to do so could lead to serious future difficulties and controversies. Thus, if the first round of legislative action granted rights to United States private enterprise which further consideration indicated were unwise and should be revoked, the result might be to precipitate a violent battle on the Hill, in the press, and throughout the free-world capitals, over the issue of withdrawing rights from United States free enterprise to provide them for international ownership and control.

The pragmatic course, accordingly, seems to be to initially grant only such rights to private parties as clearly will not conflict with major United States obligations and objectives in relation to other nations and international action.

4. Further public policy consideration

The chairman and members of the joint committee have demonstrated rare courage and devotion to public responsibility in their effort to assure full consideration of major public policy questions. Accordingly, they may wish to receive further analyses of very important national security and public policy problems and issues before undertaking legislative action.

The wisdom and spirit of the Atomic Energy Act of 1946, and the new problems now confronting Congress, call for at least the best analyses of political, social, economic, and international implications which can now be made, even though available information may not be adequate to provide the definitive reports envisaged in section 7.

Therefore, it is suggested that the joint committee (or its chairman) request that prior to further action in January:

(a) The AEC present the best response it can to section 7;

(b) A group of the best qualified individuals on the National Security Council staff, the AEC, State, Defense, CIA, FOA, Budget (and possibly other agencies, including Interior, Commerce, and the Federal Power Commission, as needed) work together under Executive Office of NSC leadership to submit a combined analyses of major policy problems and suggestions for a comprehensive program; and

(c) A group of citizens outside of Government best qualified to analyze both industry and national-security problems submit a report covering comparable broad issues and discuss particularly possible further action to maximize early private participation.

The joint committee staff might help significantly by suggesting major issues to be covered.

The mere statement of the request by the joint committee or its chairman could get this additional effort moving forward immediately to a scheduled submission, would save months by contrast to other procedures, and quite probably would lead to a far better performance by all concerned.

III. PROGRAMING TO PROVIDE MAXIMUM ACTUAL PROGRESS

1. *Hit or miss versus programing*

There is a real possibility that momentum may be lost and progress reduced to far less than it could be by—

(a) Not recognizing that merely amending the act to authorize private benefits does not in itself assure actual development;

(b) Argumentation over amendments delaying further participation—and even delaying Government action;

(c) Unpredictability of year-by-year Government action, stops and starts and shifts in emphasis;

(d) Uncertainty as to the magnitude of Government effort (and expenditure), and hence the desirability of participation; and

(e) Reluctance of many potential private participants to undertake substantial investment or effort until after they have seen the results gained by a lead-off group.

Moreover, it seems to me to be unwise to have the scope of the research and development program and kinds of projects which shall go forward influenced very significantly by the chance preferences of whatever industry team may first happen to be ready to put up capital.

As an alternative, I urge that a combined Government and industry program be worked out which would—

(a) Indicate in advance the objectives and period for the program—(5 years might be desirable);

(b) Specify what analyses and projects are to be undertaken;

(c) Indicate how these projects are to be assigned to Government and various industrial participants;

(d) Set forth a proposed schedule for the various stages from research through design, pilot plant, and full-scale construction of various possible projects;

(e) Authorize Government programs and indicate private capital and expenditures which may be warranted; and

(f) Provide an opportunity and a time limit (perhaps 6 months) for private companies and others to submit proposals and bids on portions they might cover, together with freedom for Government to "carry the ball" if private capital does not make a satisfactory firm offer before the end of the time limit.

2. *Suggestions for Government and industry programing*

My suggestions for programing are indicated more explicitly below.

(a) The program should provide for analysis and development of various desirable applications (i. e., ship propulsion unit, multipurpose power and plutonium unit, various single-purpose power units embodying various features of raw material, moderator, coolant, processing, etc.). The Reactor Development Division of AEC, Argonne Laboratory, and others could be requested to block out research and development work needed to meet particular needs. (By contrast to the chance concentration of private capital on the one power unit a given group wants, the program should provide for a broad range of research and development activities designed to achieve optimum total results.) Realization that a 5-year program is involved may overcome the present tendency to try to jam into one initial unit a combination of purposes and characteristics which may seek to combine weapons, propulsion, and power justifications; and various stages of research through construction even though, in fact, it may be better to pursue the different objectives by separate stages of single-purpose units.

(b) The most desirable next step to carry forward each of the desired applications should be carefully considered. For some applications a pilot plant may be the most desirable next step. For other purposes, valuable information could be gained by preparation of designs without going forward to the much greater expenditure for construction or installation in end-use structures such as ships, planes, or power plants. Actual reduction and analysis of costs for commercial power may require actual construction of one or more very large power units.

But development of certain processing improvements may call for substantial initial research and various small-scale pilot projects.

(c) A sensible sequence of research and development should be worked out to permit desirable modifications as new information is obtainable. But apart from that needed flexibility, potential contractors and other participants should be given as definite an indication of the program as possible in order to minimize the hesitation, delays, and waste involved in year-by-year action, and to maximize useful technical effort.

(d) Selection of projects (and allocation of Government funds and contracts) should take into account (i) military needs, private utility and industrial needs, and the desirability of advancing United States world leadership in peaceful applications and (ii) the relation between the funds requested for various United States budget items and the importance of benefits which may be obtained.

(e) The Government's national-security interests and defense responsibilities will require some expenditures which may not be reduced significantly by any presently assured prospects of private participation. Provision of fissionable materials on the most efficient basis for their extremely important national-security function as a deterrent to Soviet Russia may require and justify further technical research and development which may be of use in the nuclear-power field. The Government will also presumably have a major responsibility for expenditure for development of submarine, carrier, or aircraft-propulsion units, and for overseas military needs. Therefore, the Government should undertake a substantial part of the fundamental research and laboratory activities which will contribute both to defense needs and the technological advances that are a prerequisite for industrial progress and for achievement of the national-security goal of United States world leadership. Government and private industry might also consider joint development of a large-scale power unit which could be tied in with Hanford, Oak Ridge, Paducah, or other project processing operations or activities to meet their power needs, reduce power shortages, make other blocks of power available for electric utilities and industrial companies, and avoid the present high-cost exclusion-area impediments to early development by private companies.

While the amounts would vary from year to year (and must be determined specifically by Congress), the Government might utilize on an average, roughly \$30 million per year for various combinations of research and development in the fields noted above. It is not unreasonable to say that in a 5-year period the Government might devote \$150 million to the stated purposes.

(f) Private-industry consideration and participation should be undertaken on a broader scale. It is assumed that private industry should put up capital for projects which are intended primarily for private use and benefit.

The natural tendency of utility and industry officials, responsible to their stockholders and potential capital suppliers, has been to measure benefits exclusively as an alternative to doing the same particular job (generation of electric power, for example) by conventional means. Although that demonstrates fine financial integrity, it underestimates the advantages to the companies, to industry generally, and to the Nation of carrying forward the technological development of nuclear power. In this connection, it should be noted that electric-utility companies feel potential power benefits to them justify allocation of company resources to pursue atomic-power development; construction and engineering companies like Bechtel may feel justified by potential design and construction benefits; chemical companies like Dow and Monsanto may feel justified by anticipated chemical processing and energy-supply advantages; equipment manufacturers like General Electric and Westinghouse may anticipate sufficient benefits from design, patents, and construction and sale of reactor equipment and auxiliaries; instrument and control-equipment manufacturers and electronic suppliers may anticipate profitable subcontracts, etc. For companies with widely diversified and integrated operations (or large groups of companies cutting across several fields) many benefits in addition to power can be obtained from the sale of byproducts, and from know-how and applications which can be used advantageously by those companies on their engineering, processing, construction, control, equipment, metallurgical, and other needs or activities. Taken together, the benefits may indeed be very large for the combination of participants—and would be magnified many times by broad application throughout industry.

(g) Close cooperation between Government and industry will be indispensable because of the many inherently inseparable national-security and power-development factors. As a practical matter, there is a continuing need for Government work to be carried out by private contractors and for private participants to have access to Government research laboratories and development possibilities.

Accordingly, it appears highly desirable to work out a program for joint development. Discussion above indicates that it might be desirable and reasonable for the Government to "firm up" its share of the combined total 5-year job, including an advance authorization for expenditures estimated at perhaps \$150 million, and its advance anticipation to the private share which may be warranted. (Perhaps a minimum of \$150 million of private funds might be warranted by Government-programed activity, supplemented to the full extent of any additional voluntary private effort.)

(h) Clear statement of necessary time limits for analysis, receipt of bids or proposals, and work progress would provide important advantages for national security (and industry) in getting on with the job of "doing what ought to be done." If industry comes forward within the stipulated time, fine indeed. If not, the National Security Council and others could measure prospects and action realistically, instead of continuing to dangle on hopes.

3. *Advantages and effectuation of programing*

Advance indication of the objectives, magnitude, projects, and time schedule for research development, design, and construction over a period of 5 years would provide a much better market target and incentive for private industry to tackle.

Private parties would then be in a better position to decide upon the resources they should devote to their own preliminary studies, and efforts to place bids, provide professional skills, become contractors, and invest funds.

Moreover, while at present secondary suppliers of items such as electronic-control equipment find it almost impossible to judge from unpredictable Government or private capital reactor development what action they should take to enter the field as suppliers, the alternative of an overall program worked out in advance would enable secondary suppliers to move in more rapidly as participants and thus bring to bear a great deal of their very specialized know-how which is especially needed for greater development.

Thus, a firm program of several hundred million dollars may be a much more effective stimulus to actual private participation than a debate which after considerable time might (or might not) give private parties certain legal rights to benefit from projects which might (or might not) be undertaken.

To permit rapid large-scale private participation, it is suggested that (if competition is protected as provided by the Atomic Energy Act of 1946, and protection not left to the ill-fitting, cumbersome, and time-consuming antitrust laws) many kinds of industrial companies might be authorized to cooperate to secure wider benefits at lower cost per company and to subscribe to capital of large unified corporations, and thus make feasible development which could not be handled by small private units.

Companies involved might assign specialized personnel to such corporations to develop team know-how and studies which would make it possible to proceed more rapidly with technical development. Conceivably, participating companies might be asked to subscribe capital commensurate with the magnitude of activities or contracts each particular company might handle.

The Government would presumably have to protect the public interest by requiring open access to all desiring to enter the field on comparable conditions, and by handling the contracts on a competitive-bid basis. But the Government might gain by having going concerns which it could direct to undertake activities clearly necessary to advance development progress. Insofar as the Government directed action for security, it might provide protection from antitrust prosecution comparable to that granted in World War II.

Within the Government, the central focus for development activities will presumably continue to be the AEC. Within the AEC it would be highly desirable to provide a suitable group devoted to atomic-power development which would be free from the time demands and responsibilities for weapons progress and other top-priority activities. In the future the AEC will presumably work more closely with other agencies to resolve varied policy problems which cut across the entire executive branch.

If Government grants a really good opportunity for private industry to participate as noted above, it should grant equal opportunities to Government agencies such as municipal utilities, TVA, and Bonneville to prepare bids or proposals for activities (such as power generation) which they are authorized to conduct by their basic legislation and on which they can make a real technical or economic contribution. Exclusion of the skills and development possibilities those large power systems could provide would be analogous to (and as undesirable as) Government exclusion of private enterprise.

Moreover, philanthropic foundations, universities, and research institutions should be given full opportunity and encouragement to participate. They could be especially helpful in providing for special studies and projects (such as analysis of foreign development problems or international implications) which are not easily handled through customary activities of private industry or Government.

Given a concrete program, it might also be easier to evolve over a reasonable period of time the modifications to the present act which would actually be desirable, and to provide private benefits and incentives which would actually be consistent with national-security needs and the public interest.

IV. ACTION BY CONGRESS AND THE PRESIDENT TO INCREASE THE EFFECTIVENESS OF UNITED STATES EFFORTS TO ACHIEVE WORLD LEADERSHIP

I urge that forthcoming legislative action provide a clear sense of purpose which could increase political acceptability and ease future action in the United States and the rest of the world. Specifically, I believe that there should be a legislative declaration setting forth in broad terms and in clear language (which can be understood by people throughout the world) the national policy objective of peaceful use for the benefit of mankind.

It is hoped that the executive branch and Joint Committee on Atomic Energy will formulate a bold program which will gain the early approval of Congress.

The President should then "kick off" the program in a speech representing the entire Nation which can dramatize to the entire world America's firm and united decision to provide leadership for peace instead of war.

FISSION PRODUCTS LABORATORY,
UNIVERSITY OF MICHIGAN,
Ann Arbor, Mich., August 7, 1953.

Congressman W. STERLING COLE,
Chairman, Congress of the United States
Joint Committee on Atomic Energy, Washington, D. C.

DEAR CONGRESSMAN COLE: This is a reply to your letter of July 24 requesting comments relating to the definition of a Federal policy on industrial atomic power development for the consideration of the Joint Committee on Atomic Energy.

It would seem that the Federal policy on industrial atomic power development should be based on what is considered best for the entire country in the years to come. The use of nuclear energy for industrial power offers a positive and beneficial use of this tremendous force which may greatly benefit our children and grandchildren, whereas the use of nuclear energy for weapons is a negative use which can only serve to destroy. The real future of atomic energy must be in its peacetime applications.

If nuclear energy is to be used to benefit mankind, industry must be permitted to build atomic power reactors and must be encouraged in this regard by removing some of the bonds which presently exist that shackle industry. Sooner or later the Government must cease its monopoly of refined uranium and more information must be made available on the design and use of reactors. Classified information should be restricted to the design of weapons. Our own research on the utilization of waste fission products produced by the operation of nuclear reactors has been hampered by the impossibility of disclosing the quantity of fission products for fear that this information could be used to determine the quantity of uranium processed, and thereby give information regarding the quantity of A-bombs which this country has produced. The entire procedure of classification should be reviewed and revised with the idea of promoting the development of beneficial uses of nuclear energy and restricting only the information relating directly to weapons.

A great amount of the research at the University of Michigan is devoted to the investigation of ways in which atomic energy can benefit mankind. Much of this work is being supported by funds of the university obtained as contributions to our Michigan Memorial Phoenix project, a war memorial to the Michigan dead of World War II. As part of the program of the Phoenix project the university is building a research laboratory and desires to build a sizable research reactor. Such a reactor could provide a great amount of information which would be useful in designing power reactors. However, the university

has already encountered some stumbling blocks. First, I understand that it is against the law for the university to use the amount of enriched uranium calculated as necessary for the reactor desired. Second, some designs of reactor fuel elements which might be used to advantage are classified with the result that it may be necessary to use less suitable and less safe fuel elements.

One problem which I encountered in our research on uses of radiation from waste fission products was the question of patent rights. The Engineering Research Institute of the University of Michigan has a client, a manufacturer of chemical products, who desires to study the promotion of chemical reactions with radiation. This client will pay for the use of radiation facilities and for the research involved, but asks for the usual patent rights on the results of the research. I understand that the law gives no patent rights to the investigator in such cases, but that all patent rights are the property of AEC. As a result the client has lost interest in the research.

It is certainly heartening to learn that your committee is reviewing some of these problems and policies.

Sincerely yours,

L. E. BROWNELL,
Supervisor, Project M943.

SOUTHWEST HARBOR, MAINE, August 5, 1953.

HON. W. STERLING COLE,
*Joint Committee on Atomic Energy,
Congress of the United States, Washington, D. C.*

DEAR MR. COLE: This is to acknowledge your letter of August 1 and to thank you for your kind invitation to submit a statement on atomic power development problems for inclusion in the public record of your recent open hearings.

Although I have given this subject considerable thought, I would prefer not to submit a separate statement for the record at this time. I may remark, however, that in general I concur with the position taken by Dr. Rabi as I understand it, and that specifically I am in accord with the Commission's statement of policy on nuclear power development.

I am pleased to note that there will be an opportunity later to submit suggestions for specific legislative revisions.

Respectfully yours,

OLIVER E. BUCKLEY,
Member of General Advisory Committee.

CARBIDE & CARBON CHEMICALS CO.,
Oak Ridge, Tenn., July 9, 1953.

HON. STERLING COLE,
*Chairman, Joint Committee on Atomic Energy,
Congress of the United States, Washington, D. C.*

MY DEAR CONGRESSMAN: We regret the delay in replying to your letter of July 2, 1953, addressed to Mr. Morse G. Dial, president of Union Carbide & Carbon Corp., because of Mr. Dial's absence from the city.

As we recalled to you on the telephone today, Dr. Alvin Weinberg, research director of the Oak Ridge National Laboratories, operated by the Union Carbide & Carbon Corp., appeared before your committee on July 6 and gave testimony in connection with nuclear-power development.

In view of that fact, it is our opinion that any additional testimony that might be given pursuant to the request contained in your letter would be repetitious of testimony already presented by Dr. Weinberg and, therefore, as we advised you on the telephone today, we feel that it might not be necessary to take the additional time of the committee. If, however, after giving further consideration to this matter, you desire us to again appear before the committee, and so advise me, I will be pleased so to do.

Yours sincerely,

CLARK E. CENTER.

CHAMBER OF COMMERCE OF THE UNITED STATES,
Washington, D. C., July 6, 1953.

HON. W. STERLING COLE,
*Chairman, Joint Committee on Atomic Energy,
The Capitol, Washington, D. C.*

DEAR MR. COLE: The Chamber of Commerce of the United States strongly supports the Atomic Energy Commission's recommendations for greater industrial participation in the development of atomic power.

We also endorse the current efforts of the Joint Committee on Atomic Energy to give the public "a more comprehensive and accurate understanding of the problems which our Nation faces in developing atomic energy for peacetime purposes."

Members of the national chamber at this year's annual meeting adopted the following policy statement on atomic energy and private enterprise:

"The chamber urges the continued cooperation by the Atomic Energy Commission with private enterprise in studies leading toward the development of atomic energy for civilian use. Such studies and research, including the construction of the necessary pilot plants, should rightly be a joint responsibility of the Federal Government and private enterprise.

"The chamber is strongly opposed, however, to the entry of the Government directly into the commercial exploitation of the use of atomic energy. Such commercial production should be financed and operated by private enterprise, subject only to necessary security controls, and the Atomic Energy Act of 1946 should be so amended. The Atomic Energy Commission should make available to private enterprise all nonclassified information bearing on atomic energy."

The national chamber believes the Atomic Energy Act should be amended to permit the Government to sell, lease, or lend fissionable materials to industry. Former AEC Chairman Gordon Dean has stated that the amounts of such materials needed by industry to expedite development of an atomic-power program would be insignificant and would not retard the vital atomic-weapons program.

The present Government monopoly on fissionable materials restricts the extent to which private companies can enter the nuclear-power field to learn how to reduce the cost of atomic powerplants. Furthermore, emphasis on the military need for atomic weapons does not permit adequate study of ways of adapting atomic energy to industrial uses.

The national chamber also favors amending the Atomic Energy Act to permit the AEC to declassify more information and make it available to properly cleared industrial scientists and engineers. The procedure for declassifying the information and releasing it should be reexamined, and study should be given to speeding the clearance of individuals who will use the information, in view of the probability of a large increase in the numbers of such persons.

We agree that the recent proposals of the AEC are, in the words of former Chairman Dean, a "gateway program—a gateway from a Government monopoly and from the present policy impasse in the field of atomic power."

The national chamber is optimistic about the future applications of atomic power to industrial and consumer use, and believes that a continuation and expansion of cooperation between the Government and private industry will hasten the realization of this objective.

The pressures of a world war brought about the rapid development of the atomic bomb, and the pressures for world peace dictate the need for harnessing, at the earliest possible date, this great source of power for the good of all mankind. This is a responsibility which the national chamber believes private American enterprise can meet under the guidance of your committee and the Atomic Energy Commission.

We request that this letter be made a part of the record of the joint committee hearings.

Cordially yours,

CLARENCE R. MILES.

COMBUSTION ENGINEERING, INC.,
New York 16, N. Y., August 7, 1953.

MR. STERLING COLE,
Chairman, Joint Committee on Atomic Energy,
Washington, D. C.

DEAR MR. COLE: It is a pleasure to acknowledge receipt of your letters of July 24 and August 1 with respect to the opportunity you have accorded us to introduce a statement into the record of your current hearings relating to Federal policy on industrial atomic-power development.

The notice given to us in your most recent letter that any statement on our part must be in your hands by August 10 leaves us with too short a period adequately to prepare such a statement that would represent the considered judgment of our organization. My associates are giving thought to specific provisions in the present legislation, and we expect now to have suggestions as to amending the law as it now exists in your hands during September. This will be in accord with the suggestion contained in the second paragraph of your latest letter.

It is disturbing to read a dispatch out of Washington dated August 3, in which Representative Holifield was quoted as stating that the committee's current hearings have "completely repudiated" any proposal for quickly changing the law to let private industry into the atomic field.

The newspaper story further attributes to Representative Holifield an inference that certain utility and manufacturing interests are pressuring the Atomic Energy Commission and your committee to obtain hasty passage of legislation without due consideration for the public interest. This is an accusation that seems both unfortunate and unwarranted and we would be interested to know whether it is supported by any general attitude within your committee.

Yours very sincerely,

BRODERICK HASKELL.

CONSOLIDATED EDISON CO. OF NEW YORK, INC.,
New York 3, N. Y., July 14, 1953.

HON. W. STERLING COLE,
Chairman, Joint Committee on Atomic Energy,
Congress of the United States, Washington, D. C.

DEAR MR. COLE: Thank you for your letter of July 13 suggesting that we might submit written comments for the consideration of the Joint Committee on Atomic Energy with respect to the definition of a Federal policy.

Mr. James F. Fairman, a vice president of our company, accompanied Mr. Walker Cisler, president of the Detroit Edison Co., at the hearing before your committee on July 1. At that hearing Mr. Cisler presented a statement on behalf of his company and the Dow Chemical Co. and the companies associated in that project, of which we are one. This statement sets forth our views on this matter.

Sincerely yours,

HUDSON R. SEARING, *President.*

PERRY, Mo., July 3, 1953.

Re Patent rights.

HON. W. STERLING COLE,
Chairman, Joint Committee on Atomic Energy,
House Office Building, Washington, D. C.

SIR: I desire that this expression of my views be incorporated in the record of hearings before your committee.

For nearly 20 years I was in the active practice of patent law in Washington, D. C., returning to Missouri some 6 years ago. For several years I was chairman of the committee on legislation for the patent section of the American Bar Association, during which time it was my duty to appear before committees of the House and Senate and relate the action taken by the association with respect to all proposed patent legislation. I have long been a member of the American Institute of Electrical Engineers, a senior member of the Institute of Radio Engineers, and formerly chairman of the Washington, D. C., section, and, accordingly, my

interest in matters before the House and Senate was not confined solely to patents, but, more broadly, in all matters relating to scientific progress and the industrial growth of our country.

On many occasions it was my duty to express the emphatic opposition of the American Bar Association, which was also my own personal opinion both then and now, to all forms of compulsory licensing of patents. Broad resolutions adopted by the association and repeated before committees of both the House and the Senate on many occasions reaffirmed that position time and time again.

When the patent provisions of the present act establishing the AEC were under consideration appeal was made to me personally, and on behalf of the American Bar Association, to relax our position, due to the emergency of the war, the understanding being that the restrictions were then necessary as to patent rights and ownership by the Government solely because of the emergency. It was further the then opinion of General Groves and others that after the passing of only 1 or 2 years the patent provisions of the act would be modified in accordance with views of the association, in brief, as follows:

"Patent property is no different from any other type of property, is entitled to the same consideration, no greater and no less, than other types of property, the acquisition, ownership, and enjoyment of which is fundamental to our form of government and to continued industrial progress of our Nation."

Respectfully,

CHESTER L. DAVIS, *Attorney at Law.*

E. I. DU PONT DE NEMOURS & CO.,
Wilmington, Del., July 6, 1953.

HON. STERLING COLE,

*Chairman, Joint Committee on Atomic Energy,
Congress of the United States, Washington 25, D. C.*

DEAR MR. COLE: This will acknowledge your letter of July 2, in which you suggest that I, or some other representative of the du Pont Co., join your committee on July 15 for a discussion of some of the problems incident to a definition of Federal policy on industrial atomic-power development. This is indeed an important subject, and I would like nothing better than to be of assistance to your committee, but the fact is that neither I nor the du Pont Co. has sufficient point of view to be able to make a significant contribution.

Toward the end of our term as contractor at the Hanford Engineer Works we gave most serious consideration to the possible interest of the du Pont Co. in the commercial future of this new technology. We came to the conclusion at that time that the only possibility of substance was the use of atomic energy for the generation of power. We are, however, a chemical company, and have consistently devoted our energies to that field, and we felt that power generation was so far removed from our interests and experience that its development could far better be left to other companies with greater skill and commercial incentive in that area.

We are still of that disposition, since nothing has transpired in the intervening years to make us feel that we are any more suited now than in 1946 to assist in the development of atomic energy for power purposes. For these reasons, we have quite literally given no serious thought to the type of Federal policy that would implement industry's participation in atomic-power development.

It seems obvious to me that the exploitation of atomic energy, whether for power or for other purposes, is not only important but presents problems of extraordinary difficulty. In forwarding these developments it could not fail to be helpful to have as many teams of able people working in the field as possible, with a minimum of taxpayer subsidy. These considerations would make it appear desirable to open the field of atomic development as widely as possible, always with due regard for the necessity of guarding the national security, and with that objective I am in complete sympathy.

I am sorry indeed that I have no more detailed and constructive point of view to present. The subject is an important one, and I wish your committee all possible success in its deliberations.

Sincerely,

C. H. GREENEWALT, *President.*

DUQUESNE LIGHT Co.,
Pittsburgh 19, Pa., August 4, 1953.

HON. W. STERLING COLE,
Chairman, Joint Committee on Atomic Energy,
Congress of the United States,
House of Representatives, Washington, D. C.

DEAR MR. COLE: We are in receipt of your letter of August 1 stating that our comments on industrial atomic power development must be in your hands by August 10 if they are to be included in the published record of the joint committee hearings. We will be unable to complete our statement by that date, but we would appreciate the opportunity to submit it, together with suggestions for specific legislative provisions, prior to October 1 to permit analysis and evaluation before the next session of the Congress.

Sincerely yours,

PHILIP A. FLEGER,
Chairman of the Board.

FAIRBANKS, MORSE & Co.,
Chicago, August 3, 1953.

HON. STERLING COLE,
Chairman, Joint Committee on Atomic Energy,
Congress of the United States, Washington 25, D. C.

DEAR MR. COLE: I appreciate very much the opportunity you have given me to present to you and the committee our thought with reference to the problems raised by the imminence of the use of atomic power for industrial development. I am sure that you and the members of your committee are familiar with the fact that Fairbanks, Morse & Co. is at present supplying the Atomic Energy Commission with some of its requirements. This relationship has been of the most pleasant and I know on our part, and I believe on the part of the Commission, there exists a mutual respect that comes with doing a job well.

For some months past we have been discussing with members of the staff of the Commission, at their request, the desirability of our company addressing itself to an economic and engineering study of the problems involved in the design and construction of an atomic-energy plant having a capacity of from 10,000 to 50,000 kilowatts.

I would like to call to your attention, Mr. Chairman, just why members of the staff of the Commission would request this company to become interested in this particular power plant capacity range.

Fairbanks, Morse & Co. has pioneered—perhaps more than any other company—in bringing electric power to municipalities, towns, and, at a more recent date, the REA cooperatives. Fairbanks, Morse & Co. was one of the earliest builders in this country of diesel engines and the electrical generating equipment to go with it. Through Fairbanks, Morse & Co., early in this century, many communities were able to get electric current. Today these generating plants serve these communities with the same economy and satisfaction as when they were originally built. Expansion and modernization of the equipment have kept step with new discoveries in the field so that today the most modern equipment of this type is manufactured by us. To many municipal officials, rural electric cooperative directors, and others, Fairbanks, Morse & Co. is synonymous with quality, efficiency, and dependability in the field of production of electric power. Historically, therefore, the Commission found an American company in this field where prior experience and relationship promised an opportunity for early and fruitful development.

In our discussions with the members of the staff of the Commission, we expressed the view that an atomic energy powerplant of the capacities under discussion would fall with the projected requirements of many of the REA cooperatives. We further expressed the view that to construct such a pioneer installation for the use of a REA cooperative would be peculiarly appropriate in view of the quasi-governmental nature of the operation of these nonprofit cooperatives and the complete governmental control of the atomic-energy program itself.

As a result of these discussions, we have therefore proposed, by letter, to the Commission that at the earliest practical date we be authorized to conduct a study looking toward the feasibility of our designing and constructing an atomic powerplant of approximately 30,000 kilowatts capacity. This capacity, incidentally, was decided upon by the needs of the locality which a certain prelim-

inary survey showed could benefit under the present conditions involved in the erection of such plant. A preliminary review of the problem would indicate that the Rural Electric Cooperatives for which this plant would be designed would assume all costs for the equipment beyond the reactor. Such costs, of course, would be the conventional costs for the equipment which would be normally used by the cooperative in a generating plant of this size, exclusive of the boiler itself, namely, the power-generating equipment, switchgear, and transformer and distribution equipment. The cost of the reactor itself could be met in several different ways, depending upon the results of the economic and engineering study which we have proposed to the Commission.

The reactor itself, together with the fuel for its operation, would, of course, be under the complete control of the Commission. It would appear to be evident that some portion of the cost of the reactor would of necessity be written off to experimental research and development of such a prototype reactor. It would be possible, however, for the Commission to supply the heat energy from such a reactor to the Rural Electric Cooperative at some mutually agreed upon rate which would bring a certain amount of return on the Commission's investment. At a later date, and depending upon the passage of appropriate legislation by the Congress, it would be possible for the Commission to arrange for transfer of ownership of the reactor to the cooperative under suitable controls designed to insure proper national security and the public safety. It is quite possible that the Rural Electric Cooperative Association itself would be quite interested in this suggested study and would come forth with specific recommendations of their own as to the handling of such a reactor installation.

I wish to assure you, on behalf of myself and our company, that we stand ready to cooperate with you and the Commission.

Very truly yours,

R. H. MORSE, Jr., *President.*

INSTITUTE FOR NUCLEAR STUDIES,
THE UNIVERSITY OF CHICAGO,
Chicago, Ill., July 15, 1953.

HON. STERLING COLE,

*Joint Committee on Atomic Energy,
Congress of the United States, Washington 25, D. C.*

DEAR MR. COLE: I have your letter of July 13 with a list of questions concerning national policies in the field of atomic-power development.

You must realize that for a number of years I have been more a spectator than an active worker in this field because my interest has been taken more by pure research than by its technological applications. I would hope that you will keep this in mind in evaluating my answers to your questions.

1. On recent visits to the Argonne National Laboratory, I had the pleasure to discuss with Dr. Zinn and his associates the progress that has been made in making atomic power a possibility that can no longer be disregarded, even from the economical point of view. I concur with their opinion that the time may have come to consider construction of power reactors on an industrially significant scale. Only in this way could a relevant experience on further possibilities be gathered. Doubtlessly it would be desirable to have private industries take a major role in this development.

2. As a guess, I would say that we probably are still ahead of other countries in atomic-power development, but I do not believe that our margin of superiority is comfortably large. In the atomic-power industry, of course, conditions in this country are different from what they might be in other parts of the world, partly on account of our greater resources of conventional fuels. On the other hand, the atomic-power industry has such evident ties with weapons production that it seems to me inadvisable to lag behind other countries even though the need for strictly power purposes may not be so great.

3. Atomic power from the economical point of view may be considered from various angles. It may be compared as a power source with what can be obtained from conventional fuels. In this respect, the unique advantage of atomic power is the lightness of the fuel that could potentially make large sources of power available very far from coal or oil deposits. From a longer range point of view it may be considered also as a substitute for present power sources, even in locations where they are abundantly available. This will become especially a possibility if the breeding process ultimately will become practical. As you know, encouraging progress has been made along this line but results are still far in the future.

Finally, atomic-power economics may be considered in connection with production of plutonium for atomic weapons. This consideration may help support in part the cost of developing atomic powerplants, at least through the transition period.

4. I am convinced that the development of atomic power should not be burdened with excessive security restrictions. I believe that this is the case because the security apparatus tends to slow up progress by obstructing the free flow of ideas. The practical result of excessive security is that the groups within the fence are not stimulated by the competition of ideas coming in from the outside, and may easily lose their alertness.

5. As you know, most of the secrecy labels on pure science have been removed, and this has helped very greatly the development of nuclear science in this country. A situation, however, remains that operates adversely on our development, and this is the excessively restrictive policy on admission to this country of scientists from foreign nations, and mostly from Western Europe. As a consequence, our scientists lose the stimulus that comes not only from exchange of ideas, but also from a healthy sense of competition with our western friends. The actual losses to our scientific potential seem to me quite out of proportion with the danger of admitting to our shores an occasional person who may not share completely our political views.

6. I read the statement of policy of the Atomic Energy Commission attached to your letter and I am in full agreement with the views there expressed.

I shall be very glad to answer any further questions that you may want to ask me.

Sincerely yours,

ENRICO FERMI.

KAISER ENGINEERS,
DIVISION OF HENRY J. KAISER CO.,
Oakland 12, Calif., July 15, 1953.

HON. W. STERLING COLE,
Chairman, Joint Committee on Atomic Energy,
Congress of the United States, Washington, D. C.

DEAR SIR: In reply to your letter of July 11 the management of Kaiser Engineers is appreciative of the opportunity to discuss with your committee some of the problems incident to definition of a Federal policy on industrial atomic-power development.

However, as this division has only recently been activated, it is not fully prepared to present testimony at this time and respectfully requests a deferment.

When our program is more fully developed from its preliminary stages, and constructive opinions formed, they will be available to your committee for its consideration, as indicated.

Sincerely yours,

KAISER ENGINEERS,
J. H. HAYNER,
Manager, Atomic Energy Division.

UNIVERSITY OF CALIFORNIA,
RADIATION LABORATORY,
Berkeley 4, Calif., July 27, 1953.

W. STERLING COLE,
Chairman, Joint Committee on Atomic Energy,
Congress of the United States, Washington, D. C.

DEAR CONGRESSMAN COLE: As you know, I have been fully occupied for some time with other phases of the atomic-energy program and have not had an opportunity to give extended thought to the problem of a policy for the development of industrial atomic power. Therefore, I should not undertake a statement along this line at the present time.

With all good wishes,
Sincerely yours,

ERNEST O. LAWRENCE.

NEW YORK, N. Y., July 14, 1953.

Hon. W. STERLING COLE,

*Chairman, Joint Committee on Atomic Energy,
Congress of the United States, Washington, D. C.*

MY DEAR CHAIRMAN COLE: Thank you for your letter of July 11 in which you invite me to participate in a hearing of the joint committee on July 22, dealing with the consideration of amendments to the Atomic Energy Act in respect to private industrial development of atomic power.

I am sorry to say that some commitments which I find I am unable to revise at this date will prevent my accepting your kind invitation. While there may be little that I can contribute to your discussion, in addition to what I have already written on the subject, I would have enjoyed the opportunity to renew my acquaintances with members of the committee, before whom I have spent some of the most interesting hours of my public service. I find that as one recedes farther into the pleasant and soothing anonymity of private life, what he remembers most clearly are the friendships he made in the strenuous days of public responsibilities.

I note in your letter that the present hearings are exploratory, and that legislative recommendations will not be forthcoming from the executive branch this year. I suggest that at some later date if further hearings are held, and it seems to the committee that an appearance before the committee would be of any value, you may wish to renew your invitation, with the hope on my part that my plans will permit my being with you.

May I extend to you my congratulations on your selection as chairman of the joint committee, and my expression of personal esteem and respect.

Sincerely,

DAVID E. LILIENTHAL.

NEW YORK, N. Y., July 29, 1953.

Hon. W. STERLING COLE,

*Chairman, Joint Committee on Atomic Energy,
Congress of the United States, Washington, D. C.*

DEAR CHAIRMAN COLE: Thank you very much for your letter of July 21. I am enclosing a copy of an interview as it appeared in the St. Louis Post-Dispatch on January 4, 5, and 6 of this year, in which I express views which may not have come to the committee's attention. I will keep in mind your kind suggestion that, if later I have comments which might be of interest to the committee, I come forward with them on my own initiative.

I am going to Corning for a visit at the Corning Glass Works tomorrow, which puts me in mind of the last time I believe I had an opportunity to see you, at the time of the Corning conference. While I am in your bailiwick, I will try to behave myself properly.

With personal regards, I am

Sincerely,

DAVID E. LILIENTHAL.

[St. Louis Post-Dispatch, January 4, 1953]

ATOMIC SECRECY POLICY A FAILURE, LILIENTHAL SAYS, URGES CITIZENS' COMMISSION TO DRAFT NEW LAW—WOULD GUARD MILITARY ASPECTS BUT PERMIT WIDE DISSEMINATION OF KNOWLEDGE FOR DEVELOPMENT BY INDUSTRY—CITES DANGERS IN GOVERNMENT CONTROL OF IDEAS

(By Richard G. Baumhoff, a staff correspondent of the Post-Dispatch)

NEW YORK, January 3—Creation of a strong citizens' commission by General Eisenhower, after he becomes President, to prepare recommendations for a new atomic-energy law was urged today by David E. Lilienthal. The purpose is to open the way for competitive private industrial development of the vast storehouse of nuclear fission.

Lilienthal, first Chairman of the Atomic Energy Commission, made his views known in an exclusive interview with the Post-Dispatch. They were sought in the light of his experience and because of numerous recent statements from official and other sources about the frustrating delay in applying atomic energy for peaceful purposes, notably for electric power production.

It is Lilienthal's belief that secrecy in atomic matters has failed flatly and that many features of atomic knowledge no longer are atomic secrets but are possessed by Russia.

MUST SEE WHAT IS NOT SECRET

"Our first step," he declares, "is to realize that we must take a hard, uncomfortable and even painful look at what is secret now and what is not secret because the Russians already have it. On that basis we must write a new law on the present state of facts. None of this will make sense to people who believe the Government ought to dominate this field, that here is something which should be kept nationalized and under political direction. I don't want to argue against that view, but want only to say that I don't agree with it."

Secrecy, he insists, should be ended as far as possible, in order to permit wide dissemination of atomic knowledge in scientific and industrial circles. This will lead, he is convinced, to the opening of great new avenues of industrial development, not necessarily related directly to nuclear fission, or atom splitting. Now, he holds, is an appropriate time to make a thorough change in American policy on secrecy.

His argument runs this way:

1. The basis for existing policy is gone; secrecy in many matters is fiction, not reality.
2. A new policy is required because of the great benefits to mankind from private-enterprise development of atomic energy and related fields.
3. It has become more than ever apparent that there are serious dangers in continued governmental domination of ideas and of technical thinking, as is the case now.

The change in national administration offers a timely opportunity for a sharp change in atomic policy, Lilienthal points out. The Truman administration, he notes, was committed to the 1946 McMahon Act that created AEC, the Atomic Commission, and laid the strictest sort of Federal secrecy on all atomic matters.

NO EASING OF MILITARY SECRECY

Emphatically, Lilienthal would not relax secrecy as to the military aspect of atomic energy. He feels certain that a means of separation could be worked out successfully by such a citizens' commission as he recommends. He does not attempt to spell out the details of this himself, nor to blueprint precisely the sort of new law that should replace the McMahon Act.

Lilienthal, Chairman of TEC from October 26, 1946, to February 15, 1950, previously was Chairman of the Tennessee Valley Authority. He was chairman of the State Department board of consultants on whose report the Baruch plan for international control of atomic energy was based, within a year after the first atomic bombs were loosed.

Warnings by him at the time he retired from AEC and a few months later in two articles in Collier's magazine as to the dangers of secrecy and the need for change have been confirmed in subsequent developments, he declares. In the Post-Dispatch interview he has gone much further than before by proposing specific courses of action.

Current moves to expand greatly AEC's activities, including the huge new plants under construction near Paducah, Ky., and Savannah, Ga., emphasize the need for early change of policy, Lilienthal maintains. Otherwise, he fears, this expansion carries grave implications of danger to the democratic and free-enterprise systems.

"I hope," says Lilienthal, "that Eisenhower as President will appoint a citizens' commission, directly responsible to him, to deal with the whole subject of atomic policy. Here is an opportunity for reexamination of our position by fresh minds. It seems to me the time is now ripe for this. It certainly is time for a change in our atomic industrial policy. The report of this commission should be made to the American people."

FOR FRESH VIEWPOINTS

He does not think that anyone having past connections with the subject, including himself, should be placed on the citizens' commission. Consciously or unconsciously, he fears, persons heretofore identified in this field might tend to have their thinking channeled by past experience or restraints, "vested interests" in ideas or pride of opinion.

He would exclude Members of Congress from the commission, because those who have dealt with the subject, although able and well intentioned, cannot separate themselves from past patterns of thought. He would include persons in the late thirties or the forties, to gain their relatively youthful viewpoint.

"We have a great atomic industry that has sprung up in a decade," says Lilienthal. "It represents no private investment, no risk of loss nor chance of profit.

"But even worse than this unusual condition is the amazing situation that in this whole new field the question of who shall think about problems, how much effort shall be expended in certain directions, what ideas may be pursued, is all a matter for the Government to decide. It is as bad to have Government control of thinking in this field as in the field of civil liberties.

"What I am proposing involves a very drastic rewriting of the law. The present law was not and could not be built on public understanding. It was based on ideas of secrecy and of the importance of the atomic weapon which no longer are valid.

"The present law represents Government monopoly of ideas. Only a doctrinaire Socialist would have stood for that, but for the conviction at the time of enactment that we could rely on secrecy and that we had in the atomic bomb an absolute weapon.

ARMIES, NAVIES STILL NEEDED

"We had the notion then that armies, navies, and air forces were outmoded. We have found, however, that we need more of those forces than before, although certainly we must possess a good stockpile of atomic weapons. In Korea, it has not been feasible to employ atomic weapons. We do not have an absolute weapon.

"I would proceed now on the foundation that what we have is not a weapon, but a great discovery. Its fullest development could lead to many things, just as did the development of electricity and of petrochemicals."

Lilienthal does not blame the Atomic Energy Commission, now headed by Gordon Dean, for failure to push atomic-electric power and other industrial advances. He expresses the highest regard for the Commission and its staff of "extraordinarily able, devoted men."

Rather, he blames the system that grew up out of the first excited period after the bombing of Hiroshima in 1945. He is convinced, in view of what has happened since, that the public would be best served by opening up the atomic field to the widest possible extent.

As to the general procedure he envisions to carry out his ideas, Lilienthal says:

"There should be even closer control on the weapons side, though without being silly about this. Military secrecy need only apply to what really remains secret.

"Government monopoly of ideas around the whole area of manufacture of atomic materials should be removed.

"We should open up the whole field of electric-power reactors. Private activity in this field would come after we get the information out in the open. Industry cannot come halfway in this unless it has a chance to explore the profit possibilities for itself and find means of dealing with atomic energy more cheaply than is being done now.

"We should permit private ownership of atomic materials, under appropriate licensing and with the owners accountable for every gram. Of course, we cannot permit the materials to fall into the wrong hands. By materials I refer particularly to uranium, plutonium, and enriched uranium (including the fissionable isotope, U-235).

"There is a psychological bar in attempting to operate an electric power reactor without ownership of the atomic materials. It is true that the contractors operating the Government plants have full physical possession of the atomic materials now, but this differs materially from actual ownership.

"The matters of health and safety in handling the radioactive materials under private ownership, which have been matters of concern, could be handled by regulation.

SHIFT BY STEPS

"It seems to me to be clear that the production of fissionable materials constitutes a good place to start shifting atomic energy over to the American competitive system by steps.

"We could not denationalize ownership overnight of the AEC plants at Oak Ridge, Tenn., and Hanford, Wash. We have to keep them operating. In the transition period the Government could continue to operate them through cost-

plus contractors, but meanwhile it could start making information available to all of private industry.

"Eventually the plants could go out of public ownership. It might not be the same plants as now, for better means of production will be found in the meantime, if we open the windows and let in the fresh air of competition."

Oak Ridge and Hanford are vast and highly secret establishments. Oak Ridge uses the gaseous diffusion method on a large scale to separate the fissionable isotope, U-235, from uranium. It also has a big research center. Most of the U-235, according to a recent official statement, now goes into "parts for atomic bombs."

Hanford produces plutonium, a new element of the atomic age, from metallic uranium. The same official statement said the plutonium is "fabricated into weapon parts."

"I would say the new law," Lilienthal continues, "should start with strong declarations that would admit the policy of secrecy hasn't given us what was expected of it. Therefore, information about processes such as those at Oak Ridge and Hanford that could have many industrial, nonmilitary applications should be made available to engineering and industrial America.

"When that happens, there are tens of thousands of able minds in the country that could be applied to the use of the information. They could be expected to come up with ideas on cheaper, less complicated ways of doing some part of what is done now in the AEC plants. They would also go off in other directions, to find new uses and applications.

"That kind of thing has always been true of America, and I think it is true now. There would be a proliferation of ideas. Someone not only might come up with a cheaper way of producing these materials, but conceivably in a very short time will also come up with venture-capital ideas in this field. Such a venture almost surely will include electric power production.

"What's at stake is finding ways whereby man can change the nature of matter. Neoprene (a synthetic rubberlike substance) was discovered by accident by a chemist who was looking for something else. That kind of thing doesn't happen when you put a great Government tent over a whole area of knowledge, as has been done with atomic energy. It doesn't happen unless the information is available for the Thomas Edisons, the Henry Fords, and, too, the glorious crack-pots of science.

"An enormous amount of industrial and chemical possibilities having nothing directly to do with the atom might flow from the freeing of information. For example, these might lie through the application for other purposes of some of the things developed in the atomic plants, such as some of the complex equipment in the gaseous diffusion plant.

"The tremendous television industry might have been squelched if radar of World War II had been kept a Government monopoly. After World War I the Secretary of the Navy fought to keep the wireless under naval control for security reasons. If that had been permitted, we wouldn't have the vast electronics industry that grew out of radio.

"The gravamen of our difficulties is that atomic energy is now exclusively governmental. No matter how much industrial cooperation is obtained, how many individuals are cleared for atomic work, or how many companies are added as Government contractors, we are not treating the knowledge in a way consistent with the method of free society. That method opens the path of advancement through the fellow with the unconventional technical idea or the fellow whose search is not just for one specific thing."

NO ADEQUATE INCENTIVE

"Under the Government's cost-plus system of plant operation, there is no adequate incentive for reduction of costs, since engineers naturally want every gadget they can get and every factor of safety they can think of. It requires pressure to move in the other way, toward competition of ideas. That we don't have, and won't have, until we tackle the secrecy issue flatly and openly. It's a serious and difficult issue that calls for courage and plain speaking.

"What we are dealing with is not just a question of making electric power, or producing isotopes for medical or other use, or even of the ownership of Government plants. What we start with is a set of fundamental discoveries—not, say, section 7 of the act, or the treatment of patent rights, or the question of leasing or selling plutonium.

"Rather, here in the United States in the middle of the 20th century we have in our hands one of the greatest discoveries about the world that can be opened

up to man. This is a great moment of history, and we are prepared for that great moment, in that we are able to take advantage of it, if we will.

"If it had happened before the industrial age, it might not have been so important. It has come at the right time, as another step after fire, the wheel, understanding of gravity, and harnessing of electricity.

"But the question is, How do we go about developing atomic energy? Does our way make sense, or will our American competitive industrial system and our educational system be the first great casualties of the atom? At present we ourselves are subverting our own democratic and competitive system unnecessarily.

"No dogmatics are involved. No one has an ideological insistence on governmental monopoly of this discovery. We don't have a situation of Socialists versus competitive industrial advocates. In a way that makes the problem easier; in a way more difficult, for as it is people agree with you in principle but nothing happens.

"Under the present system, industrial manufacture of atomic materials is deemed part of the production of atomic weapons. Of course that's true, but it's also true that the raising of cotton and production of nitrogen relate to production of military explosives.

"The fact that the basic factories at Oak Ridge and Hanford produce what goes into a bomb—U-235 and plutonium—doesn't settle the question whether those plants are predominantly military establishments, which should be owned by the Government on the same footing as Los Alamos, a weapons center, and Sandia, the weapons-testing site. Yet all these places are dealt with now under the same concept of law."

CHANGE IN OWN POSITION

Lilienthal says the change in concept he envisions represents a change in his own position, guided by changing facts of atomic life. When he was AEC Chairman, he called in industrialists for consultation, setting the stage for the later move, now hanging fire, whereby some big industrial concerns have undertaken to explore use of atomic energy for electric-power production. Even before he resigned from AEC he was greatly disturbed over the nationalization of the atomic industry.

While in AEC, he recalls, he was keenly aware of the lack of public scrutiny, whereas he thinks one of the reasons TVA, his former field, has done so well is that it has been open to public scrutiny and criticism, which he considers essential to good management.

It is quite usual, he points out, for the Federal Government to carry on scientific work, and he approves of this, as in the case, for example, of TVA's chemical research at Muscle Shoals or the Forest Service's laboratory at Madison, Wis. However, he makes the point that such establishments are not conducted to acquire property rights in their product for the Government, but to increase and disseminate knowledge, in contrast to the treatment of atomic energy.

Although it is true that private industries might make profits from the use of atomic knowledge developed by the Government with tax funds, Lilienthal regards this as only incidental to the greater benefit that would result for mankind. He thinks basic changes in the patent-restriction provisions of the Atomic Energy Act might be made.

Lilienthal, a Stevensonian Democrat, long known as a fighting liberal and a sincere adherent of democracy, emphasizes that he is "strictly a private citizen now," with no intention or expectation of getting back into Government. He is chairman of Attapulgas Minerals & Chemicals Corp., miners and processors of industrial minerals (fuller's earth, potash, phosphate, etc.), and consultant for the Wall Street investment banking house of Lazard Freres & Co.

[St. Louis Post-Dispatch, January 5, 1953]

LILIENTHAL ASSERTS PRESENT LAW BARS EFFECTIVE EFFORTS TO DEVELOP ATOM ENERGY BY PRIVATE ENTERPRISE—FORMER AEC CHAIRMAN CITES INSTANCES TO SHOW SECRECY HAS FAILED, WHEREAS "PRETENSE OF SECRECY" STANDS IN WAY OF PEACEFUL USES FOR GOOD OF MANKIND

By Richard G. Baumhoff, a staff correspondent of the Post-Dispatch

NEW YORK, January 5.—"Whether or not the Atomic Energy Commission could arrange more work on the development of electric-generating atomic plants

without lessening security is a question closed to adequate discussion because of the necessary secrecy surrounding pertinent facts."

This passage from the December 22 report of the National Security Resources Board on general material resources policy has been taken by David E. Lillenthal as a text for his argument that the time has come to end secrecy on atomic energy.

As told in yesterday's Post-Dispatch, Lillenthal, first chairman of the Atomic Energy Commission and previously chairman of the Tennessee Valley Authority, urges that President-elect Eisenhower create a citizens' commission to recommend a new Atomic Energy Act and open this great source to private industrial development.

"That statement in the NSRB report," says Lillenthal, "is the perfect circular reasoning. It says that even the question of whether you really have security of atomic secrets is a closed book because you can't look in to see."

Further, he declares, this attitude, mandatory under the present law, prevents any effective effort by private enterprise and private thinking to develop atomic energy as a means of producing electric power or for other industrial possibilities of transcendent importance for mankind.

FAILURE OF SECRECY

"Having discovered regretfully—for it's a tragic thing—that our policy of secrecy has failed," Lillenthal adds, "then we should no longer pretend that it hasn't.

"Everyone fails to face the central issue—the failure of our policy of secrecy. Extreme secrecy, the odd 10-20-30 vaudeville kind, has been our dogma. This pretense of secrecy prevents us from finding our way out of the maze of dealing with atomic energy."

Lillenthal recites instances to support his thesis that atomic secrecy is a failure.

For example, he recalls that when he was AEC Chairman he had to watch his tongue lest the word "implosion" slip out publicly. This is a new term of the atomic age. It means an explosion focused inward, as in an atomic bomb, as contrasted to the normal outward blowing of, say, dynamite.

Yet in the New York Times of March 12, 1951, he found the word, together with considerable detailed description bearing on the fabrication and operation of an atomic bomb. This occurred in a legitimate news report of the Rosenberg spy trial in United States District Court in New York.

The judge directed the court stenographer not to transcribe this part of the testimony, which was given with spectators excluded. However, newspaper reporters were permitted to remain and no restraint was placed on them. The witness was one of the espionage defendants who had pleaded guilty.

ARMY PRESS RELEASE CITED

Next, Lillenthal cites a press release by the Army, August 12, 1945, telling of the extreme and unusual measures taken by the Army to preserve atomic secrecy. This was shortly after existence of the atomic bomb had been disclosed, and before AEC was created to take over atomic energy from the military.

"Yet," he comments, "we now have the bitter knowledge that at that time our atomic operations had been riddled with spies. We now know there were traitors to this country, and to England and, therefore, also to this country, who operated within the atomic establishment."

The Army release shown by Lillenthal said that even agents of the FBI had to get special passes to enter atomic plants. Clearance of atomic workers was handled by the military, not the FBI. Lillenthal thinks it was unfortunate that the "professional FBI" was not in charge of this work.

"This country did try its darnedest," says Lillenthal, "to keep atomic energy secret. We thought we could do it forever. That was the opinion of witnesses before the congressional committee that drafted the Atomic Energy Act of 1946.

RUSSIA HAS A-BOMB

"We have known since September 1949, 3 years after that law was enacted, that Russia had the atomic bomb. So it is obvious that Russia has an atomic

materials industry. While that industry may conceivably consist of only one plant, still it is on a factory scale.

"Hence our assumption that atomic energy is secret and has been kept secret has been destroyed.

"At least one of the experts closest to our whole project, Klaus Fuchs, was a spy, with a degree of ability capable of transmitting technical information. This was not the case of a mere Mata Hari but of a fellow who knew as much about the complicated subject as the people he was dealing with."

In Lilienthal's opinion, AEC soon may recommend amendments to the present law, looking toward increased cooperation with private industry. This, essentially, is what was urged in the recent NSRB report. However, he fears the move may be "just a bone, to quiet our concern." Instead, he argues for a complete new law and outright change of policy.

He does not expect that this can be carried out unless the people of the Nation demand it of Congress. The work of a citizens' commission such as he recommends would pave the way for such a demand.

Chairman Gordon Dean of AEC, in a speech December 15, discussed the secrecy issue briefly. He mentioned the desirability of permitting private industry to obtain more information, now secret, for developing atomic-power plants, but he did not propose a new law. Instead he said that some policy decisions by AEC and possibly some "legal changes" may be needed to accomplish the purpose.

"There is a legitimate and essential area of secrecy, a hard core which everyone will fight to preserve," Lilienthal points out. "We can do that effectively, if we try. While the subjects of that core will change with the times, we should redouble our efforts to make it secure.

"This proper area of secrecy relates to atomic weapons, to techniques of fabrication, the rate of our progress, the volume of the weapons, where we keep them, and things like that. Certainly the American people don't feel they have to understand the mechanism of the hydrogen bomb, or how far along we are with that weapon. It is as essential and legitimate to keep that sort of thing secret as it is not to disclose the disposition of our troops in wartime.

"Unfortunately, there has already been public discussion of some things we should not be talking about—such things as atomic artillery shells, or whether atomic bombs can be carried by carrier-based naval planes. The talk of the military services about such things has been indiscreet, if not utterly wrong."

Lilienthal, however, draws a historic comparison with the plans for the Civil War gunboats, the introduction of TNT and the invention of radar. When those things were new, he says, they had to be kept secret—not just because they represented instruments of warfare, but because at the time disclosure would have given away information about military plans and intentions. Later, there was no point to secrecy on them.

In his opinion, private industry in many cases does a better job of protecting its own secrets than the Government has done with atomic energy.

Lilienthal goes beyond the issue of secrecy in atomic energy, in the earnest belief that such secrecy leads to other evils in government.

"This," he says, "is becoming a thing that cannot be discounted as a general trend in our Government. The files of the Pentagon are full of papers marked 'secret,' many of which, I'm sure, need not be so marked. I have a definite feeling that this unwholesome and undemocratic tendency has been encouraged by the extremes of our treatment of the atom. This statement implies that a document is sometimes stamped 'secret' deliberately in order to avoid public accountability. I'm afraid that in many cases this is unhappily the fact.

"Yet the prying and the probing of the public is the only safeguard we have for our democracy. Public accountability is defeated by excessive secrecy."

[St. Louis Post-Dispatch, January 6, 1953]

LILIENTHAL DOUBTS ATOMIC ENERGY CAN BE USED SUCCESSFULLY FOR ELECTRIC POWER TILL SECRECY ENDS—TECHNIQUE NO LONGER A PROBLEM, BUT HE SAYS COSTS MUST BE SLASHED TO MAKE PROCESS PRACTICAL.—A TASK FOR BEST BRAINS OF BUSINESS AND ENGINEERING

(By Richard G. Baumhoff, a staff correspondent of the Post-Dispatch)

NEW YORK, January 6.—Production of electric power is one of the most fruitful fields for industrial application of atomic energy in the immediate future, in the opinion of David E. Lilienthal.

He believes that the public, and the power industry, would be greatly benefited by this development. However, he fears that atomic energy cannot be successfully applied to the power field until atomic secrecy in industrial matters is ended by a new law.

Lilienthal, first Chairman of the Atomic Energy Commission and previously Chairman of the Tennessee Valley Authority, one of the Nation's great public electric-power producers, gave his views on the need for a new law in an interview in last Sunday's Post-Dispatch. He urged that President-elect Eisenhower establish a citizens' commission to work out a reversal of policy and prepare for a new law that would permit industrial access to atomic information.

Lacking such a change in policy, the outlook is dim, in Lilienthal's view, for successful entry of private industry into the field of power from the energy of the split atom.

MONSANTO, UNION ELECTRIC

Several groups of private concerns have been engaged for some time in efforts to work out a feasible means of achieving this. One group consists of Monsanto Chemical Co. and Union Electric Co. of St. Louis. Their preliminary report, pointing the way to action, has been submitted to AEC, but nothing more has been heard from it, as far as is publicly known.

"To produce power from the heat of fission no longer is a problem," Lilienthal points out. "That really hasn't been a problem since the historic first demonstration of nuclear fission under the grandstand at Stagg Field, Chicago, in 1942.

"In other words, when heat is developed, as it is in nuclear fission, you can use that heat to produce electricity. However, that means little except as a start. It is only when the heat can be had at a fraction of the cost now involved in the atomic materials plants that this process will become economically justified.

"Until industry can apply itself to the task of bringing down the present outrageously high costs to a competitive economic level, we will never enjoy the benefits of atomic power except for military purposes. If our great industrial history means anything, this simply won't happen until the whole business management, engineering, and chemical profession and some Edison-type inventors have their chance for a crack at it in a wide-open competition of ideas, based upon a wide-open access to knowledge.

"Building secret power plants for submarines, where absurdly high costs are no deterrent, makes no sense so far as the general public's interest in atomic power for their homes and factories is concerned.

"The people who are now working for the AEC and its contractors on power reactors are superb people. Such companies as Monsanto Chemical, Union Electric, and the others are the cream of the crop without a doubt. But all of them represent only a tiny fraction of the minds of this country that have a whale of a lot to contribute, and will, when we get rid of the fiction that these things are secret and return to our proved competitive system."

PROPOSAL BY MONSANTO

Monsanto's proposal, as urged originally in June 1950 by its president, Charles Allen Thomas, calls for a plant where Government-owned enriched uranium would be used in a reactor to produce plutonium by controlled nuclear fission. The plutonium would go to the Government for atomic weapons, while the heat of fission would go to the plant operator as the fuel for ordinary electric generating operation. The sale of the plutonium would be expected to cover the high cost of the atomic operation.

This plan was proposed within the framework of the existing Atomic Energy Act of 1946. That law makes stringent secrecy requirements and limits atomic materials to Government ownership. Lilienthal not only calls for lifting secrecy from industrial atomic matters, but for permitting private ownership of fissionable materials. He would provide for private ownership under careful licensing and accountability for the materials.

As to the proposal for such a joint plutonium-power operation Lilienthal says: "Who knows whether the reactor might be built for a fraction of what it now would cost, if the whole of industry could get at the information on which to develop it, and could undertake to criticize and outdo each other? Just what can be accomplished cannot even be dimly seen until we get all the information out in the open arena of American competition of ideas.

"The trouble so far is that we always get back into the old groove of thinking

The issue is not the narrow one of what to do about a plutonium-power plant, but of permitting the cost-cutting ability of all competitive industry and all inventors to bear on the matter."

RELUCTANCE BY AEC

AEC, it is known, has been unwilling to bind itself to a long term of years for purchase of plutonium at an agreed price. The Union Electric-Monsanto discussion has been in terms of about 30 years, as an assurance that the great plant investment would pay out.

On the other hand, AEC obviously fears that changes in the course of time might make the value of plutonium less, or even make it obsolete as an atomic material. A suggestion that an accelerated tax write-off provision, say 5 years, on the plant might solve the investment problem and shorten the term of AEC's commitment was met by a showing that the production cost of power then would be too high to be economically feasible.

Asked by the Post-Dispatch whether, in his opinion, the AEC has failed in any way to push the movement for atomic power, Lillienthal says the Commission and its advisory committee have done an admirable job. He adds: "They are a wonderful group of men, and so are the extraordinarily able industrial contractors and those who have proposed industrial powerplants."

He lays the whole problem of power development at the door of secrecy enjoined by the 1946 Atomic Energy Act, while he insists that the need for secrecy, except on strictly military phases, no longer exists.

"If you assume the necessity for secrecy," says Lillienthal, "then the production of power must be secret and military in nature. Hence, as long as you regard such atomic materials plants at AEC's Oak Ridge and Hanford as secret and military, electric power will remain in that category."

COUNTY OF LOS ANGELES,
BOARD OF SUPERVISORS,
Los Angeles 12, August 6, 1953.

HON. W. STERLING COLE,
*Chairman, Joint Committee on Atomic Energy,
Congress of the United States, Washington, D. C.*

DEAR CONGRESSMAN COLE: Having been one of the persons selected to witness the atomic-bomb blast at Las Vegas, March 17, 1953, and having had occasion to discuss with numerous citizens the significance of this and similar events and also the underlying issues involved, I feel there is a strong sentiment here in the West to the effect that atomic energy is so alarmingly revolutionary and far-reaching in its character that Government controls must be maintained and safeguarded to a high degree.

Undoubtedly the great future of atomic-energy development lies in the peacetime fields. There is strong sentiment in support of the principle that typical American free enterprise will not be interfered with by retaining the basic industrial development and technical experimentation within the framework of the Government itself. The alternative of leasing out atomic-energy experimentation and granting to large private concerns the secret or semisecret findings that have resulted from billions of dollars spent by the Government in research, is not sound Government policy in that it will promote monopoly or near-monopoly rather than further enhance and strengthen genuine free enterprise.

One of many fields in which the Government could well afford to do exhaustive and definitive experimental work has to do with transportation by air, land, and sea. Probably the greatest single benefit which could be derived from atomic energy would be to carry forward the experiments in these fields to the point where known principles and basic operandi could be made available to the entire industry so that all alike might engage in competitive application of atomic energy to automobiles, airplanes, steamships, etc.

Another field offering great possibilities for development has to do with the conversion of sea water to fresh water. Only a great organization such as a department of the Government can afford to undertake the expensive and exhaustive research entailed in such a project. Furthermore, it could not possibly be assigned to private industry because if and when successful solution of seawater conversion is achieved, no private interests could rightfully utilize such discoveries to the exclusion of large areas of population which could benefit by

such conversion. The entire Southwest is profoundly concerned with the project and earnestly hopes that the Federal Commission will do everything in its power to bring these efforts to a successful conclusion at the earliest possible date.

Sincerely,

JOHN ANSON FORD, *Chairman.*

NOTE.—In reviewing the above I find I have failed to indicate categorically what I have assumed was clearly implied, namely, I am speaking only as an individual and not for the board of supervisors.

J. A. F.

MINNEAPOLIS-HONEYWELL REGULATOR CO.,
Minneapolis, Minn., August 3, 1953.

HON. W. STERLING COLE,
Chairman, Congress of the United States
Joint Committee on Atomic Energy,
Washington, D. C.

MY DEAR MR. COLE: While the Minneapolis-Honeywell Regulator Co. has and will continue to have a fundamental corporate interest in the instrumentation and control associated with the development of atomic power by industry, it believes that it is in no position at this time to make any specific or formal comments regarding this subject. We do generally regard favorably the basic idea of a broader development of atomic power by industry and other groups outside the Atomic Energy Commission. Similarly, we recognize the enormous problem presented by the security aspects associated with a major transition of the sponsorship for such development to organizations and agencies outside the Federal Government.

We sincerely appreciate your extending to us the opportunity to make comment. While we do not feel that at this time we can assist you in your efforts to define a Federal policy on this matter, we are extremely interested in the activities of your group and would be appreciative of any opportunities in the future to be of assistance to you.

Sincerely yours,

FRED R. HAVILAND, Jr.,
Director of Market Development.

UNIVERSITY OF CALIFORNIA,
LOS ALAMOS SCIENTIFIC LABORATORY,
Los Alamos, N. Mex., July 15, 1953.

HON. W. STERLING COLE,
Chairman, Joint Committee on Atomic Energy,
House of Representatives, Washington, D. C.

DEAR SIR: This letter is in response to your invitation of a statement in connection with the hearings of the Joint Committee on Atomic Energy on the question of civilian nuclear power.

I have received and read the statement of Prof. I. I. Rabi, the Chairman of the General Advisory Committee, United States Atomic Energy Commission, as well as the Statement of Policy of the Atomic Energy Commission, together with its appendixes. I find myself in general agreement with the views and the philosophy expressed in these documents. There is only one point that I would like to elaborate somewhat further.

This deals with possible Government commitments to purchase plutonium. This matter is referred to in section 5 of the AEC Statement of Policy and in section D of the General Outline of Proposed Legislation in the appendix Description of Proposed Legislation. In these paragraphs the possibility of Government guaranties of fixed-price purchases of plutonium is provided for, but the desire of becoming economically independent of such obligations is also unambiguously expressed.

This problem is a difficult one, and, in any case, the Commission's position is primarily a matter of degree and of emphasis. I would like to argue in favor of shifting this emphasis more toward guaranteed Government purchases of plutonium. I think it unlikely that commitments of this nature should turn out to be undesirable in any foreseeable future, or that any degree of availability of plutonium that we will plausibly achieve can prove to be uneconomical or exces-

sive. The potential uses for this material are more varied than is now generally recognized, the value of flexibility in its commitment is very great, and all this hinges critically on its freest possible availability.

Sincerely yours,

JOHN VON NEUMANN.

WELLFLEET,

Cape Cod, Mass., August 6, 1953.

HON. W. STERLING COLE,

Chairman, Joint Committee on Atomic Energy,

DEAR MR. CONGRESSMAN: Thank you for your invitation to submit to your committee my comments on problems relating to the development of atomic power for industrial use. The subject has long interested me, since serving as counsel to the Senate Special Committee on Atomic Energy under whose aegis the basic legislation was drafted. Had I had the opportunity to attend the recent hearings of your group and to hear the various witnesses express their points of view I would have been glad to submit my own opinions. I have however been at my summer home in Massachusetts during the entire period and therefore do not feel I should avail myself of your kind offer, at least until I have read the transcripts. Under the circumstances I think it advisable to defer giving my opinions until the committee takes up specific legislative proposals at the next session of Congress. At that time I should like very much to be heard in person on matters regarding which I have had experience. I hope you will then find it possible to renew your invitation.

Sincerely,

JAMES R. NEWMAN.

PUBLIC AFFAIRS INSTITUTE,

Washington, D. C., August 10, 1953.

HON. W. STERLING COLE,

*Chairman, Joint Committee on Atomic Energy,
Congress of the United States.*

DEAR MR. CHAIRMAN: I appreciate your request of July 22, 1953, for my comments in connection with consideration by the Joint Committee on Atomic Energy of problems incident to a definition of Federal policy on industrial atomic power development.

To establish the basis for my statement, I would respectfully suggest that—

(1) This country's need for nuclear power is not so immediate or urgent as to warrant risking the great advantages of continued Government development by amending the Atomic Energy Act to turn over this new extension of the public domain to private power companies on the general promise that more rapid progress would result.

(2) There is no ground for anticipating that, once the threat of public development of nuclear power is removed, private enterprise will push its development as rapidly as it could be achieved under continued Government control.

(3) Assuming maintenance of necessary safeguards for individual, community, and national security, the matter under consideration belongs in the general field of power policy and should be treated in such a way as to bring the development of nuclear power within the general embrace of existing Federal power policy.

(4) The international aspects of the question, involving the adequacy of the materials base for expansion of our energy civilization, warrant the most careful consideration.

(5) There is ample time to permit the encouragement of widespread public understanding of the issues involved before changes are made in the policy established by the Atomic Energy Act.

NO URGENT NEED FOR NUCLEAR POWER IN THE UNITED STATES

The United States has no urgent need for the development of commercially feasible nuclear power as such. On the contrary, the country has an abundance of conventional energy resources to meet its immediate needs, as well as for estimated expansion in production of electric power over the next 25 years.

There is every evidence that the Nation's coal and oil-shale reserves are ample to supplement its overburdened petroleum reserves as a source of motor fuel, and, in addition, to support the burden of the Nation's rapidly growing demand

for electric power until the continued activities directed by the Atomic Energy Commission have brought nuclear power to the commercially feasible stage.

It is true that the President's Materials Policy Commission predicts an increase in the Nation's electric-energy requirements from just under 400 billion kilowatt-hours in 1950 to 1,400 billion in 1975, with coal's responsibility going up from about 90 million to 300 million tons. But in 1950 the 416,000 bituminous-coal miners averaged only 183 days' work during the entire year to produce the required 516 million tons of coal. This compares with the Bureau of Mines, 1949, estimate that on a full-time basis the country's mines would have produced a total of 860 million tons, or more than enough to meet the Materials Policy Commission estimate of 825 million tons required for all purposes in 1975.

The urgency of the need for nuclear power may also be considered in terms of what commercial development of nuclear power might offer in the way of lower power costs or reductions in electric rates. Here, however, the policy under which nuclear power is marketed becomes more important than the absolute reductions in the cost of producing electric energy, which would at best be slight. This would point to no modification in the general provisions of the present Atomic Energy Act, but rather to their implementation in terms of a program for Federal development of nuclear power.

In this connection, consideration should be given to the fact that, as in the case of development of hydroelectric power, fixed charges will probably constitute a larger proportion of the cost of nuclear power than of electric power produced from conventional fuels. Thus, Prof. Manson Benedict, of the Massachusetts Institute of Technology, in the March 9, 1953, issue of *Chemical and Engineering News*, points out that if nuclear fuel were obtained at no cost at all the allowable powerplant investment could not exceed \$258 per kilowatt of capacity to be competitive with \$158 per kilowatt plants using conventional fuels in Boston, Mass.

With the successful development of a breeding reactor, the fuel cost may be reduced to a negligible figure. But, according to Professor Benedict, the \$500 to \$600 per installed kilowatt, estimated by Dr. Donald Loughbridge, assistant director of the Atomic Energy Commission's Division of Reactor Development, as the cost of a nuclear powerplant using present-day techniques, would have to be cut in half before nuclear fuels could compete with coal in Boston, Mass.

On the other hand, with the investment cost of a nuclear plant brought down to \$258 per kilowatt of installed capacity, public financing would mean a saving of some \$8 per kilowatt-year as compared with private financing, assuming tax equality. With such a plant delivering electricity on a high-capacity-factor basis, this would mean a saving of somewhat over 1 mill per kilowatt-hour, or more than the possible reduction in fuel costs estimated by Phillip Sporn, president of the American Gas & Electric Co., as the possible contribution of atomic power.

The importance of keeping power costs down goes beyond the savings to consumers. It involves the future of our economy. As pointed out by the President's Materials Policy Commission, the central problem of electric energy is how to increase the Nation's supply $2\frac{1}{2}$ times during the next 25 years without running into considerably higher costs per unit. According to the Commission, shortages of electricity and rising real costs would impede economic growth and "could throttle national effort in the event of war." Savings in fixed charges, therefore, may become a matter of national interest.

PROPOSED CHANGES IN THE ACT PROMISE NO GREATER PROGRESS

Analysis of proposals to change the Atomic Energy Act, in the light of the history of the varying relationship of large corporate interests to technological progress, suggests that the real objective of the private power companies is to prevent the development of commercially feasible atomic power in Government built and operated plants, rather than to expedite the application of this new form of fire to commercial power production.

The private power industry is predominantly one of regulated monopoly with little, if any, profit incentive of the kind which stimulated the development of the automobile industry. Furthermore, there are powerful forces in the entire complex of the country's energy economy which might well oppose innovation so long as expanding sales of conventional fuels are exceedingly profitable. Thus, there is evidence of a definite tendency to slow down progress in the commercial production of oil from shale or the synthesis of oil and natural gas from coal.

In both of these fields the United States Bureau of Mines has brought pilot-work to the stage where private enterprise might readily take over. And

in these fields there are no such legislative obstacles to the entrance of such enterprise into the further development, as are allegedly holding back the development of nuclear power.

The significance of lack of progress in these fields is highlighted by the fact that, in terms of our entire energy economy, the synthetic production of oil and gas is probably of more immediate public interest than the application of atomic energy to the generation of industrial power. Today these fuels, representing only about 2 percent of the Nation's conventional mineral energy resources, are carrying more than 50 percent of the load. By any estimate, their remaining service lives are relatively short and dependence upon imports has serious implications in terms of national security.

Furthermore, natural-gas markets in the Northeast are demanding more gas from the Southwest faster than the big pipelines can expand their deliveries. Meanwhile, as a result of the rapid rise in field prices for this elite fuel, the cost of natural gas to distribution companies in the Northeast is reaching levels with which synthetic gas produced in the Appalachian coal fields might readily compete.

In spite of these seemingly favorable economic factors, it seems unlikely that private enterprise will press the development of any synthetic substitutes for oil or natural gas so long as the big oil interests have reserves to unload. This suggests that the Nation's great energy-industry complex may be more interested in delaying than in expediting the application of atomic energy to the field of power.

DESIRABILITY OF FEDERAL ASSISTANCE TO CONSUMER AGENCIES

The most important counterpoise to monopoly in the field of electric power is the opportunity for consumers of electricity, through their municipalities, public utility districts, or rural electric cooperatives, to undertake their own electric service. This can be demonstrated through a wide range of practical examples.

If the time ever arrives when such self-supply of power becomes technically or economically beyond the means of even relatively small consumer communities, the protection of the public interest in this vital field will be seriously weakened. Unless supplemented by this potential public competition, public utility regulation cannot cope with large power monopolies.

The policy of the Nation in this field should, therefore, include provision for participation by consumer groups along two lines:

(1) Federal assistance in the organization and financing of a joint municipal-cooperative experimental project for the development of commercially feasible applications of atomic energy to the development of commercial electric power.

(2) Atomic Energy Commission undertakings in various parts of the country for commercial development of nuclear power with a view, not only to the conquest of this new resource, but also to the continuing assurance of economical power supply to all municipalities, public power districts, or rural electric cooperatives.

To avoid discrimination in favor of private monopoly in the power field, it is essential that the Federal Government work out a sound basis for cooperation with the power agencies of State and local governments, as well as with rural electric cooperatives, along these lines.

The combined interest represented by existing public and cooperative electric systems, involves an investment of about \$5 billion, supplying some 9 million customers with about 50 billion kilowatt-hours a year. This is equivalent to about 5 times the Consolidated Edison System serving the New York metropolitan area, or 10 times the Detroit Edison, so far as investment is concerned. But it is so scattered as to require the Federal Government to provide the integration of effort needed to make possible the development of economically feasible nuclear power, as well as the integration of power supply for the regional galaxies of such nonprofit systems.

Such assistance to public and cooperative power systems has been the key to Federal power policy for nearly 50 years. It has centered around the development of the country's waterpower resources, which the conservation movement, as well as the law, have considered as resources of the people.

First, the 1906 Reclamation Act provided that power developed in connection with Federal irrigation projects should be marketed with a preference to public agencies. Next, the 1920 Federal Water Power Act, now part I of the Federal Power Act, provided that, in connection with any private application for a license to develop hydroelectric power, the Federal Government should have the first refusal to develop the site in question. Thereafter, if any State or municipality

applied for development of the site, it should have a preference over the private applicant.

There followed the Tennessee Valley Authority Act, the Fort Peck Act, the Bonneville Power Act, the Rural Electrification Act, and the Flood Control Act of 1944, all of which adopted the principle first established in the Reclamation Act of 1906, broadening it to include rural electric cooperatives with public electric systems as entitled to first claim to power supply from Federal river-basin projects. Federal development of power had, meanwhile, become one of the objectives in broader multiple-purpose river-basin programs which, in addition to irrigation, include soil conservation, forestry, flood control, navigation, pollution control, fish and wildlife management, and recreation.

The evolution of this policy furnishes a modern implementation of the acknowledged legal right of communities to public or cooperative electric service. But this implementation is unevenly distributed over the land, because certain regions are blessed with more ample waterpower resources than others. Federal development of commercially feasible nuclear power, within the general framework of Federal power policy, will make possible an equalization of the availability of power from Federal projects, as between the regions which have and those which have not opportunities for hydroelectric development on a scale sufficient to meet the requirements of public or cooperative electric systems.

There is another aspect of the problem of assuring consumer-owned power agencies real participation in the development of commercially feasible nuclear power. This involves the fact that the more economical nuclear power plants will be found to be relatively large in size.

In terms of the foreseeable future, it appears that the reactor unit of a nuclear power plant may cost approximately as much for a relatively small plant as for one of very large capacity. For the smaller municipal and rural cooperative electric systems to get the full benefits of low-cost nuclear power, therefore, it will be necessary for them to share in the supply furnished by a plant or interconnected plants which would be quite beyond their means or needs. This can be arranged only by Federal or State responsibility for the wholesale power supply, unless the municipal and cooperative electric systems are to be forced to depend upon competing private monopoly for their share of nuclear power.

ATOMIC ENERGY AS A RESOURCE OF THE PEOPLE

Atomic energy, as a resource for the generation of electric power and perhaps ultimately even more important uses, is available because of the greatest mobilization of scientific and industrial genius that has ever been brought to bear on a single aspect of the wonderful complex of forces that we call the universe. This mobilization was made possible and carried through as a tremendous investment project of the American people through their Federal Government.

The people of this country were entering a new investment field of a magnitude and complexity beyond the scope of any combination of enterprise acting under the rules of the private financial market. The people have already approved an investment totaling at least \$10 billion in this extraordinary resource-creating public enterprise.

It would, therefore, represent a betrayal of democracy to permit this new resource to be reduced to private possession. Like the flowing waters in our rivers and the waterpower potentialities associated therewith, it should remain a resource of the people, a part of the public domain, not to be permanently alienated in whole or in part. This means that the present provisions of the Atomic Energy Act, under which fissionable materials, new discoveries in the field of atomic development, and the basic elements in the industry are public property, should remain in effect. But it means more, for it requires the working out of provisions in harmony with existing waterpower law to safeguard the public interest in the best utilization of nuclear energy to produce electric power.

SOCIAL, POLITICAL, ECONOMIC, AND INTERNATIONAL EFFECTS

The Atomic Energy Commission is required by law to report to the President on the social, political, economic, and international effects of industrial use of atomic energy whenever such use has been developed to the point where it is of practical value.

In terms of the country's domestic economy, the effects of the use of nuclear power must be viewed in the light of two possible alternatives: (a) Its use to maintain the potentialities of public or cooperative competition as a supplement to regulation of private monopoly in the field of electric power; or (b) its use

by such private monopolies to strengthen their predominance and gradually eliminate the competitive force of municipal or cooperative power systems. The latter would involve the ultimate fostering of a colossus in the energy field which would be hardly compatible with the continuance of our democratic society.

In terms of the country's foreign policy, based as it is on continued friendship and cooperation with free peoples, the retention by the Government of control of the development of nuclear power on a commercially feasible basis could have tremendously important international effects. The contributions which this country can make to the efforts of other peoples to raise their living standards will be greatly facilitated if the Government has a proprietary interest in the development of nuclear power. This may well prove the most important thing we have to offer toward modernizing nations which are lacking in conventional energy resources.

Associate Director Robert Maynard Hutchins of the Ford Foundation has highlighted this point with the statement: "If it were not for the fact that the United States, which regards atomic energy as a weapon, is the center of research and development in the field, atomic energy might be coming to the rescue of countries that are poor in energy and that are unlikely to reach a satisfactory standard of living unless they can find new resources of it."

Hutchins mentions particularly India, as hardly likely to achieve industrialization on a large scale in the absence of discoveries of coal and oil or the exploitation of atomic energy, and many of the countries in Latin America must be reckoned in the list. Furthermore, Western Europe faces a particularly serious energy problem, as its better coal seams are mined out.

It is, therefore, of vast importance that a national policy covering the development of nuclear power include provision for the greatest flexibility in the use of this new energy resource as an instrument of foreign policy.

TOWARD ADEQUATE PUBLIC UNDERSTANDING

There is grave question whether there is sufficient public understanding of the issues involved to protect the public interest in a final determination of policy to govern the development and use of nuclear energy for industrial power. As pointed out by Oscar M. Ruebhausen, chairman of the New York Bar Association's committee on atomic energy in industry:

"There is today no substantial body of informed public opinion that can be drawn upon to formulate an atomic program for the future. There are, it is true, scattered throughout the country, both in the Government and out of it, groups of able men qualified to pass on atomic problems but *never in the history of our democracy have we been compelled to rely on so few to debate problems so vast*. There is a critical need for informed public thinking on these questions." [Italics mine.]

Either the Joint Committee on Atomic Energy or the Atomic Energy Commission might well sponsor a popularly presented objective effort to assure wide public understanding of the nature of atomic energy as a source of power, the various approaches to its use, the problems involved, the ultimate value of the new resource in economic terms, the relationship of atomic energy as a source of industrial power to the military aspects of the problem, the many ways in which the pioneer work in commercial use could go forward, and the possibilities of maintaining safeguards against monopolization of its advantages.

This effort to broaden public understanding might include, as Mr. Ruebhausen suggests, a new and determined move by the Atomic Energy Commission, without compromising military secrets, to declassify those facts which are essential to informed public judgment on a proper policy for full industrial use of atomic energy.

RECOMMENDATIONS

On the basis of the considerations outlined above, there are two broad conclusions as to the further development of Federal policy on industrial atomic-power development.

In the first place, there should be no general overhauling of the Atomic Energy Act until the wider dissemination of fundamental information on the subject, in popular form, has produced a better-informed public opinion. Meanwhile, the Act in its present form appears to safeguard the public interest, at the same time leaving the Atomic Energy Commission free to encourage desirable progress in the application of atomic energy to the production of commercial electric power

and to relax unnecessary restrictions on the release of information. No immediate amendment appears necessary.

In the second place, longer-range consideration of the more precise definition of policy concerning future use of atomic energy as a resource for power production should have as its objective the broadening of the Nation's present resources policy to cover this new public power resource. This might be accomplished by enacting a new part to the Atomic Energy Act, including some such provisions as the following:

(1) Declaration that atomic energy, including all fissionable materials, is a resource of the people of the United States, a part of the public domain, to be utilized in the public interest, and that ownership, possession, and control of this resource shall always remain vested in and inalienable to the people.

(2) Provision for Federal construction and operation of atomic powerplants (a) whenever requested by public, cooperative, or private electric systems, either singly or in combination, provided a sufficient market is shown to warrant such a project, or (b) where Federal development of such power would provide a basis for sound expansion of industry.

(3) Provision for marketing power from Federal atomic powerplants in such manner as to (a) encourage the most widespread use at the lowest possible rates consistent with sound business principles, (b) accord a preference to public bodies and cooperatives in the sale of the power, and (c) enable the marketing agency to build such transmission facilities as may be necessary to make the power and energy available in wholesale quantities on reasonable terms to public bodies, cooperatives, and privately owned companies.

(4) Provision for licensing non-Federal development of atomic power on a basis similar to the licensing of non-Federal development of waterpower, such provision to include: (a) Limited-term licenses, (b) opportunity for recapture at end of license period on a net-investment basis, (c) no capitalization of rights or patents, (d) profits over an agreed fair return to go into an amortization fund for reducing net investment, (e) uniform accounting on a cost basis, (f) preference to public and cooperative systems in obtaining licenses, (g) equality for public and cooperative electric systems in obtaining power from licensed atomic powerplants, with licensees obligated to expand capacity to the extent necessary to assure such equality, and (h) Federal regulation of power system so licensed, with authority to require interconnection and coordination after hearings.

(5) Provision for the planned contribution of the advantages of atomic power to economically underdeveloped nations, particularly to those lacking domestic-energy resources, on a basis of mutual assistance, not exploitation.

(6) Provision for broadening the field of the Atomic Energy Commission as a permanent resources-creating agency, with authority to finance, undertake, and direct great undertakings requiring the mobilization of the scientific and industrial power of the country for peacetime purposes.

BROADER OUTLOOK

The atomic age has opened at the critical moment when wars, with their omniverous appetite for materials, superimposed upon the vast expansion in the peacetime demands of so-called advanced nations, threaten the standards of living of these peoples and the hopes of other peoples to rise in the ladder of material civilization. The urgency of the situation is reflected in the report of the President's Materials Policy Commission, when it speaks of "soaring demands, shrinking resources, the consequent pressure toward rising real costs, the risk of wartime shortages, the ultimate threat of an arrest or decline in the standard of living which we cherish and hope to help others attain."

The Materials Policy Commission points out that, if all nations of the world should achieve the same standard of living as our own, the resulting world need for materials would increase to 6 times the already massive consumption. It states its conviction that the United States and other free nations must coordinate their resources to the ends of common growth, common safety, and common welfare.

Only as we maintain institutions corresponding with the new powers of the atomic age, institutions which transcend without superseding private enterprise, can we hope to meet this challenge. Such institutions, of which the Atomic Energy Commission is a prototype, will undertake great projects for the creation of new and inexhaustible resources which alone can assure the continuance of the tremendous resource-consuming structure reared by private enterprise. They will, at the same time, maintain control of the use of these new resources in order to assure equitable distribution to meet the needs of all peoples.

In these terms, I would respectfully urge the Joint Committee on Atomic Energy to give careful consideration to increasing, rather than diminishing, the utility of the Atomic Energy Commission as a publicly financed corporation, specifically empowered to carry forward the development of the atomic age in this broader peacetime field. It should be developed as one of the new instruments of democracy, combining the flexibility of the corporate form with the responsibility of Government in the field of large public investment. The objective should be the broader and more efficient use of the new resources opened up by progress in the nuclear field during the last 10 years in order to provide a more ample base for future expansion of private enterprise in the fields for which it is best adapted.

Respectfully submitted.

LELAND OLDS.

STATEMENT OF J. E. COATES, PRESIDENT, PATENT LAW ASSOCIATION OF LOS ANGELES,
JULY 30, 1953

The Patent Law Association of Los Angeles, through its legislative committee, has given careful consideration to the advisability of amending the patent provisions of the Atomic Energy Act of 1946. It is the recommendation of this association that the act be amended in several respects.

THE PATENT GRANT

The Congress deemed it advisable at the time the act was passed to prohibit patents for inventions usable solely in the production of fissionable material or the utilization of fissionable material or atomic energy for a military weapon. This view was on considerations of security for there was at that time no permanent legislation to prevent the issuance of patents affecting national security. Since that time the Invention Secrecy Act of 1951 (Public Law 256, 82d Cong.) has become a permanent law. That law provides for delay in the issuance of patents relating to matters affecting the national security and is adequate to prevent improper disclosures of inventions in the field of atomic energy.

The United States Patent Office has a special division for examining patent applications on classified subject-matter including those relating to atomic energy. Since the Invention Secrecy Act provides adequate security and the Patent Office is prepared to examine applications there no longer exists any valid reason for a prohibition against such patents which is contrary to the spirit of our basic patent law. This provision should be repealed so that those who are capable of making contributions in this field will have the incentive of the same reward for their efforts as may be obtained in other fields.

COMPULSORY LICENSING

The provision of the act which compels licensing in the commercial fields of atomic energy is contrary to the basic patent laws of the United States. Compulsory licensing has been advocated and enforced in many foreign countries, the only noticeable result being the discouragement of venture capital. The exclusive right of a patent justifies the private investor in taking the risk of commercial success. When the right is made nonexclusive and the field opened to copyists then the incentive disappears. Without the private investor the inventor has no prospect of financial backing and his incentive disappears.

The argument that the background knowledge resulting from research sponsored by the Government should not be used to create a private right is untenable. The atomic-energy field is the same as any other field in this regard for the inventor of an improvement in any field makes use of the background knowledge contributed by others. A patentee does not stake out a claim in the public domain but is merely given a right to exclude others from using the new invention made by him without his consent. When an inventor produces a new invention in the commercial field of atomic energy he should enjoy the same exclusive rights as any other inventor. This can be accomplished only by repeal of the compulsory licensing provisions of the act.

TITLE TO PATENTS

There is no need or justification for the provision of the act which empowers the Commission to requisition or condemn patents which it desires to administer.

Under the act of 1910 as amended (28 U. S. C. 1498) the Government has the right to use any patent upon payment of just compensation to the patent owner. Thus the Government is never hindered in the use of patents for governmental purposes. Any provision that goes beyond this is unnecessary and should be repealed.

PATENT RIGHTS OF CONTRACTORS

The military branches of the Government have a general policy in dealing with contractors who do research and development work of leaving with such contractors the title to inventions made by them, taking a nonexclusive license for governmental purposes. Such policy gives the Government all of the rights which it needs, at the same time giving to contractors the incentive to do such work on a low margin of profit. The needs of the Government with regard to atomic energy, particularly in the fields which are primarily commercial, are basically the same and would be satisfied by the same policy. It is believed that the Commission should adopt this same general policy rather than one of assuming complete control over the disposition of patent rights. As pointed out above, this latter policy merely results in discouraging private capital from the field, with the unfortunate result that public funds must continue to be used substantially exclusively to carry on the needed research.

CONCLUSION

Tremendous sums of money have necessarily been spent by the Government to accomplish the initial phases of atomic-energy research and development. The Invention Secrecy Act of 1951 now provides adequate security for the military phases of the work. To accomplish the maximum progress in the commercial fields of power production and utilization the act should now be amended to encourage private capital to take the same type of financial risk that it assumes in other fields. As private research and development increase, the need for the use of public funds in this field will proportionately decrease and the people of the United States will obtain the maximum benefit in industrial progress and national security.

PHILLIPS PETROLEUM Co.,
Bartlesville, Okla., July 10, 1953.

HON. W. STERLING COLE,
Chairman, Joint Committee on Atomic Energy,

Washington, D. C.

MY DEAR MR. COLE: We acknowledge your letter of July 2 addressed to our chairman, Mr. K. S. Adams, which was forwarded from our New York office to our operating office at Bartlesville. Mr. Adams is away on an extended trip, hence I am replying.

We appreciate very much the opportunity offered to discuss with you and the joint committee the problems relating to definition of a Federal policy on industrial atomic-power development. Some of our views have been transmitted to the joint committee through staff discussions.

In accord with your request we are attaching reproductions of pages 95 through 100, relating to industrial nuclear power, of IDO-16088, a nonclassified document dated March 23, 1953, entitled "Atomic Energy in Retrospect and Prospect," by R. L. Doan (manager, atomic energy division, Phillips Petroleum Co., Idaho Falls, Idaho).

I thank you for affording us the opportunity to appear before the joint committee.

Sincerely yours,

R. W. THOMAS,
Vice President.

ATOMIC ENERGY IN RETROSPECT AND PROSPECT

We now come to the "\$64 question," which has received wide public discussion during the past year or two in connection with the Atomic Energy Commission's so-called industrial participation program. The question may be stated somewhat as follows: "How soon, and under what conditions, can a feasible basis be found for the investment of private capital in a joint venture with the Government in the field of industrial nuclear power production?" The fact that such a venture must of necessity be a joint one with the Government at once presents the problem of the relative interests of the two parties in the plant investment,

the operating costs, and the manufactured product. In the particular case of nuclear power production, which requires the simultaneous production of fissionable material to make it even approximately competitive on an economic basis with conventional power, it is impossible to make an objective evaluation of economic feasibility without first defining the relative interests of the Government and the company. Depending on how much of the total cost the Government is willing to assume on the basis of its interest in plutonium, the nuclear power might be considered economic or uneconomic. However, this would be purely a matter of cost allocation. All of the plutonium produced to date has been made under the urgency of military objectives which must of necessity consider delivery schedules ahead of production costs. It is tempting, therefore, to say that if the Government will guarantee to buy the plutonium output of a dual-purpose nuclear power reactor at a price equal to present production costs, or will finance the building of the reactor and take over the processing of the irradiated nuclear fuel, an industrial concern might feel justified in financing the electrical part of the plant and get its profit through sale of the power. Either procedure might be considered "economic" so far as the power cost is concerned, as long as there is a real military need for the plutonium produced. But this is not the kind of economics upon which to launch a new industry.

Obviously if atomic energy had no military implications there would be no necessity for all of the present restrictions surrounding activity in this field and little need for extended discussion on the economics of nuclear power. Private companies who saw a chance to make a profit through the sale of uranium would go into the business of exploration and production. If engineering studies showed a favorable "payout" on nuclear powerplants through the sale of electrical power, plutonium, and other radioisotopes in a free and open market, the necessary capital for the venture would probably be forthcoming. On the other hand, if engineering and economic studies did not indicate a profit to be made commensurate with the risk involved, the arrival of the atomic age on the industrial scene would be delayed until such time as a favorable economic picture did develop, regardless of the spectacular nature of atomic energy itself. Somewhere down the line of Government-sponsored activity in atomic energy, when all military requirements are essentially fulfilled, the same "hard-rock" economic philosophy should come into play in Government financing of this activity. The only sound long-term basis for the development of a nuclear power industry is one in which the fissionable material used and produced is valued strictly on its worth as a commercial product. This would be higher than the fuel value alone, because of the byproduct value of the radioactive isotopes that could be produced, but it would be considerably lower than the present military value.

It is, of course, out of the question to talk about a free and open competitive development of atomic energy, for reasons familiar to everyone in this audience. Probably all of the present legal restrictions embodied in the Atomic Energy Act of 1946 are well justified on the grounds of national security and the public interest. Nevertheless, the nature of these restrictions presents a well-nigh insurmountable barrier to industrial participation in the development of nuclear power on a private capital basis. Changes in the present law that would alleviate some of these restrictions have been suggested by various persons, but none of these changes, nor any others likely to become possible in the foreseeable future, will alter the basic roadblocks to privately financed industrial progress in this field; namely, the fact that a single agency, the Government, controls all of the raw material, is the sole customer for the fissionable material which might otherwise constitute a major income-producing item, and makes most of the rules of operational procedure.

What, then, can be done in a situation where everyone recognizes the potential future benefits of nuclear power but the circumstances are such that private industry cannot go forward on its own? The obvious answer would appear to be that the Government itself, which holds all the cards, should do whatever going forward we all agree to be desirable, with industry participation either on a fee or plant-lease basis. The fee or terms of the lease could be set up in such a way as to provide a premium for top quality performance, thereby bringing incentive into play to cut down costs. This can be done more readily in a production or manufacturing operation than in one that is primarily experimental.

However, before undertaking to "go forward" in the field of nuclear power it would appear sensible to ask ourselves the question, "where are we going and why?" Neither the spectacular nature of atomic energy nor the fact that a lot of heat energy is being thrown away at all of our plutonium production reactors

in themselves constitute valid reasons for harnessing the power of the atom. If the value of the power to be recovered by installing heat exchangers and generators at Hanford or Savannah River is sufficient to justify the cost of the extra equipment, that is something that should be done. In fact, it would have considerable merit, in view of the large demand which atomic energy activities are making on the electrical generating capacity of the country. If, on the other hand, the installation of such equipment cannot be justified on economic grounds it should not be undertaken, unless the value of the resultant international prestige will make up the deficiency in payout.

This brings up a very important question which has not received the public attention it deserves. Its importance stems from the fact that, whereas it would automatically receive an economic answer if atomic energy could take its place in competitive industry, the possibility exists that because atomic energy must necessarily be a Government monopoly under present conditions, the development of nuclear power might be undertaken under political pressure rather than economic pressure. The question is this: "How urgent is it to get on with the development of nuclear power and how far should we as a nation go in building central station nuclear powerplants?" Undoubtedly the Atomic Energy Commission has been pondering this question for some time. Each of us will have his own opinion in this regard and there is probably no answer that would receive universal acclaim. My own feeling is that, because of the high probability that fissionable material can sooner or later be economically substituted for coal and oil in those specialized applications for which it is adapted, it is important that the Government undertake in the reasonably near future the development and construction of 2 or 3 distinctly different varieties of dual-purpose nuclear powerplants for the purpose of getting essential engineering, operating, and economic data that can only come from actual experience. These plants should be large enough, preferably 25,000 electrical kilowatts or more, so that the operating data will have some industrial significance. They should be located where the power can be utilized to the best advantage, and designed with proper regard for economy in construction and operating costs. But it should be accepted in advance that they are experimental plants built for the purpose of gaining experimental data which will have national usefulness in putting nuclear power to work whenever it becomes feasible to do so. Consequently the value of the information obtained should be considered as one of the principal commodities of these plants and should serve to compensate for the higher power costs that will almost certainly prevail in comparison to commercial rates in the same locality.

It is still much too early in the atomic age to make any reliable predictions as to the ultimate destiny of atomic energy in our economic society. Its destiny may be the complete and total destruction of our way of life. Being of a basically optimistic nature, however, I predict that nations will yet find a way of living peaceably with themselves short of the all-out use of atomic bombs, and that 10 years from now we will still be arguing what to do about fitting atomic energy into the industrial hierarchy.

PUBLIC UTILITIES COMMISSION,
STATE OF MAINE,
Augusta, July 20, 1953.

HON. W. STERLING COLE,
Chairman, Joint Committee on Atomic Energy,
Washington 25, D. C.

DEAR MR. COLE: Your letter of July 11 and I have apparently been playing musical chairs with each other around the State of Maine for the last week or so, but it finally caught up with me this afternoon.

It will be impossible for me to get away from my work as chairman of the State public-utilities commission in time to testify on the 22d, as you suggest. I will have some fairly strong views on getting atomic power into industrial hands. I have been away from the whole matter for well over a year and a half and doubt seriously whether any statement which I could prepare would be of real interest or help to the committee. However, if at a later date you think it would be helpful for me to appear in order to venture some suggestions and to participate in discussion, I will be glad to do so.

With kindest personal regards, I remain

Yours sincerely,

SUMNER T. PIKE, *Chairman.*

UNIVERSITY OF CALIFORNIA,
DEPARTMENT OF CHEMISTRY AND CHEMICAL ENGINEERING,
Berkeley 4, Calif., July 21, 1953.

Hon. W. STERLING COLE,
*Chairman, Joint Committee on Atomic Energy,
United States Congress, Washington, D. C.*

DEAR MR. COLE: I am happy to respond to your recent request for my views on desirable changes in atomic-power policy. May I first summarize very briefly my estimate of the general technological status of nuclear power:

1. Nuclear power is definitely feasible.
2. There is an adequate supply of nuclear fuel.
3. Although the relative economy of atomic power is not yet certain, general trends indicate that atomic power will become economical for a gradually increasing range of purposes and locations.

On this basis I conclude that it is unquestionably of advantage to the United States to develop atomic power promptly. The questions concern the best framework of policies. It is my opinion that the greatest progress and most satisfactory results will arise if atomic power is integrated into our present industrial and power economy as rapidly as is feasible. To promote this integration a number of policy changes are necessary. Some will require legislation; others may be attainable within present legislation if the Congress indicates a clear intent that the present provisions should be interpreted more liberally.

It is obvious that private ownership, subject to appropriate controls, of nuclear-power facilities and of fissionable material must be allowed. Also, it is clear that there should be reasonable private-patent rights. The more troublesome problems may arise in the areas of information policy and safety policy; yet I believe there are no basic difficulties here.

There should be a general separation of important atomic-weapon information from other presently classified atomic information. At one time there was an overlapping of weapon and reactor information. Without possible involvement in classified information, I cannot explain in detail the reasons, but I am convinced that it is now possible to segregate all really important weapon data from the reactor area. Our security of weapon data would be greatly improved if it were clearly segregated and if security clearances for the weapons area could be handled separately from other areas. The Commission should be given broad authority to handle reactor data as it deems best. I believe that a great body of presently classified reactor data might well be published. However, it should also be possible for reactor data to be handled at a low classification without the limitations now associated with atomic energy restricted data.

Safety policy must be made realistic. There has been a tendency to consider that any reactor mishap would lead to a major catastrophe with vast amounts of radioactivity spread over a broad area. Yet as experience increases we see that the actual operational failures have led to damage of an extremely local character if there was any damage at all. We want atomic power to be the safest type of power, but we do not want to see it impeded by arbitrary regulations. In particular there should not be a fixed-exclusion area regardless of the intrinsic safety of the reactor. The aim should be to place responsibility on the reactor builders and operators rather than upon some separate group.

It will be necessary for the Government to continue to support the basic research in the atomic-energy area at least until a large industry has developed. Traditionally, most basic research has been supported by universities or governments; hence this is no departure from normal practice. Also the public should realize that the major atomic-energy expenditures to date have been for weapons development and production. The level of expenditure for basic atomic-power research is substantial but is far smaller than the present weapons-production budgets. This program should include provision for experimental-reactor construction, because it is often faster and cheaper to test a novel type of reactor as a whole than to test all of its components separately.

While I have no brief to present in favor of combined power and plutonium production reactors, I would think it unfortunate if such proposals were arbitrarily excluded. The important matter is to get useful power producers into operation so that we may gain experience. We should keep ourselves free to choose the routes which may be expected to yield the greatest progress for the smallest cost.

Finally, I should like to emphasize that there are a multitude of types of power reactors. Also there are a wide variety of auxiliary devices which will improve reactor operation. We need not fear that private entry in this field will lead to

a monopoly based on patents on a particular design or type. Rather we need the freedom of private enterprise to make independent judgements as to the most promising types of reactors and to follow these judgements without the necessity of convincing a central authority that a particular selection was best. Also we need the incentives of competition to reduce the costs of reactor construction and operation.

You are to be congratulated for exploring this subject thoroughly at this time and I am sure that valuable policy changes will develop. If I can assist in any way please do not hesitate to call on me.

Yours very sincerely,

K. S. PITZER,
Dean, College of Chemistry.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY,
DEPARTMENT OF FOOD TECHNOLOGY,
Cambridge, Mass., July 31, 1953.

HON. W. STERLING COLE,
*Congress of the United States, Joint Committee on Atomic Energy,
Washington, D. C.*

MY DEAR CONGRESSMAN: Answering your inquiry of July 24 concerning any written comments I may wish to make on problems incident to the definition of a Federal policy on industrial atomic-power development, I thank you for your suggestion but I feel I have nothing to present at the moment which is pertinent. Thanking you again for your consideration.

Sincerely yours,

B. E. PROCTOR.

RADIOACTIVE PRODUCTS, INC.,
Detroit, Mich., July 31, 1953.

HON. W. STERLING COLE,
*Chairman, Joint Committee on Atomic Energy,
House of Representatives, Washington, D. C.*

DEAR CONGRESSMAN COLE: This will acknowledge the receipt of your letter of July 24 inviting such comments as we may have pertinent to the amendment of the Atomic Energy Act of 1946. I welcome this opportunity and am pleased to offer the following comments:

While the companies who are interested in the development of economic nuclear power are capably represented in respect to such amendment, I wish to speak in behalf of another segment of this industry which might be considered as a "fringe" or incidental activity to that of nuclear power production.

Specifically, I refer to companies such as Radioactive Products, Inc., who are engaged in the secondary distribution of radioactive isotopes and are engaged in the development of new applications of these materials to various industrial and other problems. These companies are, for the most part, quite new and small but are engaged in solving problems relating to most of the major industries of our country. Their work may well prove to be the key to the early development of economic nuclear power, although it is quite unlikely that their activities will ever justify the construction of a reactor for their purposes.

There are a number of aspects of the present Atomic Energy Act which seriously hinder the activities of these companies. As an example, I should like to review some of the difficulties which might be encountered by a company such as ours who wishes to evaluate and develop an application of byproduct materials involving extremely high radiation levels such as may be encountered in cold sterilization or the catalysis of a particular chemical reaction.

First, this investigator is unable to acquire information as to the materials that are potentially available from a large-sized operating reactor. Such information is generally available only to the personnel of contractors of the Atomic Energy Commission who have a specific need for this information in connection with that contract. If he is employed by one of the larger companies, on the other hand, his opportunities are much greater since it is quite likely that the large company will have an Atomic Energy Commission contract sufficiently pertinent that he can acquire this exploratory data. Let us suppose, however, that this investigator is able to acquire the necessary information, and determines that his proposed application may be feasible. He would like to purchase a fuel element recently removed from a reactor, or else to have an irradiation of

his own uranium sample made in one of the reactors. It is only by the broadest interpretation of the law (as I understand it) that such transfer is allowable. Were this broad interpretation made, however, and were he to receive the material or services requested, he would be immediately involved in a tremendously complicated and expensive procedure in accounting for every trace of the fissionable material which had passed into his hands. He would, further, be in possession of physical objects and information which would require extreme security measures. He would assume liabilities beyond any ordinary industrial practice for the perpetual safe handling of the materials that came into his possession. His distribution and use of these materials would henceforward be under the control of the Atomic Energy Commission. Certainly a consideration of this succession of difficulties would discourage the initiation of any but the most obvious likely applications.

Let us look specifically at the origins of these difficulties and offer suggestions which might alleviate:

1. Security

While we recognize fully that the information involved in the above investigation would touch upon significant reactor design parameters, operating characteristics and, possibly, even fissionable material production rates, this is equally true for those companies engaged in the study of nuclear power. The Commission has granted clearances to such groups who have undertaken very substantial study programs. There is, however, no ready mechanism by which a small company is able to secure such "study clearance" for qualified personnel wishing to undertake projects of a lesser magnitude.

2. Accountability

While the possession of even minute quantities of fissionable material would have been of immense value to our potential enemies at one time, this is hardly true today. We suggest, therefore, that reasonable amounts of these fissionable materials be available with no, or highly simplified, accountability procedures. If private industry should develop a nuclear power system, these materials will assume their true economic value in terms of their energy-producing potentiality. The accountability measures will then become inventory procedures which, according to commercial practice, will be of a complexity justifiable by the value of the material.

3. Control byproducts

The Atomic Energy Commission is now charged with the responsibility for the safe handling of byproduct materials. While there is no question of the fairness and reasonability with which they have administered this program, the legal implications of the purchase of such material today are far beyond the limits of reasonable business obligations. A secondary distributor of these materials assumes liabilities, it is my understanding, that he cannot pass on to other subsequent purchasers and users of these materials. While these restrictions on the use of byproduct materials are understandable in terms of the Atomic Energy Act of 1946, they were not (as with other aspects of the act) prepared with the thought of potential commercialization of this field.

4. Small companies

As indicated in section 1 above, but in a more general sense, we wish to urge that the potential importance of small companies who are engaged in the development of these many facets of this new industry be borne in mind, and their particular problems should be considered in the amendment of the Atomic Energy Act of 1946.

Very truly yours,

HOMER S. MYERS, *President.*

THE RAND CORP.,
Santa Monica, Calif., July 28, 1953.

Hon. W. STERLING COLE,

*Chairman, Joint Committee on Atomic Energy,
Congress of the United States, Washington, D. C.*

DEAR MR. COLE: We are honored to have you invite our comment on industrial atomic power development. The subject is not in our normal field of study; I regret, therefore, that we are unable to offer a useful comment.

We shall follow the results of your committee with a great deal of interest.

Sincerely,

F. R. COLLBOHM, *Director.*

ELECTRIC BOAT DIVISION,
GENERAL DYNAMICS CORP.,
Groton, Conn., August 7, 1953.

HON. W. STERLING COLE,

*Chairman, Joint Committee on Atomic Energy,
Congress of the United States, Washington, D. C.*

DEAR MR. COLE: This is in reply to your letter of July 13, inviting my written comments on some of the problems incident to definition of a Federal policy on industrial atomic power development. I am aware of much of the testimony presented before your committee and material published in the press on this subject and will attempt to avoid undue repetition. The points which follow, however, are ones which in my opinion merit special emphasis or the inclusion of which is necessary to keep the whole problem in better perspective.

I would like to risk the suggestion at the outset that concentration on the problem of industrial atomic power development may be an inadequate approach to the Nation's whole atomic-energy program. I believe the whole problem is to initiate and foster a transplantation of the AEC program from a condition of Government monopoly to a condition of normal free enterprise—to the extent compatible with national security—and without impairing progress in the prosecution of the AEC's current programs.

This is not to underrate the importance of industrial atomic power development but to emphasize that, the total potential of atomic energy is so great and so varied, there may well be other developments of equal or greater significance than the use of the atom for commercial power. Solid state physics and resulting synthetic metals and alloys may open up a whole new chapter in this mechanized age. Significant effects on the world's food supply may result from developments based on controlled application of photosynthesis. Medical applications may prove revolutionary. The transitions necessary to speed up and broaden progress on these varied fronts may require successive legislative steps and no one formula or panacea may be adequate.

In making such transitions without impairing current progress, the approach to the specific industrial atomic power development must not ignore the impact on the present and projected programs for nuclear propulsion. The naval nuclear propulsion program has made tremendous progress in a strikingly short time. The accomplishment to date warrants a hard look as to what made it possible. To my mind the answer, as it was in the case of the bomb, is the centralized control which has led and directed the efforts of several Government agencies and many industrial companies in a broad but coordinated program toward specific goals, spearheaded by leadership which knew what it wanted and when. A great portion of the accomplishment to date, and that to come, is directly applicable to the sought-for economic commercial atomic power. It would be a grave error to allow effort to level off or fall into confusion after the first achievement of significant useful power, as it did in the first years following the attainment of the Nation's first atomic bomb.

The team harnessed into the present nuclear propulsion program knows of many points in which significant improvement is possible and knows that this further progress is not dependent on legislative changes but only on continued support. Some of this further progress is dependent upon improvement of pieces—such special components as heat exchangers, new type pumps, and engineered valves—and many of the leading manufacturers of these special components that would be engaged in a commercial power program are already directing the full efforts of their specialists to these problems. The continued high rate of progress in this program, with its large degree of applicability to industrial power should not be interrupted or retarded by sudden and immediate diversification of effort coincident with implementation of the AEC proposed changes.

Desirable as it is for private industry to assimilate portions of the AEC program along traditional American patterns, the transition from Government monopoly to a system of free enterprise must take into account the following considerations:

1. That projects of substantial significance now under Government sponsorship not be sacrificed nor impaired. To allow disruption could not only jeopardize military goals but could also deter, rather than further, the future development of atomic power for peaceful purposes.

2. That the creation of rights in private industry to exploit the atom not result in a premature relaxation of Government's efforts in this field.

3. That the transition be effected without draining existing organizations already engaged in essential atomic work of key personnel.

These considerations require the continuance, without slackening of effort, of the current drive on immediate technical objectives. Even with respect to commercial atomic power, the greatest immediate progress, in my opinion, will come from building on knowledge already gained in the nuclear propulsion program, just as the lessons of other military developments have been applied to civilian commercial uses, such as the locomotive diesel which evolved from the marine diesel and the television industry which evolved from wartime radar.

It is apparent that many students of the problem feel that ways must be found soon to redirect the atomic-energy program into more normal channels; that as the Commission's industrial empire grows, the dangers of monopoly increase; that preoccupation with urgent military requirements may not result in balanced support of industrial programs; that the master-planning concept cannot be counted on to chart a wise course for industrial developments to the exclusion of the forces arising from the interplay of free enterprise and competition of ideas; that under a monopolistic management, Government may insinuate its influence into business life to an unwarranted degree. To my mind there is the added practical difficulty that the continued control and financing by a single Government agency, of a total program which is already passing in magnitude the total Federal Government operation prior to World War I will grow unwieldy and may grow sluggish and confused, if permitted to continue indefinitely.

How can the needed transition be set in motion without disrupting the present program? In my opinion, this can be accomplished only in stages and by studied steps after careful analysis of the impact of each proposed change on the overall program. Although fundamental changes in the law, such as the Commission has recommended, may be desirable to establish a proper framework, enactment of such a statute should not of itself be understood as congressional sanction for any specific course of action. This type of broad legislation may induce private industry to identify and seek its proper level as a rightful contender, but the passage of such legislation does not in itself provide the answer as to how the transition should be made.

The several types of legislative actions and their sequence requires a review and interpretation of the technical and economic and security position of any segment of the overall program under consideration. To that end, I suggest that the deliberations of both your committee and the Commission would be assisted by setting up under joint congressional-executive sponsorship a small but topflight group of persons familiar with the various facets of the problem. I suggest that such a task force consider the overall atomic-energy program but not attempt to produce a complete plan in any one study assignment. It would submit recommendations from time to time as it arrives at conclusions which it considers to be mature and thoroughly reasoned out. This group need not be limited to items requiring legislative revisions where it appears that a reexamination of present policy is indicated. Such an example may be a reconsideration of portions of the present "declassification guide." Sensitive as this subject is—and much as any relaxation in the guide needs critical examination by all concerned—a fundamental reappraisal may result in a high yield. I personally feel that higher fences around smaller areas make for better national security. There can hardly be a realistic approach to this problem on the part of the Commission as long as the apparent national policy is that all matters pertaining to the AEC program are restricted data.

This special panel could well apply itself to the following questions among others:

1. Considering the present status of the nuclear propulsion program and its anticipated developments in the next few years, should design and construction of a commercial powerplant be proceeded with now, either by the Government or by private industry? What would the impact of such a new program be on the nuclear propulsion program?

2. Should the establishment of normal industrial patterns be attempted now by allowing private ownership of fissionable materials and facilities for their production? Should ownership be extended to processes and facilities needed to separate and enrich fissionable material and to separate and recover or dispose of irradiated materials?

3. Is there an alternative or additional route to assimilation of the atomic program by industry by "decontrolling" segments of the program under the jurisdiction of the Atomic Energy Commission on a programmatic basis?

4. Are there advantages to be gained from transferring part of the Atomic Energy Commission program to other Government agencies? For example, should the quantity production of ordnance, after perfection and tests and approval of standard types, be transferred to Department of Defense? Should portions of the biology and medicine program be transferred to public-health services? Are there large portions of the general research program (not concerned with weapons) overdue for assumption by other public or private organizations?

5. To what extent can declassification of areas outside weapons and reactor technology be effected without impairing security?

6. To what extent should the patent provisions of the Atomic Energy Act and the Commission patent policy be revised?

7. To what further extent can private industry under a clear statement of Federal policy, perform enlarged research and development work and engage in the production and sale of components and facilities independent of the Commission and on its own initiative?

In summary, industrial atomic-power development is one piece of a broad problem. Action to broaden it must include practical consideration of the technical status and momentum of the significant allied propulsion and other AEC programs. Other equally important segments of the total AEC program may well require other forms of legislative or other action and other timing of that action. Although the current Commission recommendations represent a start, continued total progress and adequate consideration of other phases of the program well justify, during the transitional period, detailed study of proposed courses of action by a qualified panel representing all interests.

Sincerely yours,

CARLETON SHUGG.

SOUTH CAROLINA ELECTRIC & GAS CO.,
Columbia, S. C., August 7, 1953.

HON. STERLING COLE,

Chairman, Joint Committee on Atomic Energy,
Senate Office Building, Washington, D. C.

DEAR CHAIRMAN COLE: Thank you for your letters of July 24 and August 1 to Mr. S. C. McMeekin, president of this company. As Mr. McMeekin is currently out of the city, and an answer to your letters is necessary by August 10, I am taking the liberty of replying.

This company is very much interested in participating in the study of the feasibility of producing electrical power with nuclear fuels, and entering into certain phases of the work related thereto. We believe that changes in existing statutes necessary to permit such industrial participation should be made, and that a policy should be stated in favor of participation and development by private industry.

Also, of course, access would have to be made available on a classified basis to concepts and data which will contribute to a better understanding of this field.

We also wish to work with the staff of the Savannah River project on all possible phases of this work, due to the close proximity of this project, as well as the fact that we are furnishing them electrical power.

We appreciate very much your cooperation in this matter.

Very truly yours,

J. M. COSTELLO,
Executive Vice President.

AMERICAN GAS & ELECTRIC CO.,
New York, N. Y., August 7, 1953.

HON. W. STERLING COLE,

Chairman, Joint Committee on Atomic Energy,
Congress of the United States, Washington, D. C.

MY DEAR CHAIRMAN COLE: I appreciate your letter of July 24, 1953, inviting my comments in connection with your committee's current consideration of the problems incident to definition of a Federal policy on industrial atomic-power

development. I have been greatly impressed with the range and the depth of the hearings which your committee has just concluded on this subject and which I have followed as closely as possible without having available all the transcripts. I look forward to studying these hearings in detail as soon as they are published.

In the meantime, however, it seems clear to me that the committee has performed a most useful service in opening up these problems publicly and in securing such illuminating statements of the numerous points of view which characterize the thinking on this subject by representatives of Government and of private interests. In view of the character of the committee's hearings, I doubt that at this stage I could offer any comments that will materially add to the record.

However, for whatever it may be worth, I should like to describe the position of my company in regard to technological developments in general and atomic power in particular. Our record in relation to other technological developments is one of which I think we can be justly proud because of the advances in the art of generation, transmission and distribution of power to which, in collaboration with the manufacturers of equipment, we have contributed over the past quarter of a century. It is fair to say that our company has had a significant part in the remarkable improvement over this period in efficiency and, therefore, attainment of greater economies in the production of electric power by present methods, especially in coal-fired steam boilers. It is natural that one of our primary interests should have been in the improvement of the art of generating electric power with coal because the American Gas & Electric system is located in the heart of the Appalachian bituminous-coal territory. It is also for this reason that even if the more optimistic views as to development of atomic power should be realized, it would be a long time before such power could be competitive with electricity produced as efficiently as our is in an area like ours which is so favorably situated with respect to coal resources.

At the same time my colleagues and I have been actively engaged in studying the questions involved in atomic power ever since 1945. Our continuing studies convince us that the time is now ripe for vigorous efforts to perfect processes by which electric energy may be produced economically with nuclear reactors. And because as an electric utility we have responsibility for everything having to do with the production and distribution of power and in the improvement of the art with respect thereto, my company is not only vitally concerned with this subject but is prepared to devote currently a substantial amount of money and talent to developmental work in this field. We see no immediate prospect that we could attract or would be justified in expending capital in the amounts necessary to construct solely with private funds large-scale nuclear reactors immediately. For the immediate future, rather, we feel that our contribution should be and will be on a scale appropriate for research and developmental undertakings.

In this research and developmental work, in which we are already taking part in considerable measure and with expectation of expanding, we have been and expect to cooperate and collaborate with other concerns from our own industry and from other industries and with the Government.

There is every indication that if work is pushed it will bring us to the position where the prospect will open up for full-scale private development of commercial atomic power. To this end it will be helpful that Federal legislative and administrative policy be reshaped in such a fashion as to encourage and promote this eventuality, because it is clear, as your committee so pointedly summarized the situation in your release of July 31, that the climate of Federal legislative and administrative policy will have a significant bearing on realization of this goal.

As to the specifics of desirable redefinition of Federal legislative and administrative policy, which I realize is your committee's main concern, I should appreciate an opportunity to comment further after I have had the benefit of study of the published hearings.

Sincerely yours,

PHILIP SPORN, *President.*

STANDARD OIL DEVELOPMENT CO.,
New York, N. Y., August 7, 1953.

MR. STERLING COLE,

*Chairman of the Joint Committee on Atomic Energy,
Congress of the United States, Washington, D. C.*

DEAR MR. COLE: In accordance with your letter of July 24, I am writing to give my views on some of the problems incident to definition of a Federal policy on industrial atomic power development. The views which I am presenting are my personal views. The views of the General Advisory Committee of the Atomic Energy Commission, of which I am a member, have not yet been formulated in regard to this question.

Before presenting my views on changes in legislation which may aid in the industrial atomic power development, I would like to review what I feel the Atomic Energy Commission has accomplished in this direction, and the general economic background for atomic power as I understand it.

I feel that the Atomic Energy Commission has done an outstanding job in the utilization of atomic energy for improved military weapons and in producing the materials required for this purpose. This has been the main responsibility of the Atomic Energy Commission and is the field in which they have put the most emphasis. At the same time, through work financed by the Atomic Energy Commission, much information has been obtained to serve as background for the industrial application of atomic energy. This information has been utilized in the development of the atomic-powered submarine which is closely related to industrial atomic power. The successful operation of a pilot type of breeder reactor by the Atomic Energy Commission is also an important step in the development of industrial atomic power.

The production of industrial atomic power is closely related to the production of plutonium or other fissionable materials and the same general types of equipment are involved. Very likely in any industrial atomic power development plutonium would be produced as a byproduct. Partly as a consequence, the Commission has given serious consideration to industrial atomic power and has carried out numerous engineering studies and a good deal of experimental work directed to giving a suitable technical background for production of atomic power.

The studies of the possibilities of atomic power carried out by various industrial and utility companies have indicated that, based on present technology, electricity produced from atomic energy may be somewhat more expensive than electricity produced from normal fuels. It seems reasonable that with further advances in technology atomic energy may reach a competitive status with conventional fuels for production of industrial power and in the long run it is likely it will offer a cheap form of basic energy for this purpose. From the standpoint of overall national welfare, it seems unwise to have legislation standing in the way of normal development of the industrial application of atomic energy and from many standpoints the existing legislation does have this effect. Present legislation largely removes all normal incentives for private companies to spend their own money in work directed toward the industrial utilization of atomic power.

Research and experimental development leading to industrial atomic power can be handled in 1 of 3 ways. One way, which is the present way and is the one essentially set by present legislation, is for this research and experimental development to be handled entirely by the Atomic Energy Commission. As an alternative to this, with proper changes in legislation, such development of industrial atomic power could be handled with their own funds by such private companies as may be interested in this field and the Atomic Energy Commission could entirely drop out of the industrial atomic power development. A third procedure would be for both private companies and the Atomic Energy Commission to work independently with their own funds on the experimental development of atomic power and at the present time this would seem to be the best mode of procedure. For private companies to spend money in this development, as brought out above, however, changes in legislation are desirable. I would not favor the Atomic Energy Commission owning or operating large atomic powerplants except insofar as such facilities may be desirable for furnishing their own power needs.

The Atomic Energy Commission and its contractors have a large number of capable people who can further the development of atomic power and undoubtedly will do a good job in this direction. Groups of this kind, however, are supported entirely by Government funds and do not have a profit incentive to make

their work as effective as possible in the shortest possible time, and also have no competitive factors to spur them to the most economic and rapid solution to the problem. A proposal in a large group, such as that represented by the Atomic Energy Commission and its contractors, must necessarily be considered by central groups and decisions reached by central committees, and such a screening program quite often results in an undesirable compromise of views.

If legislation were changed to make it attractive for private industry to work on the development of industrial atomic power, the number of people considering various possibilities in atomic power would in time be greatly increased. These added people in private companies would be activated by an incentive for profit and by competition to push the development forward to a degree that does not exist in Government-financed groups. Such companies would also vary in objective. There is no real substitute for the progress that can be made by a lot of people thinking about a problem such as this and being allowed to spend their own money on what they think offers attractive possibilities. I feel the joint committee should give serious consideration to the possibility that other countries than the United States may make more rapid strides in the development of industrial atomic power due to the fact that they may not have the restrictive legislation that this country has, which in effect limits the work on industrial atomic power to that which is financed by the Government.

As pointed out above, I feel that more progress will be made on the development of industrial atomic power if private companies using their own funds take an active part in such development. It should be realized, however, at the start there may not be many companies who would be immediately attracted to this field and that some time may be lost if the Atomic Energy Commission does not continue work itself in the field of research and experimental development leading to industrial atomic power. For this reason I would favor changes in legislation which would make it attractive to private companies to participate in the development but at the same time I would not favor at this time the Atomic Energy Commission discontinuing its work in this field. I do feel, however, that the Atomic Energy Commission should from time to time adjust its efforts in the light of what private industry may be doing and as private industry takes a more active part in the program I would think the Atomic Energy Commission should be less active.

The Atomic Energy Commission has made certain proposals in regard to modification of existing legislation so as to permit ownership, use, and transfer of fissionable materials by private companies under license of the Atomic Energy Commission. It is my understanding that the proposed changes would still leave the Commission in absolute control of the transfer and disposition of fissionable and source material which I think is essential from a national security standpoint. These changes, along with the right of the Atomic Energy Commission to lease and sell fissionable material and source materials to private companies, are essential for the participation of private companies in the industrial atomic energy power development. These proposed changes may involve modification of sections 7 (b) and 7 (c) of the Atomic Energy Act. As the Atomic Energy Commission has indicated, it may be too early to submit the sort of report called for in section 7 (b). If legislation is enacted to allow licensing of private companies to own, use, and transfer fissionable materials, it would seem to me that there should be some revision in the conditions under which this is done, as now called for in section 7 (c) of the act. Conditions (1) and (2) of section 7 (c) dealing with the indicated useful purpose being commensurate with fissionable material requirements and with health and safety standards seem wise. I am afraid, however, that provision (3) of this subsection would have the effect of reducing competition among private companies. This condition (3) calls for licensees making available to the Atomic Energy Commission detailed information and data concerning their activities, with the thought it seems to me that the Commission may pass this information on to other licensees. I think that information obtained from a licensee should be held confidential by the Commission and not passed on to other licensees. The Commission should obtain detailed information on those phases of a licensee's work that are important from the standpoint of national security but only such additional information as may be required to determine if conditions (1) and (2) are met.

In order to insure that private companies will take an interest in atomic-power development, I feel that revision should be made in the patent section of the act as covered in section 11. I can see no real reason why patents should not be allowed on inventions that are solely directed to the production of fissionable materials or the use of such materials. I would think allowance of patents

in these fields would stimulate research and development by private companies and that patents in this field should be treated in the same way as patents in any other field, whether it concerns atomic energy or not.

Section 11 (c) of the act essentially calls for compulsory licensing of many patents utilizing fissionable materials or atomic energy. This compulsory licensing is at a royalty to be determined—in the first instance by the Atomic Energy Commission, and in the final instance by the courts. I cannot see where there is any real need for such a provision for compulsory licensing and it puts a great deal of power in the hands of the Atomic Energy Commission from the standpoint of fixing royalty rates. In my opinion, this provision of compulsory licensing will have the effect of discouraging, at least to some extent, private companies from entering the industrial atomic-energy field. Utilization of all other forms of energy up to the present have been successfully carried out without such restrictions on patents and it is difficult to see where they are particularly needed in the atomic-energy field. Actually, radiation energy may in the long run be a more important form of energy than atomic energy from an industrial standpoint and there are no such restrictive patent provisions in the radiation energy field. Section 11 (d) of the act gives the Atomic Energy Commission power to take, requisition, or condemn patents in the whole field of atomic energy. These powers are very broad and the possibility of their utilization may discourage private companies from going into the atomic-energy field. Here again it is hard to see why these powers are necessary.

The argument has been advanced that modifications of the patent provisions of the Atomic Energy Act, such as are discussed in this letter, would give an undue advantage to those companies or organizations who have worked closely with the Commission in the atomic-energy development through contracts with the Commission. Such companies would have some advantages over other companies due to the familiarity with what has been done and the fact they have trained personnel familiar with atomic-energy technology. This possible advantage to certain companies would, however, have to be weighed against the disadvantage of not having private companies participate, using their own funds, in the atomic-energy development. I would think that any patents based on inventions resulting from work financed by Government funds should be assigned in so far as they apply to the atomic-energy field, to the Government who, in turn, should dedicate the patents to the public. In addition, the past work and reports of the Atomic Energy Commission should be available as prior art for reference against patent applications in the atomic-energy field. The Atomic Energy Commission should act as a public representative to insure that patents are not granted covering inventions that have been made in the past in the course of the work financed by the Atomic Energy Commission. Provisions of this type would go a considerable way toward removing advantages companies might have due to their past close connection with the Atomic Energy Commission.

From the standpoint of the whole industrial atomic-energy development, it would be most helpful if the Atomic Energy Commission would declassify information dealing with the production and utilization of atomic energy for industrial power as rapidly as is consistent with national security. Most progress will be made in atomic-energy development with the broadest dissemination of existing knowledge.

Changes in legislation of the general type I have proposed would, I believe, be of long-range advantage to the Nation and will keep the Nation at the forefront in the development of industrial atomic power. The foremost consideration in any changes in the Atomic Energy Act should be national security. In my opinion, with proper control, active participation of private companies in the development of industrial atomic power will benefit national security.

Very truly yours,

E. V. MURPHREE, President.

UNIVERSITY OF CALIFORNIA,
RADIATION LABORATORY,
Livermore, Calif., July 23, 1953.

HON. STERLING COLE,

Chairman, Joint Committee on Atomic Energy,

Congress of the United States, Washington, D. C.

DEAR SIR: In response to your invitation to make a statement in connection with the development of atomic energy by private enterprise, I should like to discuss two topics concerning which I have some specific experience. These

are the safety of nuclear reactors and the connection between power production and military application.

Briefly, my opinion can be stated as follows: First, nuclear power-producing units will be dangerous instruments and careful thought will have to be given to their safe construction and operation and, second, there is a great and increasing need for fissionable materials in the military field.

I should like to recommend, first, that an advisory committee should be set up to review planned reactors and supervise functioning reactors under the control of private enterprise. Instead of setting up a new committee, the present Advisory Committee on Reactor Safeguards of the Atomic Energy Commission might serve this purpose; and second, that the Government stimulate power production by private enterprise by guaranteeing to buy militarily useful byproducts at a predetermined price and in limited but large quantities for a period of 5 or 10 years.

SAFETY OF NUCLEAR REACTORS

For the past 6 years I have served as the Chairman of the Reactor Safeguard Committee. Recently, this committee and the Industrial Committee on Reactor Location Problems have been merged into the Advisory Committee on Reactor Safeguards, and I am participating in the work of this new committee.

Up to the present time we have been extremely fortunate in that accidents in nuclear reactors have not caused any fatalities. With expanding applications of nuclear reactions and nuclear power, it cannot be expected that this unbroken record will be maintained. It must be realized that this good record was achieved to a considerable extent because of safety measures which have necessarily retarded development.

The main factors which influence reactor safety are, in my opinion, reasonably well understood. There have been in the past years a few minor incidents, all of which have been caused by neglect of clearly formulated safety rules. Such occasional accidents cannot be avoided. It is rather remarkable that they have occurred in such a small number of instances. I want to emphasize in particular that the operation of nuclear reactors is not mysterious and that the irregularities are no more unexpected than accidents which happen on account of disregard of traffic regulations.

In the popular opinion, the main danger of a nuclear pile, is due to the possibility that it may explode. It should be pointed out, however, that such an explosion, although possible, is likely to be harmful only in the immediate surroundings and will probably be limited in its destructive effects to the operators. A much greater public hazard is due to the fact that nuclear plants contain radioactive poisons. In a nuclear accident, these poisons may be liberated into the atmosphere or into the water supply. In fact, the radioactive poisons produced in a powerful nuclear reactor will retain a dangerous concentration even after they have been carried downwind to a distance of 10 miles. Some danger might possibly persist to distances as great as 100 miles. It would seem appropriate that Federal regulations should apply to a hazard which is not confined by State boundaries. The various committees dealing with reactor safety have come to the conclusion that none of the powerful reactors built or suggested up to the present time are absolutely safe. Though the possibility of an accident seems small, a release of the active products in a city or densely populated area would lead to disastrous results. It has been therefore the practice of these committees to recommend the observance of exclusion distances, that is, to exclude the public from areas around reactors, the size of the area varying in appropriate manner with the amount of radioactive poison that the reactor might release. Rigid enforcement of such exclusion distances might hamper future development of reactors to an unreasonable extent. In particular, the danger that a reactor might malfunction and release its radioactive poison differs for different kinds of reactors. It is my opinion that reactors of sufficiently safe types might be developed in the near future. Apart from the basic construction of the reactor, underground location or particularly thoughtfully constructed safety devices might be considered.

It is clear that no legislation will be able to stop future accidents and avoid completely occasional loss of life. It is my opinion that the unavoidable danger which will remain after all reasonable controls have been employed must not stand in the way of rapid development of nuclear power. It also would seem that proper legislation at the present time might make provisions for safe construction and safe operation of nuclear reactors. In case an accident should occur which involved the lives of many people, pressure for such legislation

would become overwhelming. Proper steps taken at the present time could reasonably prepare for accidents and minimize the suffering that is caused, when and if they should occur.

It would seem reasonable to extend the Atomic Energy Commission procedures on reviewing planned reactors and supervising functioning reactors to nuclear plants under the control of private enterprise. To what extent these functions should be advisory or regulatory is a difficult question. I feel that ultimate responsibility for safe operation will have to be placed on the shoulders of the men and the organization most closely connected with the construction and the operation of the reactor.

POWER PRODUCTION AND MILITARY APPLICATION

The first- and best-known military application of atomic energy was connected with strategic bombing. In the popular mind, such strategic bombing has been identified with the destruction of cities. The belief is widely held that a relatively limited number of atomic bombs cannot only cause terrifying destruction but would produce saturation, that is, only a limited number of atomic bombs would be needed. It is my conviction that this opinion is based on a misconception and that indeed a great stockpile of fissionable material could be usefully applied in warfare. Furthermore, it seems to me that a more general use of fission weapons will not result necessarily in a more thorough destruction of cities but might rather be used against military targets of the more conventional type. It seems to me, therefore, that a less expensive source of fissionable materials would be desirable. Such a less expensive source could be obtained if atomic reactors were constructed for the dual purpose of providing power and producing fissionable materials.

Strategic targets include industrial plants and military installations far behind the enemy's lines. Depending on the vulnerability of these targets and on their contribution to the enemy's war effort, one may well be justified in using atomic bombs against these targets. The size of the target need not be decisive and the number of such targets may be quite appreciable.

The possible tactical targets are even more numerous. Any concentration of fighting forces or of materiel near the fighting lines constitutes tactical targets. Strongly defended positions might be attacked by atomic bombs. Atomic weapons could be used against beachheads or against enemy forces attempting to cross a natural obstacle. Conversely, atomic weapons could be employed to prepare a landing on a beachhead or the attack of a parachute force. The vulnerability of naval vessels to atomic bombs has been demonstrated in the Bikini tests. Vehicles less expensive than naval units may present atomic-bomb targets, particularly if the cost of the bomb is lower than the cost of the vehicle which one attempts to destroy. An enemy bomber or even an enemy fighter plane might be considered as a possible target for an atomic bomb.

It might seem extravagant to use atom bombs for all these different types of targets. The question of extravagance or of sound economy must be considered, however, in connection with the ease of delivery, with the expense of delivery, and with the expense of the fissionable materials. In can think of no exception to the rule that the cost of delivery will be less if one produces a certain damage by atomic weapons rather than by more conventional means. It is therefore the cost of fissionable materials which will decide how extensively one can use atomic weapons in warfare. The more the cost of atomic weapons can be reduced, the greater will be the number of applications where relatively cheap delivery systems can replace the much more expensive conventional methods. Increase in our stockpile of fissionable materials may therefore reduce the military expenditure without reducing military potential.

It seems to be doubtful whether, on the basis of present technology, atomic energy can produce power in an economically profitable manner. Power production can, however, be conducted in such a manner as to produce militarily useful materials. It would seem to me reasonable to stimulate the construction of power-producing reactors by guaranteeing a price at which the Government will buy the militarily useful byproducts. This price should of course be set lower than the price at which the Atomic Energy Commission is producing fissionable materials at the present time. It probably will be necessary to set a limit to the amount of fissionable material which the Government is prepared to purchase and also to set a limit to the time during which such purchases will be made at the fixed

price. Nevertheless, it seems probable that if a fair price is guaranteed for a period like 5 or 10 years, this will be an effective stimulant to the Nation's atomic-power industry. This industry is likely to become a factor in national defense which may not be second even to the steel or aircraft industries.

The above contains the substance of the testimony which I have prepared for the joint congressional committee. I should like to express my very great regret that at the date set for the hearing it was completely impossible for me to leave Livermore. It would be a great pleasure to appear before the joint congressional committee at any time to amplify the above statements or else to help in any other way that you can think of.

Yours very truly,

EDWARD TELLER.

TRACERLAB, INC.,
Boston, Mass., August 11, 1953.

The Honorable W. STERLING COLE,
House of Representatives, Washington, D. C.

SIR: Your request of July 24 arrived when I was on the west coast, and I apologize for not acknowledging it until now.

Tracerlab's work incorporates the industrial and laboratory applications of radiosotopes and thus far has not been directly connected with the construction of reactors or nuclear power. While we have interest in pile instrumentation and the processing of fissionable materials, we are not at the present time directly promoting private financing, constructing, and operating reactors for the production of electrical energy.

For the management and directors of Tracerlab I can say that we endorse entirely the proposals by Mr. Gordon Dean to the meeting of Edison Electrical Institute on June 4, 1953, and Mr. Oscar M. Rubehausen of the Atomic Industry Forum to the Association of the Bar of the City of New York. The principal points in both of these talks are well known to you and to your committee, namely, the permission of private ownership of atomic facilities and fissionable material under AEC control, review of security provisions of the patent policies of the act to clarify and recognize private ownership of inventions and patents.

Very truly yours,

WILLIAM E. BARBOUR, Jr., *President.*

PRATT & WHITNEY AIRCRAFT DIVISION UNITED AIRCRAFT CORP.,
East Hartford 8, Conn., August 4, 1953.

HON. STERLING COLE,
Congress of the United States, Washington, D. C.

DEAR SENATOR COLE: This is in reply to your letter of July 22, asking us for our comments in connection with a Federal policy on industrial atomic-power development.

Our interest and concern at the present time is only in the application of atomic energy for the propulsion of aircraft for the military and we, therefore, do not believe we are in a position to make any recommendations. It is our opinion, however, that it will probably be a considerable time before there will be any other than a military use for this type of propulsion and we believe, therefore, formulation of a policy concerning it can probably wait until experience is obtained in industrial uses.

We are, however, concerned about the patent provisions of the present act and consider these to be unduly restrictive. In this regard, we concur in the recommendations of the National Association of Manufacturers committees on research and patents in respect to the desirability of amending the patent provisions of the act. The following are the basic recommendations:

"All patentable inventions relating to the field of atomic energy should be patentable by the inventor under the patent laws of the United States subject to the procedures followed on other items of national defense.

"That, in the contracts granted by the Government to private contractors, the patent clauses in such contracts should conform to the practice prevailing in the armed services procurement regulation for products of a nonatomic nature."

Sincerely yours,

W. P. GWINN, *General Manager.*

UNITED STATES PATENT OFFICE,
DEPARTMENT OF COMMERCE,
Washington, August 11, 1953.

Hon. STERLING COLE,
Chairman, Joint Committee on Atomic Energy,
Washington, D. C.

DEAR MR. COLE: I have not been unmindful of the fact that, in your letter of August 3, 1953, you expressed a desire to receive from me prior to the 10th of August an expression of my views regarding the patent aspects of the Atomic Energy Act of 1946. Naturally I am very greatly interested in those provisions of the Atomic Energy Act which you have now under consideration and which relate particularly to the handling of possibly patentable inventions which are developed during the course of the research and development work performed by or on behalf of the Atomic Energy Commission.

It is a fact, however, that neither the Patent Office as such, nor the Commissioner, can have an official view apart from that of the Department of Commerce of which the Patent Office comprises a part. The Department of Commerce has as yet taken no definite stand with respect to any proposed revision of the Atomic Energy Act. It is, however, working with other Government agencies toward the development of a plan which may be later incorporated in suggested legislation and there is little doubt that, in due course, you will be fully advised of any views which the Department, as such, may entertain.

It is probably appropriate for me to suggest to you at this time, however, that the Patent Bar took a very positive attitude of disapproval of the patent provisions of the Atomic Energy Act at the time that the bill which eventuated into the act was pending in the Senate and its counterpart was pending in the House of Representatives. The section of patent trademark and copyright law of the American Bar Association, after full consideration of the proposed bills, transmitted to the Atomic Energy Committee of the Senate, and to the House of Representatives, resolutions expressing fully the views of that section. For your information I attach a pamphlet containing the reports of the various committees of the patent section of the American Bar Association for the year 1946 and call your attention particularly to the resolution dealing with Senate bill S. 1717 which appears on page 80.

I also call your attention to the letter addressed to Congressman Boykin, then chairman of the Patents Committee of the House of Representatives, by the patent section of the American Bar Association, which letter was printed in the Congressional Record of July 17, 1946, appearing on page 9259 of that issue. In that letter the section of patent, trademark and copyright law set forth a proposed series of patent provisions which were considered by it to be entirely acceptable and to reflect the views of the Patent Bar. The House of Representatives adopted the patent provisions suggested in that letter but, in the following conference between representatives of House and Senate, the Senate views prevailed.

So far as I am aware the Patent Bar, as represented by the section of patent trademark and copyright law, has not changed the views on the subject since its presentation to the Congress of its original resolutions and suggestions in 1946. You may confirm this by making inquiry of the section through its secretary, Mr. Frank E. Foote, 201 North Braddock Avenue, Pittsburgh 8, Pa.

Sincerely yours,

ROBERT C. WATSON, *Commissioner.*

AMERICAN BAR ASSOCIATION,
July 15, 1946.

Hon. FRANK W. BOYKIN,
Chairman, Committee on Patents,
House of Representatives, Washington, D. C.

MY DEAR MR. BOYKIN: The section of patent, trademark, and copyright law of the American Bar Association of which I am the present chairman recently transmitted to the Committee on Military Affairs of the House of Representatives a resolution disapproving the principal patent provisions of the proposed Atomic Energy Act of 1946, S. 1717. While this bill has apparently not been referred to the Committee on Patents of the House of Representatives, of which you are chairman, it nevertheless seems to me to be appropriate to inform you of our views and to express the hope that the members of your committee as individuals may sympathize with the position which we have taken and express their views to others when the proposed act is under discussion on the floor of the House.

The resolution, which is quoted below, is applicable to the bill as it now stands since the patent provisions against which the resolution is directed have not as yet been changed.

Resolved, That the American Bar Association approves the principles of S. 1717 to establish a civilian commission for the control of atomic energy, its materials, material sources, production, and weapons, and the dissemination of information thereof for insuring national security; and further that the association disapproves the bill: (a) Insofar as it fails to provide for the review, in camera if necessary, by a constitutional court upon petition of an aggrieved party of any act, declaration, or failure to act of the Commission; and (b) furthermore disapproves the patent provisions of the bill: (1) Relating to compulsory licensing, and (2) to prohibiting the creation of patent property for certain subject matter."

This resolution of disapproval originated in the 23-member committee on patent law revision of our section, was approved by the section council of 10 additional practicing patent lawyers, and was submitted with the knowledge and approval of the board of governors of the American Bar Association.

There has just been directed to my attention a draft of a proposed amendment to the pending bill which, if adopted, will have the effect of wholly removing from the bill the patent provisions against which our resolution was directed and substituting therefor a series of new provisions dealing with inventions and patents. This proposed amendment follows:

"Pages 34, 35, 36, 37, 38, 39, 40: Cancel all of the patent provisions commencing with line 7 on page 34 down to and including line 18 on page 40 and substitute in lieu thereof the following:

"(a) the Commission is authorized to purchase for the manufacture or use by or for the United States Government, any and all rights in and to any invention or discovery, or application for patent or patent thereon, relating to research on or the production of fissionable material or atomic energy.

"(b) the Commission is authorized to condemn, and to determine and make just compensation for, any and all rights in and to any invention or discovery relating to research on or the production of fissionable materials or the utilization of fissionable materials or atomic energy that effects the national defense and security: *Provided, however*, That upon the determination by the Commission that the national defense or security is no longer involved, any and all rights in and to such invention or discovery shall revert to the owner, subject to a nonexclusive, irrevocable, and nontransferable license in favor of the Government.

"(c) When any person who has made an invention or discovery relating to research on or production of fissionable material, or the utilization of fissionable materials or atomic energy and shall have filed an application for a patent thereon and shall have tendered his invention or discovery to the Government of the United States for its use, he shall, if and when he ultimately receives a patent, have the rights to sue for compensation as provided for in this section, such rights to compensation to begin from the date of any use of the invention by the Government: *Provided*, That the Commission is authorized to enter into and effect an agreement with said applicant in full settlement and compromise for the use of his invention by the Government.

"(d) If any person is dissatisfied with a determination of the Commission as to just compensation, he may have his remedy by filing a suit in the United States District Court for the District of Columbia, if filed within 6 months after such determination; and such court, on notice to the Commission and other due procedures had, may thereupon determine the amount of compensation to be paid such person, as the facts in the case may appear: *Provided*, That in any such suit the United States may avail itself of any and all defenses, general and special, that might be pleaded by a defendant in an action for infringement, as set forth in title 50 of the Revised Statutes, or otherwise. Any final judgment rendered against the Commission under any provision of this section shall have like course and effect as a money judgment rendered against the United States by the Court of Claims any suit in respect of which the United States has expressly agreed to be sued; and the amount of any such final judgment shall be paid out of any appropriation applicable to the case, if any such there be; and when no such appropriation exists said judgment shall be paid in the same manner as judgments rendered by the Court of Claims in cases under its general jurisdiction.

"(e) Any party aggrieved by any final judgment in a proceeding under this section may appeal therefrom to the Court of Appeals of the District of Colum-

bia, and upon such appeal said courts shall have power to review said judgments and affirm, revoke, or modify the same as upon appeals in other action of law.

“(f) Attorneys appointed by the Commission may appear for and represent the Commission before any Government agency or judicial tribunal with respect to any and all invention, patent, and research matters in which the Commission is involved.

“(g) Any person who has made, or hereafter makes, any invention, or discovery utilizing fissionable materials or atomic energy designed or especially adapted for use as or in a military weapon, shall file with the Commission a report containing a complete description thereof. The report covering any such invention or discovery shall be filed on or before whichever of the following in the latest: (1) The sixtieth day after the date of enactment of this act; (2) the sixtieth day after completion of such invention or discovery; or (3) the sixtieth day after such person first discovers, or first has reason to believe that such invention or discovery is especially useful as or in such a weapon.”

The principal purpose of this letter is to state to you, on behalf of the section of patents, trade-marks, and copyright laws of the American Bar Association that the proposed amendment is, in my opinion, entirely consistent with the previously expressed views of our group and acceptable to it, and that, if the amendment is adopted, our resolution of disapproval of the patent provisions of the bill will no longer apply. The newly suggested patent clauses do not contain those provisions which we originally found to be objectionable, but nevertheless appear to amply protect the interest of the public and to insure the national safety while at the same time recognizing and preserving the rights of inventors, research groups, and those who bear the financial risk involved in the exploitation of new inventions, to the end that the advancement of the art of the utilization of atomic energy will not lag behind the advancement of other arts.

Respectfully,

ROBERT C. WATSON, *Chairman.*

VITRO CORPORATION OF AMERICA,
New York 7, N. Y., August 6, 1953.

HON. W. STERLING COLE,

*Chairman, Joint Committee on Atomic Energy,
Congress of the United States, Washington, D. C.*

DEAR MR. CONGRESSMAN: In accordance with your request of July 24, stating that you would appreciate any written comment that I may desire to present on the problems incident to definition of a Federal policy for industrial atomic-power development, and in further compliance with your request of August 1, that such comments be in your hands by August 10, I take pleasure in submitting the enclosed material for your consideration and use.

As requested, we believe the material submitted includes no security information of any sort.

You will note that we are submitting a special chart which I feel is essential to the presentation. If you find that there are any special reproduction problems involved in the inclusion of this chart, our staff here will cooperate with yours in the working out of details.

Your consideration and courtesy is gratefully acknowledged. In the event that additional comments on specific legislative revisions seem pertinent at a later date, we shall be happy to communicate with you again, as you suggest.

Sincerely yours,

J. CARLETON WARD, JR., *President.*

COMMENTS ON INDUSTRIAL ATOMIC POWER DEVELOPMENT

By J. Carleton Ward, Jr., president, the Vitro Manufacturing Co., Vitro Corporation of America, and Vitro Chemical Co.

Pursuant to a request by the Honorable Sterling Cole, chairman of the Joint Committee on Atomic Energy of the Congress of the United States, I am pleased to supply the following comments on the problems incident to definition of a Federal policy on industrial atomic power development.

In my opinion, the outstanding factors which make necessary the industrial development and establishment of atomic power units are two in number. First is the need for obtaining new and increased sources of power to sustain our constantly increasing industrial economy; and second is the necessity for finding, without delay, means of reducing the accelerated depletion of our natural resources.

The standard of living in the United States is, and has been, the highest in the world, and it is constantly growing greater. Support of this increasing standard of living is impossible without newer and greater power sources available for its sustenance, for this is a civilization based upon the utilization of power.

The parallel between the American standard of living and the power necessary to supply our economy is graphically illustrated by the accompanying chart, which shows the annual output of goods produced in the United States in each of the last 50 years, divided by the total population. In the same chart there is plotted the total power output for those same years, again divided by the population. (See reference.¹) These curves indicate that the increasing production of power is vitally necessary to the maintenance of our standard of living. In a highly civilized state the production of goods is a power-consuming process.

According to United States Census Bureau estimates, the population of the United States increases on the order of 3 percent a year at current rates. At the same time power demands on our utility systems increase between 7 and 8 percent per year. In other words, the power demand for our increasing economy has been doubling roughly every 10 years—thus in 1950 it was 8 times the 1920 level.

Our present power production is dependent upon the well-known resources which we have been tapping for many years, principally petroleum, gas, coal, and waterpower. We have been constantly depleting our oil, gas, and coal for many years. Geologists, who have been concerned with these natural resources, have made estimates which show that, allowing for undiscovered fuel beds in the Polar regions and under the seas, approximately one-sixteenth of our total resources, including other undiscovered areas, have been consumed since the invention of the steam engine, over 200 years ago.

The bulk of this depletion of our natural resources has occurred in very recent times, as will be seen from a reference to the power curve in the chart. Furthermore, this rate of consumption is increasing at an alarmingly rapid rate.

The Paley report of 1952² brings out the necessity for finding without delay new resources to supplement our increased use of, and rapid depletion of, our natural resources. This report, in volume 1 makes the following statement regarding depletion: "More coal, oil, and natural gas have been burned up in the past 50 years than in all previous history. It took nature over 500 million years to store in the ground these stockpiles of fossil fuels which civilization is now consuming in a flash of geologic time. The pressure of rising demand against the limits of known reserves and known technology presents the possibility of energy shortages and mounting real costs which could impair the Nation's economic growth and security. The remaining reserves of gas and oil that are known to exist in the United States are no match for the demands of the next 25 years."

It has been inferred from these, and similar considerations, that fuel costs will inevitably increase. In the oil industry constantly deeper wells are being drilled and increasingly more expensive recovery processes have had to be utilized to work the fields available. The inaccessibility of new fields is also a great factor in affecting costs of oil recovery.

In the case of coal, most of our easily mined low-cost fuel beds have already been worked, and, in spite of increasing mechanization, costs are steadily mounting. It is wise to look at the case of England, a historic coal producer, where at the present time coal seams are becoming narrower each year, mechanization is becoming more difficult, and costs are rising. From an exporter of more than a century and a half England is now becoming an importer of fuels. All this occurred in the latter years of our generation.

These considerations lead us inevitably to the conclusion that it is vitally

¹ Chart, United States Standard of Living versus United States Power Production, by Vitro Corp. of America. Source of statistics: Gross National Product in Billions of Constant 1951 Dollars by U. S. Department of Commerce. Total United States Power Production in Millions of Kilowatt-hours, by Edison Electrical Institute, New York. Total United States Population Estimates for July 1 of each year, by Bureau of Census, U. S. Department of Commerce. Scales of the chart have been adjusted so that the character of the two curves can be best compared.

² Resources for Freedom, by the President's Materials Policy Commission, June 1952, known as the Paley report. See vol. I, Foundations for Growth and Security and vol. III, The Outlook for Energy Sources.

necessary for us to develop new sources of energy. Unquestionably this means that we should use every resource within our knowledge and skill to develop the latent power available in atomic energy.

According to a McGraw-Hill survey,³ 13 countries throughout the world, in addition to the United States, "will possess 1 or more nuclear reactors within the next decade." The report states further that "shortage of conventional energy resources in these countries makes nuclear power very attractive," and that "regardless of the size of the countries, money is being found to exploit this field."

In general, these foreign reactors are of two types. The first is the small package reactor where power demands are not unduly large but where, for special reasons, power is required remote from efficient power sources. The second is the large power reactor for normal power distribution in industrial areas. Greater incentive for these reactors is found in many foreign countries because of the fact that current energy costs at the powerhouse switchboard are 2 to 3 times those for the United States.

Many statements have appeared in the public press lately to the effect that there is a considerable body of informed opinion that believes Great Britain will be the first nation to produce a practical reactor for power generation.

For the United States it is conceivable that stationary power reactors may be needed in both of the types mentioned. The small package reactor may be of considerable interest to us for remote installations such as in the large operating bases in the Arctic area. Large reactors are needed for the public-utility type powerplants and conceivably can be designed to supplement our present power-generation systems. In the latter case our stakes are very high. So it behooves us, as the greatest power-generating nation in the world, not to allow ourselves to get behind in the international race for industrial power from the atom.

The American economic system, well established as it is in a highly competitive atmosphere, has shown that whenever its competitive system is properly harnessed, it emerges to make us a leader among nations.

Two possibilities present themselves for exploitation of atomic energy by our economic system. The first, and in my opinion the preferable one, without question, is to encourage the many competent industrial technical teams that have shown a desire, through the use of their own financial resources in making nuclear-energy studies, to attempt the building of privately financed and operated power units. These attempts, unfortunately, cannot get beyond the study phase under the Atomic Energy Act of 1946, now the law of the land.

The alternative is for the Government either to attempt to design for itself, or to let a contract to a selected contractor to design for it, a typical pilot station. It seems obvious that the first possibility is more along the lines of our past successful economic history than the latter. In the absence of political considerations this would be the way in which our economy would normally go about solving the problem.

It has been said that science has not yet worked out all the data needed to design and build such atomic powerplants. In my opinion this is not a valid premise. In any new field of applied science a solution is best reached by a practical attempt to reduce a theory to practice. This is the essential character of the engineering approach as contrasted to the scientific approach. Engineering is an art and can best be described as the process of utilizing science and applying it to desirable economic objectives. Time and again new fields of science have been harnessed because of the orientation and stimulation given by an attempt to work out an engineering solution for their application. Thus, this is a complex in which science challenges engineering for application to new fields of economic usefulness for the betterment of mankind. Likewise, engineering challenges science to supply it with areas of basic information from which engineering results of economic value will be realized.

On this general theory a competitive solution for practical power generation from atomic energy will best be attained by engineering attempts carried out by organizations and men who, challenged by this opportunity, are willing to devote of their own volition their resources and their capabilities for the solution of this problem. By utilizing the principle of competitive private efforts for the design of an atomic powerplant, as compared with a direct Government-sponsored approach, the United States will avoid a doctrinaire solution which

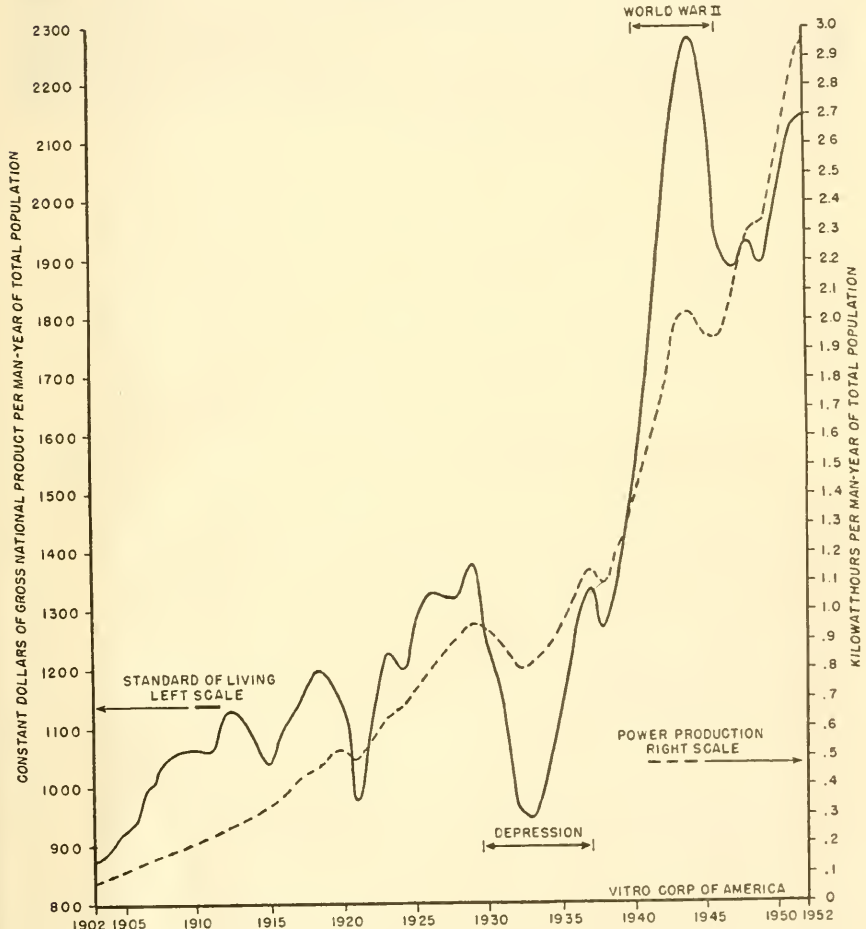
³ McGraw-Hill World News Survey in Nucleonics for December 1952, pp. 7-15.

in such a new field would be much less likely to bring about the optimum economic result. In dealing with such a complex problem as that of a successful atomic powerplant there is an obvious advantage to independent efforts for formulating solutions over the totalitarian approach, irrespective of the magnitude of the resources behind the latter.

I believe that this is the position in which the country now finds itself with respect to the problem of public power from atomic energy, and that it can be best solved by utilizing the competitive forces within our economy that are now offering to solve this challenging problem. Believing that this conclusion is warranted, then it follows that fundamental changes in the Atomic Energy Act of 1946 will have to be made to make such efforts possible.

— Already time is running out.

**U.S. STANDARD OF LIVING
VS.
U.S. POWER PRODUCTION**



SOURCES

- "GROSS NATIONAL PRODUCT" IN CONSTANT 1951 DOLLARS, BY U.S. DEPT. OF COMMERCE
- "POWER GENERATION" BY EDISON ELECTRIC INSTITUTE, NEW YORK
- "U. S. POPULATION" BY BUREAU OF THE CENSUS, DEPT OF COMMERCE

EXCERPT FROM TESTIMONY BEFORE THE HOUSE WAYS AND MEANS COMMITTEE ON AUGUST 13, 1953, REVISED AND SUBMITTED BY BEARDSLEY RUMI ON AUGUST 14, 1953

Few would dispute the businesslike principle that revenue-producing assets should be capitalized, and that the benefits realized from these assets should be paid for as they are consumed. The financing of authorities on a self-financing basis will necessitate a rate structure appropriate to the costs. There is no logic in forcing this year's taxpayer to pay for benefits to go without cost to future taxpayers for years to come.

Certain authorities might receive currently by lease or by contract from the appropriate department of the Federal or local government the revenues necessary to cover costs of operation and annual financial charges for interest and amortization. Investment in atomic energy plants for the production of plutonium could properly be included in the latter class of authorities. The Defense Department buys oil on a contract basis; why shouldn't it buy plutonium?

The question will occur to many, Where will the money come from to pay for the capital items to be excluded from the budget and for the investment needs of the various authorities? The answer is that the money will come from the same sources as it comes from today, that is, as borrowings from commercial banks, savings institutions, and the public. The difference would be that the borrowings would be associated in general, and in many cases specifically, with recognized capital investments.

INDEX

1. Byproducts, sale of, fissionable material, waste products, electricity:		Page
Biemiller, Andrew J	-----	483
Brownell, L. E	-----	595
Bugher, John C	-----	34
Cisler, Walker L	----- 137, 138, 156, 169	169
Cole, Sterling	-----	186
Dean, Gordon	----- 7, 42, 48	48
Ellis, Clyde T	-----	366
Ferguson, Malcom P	-----	403
Gale, Willis	-----	207
Hickenlooper, Bourke B	-----	366
Holifield, Chet	----- 42, 47, 48, 156, 179, 181, 187, 201, 210,	234
Lilienthal, David E	-----	605
Loughlin, Eugene S	-----	583
McAfee, J. W	-----	190
Mills, Earle W	-----	193
Myers, Homer S	-----	625
Neumann, John B	-----	612
Pitzer, Kenneth S	-----	623
Putzell, Edwin J	----- 174, 177,	183
Sigal, Benjamin C	----- 493,	495
Sporn, Philip	-----	493
Strauss, Lewis L	----- 563,	565
Teller, Edward L	-----	634
Weil, George L	-----	355
Wigner, Eugene P	-----	318
Zinn, Walter H	----- 221, 225,	234
2. Economics of Design, Construction, and Operation of Atomic Power-plants:		
Adams, Francis L	-----	122
Atwood, J. Lee	----- 326,	334
Biemiller, Andrew J	-----	483
Cisler, Walker L	----- 136, 138, 163,	167
Cohen, Karl	-----	260
Cole, Sterling	----- 111,	127
Dean, Gordon	----- 5, 6, 10, 41,	53
Doan, R. L	-----	621
Doty, Dale E	----- 119, 122, 127, 128, 129,	130
Durham, Carl T	----- 109, 119, 120, 121, 129,	130
Ellis, Clyde T	-----	360
Ferguson, Malcolm P	-----	402
Fermi, Enrico	-----	601
Gale, Willis	----- 207,	208
Hafstad, Dr. Lawrence R	-----	15, 17
Hickenlooper, Bourke B	-----	360
Holifield, Chet	----- 127, 130, 177, 187,	368
Iddles, Alfred	-----	384
Kingston, Walter E	-----	535
Loughlin, Eugene S	-----	582
Malone, George W	-----	451
McAfee, J. W	-----	189
McCune, F. K	-----	305
Mills, Earle W	----- 193,	195
Murphree, E. V	-----	630
Olds, Leland	-----	614
Patterson, James T	-----	126

	Page
2. Economics of Design, Construction, and Operation of Atomic Power-plants—Continued	
Price, Melvin	53, 227
Putzell, Edwin J	175, 176, 177, 186, 187
Sporn, Philip	493, 629
Starr, Dr. Chauncey	248, 254
Van Zandt, James E	122, 236
Weaver, Charles H	288
Weil, George L	346, 352, 356
Weinberg, Alvin M	241, 243
Williams, Walter	110, 111
Zinn, Walter H	221, 227, 236, 238
3. Foreign development of atomic powerplants:	
Beckerley, James G	40
Benedict, Mason	586
Blum, Robert	588
Cole, Sterling	4
Dean, Gordon	6
Fermi, Enrico	601
Halstad, Lawrence H	23
Mills, Earle W	195
Price, Melvin	238
Putzell, Edwin J	175
Smith, Walter Bedell	63, 67, 68
Ward, J. Carleton, Jr	639
Zinn, Walter H	222
4. Military needs for weapons, propulsion systems, and power:	
Benedict, Manson	586
Blum, Robert	587
Cisler, Walker L	139, 169
Cole, Sterling	4, 71, 128
Dean, Gordon	12
Doty, Dale E	115, 126
Gillespie, Tyrone	154
Hinshaw, Carl	81
Holifield, Chet	126
LeBaron, Robert	71
McKay, Douglas	98
Menke, John R	275
Shugg, Carleton	626
Teller, Edward	634
Weaver, Charles H	284
5. Ownership of raw materials et al., including plants:	
Atwood, J. Lee	326
Aydellott, J. H	582
Barbour, William E., Jr	635
Brown, Arnold K	315
Cisler, Walker L	138, 157, 159
Cohen, Karl	264
Cole, Sterling	93, 204, 388, 410, 531
Dean, Gordon	6, 24, 47, 49
Dixon, Edgar H	435, 437
Doty, Dale E	117
Ellis, Clyde T	365
Ferguson, Malcolm P	410
Ford, John Anson	611
Hafstad, Lawrence R	24
Hickenlooper, Bourke B	85
Holifield, Chet	47, 48, 157, 306, 389, 437, 511, 538
Iddles, Alfred	378, 388
Kingston, Walter E	528, 531
Lilienthal, David E	604
Loughlin, Eugene S	583
McCune, F. K	306, 602
Menke, John R	274
Miles, Clarence R	597
Mills, Earle W	195, 205

5. Ownership of raw materials et al., including plants—Continued	Page
Morse, R. H., Jr.....	601
Olds, Leland.....	614
Pastore, John O.....	25
Pigott, R. J. S.....	546
Pitzer, Kenneth S.....	623
Putzell, Edwin J.....	174
Rabi, I. I.....	92
Raleigh, Walter.....	417
Rowley, Edward R.....	390
Ruebhausen, Oscar M.....	476
Slugg, Carlton.....	626
Sigal, Benjamin C.....	488, 496
Smith, Walter Bedell.....	64, 66
Strauss, Lewis L.....	564
Suits, C. G.....	505, 511
Swisher, Elwood D.....	500
Walker, Eric.....	538
Weinberg, Alvin M.....	243
6. Patents on public, private, and joint developments:	
Atwood, J. Lee.....	325, 331
Barbour, William E., Jr.....	635
Beckerley, J. G.....	39
Benedict, Mason.....	587
Biemiller, Andrew J.....	482
Bolster, Calvin M.....	555
Braun, C. R.....	342
Bricker, John W.....	187, 312
Brown, Arnold K.....	315
Brownell, L. E.....	596
Cisler, Walker L.....	139, 140, 153, 169
Coates, J. E.....	619
Cohen, Karl.....	264
Cole, Sterling.....	93, 185, 200, 202, 296, 297, 310, 331, 332, 340, 342, 351, 385, 406, 430, 518, 533, 567
Davidson, W. L.....	29
Davis, Chester L.....	598
Dean, Gordon.....	7, 45, 52
Dixon, Edgar H.....	436, 437
Durham, Carl T.....	110
Ferguson, Malcolm P.....	405, 407
Gale, Willis.....	210
Gillespie, Tyrone.....	154, 158
Gwinn, W. P.....	635
Hayes, Willard C.....	580
Hickenlooper, Bourke B.....	24, 85, 88, 566
Holfield, Chet.....	42, 45, 52, 89, 94, 101, 110, 153, 181, 184, 201, 233, 257, 273, 289, 308, 380, 381, 389, 392, 419, 437, 460, 512, 514, 520, 533
Hootman, James A.....	549
Hyland, L. A.....	407
Iddles, Alfred.....	379, 380, 381, 386, 389
Kingston, Walter E.....	528, 533
McAfee, J. W.....	190
McCune, F. K.....	303, 308, 313
McKay, Douglas.....	99
Menke, John R.....	274
Mills, Earle W.....	196, 200
Morris, Samuel B.....	423, 428, 430
Murphree, E. V.....	631
Ooms, Casper.....	457
Pastore, John O.....	87, 99, 181, 188, 296, 418, 467
Patterson, James T.....	158
Pigott, J. S.....	546
Price, Gwilym A.....	296
Price, Melvin.....	394, 428
Putzell, Edwin J.....	174, 175, 181, 185, 188
Rabi, I. I.....	84, 87, 93, 95

	Page
6. Patents on public, private, and joint developments—Continued	
Raleigh, Walter	417, 420
Rowley, Edward R	391, 392, 394
Sigal, Benjamin C	491, 495
Steiger, William A	507, 514, 515, 518
Strauss, Lewis L	564
Suits, C. G	506, 512, 523
Van Zandt, James E	203
Walker, Eric	540
Watson, Robert C	636
Weaver, Charles H	284
Weil, George L	349, 351
Williams, Walter	110
Wilson, Charles S	578
Zinn, Walter H	227, 233
7. Public investment, protection of:	
Biemiller, Andrew J	480
Cisler, Walker L	140, 164, 169, 170
Cohen, Karl	262, 263
Cole, Sterling	3, 100, 553
Doty, Dale E	117
Ellis, Clyde T	362, 364
Ferguson, Malcolm P	410
Gillespie, Tyrone	155
Hayes, Willard C	580
Hickenlooper, Bourke B	339
Holifield, Chet	49, 102, 117, 153, 154, 164, 165, 209, 309, 381, 385, 512, 532
Iddles, Alfred	381
Kingston, Walter E	532
McKay, Douglas	100
Menke, John R	274
Morris, Samuel B	423
Murphree, E. V	632
Olds, Leland	614
Pastore, John O	181, 417
Putzell, Edwin J	173, 181
Raleigh, Walter	417
Sigal, Benjamin C	496
Suits, C. G	512, 522
Swisher, Elwood D	500
Voorhis, Jerry	373
8. Purpose of hearings on atomic power development:	
Cole, Sterling	2, 12
Dean, Gordon	8
Holifield, Chet	181
McCune, F. K	302
Menke, John R	275
Price, Melvin	517
Weil, George L	346
Zinn, Walter H	221
9. Research and development, who should do it:	
Atwood, J. Lee	329, 334
Benedict, Mason	586
Biemiller, Andrew J	480
Blum, Robert	588, 589
Brown, Arnold K	314
Brownell, L. E	595
Cisler, Walker L	135, 136, 138, 141, 161, 167, 170
Cohen, Karl	259, 260
Cole, Sterling	92, 94, 96, 99, 100, 103, 127, 330, 334, 355, 431
Dean, Gordon	6, 8, 50
Dixon, Edgar H	434
Doty, Dale E	115, 127
Ellis, Clyde T	367
Ferguson, Malcolm P	401, 406, 409
Fermi, Enrico	601
Ford, John Anson	611

9. Research and development, who should do it—Continued	Page
Gale, Willis.....	207, 209
Greenwalt, C. H.....	599
Hafstad, Lawrence R.....	22
Haskell, Broderick.....	598
Hickenlooper, Bourke B.....	159, 339
Hinshaw, Carl.....	81
Holifield, Chet.....	79, 95, 255, 287, 368, 380, 382, 425, 429
Iddles, Alfred.....	378
Jenkins, Thomas A.....	228, 257
Kingston, Walter E.....	528
LeBaron, Robert.....	76, 79
Lilienthal, David E.....	605, 610
McCune, F. K.....	302, 305
McKay, Douglas.....	99, 100, 104
Malone, George W.....	450
Menke, John R.....	275
Miles, Clarence R.....	597
Mills, Earle W.....	193, 196
Morris, Samuel B.....	421, 425, 429, 431
Morse, R. H., Jr.....	600
Murphree, E. V.....	630
Olds, Leland.....	614
Pastore, John O.....	87, 99, 161, 296, 298, 391
Patterson, James T.....	419
Price, Gwilym A.....	296
Price, Melvin.....	76, 80, 238, 246, 255, 393, 428, 517
Putzell, Edwin J.....	171, 174, 175
Rabi, I. I.....	84, 87, 92, 93, 96
Raleigh, Walter.....	417
Rowley, Edward R.....	393
Reubhausen, Oscar M.....	474, 476
Shugg, Carleton.....	626
Sigal, Benjamin C.....	491, 494, 498
Smith, Walter Bedell.....	64
Sporn, Philip.....	629
Starr, Chauncey.....	250, 252, 255, 257
Stevenson, R. S.....	338
Strauss, Lewis L.....	564
Suits, C. G.....	505, 517
Swisher, Elwood D.....	502
Van Zandt, James E.....	351
Walker, Eric.....	543
Ward, J. Carleton, Jr.....	640
Weaver, Charles H.....	278, 287, 298
Weil, George L.....	348, 351, 354
Weinberg, Alvin M.....	241, 242, 244, 246
Wigner, Eugene P.....	317, 320
Williams, Walter.....	105, 108
Zinn, Walter H.....	226, 228
 10. Safety of plants, operators, and surrounding areas:	
Beckerley, James G.....	37
Bugher, John C.....	30
Cisler, Walker L.....	139, 163
Dean, Gordon.....	7
Ferguson, Malcolm P.....	404
Hafstad, Lawrence R.....	16
Holifield, Chet.....	235
Menke, John R.....	275
Mills, Earle W.....	196
Pigott, R. J. S.....	546
Price, Melvin.....	230
Putzell, Edwin J.....	172
Teller, Dr. Edward L.....	633
Zinn, Walter H.....	230, 235

	Page
11. Section 7 (b) of the Atomic Energy Act of 1946:	
Biemiller, Andrew J.....	481, 486
Dean, Gordon.....	6, 7, 8, 43
Doty, Dale E.....	120
Ellis, Clyde T.....	363
Holifield, Chet.....	43, 120, 486, 566
Murphree, E. V.....	631
Sigal, Benjamin C.....	489, 491
Strauss, Lewis L.....	564
12. Security of personnel, plants, and materials:	
Beckerly, James G.....	36
Benedict, Manson.....	586
Biemiller, Andrew J.....	483
Cisler, Walker L.....	135, 170
Cole, Sterling.....	2, 17, 103, 387, 396
Davidson, W. L.....	29
Dean, Gordon.....	7
Doty, Dale E.....	116, 129
Ferguson, Malcolm P.....	404
Fermi, Enrico.....	601
Hafstad, Lawrence R.....	23
Hickenlooper, Bourke B.....	85, 339
Holifield, Chet.....	289, 307, 308, 389, 465, 473, 514, 538
Iddles, Alfred.....	387, 389
Lilienthal, David E.....	603, 605
Malone, George W.....	456
McCune, F. K.....	303, 307, 309
McKay, Douglas.....	103
Menke, John R.....	274
Mills, Earle W.....	205
Morris, Samuel B.....	424
Murphree, E. V.....	632
Myers, Homer S.....	624
Ooms, Casper.....	465
Pigott, R. J. S.....	546
Pitzer, K. S.....	623
Putzell, Edwin J.....	172
Rabi, I. I.....	86
Rowley, Edward R.....	396
Ruebhausen, Oscar M.....	471
Smith, Walter Bedell.....	63, 64, 67
Steiger, William A.....	507
Swisher, Elwood D.....	500
Walker, Eric.....	538
Weaver, Charles H.....	285
13. Timing of private participation in atomic-power development:	
Aydelott, J. H.....	582
Blum, Robert.....	588
Cisler, Walker L.....	137, 139, 156, 161, 166, 168
Coue, Sterling.....	92, 186, 285, 295, 353, 388
Cohen, Karl.....	264
Costello, J. M.....	628
Davidson, W. L.....	28, 29
Dean, Gordon.....	26, 42, 49, 52
Doan, R. L.....	621
Ferguson, Malcolm P.....	401, 411
Gale, Willis.....	207
Hickenlooper, Bourke B.....	177, 338
Holifield, Chet.....	42, 49, 51, 52, 106, 156, 165, 231, 287, 462
Hyland, L. A.....	412
Iddles, Alfred.....	378, 388
Jenkins, Thomas A.....	229
Lilienthal, David E.....	609
McAfee, J. W.....	189
McCune, F. K.....	306
Malone, George W.....	450, 453
Menke, John R.....	274, 275

13. Timing of private participation in atomic-power development—Con.	Page
Mills, Earle W.....	197
Morse, R. H., Jr.....	600
Olds, Leland.....	613, 614
Pastore, John W.....	26, 161, 298, 391, 417
Patterson, James T.....	395
Price, Melvin.....	51, 227, 238, 396, 418, 518
Putzell, Edwin J.....	174, 176, 177, 181, 186
Rabi, I. I.....	92
Rowley, Edward R.....	390, 391, 395
Shugg, Carleton.....	626
Sigal, Benjamin C.....	488
Starr, Chauncey.....	250, 256
Stevenson, R. S.....	337
Strauss, Lewis L.....	564
Suits, C. G.....	505, 518
Swisher, Elwood D.....	501
Van Zandt, James E.....	237
Ward, J. Carleton, Jr.....	638
Weaver, Charles H.....	278, 287, 295, 298
Weil, George L.....	347, 353
Weinberg, Alvin M.....	246, 247
Wigner, Eugene P.....	319, 320
Williams, Walter.....	105
Zinn, Walter H.....	226, 228, 231, 238



BOSTON PUBLIC LIBRARY



3 9999 06314 855 3

JUL 30 1956

