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PROPOSALS FOR INTERNATIONAL COOPERATION IN NUCLEAR ENERGY

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HEARING

BEFORE THE

SUBCOMMITTEE ON AGREEMENTS FOR COOPERATION

OF THE

JOINT COMMITTEE ON ATOMIC ENERGY CONGRESS OF THE UNITED STATES

NINETY-FOURTH CONGRESS

FIRST SESSION

ON

REVIEW OF ACTIONS PROPOSED BY THE ENERGY RE-
SEARCH AND DEVELOPMENT ADMINISTRATION IN THE
AREA OF INTERNATIONAL COOPERATION IN NUCLEAR
ENERGY

FEBRUARY 6, 1975

Printed for the use of the Joint Committee on Atomic Energy



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PROPOSALS FOR INTERNATIONAL COOPERATION IN NUCLEAR ENERGY

THURSDAY, FEBRUARY 6, 1975

CONGRESS OF THE UNITED STATES,
SUBCOMMITTEE ON AGREEMENTS FOR
COOPERATION OF THE JOINT COMMITTEE
ON ATOMIC ENERGY
Washington, D.C.

The Subcommittee on Agreements for Cooperation met at 2 p.m., pursuant to call, in room S-407, the Capitol, Hon. Teno Roncalio (chairman of the subcommittee) presiding.

Present: Representatives Roncalio, Price, and Anderson; and Senator Case.

Also present: George E. Murphy, Jr., executive director; James B. Graham, assistant director; Norman P. Klug, technical consultant; Albion W. Knight, Jr., professional staff member; William C. Parler, committee counsel; Randall C. Stephens, assistant counsel; Col. Seymour Shwiler, USAF (Ret.), technical consultant; and Lawrence F. Zenker, GAO consultant.

OPENING REMARKS OF CHAIRMAN RONCALIO

Representative RONCALIO. The subcommittee will come to order. The purpose of today's hearing is to review three actions proposed by the Energy Research and Development Administration last month, when it was still part of the AEC, in the area of international cooperation in nuclear energy.

Specifically, these actions are separate increases in the ceilings for distribution of nuclear fuel to Euratom and IAEA, and an extension of the present research agreement for cooperation with Israel.

The Atomic Energy Act requires a 60-day period for review by Congress of proposals of this type before they can be effectuated. The act further requires that this committee report its recommendations to Congress within 60 days after receiving a proposed ceiling increase or agreement.

As I understand it, the 30-day period will end February 13 in the case of the ceiling increases and February 15 in the case of the agreement.

Following our reports, Congress will have at least another 30 days in which to act favorably or unfavorably, as the case may be, on these proposals. What we are seeking today are the facts on which that judgment can be based.

Appearing for ERDA will be Dr. Abraham S. Friedman, the Acting Assistant Administrator for International Affairs.

Dr. Friedman, you may introduce those who are with you and you may proceed.

STATEMENT OF DR. ABRAHAM S. FRIEDMAN, ACTING ASSISTANT ADMINISTRATOR FOR INTERNATIONAL AFFAIRS, ACCOMPANIED BY WILLIAM VOIGHT, DEPUTY DIRECTOR, PRODUCTION DIVISION, AND JOHN H. PENDER, ASSISTANT GENERAL COUNSEL, ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

Dr. FRIEDMAN. Thank you, Mr. Chairman.

On my right is Mr. Pender, the assistant general counsel of ERDA. Behind me is the representative of the State Department, Mr. Dixon Hoyle, and Mr. Voight and other representatives of the ERDA staff.

Representative RONCALIO. Fine.

I might say to you, Doctor, this is Mr. Murphy who is executive director of the joint committee; Mr. Parler, our committee counsel; Mr. Stephens, assistant counsel; and Mr. Graham, assistant director; and this is Mr. Brec Cooke of my staff.

You may proceed Dr. Friedman.

Dr. FRIEDMAN. I am pleased to appear before the committee to testify on three actions which are pending before the Congress.

The first of these is a proposed amendment to extend for 2 years the 1955 research type of agreement for cooperation between the United States and Israel.

This agreement concerns civil uses of atomic energy having application in such fields as production of radioisotopes for agricultural and medical uses, reactor physics, and nuclear chemistry. The present agreement is scheduled to expire on April 11 of this year.

The amendment, like the agreement, was negotiated pursuant to section 123 of the U.S. Atomic Energy Act. The proposed amending action is unrelated to the possible conclusion of an agreement with Israel concerning nuclear power applications.

Included with the proposed amendment is an exchange of diplomatic notes, which shall be an integral part of the Agreement for Cooperation.

The purpose of the exchange is to place on the record the long-held, mutual understanding of Israel and the United States that no material, including equipment and devices, subject to the Agreement for Cooperation, and no material produced through the use of such material including equipment and devices, may be used for any nuclear explosive device, or for research on, or development of, any such device, regardless of how the device itself is intended to be used.

By that we mean that a peaceful nuclear application of a nuclear explosive device would not be consistent with that agreement. And it is mutually understood.

Under the present research agreement, Israel obtained a 5-megawatt, thermal, research reactor from the United States, which went critical in 1960, and has been fueled with enriched uranium supplied by the AEC—now ERDA.

The reactor is located at the Nahal Soreq Research Establishment near Tel Aviv. It is used for research in physics and chemistry, and the production of radioisotopes.

The reactor is a standard, "off-the-shelf" pool-type research reactor built by the American Machine & Foundry Co. This type of reactor typically operates with an enriched uranium fuel core loading of about

6 kilograms enriched to about 90 to 93 percent in U^{235} . It produces negligible amounts of plutonium. In 1973, Israel purchased the previously leased fuel.

A variety of other material for research programs has been transferred to Israel over the years of cooperation under the 1955 research agreement; for example, U^{233} for tracers in research and nondestructive testing experiments; plutonium for nuclear physics research and for use as neutron sources for activation analysis, including plutonium-238 for heart pacemaker development; and heavy water for use in a subcritical assembly at Haifa, a research tool particularly for reactor physics.

The U.S. nuclear material and reactor transferred pursuant to the 1955 Agreement for Cooperation are subject to the safeguards of the International Atomic Energy Agency, pursuant to a trilateral safeguards agreement among the United States, Israel, and the Agency concluded in 1966.

Arrangements for IAEA safeguards are to continue with respect to the proposed 2-year extension of the Agreement for Cooperation under a new updated IAEA trilateral safeguards agreement.

IAEA AND EURATOM

In addition to the proposed extension of the research agreement with Israel, we are also proposing to increase the amount of enriched uranium authorized for distribution to Euratom and the International Atomic Energy Agency.

The Euratom Cooperation Act of 1958, as amended, authorizes the distribution to the Community of a sufficient quantity of enriched uranium to support the fuel cycle of power reactors with a total installed capacity of 35,000 MWe plus 25,000 kilograms of contained U^{235} for other purposes.

The administration now proposes that the current ceiling of 35,000 megawatts of installed electric generating capacity be increased to 55,000 MWe with no change in the ceiling of contained U^{235} for other purposes.

It is estimated that the total of installed nuclear electric generating capacity in the European Community utilizing U.S. enriching services and requiring first delivery of enriched material prior to July 1, 1982, is about 42,820 MWe, or 7,820 MWe in excess of the current ceiling.

Our proposal for an increase of 20,000 MWe will provide for those nuclear plants requiring initial deliveries of enriched uranium prior to July 1, 1982, together with nuclear plants having a capacity of approximately 12,000 MWe which are expected to require initial deliveries between July 1, 1982, and July 1, 1984.

This 2-year forward planning period is in accordance with the suggestions contained in the Joint Committee report covering the recent amendment to section 54 of the Atomic Energy Act.

Thus, we are proposing to increase the ceiling by 20,000 MWe to a new total of 55,000 MWe. The 55,000 MWe would represent a maximum number of MWe that could be fueled by the United States but would not constitute a commitment to do so. This, we estimate, will be sufficient to provide enriching services for all of the nuclear powerplants to be built in the Community which will require U.S. enriching services prior to July 1, 1984.

Contracts for enriching services for reactors requiring initial deliveries before July 1, 1982—that is, totaling 7,820 MWe—have been signed or offered for signature. They contain a “conditional” provision under which the contract will terminate without penalty to either party if the ceiling is not increased.

The current IAEA ceiling, as established by section 54 of the Atomic Energy Act, is 5,070 kilograms of contained U²³⁵. The Agency intends to use material within this ceiling quantity for research and other nonpower reactor uses.

At the request of the Agency, we are now proposing that authorization be provided to permit the distribution of an additional amount of contained uranium-235 necessary to support the fuel cycles of three nuclear power reactors totaling 2,015 MWe in two IAEA member states.

This authorization would be used for two nuclear powerplants in Mexico and one in Yugoslavia which are being built by U.S. suppliers.

Each of these countries is a party to the Nonproliferation Treaty. The material, which would be provided directly to the country involved, would be covered by a supply arrangement with the Agency and be subject to Agency safeguards.

Enrichment services contracts, conditional on the establishment of the proposed ceiling, have been entered into between the administration and the authorized entities in these two countries.

This concludes my prepared remarks. I would be pleased to respond to any questions. Thank you.

Representative RONCALIO. Thank you very much, Dr. Friedman.

Representative Price, the vice chairman of the full committee is here. I will ask him to lead off with the questions.

Representative PRICE. Mr. Friedman, what is the present status of the negotiating for agreements for cooperation with Israel and Egypt that were announced some time ago?

Dr. FRIEDMAN. We prepared draft language for agreements in the power reactor field with both Israel and Egypt. We made these available to both parties. There have been some preliminary discussions with the Egyptians. At the present time, at the suggestion of both Israel and Egypt, active negotiations are in suspense. I guess the answer to your question is that at the present time nothing is happening.

Representative PRICE. I know that the existing research agreement with Israel is just minor in comparison to the proposed power reactor agreement, but what limitations are placed on the reprocessing of spent fuel in research reactors?

Dr. FRIEDMAN. Under the current agreement we are discussing?

Representative PRICE. Yes; the one we are talking about now.

Dr. FRIEDMAN. The current agreement, of course, is for a small research reactor. It is barely at the limit which the Congress determines below which—

Representative PRICE. It has a very negligible amount of plutonium.

Dr. FRIEDMAN. It is gram amounts of plutonium that is produced.

Representative PRICE. They still have some spent fuel?

Dr. FRIEDMAN. They still have some spent fuel. Under the agreement our approval would be required before the spent fuel is processed and our approval as to where it is processed would be required. At the present time none of the spent fuel has yet been processed.

Representative PRICE. No spent fuel has been processed?

Dr. FRIEDMAN. There is some spent fuel which is currently in storage.

Representative PRICE. None of it has been reprocessed?

Dr. FRIEDMAN. None of it.

Representative PRICE. Where is it in storage?

Dr. FRIEDMAN. It is in storage in Israel.

Representative PRICE. That is all I have, Mr. Chairman, at this point.

Representative RONCALIO. Thank you, Mr. Chairman.

Mr. Anderson?

Representative ANDERSON. Dr. Friedman, in your statement you say that the fuel that is presently used in this 5-megawatt thermal research reactor is highly enriched U^{235} and that this was leased but has now been sold, as I understand it, to Israel.

Is this weapons-grade material and would it be possible for it to be fabricated into nuclear weapons?

Dr. FRIEDMAN. It is highly enriched material and, therefore, that material which is not in the reactor or has not been in the reactor could be considered as weapons-grade material.

Representative ANDERSON. What would be the rough time scale for conversion and fabrication?

Dr. FRIEDMAN. Before I respond to that, may I go back just a little—well, let me respond first.

A sufficient time scale would depend, of course, on the sophistication of the weapon one would want to produce and on the sophistication of the scientists and engineers involved. We would have to assume, of course, that both of those are high.

So, the rough time scale might be short. Nuclear weapons are not in my field, but I should point out that that material is under international Atomic Energy Agency safeguards. Its accountability and its handling are under the control of the International Atomic Energy Agency, in addition to which, under our agreement, we have bilateral safeguards rights in the event that the International Atomic Energy Agency is not able for any reason to carry out the safeguards inspection.

Representative ANDERSON. To your knowledge, the IAEA has never had any difficulty in carrying out the prescribed inspections?

Dr. FRIEDMAN. No, sir.

Representative ANDERSON. Mr. Price asked the question a moment ago about spent fuel. Is there any existing facility for reprocessing in Israel? Do they have that capability?

Dr. FRIEDMAN. Not to our knowledge.

Representative ANDERSON. When you talked about operation of the reactor, you used the adjective "negligible" to describe the quantity of plutonium produced in this 5-megawatt reactor.

I notice weapons is not your field, but there seems to be a great deal of interest in view of certain situations and conditions that exist in that part of the world today on this topic.

Do you have an opinion or informed judgment on whether or not enough would be produced that would be capable of being used for weapons purposes?

Dr. FRIEDMAN. If the reactor were used around the clock at highest efficiency possible, approximately two and one-half grams of plutonium would be produced a year. It would take of the order of 5,000 grams of plutonium to produce one sophisticated weapon.

The reason I say "negligible" is that if the reactor were used around the clock it would take thousands of years to produce enough plutonium.

Representative ANDERSON. I suppose the obvious rejoinder at this time is of course they would not use plutonium, they would use highly enriched uranium, which is also available.

Dr. FRIEDMAN. Yes. But I think the most obvious rejoinder is that they might look to their other reactor which is supplied by France without safeguards.

Representative PRICE. Is that a power reactor?

Dr. FRIEDMAN. No, that is a research reactor as well.

Representative ANDERSON. How big is that?

Dr. FRIEDMAN. Approximately 24 to 26 megawatts. But that uses natural uranium and, therefore, does produce plutonium.

Representative ANDERSON. Thank you, Mr. Chairman.

Representative PRICE. What type reactor is the French reactor?

Dr. FRIEDMAN. That is a natural uranium reactor.

Representative PRICE. Heavy water?

Dr. FRIEDMAN. Yes.

Representative RONCALIO. Doctor, the committee is concerned with the creation of employment here in the United States through the manufacturing of nuclear plant components by American workers.

For the first time in several decades this is of immediate concern to our country. Considering this, do you know whether or not the countries receiving our agreements will be purchasing their components, pumps, and other materials from the United States?

Let us take one country at a time. How about Yugoslavia?

Dr. FRIEDMAN. Yes. I read your interesting article in the Congressional Record. I, therefore, prepared myself for this question.

In the case of Yugoslavia the total capital cost in building the reactor is estimated to be about \$470 million. That is a 650-megawatt reactor. Of the \$470 million, the U.S. export value, the components supplied by the United States, will be about \$215 million. In other words, about half of it will be supplied by the United States. It is a Westinghouse reactor and a significant number of the components will be supplied by the United States.

In addition, of course, the enriching services will be supplied by the United States.

Representative RONCALIO. Are you satisfied with the safeguards of the irradiated fuel there?

Dr. FRIEDMAN. Definitely.

Representative RONCALIO. Are you satisfied with how this is handled by the International Agency?

Dr. FRIEDMAN. I am satisfied by virtue of the fact that it will be safeguarded by the IAEA. We have confidence in the safeguards system, and in all of these we play a significant role in developing these safeguards procedures.

Representative ANDERSON. Would the gentleman yield for a question at this time?

Representative RONCALIO. Yes.

Representative ANDERSON. Do we have the same kind of override arrangement you described with respect to Israel where if we are at any time dissatisfied with respect to the ability of the IAEA to come in and make these inspections that we on our own can then go and do it?

Dr. FRIEDMAN. In these cases we do not.

Representative ANDERSON. You do not?

Dr. FRIEDMAN. We do not. It is strictly an IAEA system. Of course in the event that our agreement is breached, in the unlikely case that they were to throw out IAEA inspectors and breach our agreement, then we would have the right to terminate the agreement and to withdraw the material supplied.

Representative ANDERSON. If they would give it to us.

Dr. FRIEDMAN. I would hate to postulate that situation.

Representative RONCALIO. Now, with respect to Mexico.

Dr. FRIEDMAN. In the Mexican reactor there the total cost is about \$300 million. The U.S. components—in this case it is a General Electric reactor—are about \$66 million.

The Mexicans are somewhat more sophisticated in their technology and are able to contribute more of the components themselves.

Again, the export value of the enriching services is entirely American.

The second Mexican reactor is harder to estimate because that is in the negotiating stage, it has not yet been ordered. Again, it will be a General Electric reactor. They have not started construction yet.

Representative RONCALIO. What will be the effect on U.S. labor of the requested increase in amounts of U²³⁵ to be supplied to IAEA and to EURATOM?

Dr. FRIEDMAN. I think all of the effects are positive. That is, as we are able to have U.S. industries sell reactors and reactor components, that has a positive effect on the U.S. labor market. To the extent that we supply the enriching services, either as a Government service, which is presently the case, or as a private industry endeavor which may come to pass, in either case it has a significant impact on utilization of U.S. labor.

Before we were talking about the smaller, 650-megawatt reactors. If you take a typical 1,000-megawatt reactor, the total estimated cost is of the order of \$725 million. If you consider that on most reactor exports anywhere from 20 to 50 percent of the services just for the construction are from the United States, each reactor then does have a significant export value and associated with that is a U.S. labor market effect.

Representative RONCALIO. What is the realistic estimate for the success of the Pu-recycle program given the fact that the environmental impact statement for the Pu-recycle program has and undoubtedly will continue to generate extremely adverse comment?

Dr. FRIEDMAN. This is an area which is currently in the hands of the Nuclear Regulatory Commission. I might comment that it seems unlikely that the final decision will be made before June 30 which was earlier anticipated. I don't think there is enough information available for me to hazard a guess.

Representative RONCALIO. Let me, if I may, wrap up what I think is the gist of the questions that have been asked so far by this subcommittee of you, Doctor.

Are you satisfied that we, the United States, have sufficient adequate safeguards on the spent fuel in those nations you have referred to, Yugoslavia, Mexico, and Israel, in the reactors they have today?

Dr. FRIEDMAN. Yes, Mr. Chairman. Maybe I should say we are never satisfied. I am satisfied that at the present time with the technology available that that material is being adequately safeguarded, which does not mean that we are not constantly trying to improve the safeguard system.

So that I am satisfied and yet I hope we can always improve on the system.

Representative RONCALIO. Don't you feel it might be well to investigate the possibility of the return by Israel of the irradiated fuel that is there in storage that you referred to earlier?

Dr. FRIEDMAN. Once irradiated that material is essentially, you might say, self-protecting. It no longer can be used for weapons purposes unless it went through a very complicated processing

Representative RONCALIO. Chemical processing?

Dr. FRIEDMAN. Chemical processing. As I mentioned earlier, we will have an opportunity to have a say as to where that will be done. If we feel the safest place is for it to be reprocessed in the United States we will bring it here.

Representative RONCALIO. Senator Case?

Senator CASE. I don't think I have any questions, Mr. Chairman.

Representative RONCALIO. Mr. Murphy?

Mr. MURPHY. Dr. Friedman, in this afternoon's Star-News it is reported that Pakistan is willing to trade a pledge to stress safeguards for any reactor programs, whether the plant is supplied by the United States, France, or any other nuclear power, for a willingness of the United States to provide them with conventional arms. Do you know anything about this situation?

Dr. FRIEDMAN. I know nothing about the situation. I would hope that we would treat the safeguarding of nuclear material completely independent of any exchanges.

In other words, I would hope that we could get Pakistan to agree to these without any conditions. They would have to agree to safeguards on any material that we do supply.

Mr. MURPHY. As far as the Israeli agreement is concerned, it is perfectly obvious that that applies only to the research reactor.

Dr. FRIEDMAN. That is right.

Mr. MURPHY. As a practical matter, IAEA safeguards are in one area and the Dimona reactor you referred to is not covered. Is that correct?

Dr. FRIEDMAN. That is correct.

Mr. MURPHY. Are any other reactors going into Mexico or Yugoslavia that are in existence and would provide materials that are not covered by IAEA or any other safeguards?

Dr. FRIEDMAN. No, sir.

Mr. MURPHY. Can you give us some of the background that causes you to feel so sure of the effectiveness of the IAEA safeguards—Dr. Romanish's safeguards—program?

* Dr. FRIEDMAN. For one thing, it tracks reasonably well our own bilateral safeguards system. We have played a significant role in the development of the safeguards system. We have had consultants there, and, as members of the Board of Governors, we have had an opportunity to assure ourselves that before we approve any safeguards agreement with another country that the safeguards system is adequate. As long as you recognize that the IAEA safeguards system is only designed to detect diversion and not to prevent it.]

Mr. MURPHY. You state that you think it is effective because it tracks with our system.

Dr. FRIEDMAN. Our bilateral safeguards system; that is correct.

Mr. MURPHY. Do you feel that our domestic system is adequate?

Dr. FRIEDMAN. Frankly, I don't know enough about our domestic system to attest to its adequacy. I would hope the answer is yes.

Mr. MURPHY. Do you know of any material, either in the United States or internationally that is unaccounted for?

Dr. FRIEDMAN. You probably may be better acquainted with the situation than I am, but I think some years ago there was—possibly through bad recordkeeping and management—a larger amount of special nuclear material unaccounted for than one would anticipate just based on material in piping and the like. I am not well enough informed about that to go into much detail.

Mr. MURPHY. I wonder if you could provide that information for the record—any information that you have on material unaccounted for?

Dr. FRIEDMAN. Surely.

[The following material was subsequently supplied.]

Dr. FRIEDMAN. Several years ago there was unaccounted for material at NUMEC.

The AEC has thoroughly investigated the NUMEC incident which involved a significant MUF. Much of the investigation has been documented and made available to the JCAE. The result of this investigation was that the significant MUF was attributed to NUMEC underestimating process loss. NUMEC was subsequently required to pay for these losses. Reference is made to the letter from the AEC to J. Conway dated February 14, 1966.

Mr. MURPHY. And also, specifically, if there have been any exports of material that have been found on arrival to be at a different rate, or a different level, or a different amount than the amount shipped. In other words, if a hundred grams was reported as shipped and the amount on arrival was 120 grams, or 80 grams—any inconsistency or discrepancy.

Do you know of any such situations or occurrences that you can cite for the record at this time?

Dr. FRIEDMAN. I don't but I will be happy to go through the records with our safeguards people and provide it for your record.

Mr. MURPHY. Thank you.

[The following material was subsequently supplied.]

Dr. FRIEDMAN. Nuclear materials which are shipped from the United States are subject to required safeguards control, including measurements controls, inventories, records and reports, as well as other internal controls. Also, the quantity of nuclear materials shipped by the United States are reported to the safeguarding organization [whether it be provided by IAEA, EURATOM, or Bilateral Agreement] as well as to the recipient country. If the recipient country, upon measuring receipts finds a difference from the shippers' values, the responsible safeguarding group conducts an investigation to resolve the question. *

The experience in the United States on such shipper-receiver differences, internationally, has been that:

(1) The actual measured differences between the shipper and the receiver have amounted to very low percentages of the total quantity involved in the transfer; such differences are well within the measurement uncertainties and the precision of the measurement techniques. For example, looking at recent transfers of UF_6 from U.S. gaseous diffusion plants to Japanese Power Plants, we see data like the following:

(gms U²³⁵)

Shipped	Received	Shipper-receiver difference	Percent difference
181,605	181,622	17	0.00014
136,173	136,157	16	.00011
136,390	136,367	23	.00016
117,448	117,442	6	.00005
116,537	116,530	7	.00006
86,691	86,680	11	.00012
86,473	86,442	31	.00035
86,437	86,410	27	.00031

Note: The above data are typical variations in international shipper-receiver differences and represent percentage variations on the order of a thousandth of a percent. Shipper-receiver differences which are significant (e.g., differences valued at more than \$500) would be subject to scrutiny and resolution as to probable cause.

Representative RONCALIO. Mr. Anderson?

Representative ANDERSON. Dr. Friedman, you testified a moment ago that you do have a high degree of confidence in the present system of inspection, but that nevertheless we are always trying to find ways of improving that system. There was an NBC news special that you may have seen a few nights ago which went into this to some extent, and I believe that among the criticisms suggested by the program was the fact that the inspectors of the Agency are not rotated, that the same inspectors habitually inspect the same facilities and that this might, therefore, raise the possibility, and indeed the danger, that the relationship between the inspectors and the inspectees might get to be too clubby and chummy, and you don't have the kind of arms-length dealing that should exist in a situation of that kind.

What is your comment on that observation?

Dr. FRIEDMAN. I did not see the program, but there are a significant number of qualified inspectors, and there is no policy in the IAEA of assigning particular inspectors always to inspect the same reactors, the same facilities. I do not think that in the event that if members of an inspection team repeat inspections at frequent intervals and the same members go, I don't think we should interpret that as leading to any chumminess.

The inspectors have a mission. They are well trained. Their allegiance and their salary comes from the International Atomic Energy Agency. We have no reason to believe that they are other than effective, honorable inspectors.

Representative ANDERSON. I think the same program made the point that it would take a conspiracy of a fairly large number of persons to arrange for a diversion, a substantial diversion of special nuclear materials from one of these facilities. On the other hand, these are national facilities, and it is not beyond the realm of possibility, at least in my mind, for a nation that willfully wanted to circumvent the restrictions provided for under the IAEA arrangement, to pick the kind of people who would be dedicated to the national interest and would conspire to arrange for that kind of diversion.

What would be your comment on that? How would you deal with that kind of situation, if in fact, such a conspiracy existed? Would the IAEA inspection system be indeed sufficient to uncover that kind of conspiracy?

Dr. FRIEDMAN. It is my view that the IAEA system would indeed be able to cover that kind of conspiracy. I do not believe that the IAEA system is designed to prevent it.

Senator CASE. Could they uncover it beforehand?

Dr. FRIEDMAN. I am sure that the system is accurate enough to uncover it beforehand. As I say, the system is designed to ring a bell when somebody begins to break the arrangement.

Now, the IAEA does not have the police power to actually prevent them from breaking an arrangement.

Senator CASE. Would you yield?

Representative ANDERSON. I yield to the Senator from New Jersey.

Senator CASE. I am not sure I quite understand your answer that a conspiracy might be detected in advance. How would the inspectors find out about the conspiracy except by finding the material not there when they look for it?

Dr. FRIEDMAN. You see, the inspection is made up of two principal components. One is an accurate accounting of where all material is at all times. The other is by having the inspectors physically present at all times when there is an opportunity or a conceivable opportunity to remove material. So if there is a reprocessing plant, for example, where the risks are higher, the inspection is very intense and can be as intense as having inspectors in residence, actually there all the time.↓

In those areas where the material is less accessible while it is in an operating reactor, then the inspectors pay frequent visits. They have devices for determining whether the reactor is being operated as designed, or is being tampered with. So my point is if the inspectors, during one of these visits, saw somebody removing material, they might say, wait, you are violating the agreement, they would detect it, but they might not be able to physically stop it. But they would immediately announce it.

Senator CASE. I guess my question was capable of being misunderstood. When I said conspiracy, I meant an agreement or arrangement to do something and not its actually being done.

Dr. FRIEDMAN. I see.

Senator CASE. You were thinking about the latter in your answer.

Dr. FRIEDMAN. Yes.

Senator CASE. Whenever it was done it would be discovered in most cases, if not all, immediately?

Dr. FRIEDMAN. That is correct. What you meant is if they got together in the back room to talk about how they would do it, at that point the agency would not be aware of it.

Senator CASE. Thank you, sir.

Representative ANDERSON. Just one further question on this point, Mr. Chairman.

The news special that I referred to, and I think it is important to bring these matters out, because the public does gain a large measure of its understanding of these problems, not from the hearings before this committee, but from what they see on television, or read in the newspapers, and as I am informed the point of the special documentary was that the safeguards inspection system consists largely, or essentially, of an audit of the facility's own records, and anybody knows, I guess, that records after all can be altered.

If I understand your answer to Senator Case's question, that is not an entirely accurate description of the safeguards inspection system. It is more than an audit based on an examination of records. It is a physical, onsite presence during critical points in the chain where this

material might be diverted during the time that reprocessing occurs, or a physical onsite presence actually for days at a time, so that it is substantially more than just an auditing that is performed. Am I correct in that understanding?

Dr. FRIEDMAN. You are correct, Mr. Anderson. It is not only a physical onsite inspection at the critical times, but in addition to the audit, which is only one component, and a necessary one, there are devices, there are tamperproof cameras always making a video tape record, so that if anybody goes in it immediately is recorded on this tamperproof camera. There are seals which cannot be broken and resealed without being discovered. So that the agency does not rely on the audit, but it is an important component, of course. But you are correct, it is physical inspection.

Representative RONCALIO. Mr. Murphy?

Mr. MURPHY. Dr. Friedman, regarding the records in Japan, for example, in what language are they kept?

Dr. FRIEDMAN. I have not seen the records. I am certain that the records are kept in English, and at least the numbers are arabic numbers.

Mr. MURPHY. Are you stating for a fact that the records are not in the Japanese language?

Dr. FRIEDMAN. I maintain that the records which the IAEA inspectors require to satisfy themselves are in the language which the IAEA inspectors understand.

Mr. MURPHY. You are implying then, that the IAEA inspectors make their examination from the basic records. Or are you saying that if you go to the Japanese reactor you find the records in English, or a language other than Japanese?

Dr. FRIEDMAN. I can't answer that question since I have not carried out inspections, but the inspectors are satisfied that the records made available to them are in English or in a language which they understand, and they are accurate records.

* Mr. MURPHY. Wasn't it the case some time ago that when some IAEA inspectors inspected a Japanese reactor that there were very strong objections made and editorials written that they were perhaps too stringent and that they were encroaching on sovereignty?

Dr. FRIEDMAN. On the part of the Japanese?

Mr. MURPHY. Yes.

Dr. FRIEDMAN. Yes; there were, and that is the way we want the inspections to be.

Mr. MURPHY. Do you believe that any country or nation—not a conspiracy of terrorists but a nation—could divert for their own purpose? Could they beat the system?

Dr. FRIEDMAN. I think any advanced nation that decided to go nuclear could go nuclear. They would not necessarily have to beat the system. They would develop their own capability. The point is that they could not do it without triggering world knowledge.

Mr. MURPHY. Your answer then is, "No," they could not beat the IAEA system, but "Yes"; they could, like India, go their own way.

Dr. FRIEDMAN. My answer is that it would be so much easier for them to go their own way that that would be the method.

Mr. MURPHY. Thank you.

Representative RONCALIO. Mr. Price, would you care to make an observation?

Representative PRICE. What would be the circumstances if we did not renew this agreement on April 11?

Dr. FRIEDMAN. The reactor would still be safeguarded. The material would still be safeguarded in the reactor because that goes on in perpetuity. The products of the reactor would still be under safeguards. We would not be able to ship any more material, and any more fuel, so that essentially in time the reactor would be inoperative. The research done with the reactor would no longer be done. From the point of view which I presume you are addressing, from the point of view of what happens to the material, it would still be under appropriate safeguards.

Representative PRICE. Could you hazard a guess when we might get the Israeli and Egyptian agreements for cooperation before the committee?

Dr. FRIEDMAN. No; because, as I commented perhaps before you came in, Mr. Price, both Israel and Egypt have asked us not to pursue the negotiations at the present time. So, we are not pushing for it. As soon as the negotiations are on track again we will, of course, keep the committee informed.

Representative RONCALIO. Doctor, what percent of the U.S. uranium enrichment capacity is presently committed to other nations?

Dr. FRIEDMAN. I may need some help. Mr. Voight, who is the deputy director of the Division of Production, will respond to that.

Mr. VOIGHT. Mr. Chairman, when we testified on the Phase II enrichment hearings we indicated that the fully operated capacity of our diffusion plants could support 363,000 megawatts on a self-sustaining basis, assuming generic approval of plutonium recycle commencing by June 30, 1975, at least approval by that date. Of that 363,000 megawatts, in fact we have 119,000 megawatts foreign under contract right now.

Representative RONCALIO. Was your 363,000 MWe the capacity of the three existing plants?

Mr. VOIGHT. Yes. We have 220,000 megawatts of domestic under contract. Potentially we have 24,000 megawatts of conditional contracts pending. Hence the foreign could constitute about 143,000 megawatts. It is roughly about 40 percent.

Representative RONCALIO. Thank you for that.

What amount in revenues does enrichment of uranium for foreign customers produce annually now for ERDA?

Dr. FRIEDMAN. May I supply that for the record?

Representative RONCALIO. Yes.

[The following material was subsequently supplied.]

Dr. FRIEDMAN. In CY 1974, the United States received a total of \$421.7 million from foreign sales of enriching services. Of this total, \$381.4 million were revenues from current toll enrichment services and the remaining \$40.3 million were from advance sales. Deliveries under our foreign contracts are expected to level off in 1984, producing an annual revenue of about half a billion dollars at our current prices for separative work.

Representative RONCALIO. You have already told us about the status with regard to the sale of the reactor to Mexico and Yugoslavia for which the IAEA limit is being increased.

Dr. FRIEDMAN. Yes, sir.

I am sorry, was that a question?

Representative RONCALIO. That was an observation. What U.S. approvals are required for the sale of reactors?

* Dr. FRIEDMAN. [Before a reactor is sold it has to be, of course, under an agreement for cooperation. In these cases the ones to the European Community would be through the agreement with Euratom, the ones to Mexico and Yugoslavia through the IAEA.] It is not our intention to use the IAEA as a device for selling reactors abroad to member countries other than in these two cases at the present time.

The approval required in these cases and in all cases is an export license, which the U.S. Government needs to give before the reactor can be exported. In addition, if any reactors are sold to other countries they must be sold under an approved agreement for cooperation and, of course, the Congress now has the opportunity to veto any agreement for cooperation.

Representative RONCALIO. With what other countries in addition to Mexico, Yugoslavia, Israel, and Egypt are there existing or pending agreements for cooperation?

Dr. FRIEDMAN. There are existing agreements for cooperation with some 30 countries. I can supply for the record a list of these countries with the dates of the agreements.

Representative RONCALIO. That will be fine.

[The material requested follows:]

AGREEMENTS FOR COOPERATION IN THE CIVIL USES OF ATOMIC ENERGY

A. BILATERALS WITH INDIVIDUAL COUNTRIES

Country	Scope	Effective date	Termination date
Argentina	Research and power	July 25, 1969	July 24, 1999
Australia	do.	May 28, 1957	May 27, 1997
Austria	do.	Jan. 24, 1970	Jan. 23, 2014
Brazil	do.	Sept. 20, 1972	Sept. 19, 2002
Canada	do.	July 21, 1955	July 13, 1980
China, Republic of	do.	June 22, 1972	June 21, 2014
Colombia	Research	Mar. 29, 1963	Mar. 28, 1977
Finland	Research and power	July 7, 1970	July 6, 2000
Greece ¹	Research	Aug. 4, 1955	Aug. 3, 1974
India	Power (Tarapur)	Oct. 25, 1963	Oct. 24, 1993
Indonesia	Research	Sept. 21, 1960	Sept. 20, 1980
Iran	do.	Apr. 27, 1959	Apr. 26, 1979
Ireland	do.	July 9, 1958	July 8, 1978
Israel	do.	July 12, 1955	Apr. 11, 1975
Italy	Research and power	Apr. 15, 1958	Apr. 14, 1978
Japan	do.	July 10, 1968	July 9, 2003
Korea	do.	Mar. 19, 1973	Mar. 18, 2014
Norway	do.	June 8, 1967	June 7, 1997
Philippines	do.	July 19, 1968	July 18, 1998
Portugal	do.	June 26, 1974	June 25, 2014
South Africa	do.	Aug. 22, 1957	Aug. 22, 2007
Spain	do.	June 28, 1974	June 27, 2014
Sweden	do.	Sept. 15, 1966	Sept. 14, 1996
Switzerland	do.	Aug. 8, 1966	Aug. 7, 1996
Thailand	do.	June 27, 1974	June 26, 2014
Turkey	Research	June 10, 1955	June 9, 1981
United Kingdom	Research and power	July 21, 1955	July 20, 1976
Do	Power	July 15, 1966	July 14, 1976
Venezuela	Research and power	Feb. 9, 1960	Feb. 8, 1980
Vietnam	Research	July 1, 1959	June 30, 1979
Vietnam, Republic of			

¹ Superseding, research, and power agreement in abeyance; U.S. material covered by IAEA (NPT) safeguards.

B. BILATERALS WITH INTERNATIONAL ORGANIZATIONS

Organization	Scope	Effective date	Termination date
European Atomic Energy Community (Euratom)	Joint nuclear power program	Feb. 18, 1959	Dec. 31, 1985
Euratom	Additional agreement to joint nuclear power program.	July 25, 1960	Dec. 31, 1995
International Atomic Energy Agency (IAEA)	Supply of materials, etc.	Aug. 7, 1959	Aug. 6, 2014

Dr. FRIEDMAN. We have pending at various stages of planning or negotiation amendments to existing agreements or extensions of agreements with Greece, Brazil, Iran, and perhaps Egypt and Israel.

Representative RONCALIO. Are the enrichment contracts with Mexico and Yugoslavia contingent on plutonium recycle or are they firm?

Dr. FRIEDMAN. They are firm contracts.

Representative RONCALIO. What percentage of the power reactors in the world to which we are obligated to send fuel were not built with components in the United States? In other words, are we supplying fuel to furnish plants that were never built here, but rather by the French or British?

Dr. FRIEDMAN. Most of the fuel that we are supplying is for U.S. made reactors. I am not sure about how many reactors which are not U.S. made are getting fuel enriched in this country. Again, I can check for the record.

Representative RONCALIO. We would like that if it is available. [The material subsequently supplied follows:]

The U.S. currently has contracts to supply fuel to 177 foreign reactors. Twenty-one of these reactors are neither built nor licensed by U.S. firms. Thirty-six are being built under U.S. license and the suppliers of 15 other reactors have not yet been selected.

Representative RONCALIO. Doctor, what is the normal discharge enrichment for the five megawatt research reactor in Israel?

Dr. FRIEDMAN. The reactor core holds approximately six kilograms of highly enriched uranium. The reactor has been in operation now for about 10 years, starting with just startup and then being operated more continuously. In that period of time two reactor cores have been discharged. So that you might say every several years a core needs to be discharged.

Representative RONCALIO. The enrichment percentage of the spent fuel is what we are after.

Dr. FRIEDMAN. I see. It goes down from about 90 or 93 to about 88 percent.

Representative RONCALIO. Thank you very much. Although the discharged fuel contains some impurities—neutron poisons, for example—could it be used in an explosive device?

Dr. FRIEDMAN. Again, we are out of my field, but I would think—and maybe we will correct it for the record if I am wrong—but I would think that about 90 percent uranium-235 could be developed into an explosive device.

Representative RONCALIO. If we were to observe that approximately 135 kilograms each is the amount from the Mexican and Yugoslavian reactors, that would be the annual rate for plutonium; would that be right?

Dr. FRIEDMAN. Plutonium production in a 600 megawatt, 650 megawatt reactor?

Representative RONCALIO. Yes.

Dr. FRIEDMAN. I think that is about the right order of magnitude. Again, I will check the figure for you.

Representative RONCALIO. Are there any other questions?

Doctor, we want to thank you very much. We hope that your work will be fruitful and beneficial, and wish you good luck in it.

That concludes the hearing for today.

[Whereupon, at 2:45 p.m., the hearing was concluded.]

