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Report to the Ranking Minority Member, Committee on Resources, House of Representatives

February 1996

FEDERAL LAND MANAGEMENT

Information on Efforts to Inventory Abandoned Hard Rock Mines



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GAO

United States
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Washington, D.C. 20548

Resources, Community, and
Economic Development Division

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February 23, 1996

The Honorable George Miller
Ranking Minority Member
Committee on Resources
House of Representatives

Dear Mr. Miller:

Thousands of hard rock mines lie abandoned on federal lands. Many of these mines present physical safety hazards, and a smaller number cause environmental degradation through, for example, acid drainage that carries toxic concentrations of heavy metals. Many of these abandoned mines are located on federal lands in the western United States managed by the Department of the Interior's Bureau of Land Management, National Park Service, and Fish and Wildlife Service and by the U.S. Department of Agriculture's Forest Service. This report focuses on these agencies because they manage 623 million acres, or about 95 percent of the federal lands in the United States.

Concerned about the potential for damage from these mines, you asked us to report on the (1) approximate number of abandoned hard rock mines on federally managed lands, (2) types of hazards these mines pose, and (3) approximate cost to reclaim these mines.[1]

Results in Brief

No definitive inventory is available of the number of abandoned hard rock mines located on federal lands. The four major land-managing agencies—the Bureau of Land Management, the National Park Service, the Fish and Wildlife Service, and the Forest Service—are in various stages of inventorying the mine sites on the lands they manage, and other organizations have also made estimates. While the Bureau of Land Management does not have an agencywide estimate, the National Park Service estimates about 2,500 sites, the Fish and Wildlife Service about 240 sites, and the Forest Service about 25,000 sites on the lands they manage. However, because the methodologies and assumptions used to develop these estimates differ, the results cannot be meaningfully compared or added. For example, some units within the National Park Service counted as one mine site all the features associated with a mining operation (such

[1]In this report, we use the term "reclaim" to include remediation. In some cases, federal agencies remedy the effects of abandoned mines rather than totally reclaiming them either because the costs of doing so are prohibitively high or because total reclamation is not possible (for example, when acid drainage is perpetual or the mine is on privately owned land).

as tunnels, shafts, and structures), while other units counted a single feature, such as a tunnel, as a site.

The hazards posed by abandoned hard rock mines may generally be categorized as either physical safety hazards or environmental degradation. Safety hazards may include, for example, open mine shafts and undetonated explosives; environmental degradation may include highly acidic water draining from the mine sites. However, classifying the sites requires extensive fieldwork. Of the four agencies, only two—the Bureau of Land Management and the National Park Service—have ranking systems that account for the type and level of risk. Furthermore, the agencies use different factors to classify their sites. For example, while the Forest Service classifies its sites according to whether they cause or potentially cause environmental degradation, the National Park Service ranks its sites on their degree of hazard, degree of impact on the environment, and accessibility.

Accurately determining the cost to reclaim specific sites requires detailed site studies, which the four key land-managing agencies have performed to various extents. Two of the four agencies—the National Park Service and the Forest Service—have estimated the costs to reclaim abandoned mine sites on their lands, while the Bureau of Land Management and the Fish and Wildlife Service have not prepared cost estimates. The National Park Service estimates about $165 million and the Forest Service about $4.7 billion in costs to reclaim abandoned hard rock mines on the lands they manage.

A summary of each organization's estimate of the number and type of mines and, where available, the cost to reclaim them appears in appendix I.

Background

Under the Mining Law of 1872 (30 U.S.C. 22 et seq.), United States citizens and businesses may freely prospect for hard rock minerals—such as gold, silver, lead, and copper—on most federal lands not specifically closed to mining. Although all mining claims must be filed with the Bureau of Land Management (BLM), each agency is responsible for the surface management of mining activities that take place on lands it manages. When mining operators or other responsible parties have previously failed to reclaim areas where mining operations have taken place on federal lands and are currently economically unable to do so, the burden of cleaning up these properties may fall upon the taxpayers.

Regulations promulgated by BLM and the Forest Service in 1980 and 1974, respectively, require that once mining activities are completed, the mine operators must reclaim all areas disturbed by their operations as soon as possible. Furthermore, according to the Department of the Interior and the Forest Service, even before these regulations were promulgated, the operators were responsible for cleaning up their sites under state laws requiring the reclamation of such sites and under laws prohibiting the creation of nuisances. Mining operations that were ongoing when BLM's and the Forest Service's regulations were promulgated were allowed to continue, but they had to be brought into compliance with each agency's surface management regulations. According to Department of the Interior and Forest Service officials, the Comprehensive Environmental Response, Compensation, and Liability Act (42 U.S.C. 9601 et seq.) imposes liability on mining operators for cleaning up abandoned mining operations that release hazardous substances on federal lands.

National Park Service and Fish and Wildlife Service (FWS) lands have generally been withdrawn from mineral exploration. However, there are abandoned hard rock mine sites on these lands. Some are sites that preexisted the establishment or expansion of a park or wildlife refuge, and some are sites whose operators had valid existing rights when the lands were withdrawn from mining but have not reclaimed the sites.

In addition to the land-managing agencies, two other agencies within the Department of the Interior—the Bureau of Mines and U.S. Geological Survey (USGS)—have addressed the issue of abandoned hard rock mines. The Bureau of Mines is concerned with mineral production and environmental remediation technologies. USGS assesses mineral resources and mining-related environmental problems.

Nationwide Inventory of Abandoned Hard Rock Mines on Federal Lands Is Unavailable

Attempts to determine how many hard rock mines lie abandoned nationwide have not resulted in a definitive inventory of these mines on federal lands. The four major land-managing agencies are in various stages of inventorying the abandoned mines on the lands they manage. Other organizations, such as the Bureau of Mines and the Mineral Policy Center,[2] have also attempted to estimate the number of sites. However, because these sites are defined and counted differently, the individual results cannot be meaningfully combined or compared.

[2]The Mineral Policy Center is an environmental research and advocacy organization.

Status of Land-Managing Agencies' Inventories

BLM, which began an inventory in 1994, has made no overall estimate of the number of abandoned mine sites. BLM's Nevada and Utah state offices are piloting the agency's inventory approach, and several other state offices, including Colorado and Montana, have also begun field inventories, with the following results:

- The Nevada state office estimates 400,000 mine openings, structures, and other individual components of mining operations statewide, regardless of who owns the land. As the inventory progresses, it will differentiate between federal and other lands.
- The Utah state office is working with the state of Utah to inventory sites. On the basis of information from the state of Utah's Abandoned Mine Reclamation Program and some fieldwork, the estimated number of sites in Utah is 17,000 to 20,000 on public and private lands.[3]
- The Colorado state office, which expects to complete its portion of the inventory in 1996, is identifying a smaller number of sites on federal lands than it expected. While officials initially expected to find as many as 15,000 sites on federal lands in Colorado, field staff have found that few of the mines are actually located on BLM-managed lands.
- The Montana state office, working in cooperation with the Montana Bureau of Mines and Geology, has identified about 1,000 sites on BLM-managed lands in that state.

The National Park Service, in an effort begun in 1984, has counted the number of abandoned hard rock mines in almost all of its units—99 percent, according to officials—except for some in Alaska and the 3.1 million acres over which it acquired jurisdiction as a result of the California Desert Protection Act of 1994 (P.L. 103-433). The agency has tallied 2,500 sites, but the field personnel responsible for the inventory defined sites in different ways. Although the National Park Service defines a "site" as a "particular operation . . . or area where mining occurred, which may . . . [include] multiple 'openings,' i.e., shafts, adits, inclines, pits, prospects, etc.," the agency's units defined sites in different ways, according to officials. For example, one unit defined a site as a grouping of mining-related features; others designated individual features, such as a single mine opening, as one site.

According to FWS, the agency's wildlife refuges contain approximately 240 abandoned hard rock mine sites. FWS obtained this information on the number of sites by reviewing its mining files and requesting confirmation

[3]In this report, the term "public lands" includes federal and state-owned lands.

from its field offices. FWS does not consider abandoned hard rock mines a major problem on its refuges.

According to the Forest Service, there are about 25,000 sites within National Forest boundaries.[4] The Forest Service identified these sites using aerial photography and fieldwork, and the data were compiled by the U.S. Department of Agriculture's Office of the Inspector General through a questionnaire. The Forest Service is attempting to more precisely screen the sites in individual forests and expects to complete this effort in 1997.

Estimates by Other Federal Agencies

The Bureau of Mines and USGS have estimated the total number of abandoned hard rock mines on federal lands. However, these estimates cannot be meaningfully compared with any of the other estimates because they vary in scope and in the types of data used for the estimates.

The Bureau of Mines estimates that there are 15,300 sites on the lands managed by the agencies within the Department of the Interior and 12,500 sites on the lands managed by the Forest Service. These estimates are based on information in the Minerals Availability System/Minerals Industry Location System, a computerized database containing information about the location of and past activities at over 200,000 mineral deposits. However, these data were collected for purposes other than inventorying abandoned mines, and although they identify areas where mining occurred, they do not account for all mine sites and features. As a result, according to a National Park Service report and BLM officials, these data require further confirmation to ensure their accuracy.

Although USGS has not independently inventoried abandoned mine sites, it compiled data from the land-managing agencies in response to a congressional request for information about sites containing hazardous materials on the lands managed by the Department of the Interior. Using the assumption that all abandoned hard rock mines are potentially contaminated, USGS estimated that, as of July 1994, there were approximately 88,000 sites on the lands managed by agencies within the Department of the Interior. USGS obtained these data from the agencies, with the exception of BLM. For the lands managed by that agency, USGS made estimates from data included in a 1991 report by the Western

[4]According to Forest Service officials, the lands within National Forest boundaries include many tracts of privately owned lands containing abandoned mines.

Governors' Association entitled Inactive and Abandoned Noncoal Mines—A Scoping Study.[5]

Estimates by Nonfederal Organizations

The 1991 report of the Western Governors' Association reported data obtained from 33 states on abandoned and inactive hard rock mines. However, the report cautioned that "The findings presented are not comparable among states because of variability in the definitions . . . used by states, and variability in the type and quality of data available to states. Neither the number of sites, nor the cost of remediation, reported by individual states can be totalled to present a consistent national total." [Emphasis by the Western Governors' Association.] The Western Governors' Association, in an effort funded by the Bureau of Mines, is working with state and federal agencies and private organizations to recommend consistent terminology and guidelines that would aid in future inventories.

In a June 1993 report, the Mineral Policy Center estimated that there were about 560,000 mine sites on public and private lands.[6] This estimate was also based upon data reported by the Western Governors' Association, supplemented with interviews and documents from state officials and discussions with private contractors and consultants.

Abandoned Hard Rock Mines Generally Pose Two Kinds of Hazards

The problems posed by abandoned hard rock mines can generally be classified as physical safety hazards or environmental degradation. Physical safety hazards, which can lead to human injury or death, may include concealed shafts or pits, unsafe structures, and explosives. Conditions causing environmental degradation may include drainage of toxic or acidic water, which could result in soil and groundwater contamination or biological impacts. However, because not all of the agencies have completed their inventories, they have not conducted the necessary fieldwork to identify how many mine sites with problems of each type are on the lands they manage. Furthermore, the factors the agencies use to classify their inventories are not consistent from agency to agency.

[5]This report was issued by the Western Governors' Association Mine Waste Task Force in cooperation with the Interstate Mining Compact Commission.

[6]James S. Lyon et al., Burden of Gilt, Mineral Policy Center (Washington, D.C.: June 1993).

How Land-Managing Agencies Have Classified Sites

According to BLM's guidance on the inventory, as sites are identified they should be placed in categories according to the presence or potential for safety or environmental hazards, as well as reclamation needs. BLM also has a basic ranking system, but the agency has not yet compared the rankings across state or field offices. BLM's inventory in Nevada found extensive safety hazards and confirmed that most of the chemically hazardous sites are already known. The current focus of BLM's Montana state office is on approximately 100 sites that are affecting water quality.

The National Park Service classifies sites according to the type and degree of hazard they present. Each site that will require reclamation is ranked on the basis of its (1) degree of hazard, (2) degree of impact on the environment, and (3) accessibility. The weight applied to these criteria is flexible and varies according to the relevant program's emphasis. According to the National Park Service's Associate Director for Natural Resources, Stewardship, and Science, the agency has a basic knowledge of the hazards at every identified abandoned mine site. The 2,500 identified sites include nearly 7,700 hazardous openings, and the National Park Service estimates that 5 to 10 percent of all the sites pose an environmental threat, such as the impairment of water quality.

FWS program officials say that there are no known hazardous sites with abandoned mines on wildlife refuges. FWS has not categorized its sites any further.

The Forest Service is classifying its sites according to the existing and potential environmental degradation, identifying sites according to whether they may degrade water quality or other natural resources or contain hazardous materials. According to a March 1993 report by the Forest Service, over 1,500 western mining sites with significant problems of acid drainage have been identified on the lands in the National Forest System.[7] A hazardous material specialist with the Forest Service said that approximately 10 percent of the abandoned mine sites on the lands managed by that agency have a high potential to be hazardous waste sites.

How Other Federal Agencies Have Classified Sites

The Bureau of Mines and USGS have both focused on environmental effects in classifying the sites. However, their sources of data are different, and the data were compiled for different purposes. Both agencies are working with an interdepartmental task force, in which the four land-managing

[7]Acid Drainage from Mines on the National Forests: A Management Challenge, USDA Forest Service in Cooperation with the U.S. Department of the Interior's Bureau of Mines, Program Aid 1505 (Mar. 1993).

agencies are also involved, that has proposed addressing the effects of abandoned hard rock mines throughout watersheds, rather than site by site.

The Bureau of Mines used data based on the mines' past production. On the basis of a study of sites in one national forest, the Bureau of Mines has suggested that approximately 2 percent of abandoned hard rock sites might need detailed assessments; a smaller number would need environmental remediation.

USGS collected data from individual agencies, which, as noted earlier, may have different methods and strategies for classifying sites.

How Nonfederal Organizations Have Classified Sites

The Western Governors' Association and the Mineral Policy Center also attempted to categorize abandoned hard rock mine sites according to their hazards. However, as with the inventory estimates, they reported the data differently.

The states provided data for the report by the Western Governors' Association on the types of hazards associated with abandoned hard rock mines, but they did not all report in the same way. For example, Montana reported the numbers of sites, disturbed acres, mine openings, acres of mine dumps, mill sites, smelters, miles of polluted water, and hazardous structures. In contrast, Nevada reported the number of sites, disturbed acres, and mine openings, without the additional detail.

In its June 1993 report, the Mineral Policy Center classified all abandoned hard rock mine sites into six types, ranging from "benign" to "Superfund." This classification was based on information in the report of the Western Governors' Association and on follow-up with the states and the Environmental Protection Agency. Specifically, the Mineral Policy Center classified the sites as follows: 194,500 were benign, needing little if any remediation; 231,900 needed revegetation or landscaping; 116,300 presented safety hazards needing prompt but not necessarily extensive action; 14,400 needed extensive work to prevent surface water contamination; 500 needed complex work to prevent groundwater contamination; and 50 were Superfund sites, posing a severe threat to the public and needing complex cleanup.

Nationwide Cost Estimate for Reclaiming Hard Rock Mines on Federal Lands Is Unavailable

No nationwide cost estimate for reclaiming abandoned hard rock mines on federal lands is available. Preparing accurate estimates of the reclamation costs requires detailed assessments, or characterizations, of the sites, involving physical inspection and in-depth evaluation of the problems at each site. These studies are costly because the estimates can involve complex hydrology and chemistry of soil and water. Historic preservation and protection of endangered species can also affect reclamation costs. The agencies have completed a few such detailed site analyses.

Agencies' Cost Estimates

An estimate of the total cost to reclaim BLM lands is not available because the agency's inventory is not yet complete. However, according to BLM geologists, (1) costs will vary among the states depending upon the type of reclamation required and (2) the costs to clean up environmental damage are much higher than the costs to alleviate physical safety hazards. For example, the costs will be different in Colorado and Montana, where BLM officials are concerned about how the sites are affecting water quality, than in a more arid state such as Nevada. In Nevada, where water quality is less likely to be affected, BLM officials are focusing more on public safety because of the proximity of abandoned mine sites to population centers.

The National Park Service estimates that the cost to reclaim the abandoned mine sites on the lands it currently manages will total about $165 million. These costs include about $40 million for short-term, or urgent, needs. However, these estimates do not include all the National Park Service's lands in Alaska or the 3.1 million acres over which it recently acquired jurisdiction in the California desert. The estimates are based on the National Park Service's experience in reclaiming abandoned mine sites and mitigating their effects.

Although FWS has not estimated reclamation costs, the small number of abandoned mines at most of the refuges are not considered a significant problem and are not known to be hazardous, according to agency officials.

The Forest Service estimates the total cost to reclaim the abandoned mine sites on the federal and private lands within National Forest boundaries to be about $4.7 billion. This estimate includes $2.5 billion to clean up approximately 2,500 sites with hazardous waste and restore the natural resources at these sites, and an additional $2.2 billion to restore water quality and address safety problems at the remaining 22,500 sites. The Forest Service still needs to complete preliminary site investigations to rank the sites for more detailed analysis, officials said. These detailed site

assessments will give the Forest Service the information it needs to prepare more accurate cost estimates.

Cost Estimates by Other Federal Agencies

The Bureau of Mines estimated the "worst-case" cost of reclaiming abandoned mine sites on federal lands at between $4 billion and $35.3 billion. However, this estimate was based upon the assumption that as many as 10,450 sites would require reclamation, while Bureau of Mines officials expect the actual number of sites that would be reclaimed to be far smaller. USGS has not estimated reclamation costs.

In a September 1991 report, the Department of the Interior's Office of Inspector General estimated that it would cost about $11 billion to reclaim the "known universe" of all abandoned noncoal mine sites (not just those on federally managed lands).[8] This estimate was based upon the Bureau of Mines' estimate of the extent of damage rather than on the number and type of abandoned hard rock mine sites. The report did not include an estimate of the number of sites, nor did it classify the sites by the type of hazard they present.

Cost Estimates by Nonfederal Organizations

In most cases, the states reporting to the Western Governors' Association estimated the cost of reclaiming sites. However, not all the states reported such estimates, and those that did so reported statewide estimates without regard to whether the lands were publicly or privately owned.

The Mineral Policy Center has projected the total cost of cleaning up all abandoned hard rock mines (not just those on federal lands) to be from $33 billion to $72 billion. This estimate was based on data contained in the Western Governors' Association's report and on follow-up discussions with the participating states and with the Environmental Protection Agency.

Agency Comments and Our Evaluation

We requested comments on a draft of this report from the Secretary of the Interior and the Chief of the Forest Service or their designees. We met with and obtained comments from officials from the Department of the Interior's Office of the Solicitor, BLM, National Park Service, FWS, USGS, and Office of Policy Analysis and with officials from the U.S. Department of Agriculture's Forest Service and Office of General Counsel. These officials

[8]Noncoal Reclamation, Abandoned Mine Land Reclamation Program, Office of Surface Mining Reclamation and Enforcement, Department of the Interior, Office of Inspector General, Report No. 91-I-1248 (Sept. 9, 1991).

generally agreed with the factual information presented in this report. Officials from several of the agencies provided technical clarifications, which we have incorporated as appropriate.

Officials from the Department of the Interior asked that we recognize their concern that a comprehensive inventory could be mandated. According to these officials, such an inventory would be costly and take efforts away from remediation. In this regard, officials from Interior's agencies noted that the interagency approach of targeting remediation throughout a watershed towards those water bodies impaired by drainage from the abandoned mines would be more cost-effective and worthwhile than a comprehensive inventory of individual mine sites on federal lands. Interior and Forest Service officials noted that environmental problems on federal lands often result from abandoned hard rock mines on private lands located within those federally managed lands.

Because the purpose of our report was to provide information on the number of abandoned mines on federal lands, the hazards these mines pose, and the cost to reclaim them, we did not evaluate the agencies' specific approaches to inventorying or remediating these mine sites, nor did we address other issues affecting federal lands.

In conducting our review, we examined relevant reports and other documents prepared by the four principal land-managing agencies we reviewed within the departments of the Interior and Agriculture. We also interviewed program managers from these organizations in Washington, D.C., and in regional, state, and local offices, as appropriate. In addition, we reviewed reports by Interior's Office of Inspector General, the Western Governors' Association, and the Mineral Policy Center. A full description of our scope and methodology is included in appendix II. We conducted our review from May 1995 through January 1996 in accordance with generally accepted government auditing standards.

As requested, unless you publicly announce its contents earlier, we plan no further distribution of this report until 7 days after the date of this letter. At that time, we will send copies to appropriate congressional committees and federal agencies and to other interested parties. We will also make copies available to others on request.

Please call me at (202) 512-3841 if you or your staff have any questions about this report. Major contributors to this report are listed in appendix III.

Sincerely yours,



Victor S. Rezendes
Director, Energy, Resources,
and Science Issues

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Abbreviations

BLM	Bureau of Land Management
GAO	General Accounting Office
FWS	Fish and Wildlife Service
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey

Estimates of Number and Types of Sites and Cost to Reclaim, by Organization

Agency/ organization	Estimated number of sites	How sites are classified	Estimated cost to reclaim
Land-managing agencies			
National Park Service	About 2,500	Degree of hazard, degree of environmental impact, accessibility	$165 million (about $40 million short-term)
Bureau of Land Management	No overall estimate Nevada: 400,000 features[a] Utah: 17,000-20,000[a] Colorado: fewer than 15,000[b] Montana: about 1,000 sites[b]	Presence or potential for safety or environmental hazards, as well as reclamation needs	No official estimate
Fish and Wildlife Service	About 240 sites	According to officials, no sites are known to be hazardous	No official estimate
Forest Service	About 25,000 sites[c]	Existing and potential environmental degradation	$4.7 billion
Other federal agencies			
Bureau of Mines	15,300 sites on Interior lands and 12,500 sites on Forest Service lands	Environmental hazards	$4 billion to $35.3 billion
U.S. Geological Survey	88,000 sites on Interior lands	Potentially contaminated sites	No official estimate
Interior's Office of Inspector General	No estimate	No classification	About $11 billion
Other organizations			
Western Governors' Association	No estimate[d]	No classification	No estimate[d]
Mineral Policy Center	560,000 sites[e]	Six categories ranging from "benign" to "Superfund"	$33 billion to $72 billion

Note: The estimates of the costs to reclaim sites were prepared by the agencies and organizations listed above. The accuracy of the estimates prepared by the four land-managing agencies depends on detailed site studies, which they have performed to various extents. Because these agencies and the other agencies and organizations listed used different methodologies and assumptions to develop their estimates, the estimates cannot be meaningfully compared or added.

[a]Statewide, regardless of whether the lands are publicly or privately owned.

[b]On public lands.

[c]Within National Forest boundaries; may include some privately owned lands.

[d]According to the Western Governors' Association, "neither the number of sites, nor the cost of remediation, reported by individual states can be totalled to present a consistent national total."

[e]Nationwide, regardless of whether the lands are publicly or privately owned.

Objectives, Scope, and Methodology

The Ranking Minority Member, House Committee on Resources, asked us to report on the (1) approximate number of abandoned hard rock mines on federally managed land, (2) types of hazards these mines pose, and (3) approximate cost to reclaim these mines.

To determine the approximate number of such mines on federally managed lands, we obtained the available inventory information from program managers in the Department of the Interior and the U.S. Department of Agriculture. We focused on the Department of the Interior's Bureau of Land Management (BLM), National Park Service, and Fish and Wildlife Service (FWS) and on the U.S. Department of Agriculture's Forest Service because they manage 623 million acres, or about 95 percent of the federal lands in the United States. To ascertain the types of hazards these abandoned mines pose, we reviewed the agencies' documents and interviewed program managers in the two departments. To obtain estimates of the costs to reclaim these mines, we interviewed program managers and obtained any estimates that had already been prepared by the agencies in both departments. We also interviewed officials from the U.S. Department of Agriculture's Office of the Inspector General.

We reviewed relevant documents and interviewed program managers in the departments of the Interior and Agriculture. At the Department of the Interior, we met with officials from the three key land-managing agencies: BLM, the National Park Service, and FWS. We also met with program officials from the Bureau of Mines and the U.S. Geological Survey (USGS), and the Office of Inspector General. At the U.S. Department of Agriculture, we met with program officials from the Forest Service and Office of the Inspector General. We also interviewed representatives of the Western Governors' Association and the Mineral Policy Center, and reviewed their reports. We did not evaluate the agencies' or other organizations' inventory or cost-estimation methodologies.

In addition, we reviewed three audit reports issued by the Department of the Interior's Inspector General. At the time of our review, the U.S. Department of Agriculture's Inspector General was validating the Forest Service's inventory of abandoned hard rock mines. The Inspector General's report had not been issued at the time of this report.

Major Contributors to This Report

Energy, Resources, and Science Issues

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