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Report to the Chairman, Committee on
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NUCLEAR CLEANUP

Completion of Standards and Effectiveness of Land Use Planning Are Uncertain





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Resources, Community, and
Economic Development Division

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The Honorable John Glenn
Chairman, Committee on
Governmental Affairs
United States Senate

Dear Mr. Chairman:

During 50 years of nuclear weapons production, the Department of Energy (DOE) and its predecessor agencies have generated large volumes of radioactive wastes that have resulted in the contamination of soil, groundwater, and surface water. As a result, DOE faces a massive, complex, and costly cleanup effort. Over the next several years, DOE and the Environmental Protection Agency (EPA) will decide on methods to be used for environmental remediation at DOE's various sites. Standards for "how clean is clean enough" and information about future land uses of DOE's sites would be beneficial in selecting appropriate remedial actions.¹ Previous efforts to develop cleanup standards for radionuclides (radioactive substances) were not successful.

In light of upcoming remediation decisions and past delays in developing cleanup standards for radionuclides, you asked us to review DOE's and EPA's progress in determining cleanup standards and land uses. Specifically, you asked us to determine (1) how cleanup levels are currently determined for DOE's sites, (2) the status and likelihood of success of EPA's efforts to develop cleanup standards for radionuclides, (3) the status of land use planning efforts at DOE, and (4) what hurdles would need to be overcome if land use planning were to be effectively implemented in determining cleanup levels.

Results in Brief

In the absence of comprehensive federal standards specifically designed for cleaning up radioactive contamination, EPA uses other federal and state environmental standards it considers to be relevant and appropriate when selecting a remedial action for DOE's sites. The current process for identifying what standards will be used can be time-consuming and result in varying cleanup levels at different sites. Furthermore, the lack of cleanup standards for radionuclides makes it very difficult for DOE to plan

¹We use the term standards to apply to any possible type of regulatory criteria for cleanup of radioactive contaminants, including (1) a limit on the cancer risk level or radiation dose from radioactive contamination remaining after cleanup or (2) concentration levels limiting contaminants in soil and/or water.

and estimate costs for its cleanup program and disposal of waste. Realistic goals for cleanup are particularly critical for DOE because of the magnitude of its contamination problems and the technological difficulties associated with treating radioactive contamination and disposing of radioactive wastes. Cleanup costs are estimated to be at least \$300 billion.

An interagency group led by EPA and including DOE, Nuclear Regulatory Commission (NRC), and Department of Defense officials has been working since December 1992 to develop cleanup standards for radionuclides. EPA expects to publish a proposed rule in the fall of 1994 but has not set a specific time frame for issuing a final rule. Previous interagency efforts to establish standards were not successful because of a lack of resources and low priority. While the current effort has been assigned greater priority and resources, its success is still uncertain because of the complexity and controversial nature of the issues that must be resolved.

A 1991 study by the Advisory Committee on Nuclear Facility Safety to DOE recommended that land use planning be used to help identify realistic cleanup levels. As a result, DOE has begun land use planning efforts. DOE completed a future site uses study in December 1992 for the Hanford (Washington) site, and similar studies are beginning at DOE's Rocky Flats (Colorado) and Fernald (Ohio) sites. DOE set a goal of completing land use plans for its sites by the end of 1995.

Some hurdles need to be overcome if land use planning is to be effectively implemented. First, EPA generally assumes that land will be used for residential purposes, which results in the most stringent environmental requirements being imposed on every cleanup project. EPA is seeking congressional direction and clarification on how it could consider other land uses in selecting remedies and setting cleanup levels. Second, where cleanups do not achieve a level appropriate for residential use, residual contamination may be left on site, and restrictions on land use may be needed. Although the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (CERCLA), requires periodic reviews of sites with residual contamination, EPA's guidance for such reviews does not adequately address restrictions on land use.

Background

DOE is responsible for environmental cleanup and waste management at more than 130 contaminated installations in 34 states and territories. Nineteen of DOE's installations/sites are on the CERCLA National Priorities List, which identifies the most hazardous inactive waste sites.

Contaminants at DOE's sites include substances that can cause cancer, birth defects such as mental retardation, and toxic effects to the nervous system, eyes, and other organs. Cleanup activities will need to address wastes, soil, surface water, groundwater, and structures contaminated by hazardous and/or radioactive substances. For example, at DOE's Hanford site, the disposal of more than 440 billion gallons of radioactive and hazardous liquid waste in trenches, ponds, and underground cribs (underground structures designed to allow liquid waste to percolate to the soil) has resulted in soil and groundwater contamination. At DOE's Rocky Flats site, preliminary assessments have identified nitrates, solvents, and radioactive elements in groundwater as possibly requiring cleanup. As of April 1994, DOE estimated that cleaning up all its contaminated sites will cost about \$300 billion.

DOE's cleanup is governed by several statutes and interagency agreements. Under the Atomic Energy Act of 1954, as amended, EPA has authority to set generally applicable standards for the protection of the environment from radioactive materials, which could include cleanup standards. CERCLA, or Superfund as it is commonly known, authorizes EPA to clean up hazardous waste sites and to compel the parties responsible for the hazardous wastes to assist in or pay for the cleanup. In 1986, the Congress passed the Superfund Amendments and Reauthorization Act, which emphasized cleanup remedies that treat—rather than simply contain—contaminated waste to the maximum extent practicable. The 1986 amendments also required that remedial actions attain federal or state environmental requirements that are applicable or relevant and appropriate, and specifically applied the act to the remediation of federal facilities.² Sixteen of the 19 DOE sites on the National Priorities List have interagency agreements between DOE and EPA and, in some cases, the state for meeting CERCLA requirements. (Three sites that were added to the National Priorities List in May 1994 do not yet have interagency agreements under CERCLA.) In 1990, the Congress reauthorized CERCLA and authorized additional funds without making any substantive changes to the program. CERCLA is again scheduled for reauthorization in 1994.

To determine how best to clean up a site, CERCLA requires DOE to perform a remedial investigation, which characterizes contamination, and a feasibility study, which develops and analyzes remedial alternatives, both of which are subject to EPA's review. Early in this process, DOE and EPA

²Applicable requirements are those cleanup standards and other requirements that specifically address a hazardous substance at a CERCLA site. Relevant and appropriate requirements are standards that, while not legally applicable at the CERCLA site, address problems or situations that are sufficiently similar to those encountered at the site that their use is well suited to the particular site.

identify potentially applicable or relevant and appropriate requirements (ARARs), and the feasibility study discusses whether remedial alternatives would achieve compliance with ARARs. DOE and EPA finalize ARARs when they select a remedy. If the agencies disagree, CERCLA authorizes EPA to make the final determination regarding the selection of a remedy. If the remedy will result in contaminants remaining at a site after remedial action is completed, CERCLA requires that a review be conducted every 5 years after initiating action to ensure that the remedy still protects human health and the environment. The remedy, the reasons for its selection, and the need for 5-year reviews (if required) are documented in a record of decision. (App. I provides further details about the CERCLA cleanup process.)

Comprehensive Cleanup Standards Do Not Exist but Are Needed

Comprehensive standards designed specifically for the cleanup of radionuclides do not exist. The only standards designed for the cleanup of radionuclides are those for land and buildings contaminated by uranium mill tailings at inactive uranium-processing sites. In the absence of applicable cleanup standards for radionuclides, EPA and DOE identify other federal and state environmental standards that are relevant and appropriate for DOE cleanups. This process for determining cleanup requirements can be time-consuming and contentious and can result in varying levels of cleanup and public protection. Comprehensive cleanup standards are needed to allow DOE to plan and estimate costs for its cleanup program, particularly in light of upcoming decisions on cleanups.

Cleanup Levels Are Drawn From Other Requirements

Currently, other environmental standards for radionuclides are used for DOE's remedial actions, once the standards are identified through the CERCLA process as relevant and appropriate requirements. For example, federal standards that might be used include drinking water standards, Clean Air Act standards, and cleanup standards for soil near inactive uranium-processing sites. State standards may be used if they are more stringent than federal ARARs. For example, Colorado has a standard, considered a potential ARAR by state and EPA regional officials, of 0.05 picocuries³ per liter for plutonium in surface water that is adjacent to or immediately downstream of DOE's Rocky Flats site.

However, other existing environmental standards do not cover all radionuclides and media. For instance, apart from standards for uranium

³A picocurie is equivalent to one-trillionth of a curie. A curie is a measure of the rate of radioactive decay.

mill tailings, no federal standards exist for cleaning up radionuclides in soil. In addition, while existing standards such as those set under the Safe Drinking Water Act might be used as levels for cleaning up groundwater, drinking water standards do not exist for some radionuclides. If no federal or state standards exist for a given contaminant, CERCLA regulations state that residual contamination should generally not result in a lifetime cancer risk to an individual that exceeds a range of approximately 1 in 1 million to 1 in 10,000. EPA's guidance specifies methods for estimating cancer risk from residual contamination.

Current Process Can Be Problematic

The process for identifying what requirements will be used can be time-consuming and contentious. Cleanup requirements are generally established separately for each individual operable unit undergoing cleanup at DOE's sites.⁴ An environmental restoration official at DOE's Chicago Field Office noted that even sitewide standards would decrease the time and effort spent in negotiating with EPA and state regulatory agencies; currently, negotiations about ARARs may separately address each operable unit within a site. According to available data on operable units, nine of DOE's sites have a total of 245 operable units.

Setting individual standards can take time. For example, DOE and EPA debated for 3 years over which standards should be used for one operable unit at Fernald—material in the K-65 silos. No existing standards clearly applied to the management and disposal of the concentrated uranium ore by-products in Fernald's K-65 silos. EPA Region V (Chicago) and DOE (Fernald) initially selected different environmental requirements as relevant and appropriate. EPA's and DOE's staff time was used in researching and writing numerous letters to each other on this issue. In accordance with CERCLA, the agreement between EPA and DOE governing Fernald's cleanup states that EPA will make the final determination regarding what standards will be used. DOE listed the requirements that EPA chose in its September 1993 feasibility study for the K-65 silos.

Furthermore, because the question "How clean is clean enough?" is answered anew at each DOE operable unit slated for remediation, cleanup levels and levels of protection for citizens may vary from site to site. In 25 situations where cleanup levels have been set for radionuclides at 49 of DOE's sites, 6 situations (such as levels for uranium in soil) had different

⁴Operable units are usually specific geographical portions of a site.

standards for the various sites.⁵ For example, at seven sites where natural uranium contaminated the soil, five different cleanup levels—ranging from 35 to 150 picocuries per gram of soil—were established. While information on why various cleanup levels were used at different sites was not complete, the information available to us indicated that varying cleanup levels resulted from the use of different methodologies for determining cleanup levels and from differences in where contamination was located.

Need Exists for Cleanup Standards in Near Future

The need for comprehensive federal cleanup standards has been identified by DOE, EPA, congressional oversight committees, and the Office of Technology Assessment. For instance, the Office of Technology Assessment's 1991 report stated that without knowledge of the cleanup levels to be achieved, DOE cannot develop reliable cost estimates for the total cleanup.⁶ DOE's Assistant Secretary for Environmental Management has similarly testified that without cleanup standards as goals, planning and cost estimating for cleanup programs become virtually impossible.⁷

The need for cleanup standards is becoming particularly urgent. DOE will shortly face a large "wave" of decision points for its remedial actions, for which it will need information about cleanup levels. According to a DOE analysis, approximately 100 preliminary or final restoration decision points will occur in 1996 and 1997; these decision points include remedial investigation plans, remedial investigations and risk assessments, feasibility studies and other assessments of alternatives, and final remedial action decisions.⁸ Figure 1 illustrates the timing and numbers of upcoming decision points for remedial action.

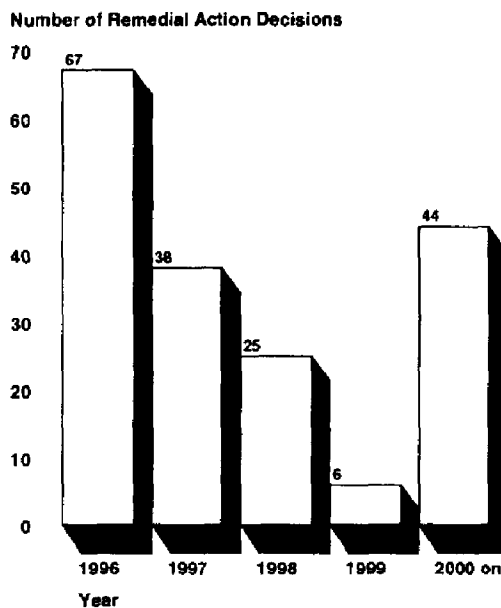
⁵Our analysis is based on DOE's data for 49 sites for which cleanup levels have been set for radionuclides. The 49 sites include uranium mill tailings sites, sites formerly utilized by DOE, and several separate restoration projects. These sites involved 25 different combinations of contaminants and media (a combination is uranium in soil; another combination is tritium in groundwater, etc.). Of these 25 situations requiring cleanup levels, 6 had different cleanup levels, 8 had identical cleanup levels for more than one site, and 11 were found at only one location.

⁶Complex Cleanup: The Environmental Legacy of Nuclear Weapons Production, Office of Technology Assessment (Washington, D.C.: U.S. Government Printing Office [GPO], Feb. 1991).

⁷Statement of Thomas P. Grumbly, Assistant Secretary for Environmental Management, before the U.S. Senate, Committee on Governmental Affairs (Sept. 21, 1993). (Mr. Grumbly's title at that time was Assistant Secretary for Environmental Restoration and Waste Management.)

⁸Only the decision point occurring first was counted; subsequent decision points for each operable unit or project were not included. The DOE analysis included all sites.

Figure 1: Preliminary and Final Remedial Action Decisions at DOE's Sites



Source: GAO figure based on DOE data.

Two bills to amend CERCLA that are supported by the Clinton administration (H.R. 3800 and S. 1834) originally proposed that EPA establish national goals and national cleanup levels for remedial action. In testifying on the bills, EPA's Administrator noted that inconsistent cleanup goals and remedies contribute to uncertainty, protracted site-by-site evaluation, and higher cleanup costs.⁹ National cleanup levels for contaminants commonly found at sites were to be based on the goals in order to provide for consistent protection to all communities. As of June 1994, subsequent amendments had deleted the requirement for national cleanup levels and proposed that EPA promulgate a national risk protocol for determining site-specific cleanup levels that would meet the national goals, while reflecting factors that vary from site to site. As of June 1994, it was unclear how radiation cleanup standards (being developed) would relate to national cleanup goals, according to officials in EPA's offices of General Counsel and Radiation and Indoor Air.

⁹Statement of Carol M. Browner, EPA Administrator, before the House of Representatives, Committee on Energy and Commerce, Subcommittee on Transportation and Hazardous Materials (Feb. 3, 1994).

Success of Renewed Effort to Develop Cleanup Standards Is Uncertain

Since December 1992, the Interagency Radiation Cleanup Information and Technology Committee has been working to develop cleanup standards for radionuclides, which EPA would issue as a regulation. The Committee is led by EPA, and includes DOE, NRC, and Department of Defense officials. Although the current effort to develop cleanup standards has been assigned a greater priority than prior efforts and has made some progress, the difficulty of the issues that must be resolved makes success uncertain.

Previous attempts to develop federal cleanup standards were prolonged, intermittent, and unsuccessful. A previous interagency group consisting of officials from EPA, DOE, NRC, and other agencies worked intermittently from 1984 to 1990 without successfully developing cleanup standards for radionuclides. By 1990, the working group had completed draft guidance for radiation exposure to the general public but had not developed cleanup standards for radionuclides. As we previously reported, the primary reason that standards were not completed was that resources were lacking.¹⁰ Additional reasons were the lack of a clear mandate and a low priority.

Recently, the development of federal cleanup standards has taken on a new sense of urgency, as evidenced by additional resources and congressional interest. To assist EPA in developing standards, DOE and EPA signed an interagency agreement in April 1993. DOE agreed to provide EPA with funding for seven full-time personnel and for other functions, such as technical support for developing cleanup standards. The interagency agreement provided EPA with \$1.5 million and runs through January 31, 1995.

Status of Efforts to Develop Standards

EPA estimates that it will publish a proposed rule to set standards for cleaning up radiation sites in the spring of 1995.¹¹ EPA has not established a specific time frame for issuing the final rule. As of June 1994, EPA and the interagency group had completed the following steps toward that goal:

- Identified and analyzed issues that need to be settled to develop cleanup standards for radionuclides, which resulted in an issue paper.

¹⁰Radioactive Waste: EPA Standards Delayed by Low Priority and Coordination Problems (GAO/RCED-93-126, June 3, 1993)

¹¹Later and under a separate effort, EPA plans to address the development of waste management regulations and/or guidance for the disposal of radioactive waste generated during the remediation of sites. EPA is also exploring the feasibility of recycle/reuse regulations for buildings and equipment contaminated with low levels of radioactivity.

- Published an advance notice of proposed rulemaking on October 21, 1993, requesting public input.
- Received advice and comments from a subcommittee of the National Advisory Council on Environmental Policy and Technology that was established to provide environmental policy information and advice to EPA on cleaning up radiation sites. (The subcommittee consists of individuals from a wide variety of governmental agencies, industry, and public interest groups.)
- Developed a preliminary draft in May 1994 of a proposed rule for cleaning up sites contaminated with radiation.

EPA has not yet published a proposed rule in the Federal Register but staff have developed a preliminary working draft specifying a radiation dose limit of 15 millirem¹² per year above natural background radiation. The 15-millirem dose limit corresponds to an estimated cancer risk of less than 3 in 10,000 over 30 years of exposure. The dose limit could be achieved either by cleanup such that doses resulting from unrestricted land use would be below the limit or through a combination of cleanup and controls, such as land use restrictions. The preliminary draft also specified that remedial actions should ensure that groundwater affected by a site does not exceed limits for drinking water set under the Safe Drinking Water Act. The draft is expected to change before it is issued as a proposed rule and is being used primarily to facilitate public discussion and comment.

EPA plans that guidance to accompany the final rule would cover how to determine concentration levels for residual contamination in soil that meet the radiation dose limit. According to the Radiation Studies Branch Chief, EPA plans that the guidance include soil concentration levels for at least two land uses (residential and industrial/commercial) as well as a model for determining concentration levels on the basis of site-specific conditions.

In addition to the interagency working group's efforts to develop generally applicable cleanup standards for radionuclides, NRC and DOE are each developing standards for certain aspects of their operations. These activities are described in appendix II.

Difficult Issues Remain to Be Addressed

Discussion of EPA's preliminary draft proposed rule by the subcommittee of the National Advisory Council on Environmental Policy and Technology

¹²A millirem is a thousandth of a rem. A rem is a unit of measurement for radiation dosage to humans.

(described above) indicates that controversial and technically complex issues remain. In its May 1994 meeting, the subcommittee had questions and concerns about acceptable risk levels, the practical and cost implications of the dose limits, the technical capability to measure the radiation levels indicated by the dose limits, local government involvement in land use decisions, the enforceability and longevity of land use controls, and the practicality of applying the rule to nonfederal sites.

EPA has discussed its planned approach to the rule with the other agencies in the interagency group. However, the approach was still under review by the interagency group as of June 1994, according to the Chief of EPA's Radiation Studies Branch. The approaches that agencies have traditionally used have differed. For instance, EPA, DOE, and NRC have historically considered different risk levels to be acceptable and have used different approaches for risk assessment. DOE had not yet provided comments to EPA on the preliminary draft proposed rule as of June 1994.

Status of DOE's Efforts to Utilize Land Use Planning in Setting Cleanup Levels

As a result of a 1991 report to DOE by the Advisory Committee on Nuclear Facility Safety, DOE has decided to utilize land use planning as part of its cleanup effort. Potential advantages of land use planning include reducing cleanup costs, identifying community needs, and helping cleanups to progress. DOE has developed guidance for identifying future land uses, completed a future land use report for Hanford, and begun such efforts at several other sites.

Land Use Planning Is Potentially Advantageous

Land use planning could be a tool for identifying realistic cleanup goals. In its 1991 final report to the Secretary of Energy, the Advisory Committee on Nuclear Facility Safety stated that it is widely understood that taxpayers cannot afford to return all of DOE's contaminated land to pristine conditions and recommended a land use planning approach. The Advisory Committee reported that under current assumptions of unrestricted use, the most stringent environmental requirements are imposed on every cleanup project. However, if a land use plan identified certain areas for restricted uses, then different cleanup criteria could result in a less costly cleanup that still protects the public, workers, and the environment, according to the Advisory Committee report.

DOE's Assistant Secretary for Environmental Management recently testified that incorporating realistic land use assumptions in the selection process for a remedy could result in substantial cost savings. He stated that changes to CERCLA (supported by the administration)—establishing

national cleanup goals, cleanup levels reflecting anticipated future land uses, generic remedies and expedited remedy selection where feasible, and a national protocol for risk assessments—could result in cost savings to DOE in the range of \$200 million to \$600 million a year, with the largest component of savings resulting from basing the selection of a remedy on future land uses.¹³

Comparative cost estimates, where available, illustrate that basing cleanup levels on expected land use has the potential to save money.¹⁴ In December 1992, DOE estimated the costs of various degrees of cleanup for four of Fernald's five operable units on the basis of an initial screening of remedial alternatives. DOE estimated that it would cost \$3.9 billion to clean up these four units to a level that would allow people to reside and farm there, which is a very stringent cleanup level because residential farming results in many possible avenues of exposure to contaminants. Three other alternatives representing varying degrees of restrictions on land use were estimated to cost from \$500 million to \$2.7 billion. The least costly alternative would involve capping and containing certain wastes, which would require restrictions on the use of land areas containing the wastes. The more costly of these three alternatives would involve more waste removal and treatment but would still dispose of remaining waste on-site; the disposal area would be set aside for restricted use. The cost estimates are preliminary and are not tied to particular land uses, as Fernald does not yet have a land use plan.

Other advantages of tying cleanup levels to expected land uses are that remedial decisions could be based on better information about community needs and that more feasible cleanup goals might help cleanups to progress. For example, the Hanford Future Site Uses Study, which was based on extensive community involvement, identified certain relatively uncontaminated areas as having high future use value and recommended that they be cleaned up and released for other uses sooner than DOE planned. DOE and EPA agreed to the earlier cleanup of these areas. In addition, DOE's Assistant Secretary for Environmental Management has advocated changing to more feasible near-term goals to make what progress is possible in this generation.¹⁵ He stated that some remedial

¹³Statement of Thomas P. Grumbly, Assistant Secretary for Environmental Management, before the U.S. Senate, Committee on Energy and Natural Resources (Mar. 24, 1994).

¹⁴Such data are not available at many DOE sites because the sites have not progressed far enough in the cleanup process to have alternative remedies and cost estimates.

¹⁵Statement of Thomas P. Grumbly, Sept. 21, 1993.

actions do not progress beyond the study phase because no technology exists to meet standards for unrestricted land use.

DOE Plans to Implement Land Use Planning

Citing the 1991 report by the Advisory Committee on Nuclear Facility Safety, DOE's 5-year plan for environmental restoration and waste management states that land use planning with participation from affected parties will be used to reduce health risks, control costs, and build consensus.¹⁶ Because of the large number of upcoming decision points, the Assistant Secretary for Environmental Management set a goal of establishing future land use plans for DOE's sites by the end of 1995. (A list of sites that DOE has initially identified as needing such plans is in app. III.)

To support land use planning efforts, DOE developed guidance for its field sites, which was issued in final draft form in January 1994. Regarding public involvement, the guidance specifies that participants in land use planning can include regulatory agencies, affected Indian tribes, state and local government officials, representatives of those who may be affected economically (such as business, labor, and agriculture representatives), environmental and public interest groups, and concerned citizens. Land use planning groups are to evaluate information on sites to determine preferred future land uses for major geographic areas of each site. These groups are to designate future land uses under the following categories: industrial and commercial (including waste management), residential, agricultural, recreational, Native American, and open space/wilderness.

Prior to the guidance's issuance, land use planning had been conducted at one of DOE's sites. Specifically, at the Hanford site, a future site-uses report was completed in December 1992 by a group including representatives of local and state governments, Indian tribes, environmental groups, labor unions, and other local interests. The report identified a number of potential uses for six geographic areas of Hanford and defined levels of access related to the land use. The levels of access used were (1) unrestricted use (areas clean enough for any human use), (2) restricted use (areas with limited use, such as industrial use, due to remaining contamination), and (3) exclusive use and buffer zones (areas that DOE continues to use for waste and some surrounding land).

The Hanford future site-uses report also made some general recommendations regarding cleanup, some of which DOE and EPA are

¹⁶Environmental Restoration and Waste Management Five-Year Plan: Fiscal Years 1994-1998, Vol. I, DOE (Jan. 1993).

starting to implement. The recommendations included placing a high priority on protecting the Columbia River, dealing realistically and forcefully with groundwater contamination, giving priority to cleaning up areas with a high use value, and consolidating wastes from throughout the complex to one area in order to minimize the amount of land devoted to waste or contaminated by waste. According to DOE's Hanford and EPA's Region X (Seattle) officials, these recommendations were incorporated into the renegotiation of the agreement between EPA, DOE, and the Washington State Department of Ecology that governs Hanford's cleanup.

Certain of DOE's other sites are in the beginning stages of developing land use plans with involvement from citizens. Both Rocky Flats and Fernald have established site-specific citizens' groups to study future site uses. Several other sites, including Savannah River (South Carolina), Idaho National Engineering Laboratory, Nevada Test Site, and Pantex Plant (Texas), have begun the process of planning their land use projects and setting up citizens' groups.

Effective Implementation of Land Use Planning Is Uncertain

Efforts to consider future land uses in determining cleanup levels and selecting remedial actions are just beginning, and their effectiveness is uncertain. EPA's practice has been to generally assume residential land use, and the agency is seeking congressional direction and clarification of its authority to consider other land uses. Effective implementation also depends on addressing (1) potential difficulties in restricting land use and (2) concerns about public involvement and writing off contaminated land too readily.

Current CERCLA Practice May Make Implementing Land Use Planning Difficult

While future land uses could potentially be considered in the CERCLA process, EPA's current practice is to generally assume one land use—residential. Because residential use can result in greater exposure to contamination, such use requires a stringent cleanup. Thus EPA considers cleanups for residential use to protect human health. Although EPA's policy allows assessing other land uses if the probability of future residential use is small, this does not occur often in practice, according to testimony by EPA's Deputy Administrator:

In practice, future land use has often been assumed to be residential. In some of these cases, the existing and prior use of the land was not residential. Unrealistic assumptions

about future land use could significantly increase the costs of cleanup without commensurate benefits.¹⁷

In addition, while CERCLA does not specifically address considering future land use, the law states that cleanup alternatives that permanently treat contaminants are preferred. Similarly, EPA's regulations provide that EPA may use controls restricting land or water use as a component of a remedy but also that these controls shall not generally substitute for more active remedies.

Proposed legislation to amend CERCLA (H.R. 3800 and S. 1834) would specifically authorize consideration of land use. According to a staff attorney in EPA's Office of General Counsel, EPA is seeking clearer congressional direction through the legislation about how, to what extent, and in what circumstances to use its existing discretion under CERCLA to consider land use. Under the proposed legislation, a working group from the affected community would recommend future land uses for EPA consideration.

Restricting Land Use May Present Difficulties

Considerable uncertainty exists in forecasting future land uses. For instance, heavily industrialized areas may later be developed as residential communities. Concern exists that institutional controls, such as restrictions on land or water use, may not be effective over the long periods that some radioactive contamination persists. DOE's Assistant Secretary for Environmental Management testified that linking the degree of remediation to land use would raise profound implications regarding society's ability to control long-term land use and obligation to make decisions respecting future generations.¹⁸ Other knowledgeable officials have also expressed concern about land use restrictions. At a DOE workshop on land use planning guidance, an Air Force official involved in base closures stated that deed restrictions, zoning, and building permits are not controls designed to protect health and the environment over the long-term and that exceptions are frequently made to zoning and permits. The Director of the Energy Research Foundation in South Carolina told us that the public will not accept institutional controls as part of remedial actions unless there is a system to maintain and monitor the controls over time.

¹⁷Statement of Robert M. Sussman, EPA Deputy Administrator, before the House of Representatives, Committee on Energy and Commerce, Subcommittee on Transportation and Hazardous Materials (June 23, 1993).

¹⁸Statement of Thomas P. Grumbly, Sept. 21, 1993.

If a remedy will result in contaminants' remaining at a site after remedial action is completed, section 121(c) of CERCLA requires that a review be conducted every 5 years after initiating action to ensure that the remedy still protects human health and the environment. Section 121(c) also authorizes action under other CERCLA authorities if judged appropriate on the basis of the review. EPA's guidance for 5-year reviews states that reviews are to include a review of documented operation and maintenance of the site, a visit to the site, and a limited analysis of the site's conditions. Also, new or modified federal and state environmental laws are to be analyzed to see if they are ARARs and if they call into question the protectiveness of the remedy.

In our recent review of EPA's systems for continuing oversight of sites where cleanup has been completed, we found that institutional controls, such as restrictions on land or water use, imply an indefinite enforcement period.¹⁹ Ensuring the continued efficacy of institutional controls is difficult, according to EPA headquarters and regional officials we contacted in the course of this review. In addition, containment remedies and barriers require maintenance to ensure continued effectiveness. For example, our report noted that a draft 5-year review of one private site found that no one had maintained the fence at the site or inspected and maintained the cap over solidified contaminated material. Trees had begun growing on the cap, and their roots threatened the cap's integrity. As a result of the 5-year review, the parties responsible for the cleanup began to maintain the fence and cap.

While 5-year reviews could be a mechanism for ensuring the continued effectiveness of land use restrictions, EPA's current guidance for these reviews does not provide sufficient detail about reviewing and maintaining land use restrictions. Such guidance is important because DOE will conduct reviews of its sites and other parties may have a role in maintaining restrictions. Specifically, EPA's current guidance for 5-year reviews has four weaknesses.

- The guidance does not clearly require a review of potential changes in land use. According to EPA's guidance, the review may consider pending changes in zoning or land uses that would undermine institutional controls that were part of the remedy; if appropriate, EPA is to notify the local government that proposed changes might compromise the remedy. However, the guidance does state that all remedies requiring access

¹⁹Superfund: Cleanups Nearing Completion Indicate Future Challenges (GAO/RCED-93-188, Sept. 1, 1993).

controls or land use restrictions will be reviewed, including confirmations that institutional controls are in place.

- The guidance does not provide details on how to ensure that controls over land use are maintained by the various parties involved. DOE's work to date in identifying potential future land uses indicates that some land may continue under DOE's control, some land may be used for wilderness or recreation areas, and some land may be released to private ownership. Thus, use of DOE's remediated sites might be controlled by DOE, other federal agencies, or a state or local government. The Director of DOE's Future Use Project Office told us that maintaining land use restrictions over long periods is a significant issue that should be discussed by DOE, EPA, and state and local governments.
- The guidance does not mention reviewing technological advances that may make further cleanup at DOE's sites more feasible. As some radioactive contamination persists for many generations, technological advances are likely to occur.
- The guidance does not specify who is to conduct or approve such reviews for federal sites, like DOE's.

EPA is currently drafting a supplement to its 5-year review guidance clarifying that an executive order specifies federal agencies' responsibilities for 5-year reviews of their sites. For DOE, the executive order and draft supplemental guidance state that the Department is delegated authority for reviews of its sites, whether or not a site is on the National Priorities List. The draft supplemental guidance also states that for sites on the National Priorities List, federal agencies should submit to the EPA regional office (1) drafts certifying the continued protectiveness of remedies and (2) supporting information; this office's concurrence should be obtained in accordance with existing interagency legal agreements. However, the draft supplemental guidance does not correct the other problems noted above. According to Hazardous Site Control Division staff working on the supplemental guidance, EPA expects to issue the guidance in the summer of 1994.

Land Use Planning Presents Other Concerns

Viable public participation in land use planning was a concern of several parties commenting on DOE's 5-year plan for environmental restoration and waste management. For instance, Oregon's Department of Energy commented that in reaching a consensus decision on land use, "It is vital that this consensus be based on ALL of the parties involved, with extensive public involvement throughout the process." At a DOE workshop on land use planning guidance, the Vice Chair of the Sierra Club National

Committee expressed concern that in the process of implementing public participation, environmental and peace organizations sometimes are left out, and the resulting decisions can lack credibility.

Finally, some organizations have expressed concern that land use planning could be used as a means for DOE to write off land that could be more fully restored. The Subcommittee on Radiation Site Cleanup Regulations of the National Advisory Council on Environmental Policy and Technology advised EPA that it should ensure that future use considerations do not become a "crutch for not cleaning up." In comments on the 5-year plan, the Colorado Department of Health stated that DOE should use care in linking cleanup levels to land use and asked, "Is the rhetoric throughout the document an attempt to justify avoiding cleanup to any level?"

Conclusions

DOE faces numerous major cleanup decisions in the near future. Comprehensive federal cleanup standards for radionuclides could help provide for better-informed cleanup plans and cost estimates. While the current effort of the interagency group to develop cleanup standards for radionuclides has greater priority and resources than past efforts, the group's success is uncertain because of the complexity and controversial nature of issues that it must resolve. If standards are developed after remedial actions for DOE's sites have been selected and finalized, cleanup remedies might not meet the standards or remedies might need to be redesigned, resulting in delays and additional expense.

The effectiveness of efforts to implement future land use planning is uncertain in light of EPA's current practice of generally assuming residential land use. The agency supports amendments to CERCLA that provide for greater consideration of future land use and would prefer more specific congressional direction before changing its practices. If CERCLA and/or EPA's practices concerning land use are not changed, some of the cost savings expected from land use planning may not be realized.

Potential difficulties in maintaining land use restrictions must be addressed to help ensure continued protection of public health from persistent radioactive contamination. The 5-year reviews required by CERCLA could help ensure the effectiveness of land use restrictions for the foreseeable future. However, current EPA guidance for 5-year reviews does not sufficiently address the review and maintenance of land use restrictions. If DOE is to conduct 5-year reviews of its sites, more specific guidance, which clearly requires the review of potential changes in land

use and discusses the roles of the various governmental agencies potentially involved in maintaining restrictions, is necessary. In addition, EPA's 5-year review guidance does not address considering technological advances that are likely to occur over the many years that contamination can persist at DOE's sites.

Meaningful public participation can reduce concerns about including all relevant parties and help ensure that land is not too readily written off as being infeasible to clean up. We encourage DOE to continue in its current path of early and extensive public participation in land use planning through site-specific citizens' groups, so that any decisions to clean up land to a level less than that needed for unrestricted land use have public support.

Matter for Congressional Consideration

If the Congress agrees with DOE's and EPA's plans to utilize land use planning, the Congress could consider amending CERCLA to provide more specific direction about incorporating future land uses when determining cleanup levels and selecting remedial actions.

Recommendations

To provide standards before many decisions about DOE's cleanups are made, we recommend that the Administrator, EPA, with other members of the interagency group, complete the work of the Interagency Radiation Cleanup Information and Technology Committee by the end of 1995.

To help overcome potential disadvantages of a land use planning approach, we recommend that the Administrator, EPA, provide more detailed guidance for 5-year reviews of sites not returned to unrestricted use and communicate this guidance to DOE. The guidance should (1) specify that such reviews address whether land use patterns are changing or likely to change in the near future and (2) discuss responsibilities for maintaining land use restrictions. If such guidance would involve responsibilities of state and local governments, EPA should consult with them in developing the guidance. We further recommend that the Administrator, EPA, specify in records of decision for DOE's sites with residual contamination that 5-year reviews be supplemented by the consideration of advances in technology that may make more extensive cleanup feasible.

Agency Comments

We discussed the facts presented in the report with DOE and EPA headquarters officials in relevant offices. These included the Directors of

the Regulatory Integration Division and the Future Use Project Office in DOE's Office of Environmental Management, and the Director of the Air, Water, and Radiation Division in DOE's Office of Environment, Safety, and Health. At EPA, officials with whom we discussed the report's facts included the Chief of the Radiation Studies Branch in the Office of Radiation and Indoor Air, the Chief of the Remedial and Operations Guidance Branch in the Office of Solid Waste and Emergency Response, a chemical engineer from the Office of Federal Facilities Enforcement, and attorneys from the Office of General Counsel. Except as noted below, they generally agreed with the factual material in this report and offered several updates and technical clarifications that have been incorporated where appropriate. Officials in EPA's Office of Solid Waste and Emergency Response, while agreeing that more information about maintaining land use restrictions was needed, disagreed with our assessment that EPA's current guidance for 5-year reviews was not adequate and that 5-year review guidance was an appropriate vehicle to address the maintaining of restrictions. Because DOE rather than EPA will be responsible for 5-year reviews of DOE's sites and will rely on EPA's guidance in conducting reviews, we believe that EPA's guidance should be revised to include the items that we noted were lacking. Furthermore, as 5-year reviews might identify a need for actions to reinforce land use restrictions, we believe that guidance for the reviews is a logical vehicle to discuss the maintaining of restrictions. As requested, we did not obtain written agency comments on a draft of this report.

We performed our review between January 1993 and June 1994 in accordance with generally accepted government auditing standards. Appendix IV describes our objectives, scope, and methodology in detail.

As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days after the date of this letter. At that time, we will send copies to the Secretary of Energy; Administrator, EPA; and Director, Office of Management and Budget. We will make copies available to others on request.

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

Sincerely yours,

A handwritten signature in black ink, appearing to read "Victor S. Rezendes". The signature is fluid and cursive, with the first name "Victor" and last name "Rezendes" clearly distinguishable.

Victor S. Rezendes
Director, Energy and Science Issues

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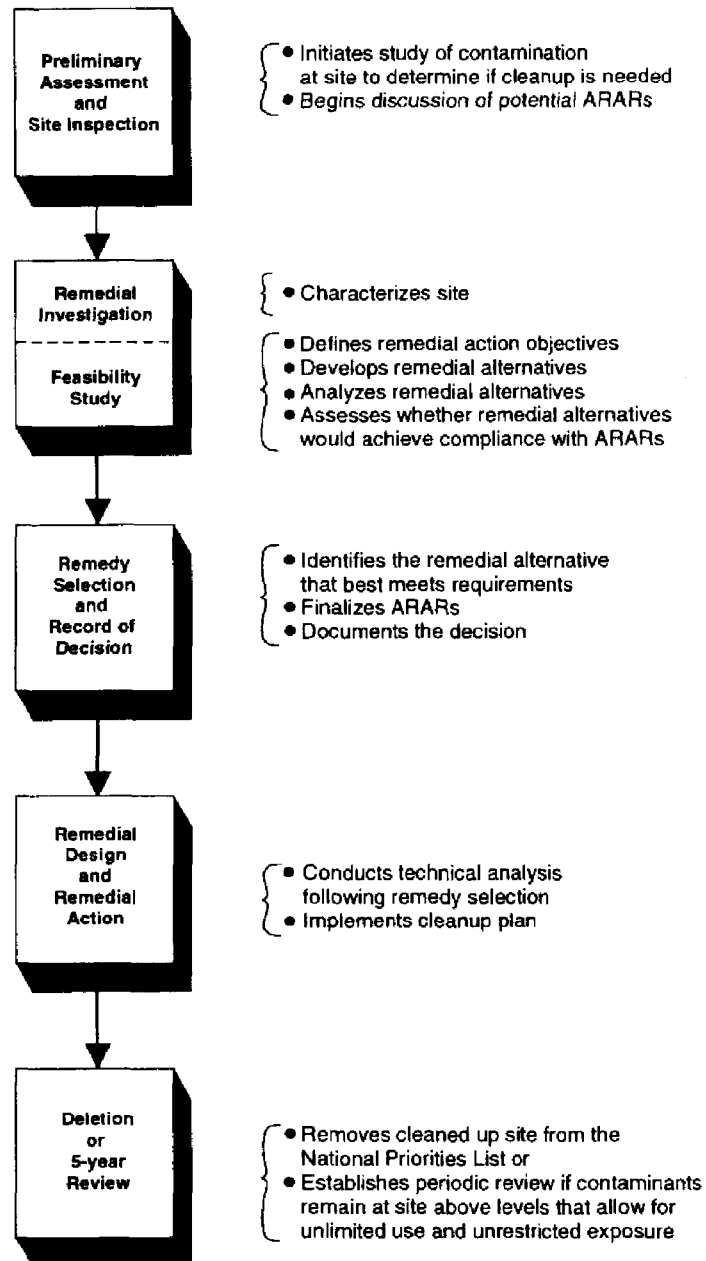
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Figure 1: Preliminary and Final Remedial Action Decisions at DOE's Sites

Abbreviations

ARARs	applicable or relevant and appropriate requirements
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DOE	Department of Energy
EPA	Environmental Protection Agency
GAO	General Accounting Office
NRC	Nuclear Regulatory Commission

The CERCLA Cleanup Process



Legend

ARARs = applicable or relevant and appropriate requirements.

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended.

NRC's and DOE's Standard-Setting Actions

The Nuclear Regulatory Commission (NRC) is pursuing enhanced participatory rulemaking (a means of obtaining extensive public involvement) for standards on decommissioning for its licensees. NRC expects to publish a proposed rule in July 1994 and a final rule in May 1995. According to the Director of the Environmental Protection Agency's (EPA) Office of Radiation and Indoor Air, EPA will closely coordinate with NRC in developing cleanup standards. Under a 1992 memorandum of understanding between the two agencies, should EPA conclude that NRC's standards for its licensees provide a sufficient level of protection, then EPA will publish this conclusion in the Federal Register for notice and comment and propose that NRC's licensees be exempted from EPA's cleanup standards.

In order to enhance the enforcement of the Price-Anderson Amendments Act of 1988,¹ the Department of Energy (DOE) is proceeding to codify its order on radiation protection for the public and the environment into a regulation that provides enforcement provisions. DOE issued its proposed rule in March 1993 and expects to publish the final rule in mid-1994. DOE proposed limiting the acceptable combined radiation dose to the public from most sources, including DOE's production and cleanup activities and radiation remaining after cleanup, to 100 millirem per year or to levels that are as low as reasonably achievable below the 100-millirem maximum. However, EPA wrote comments to DOE objecting to including cleanup in the rule in light of EPA's effort to develop cleanup standards. According to officials in DOE's Office of Environment, Safety, and Health, DOE will revise its rule to conform to EPA's standards should DOE's standards be inconsistent with or different from cleanup standards subsequently developed by EPA.

¹To ensure that DOE's contractors, in performing nuclear activities, protect human health and safety and the environment, this act authorized DOE to develop and issue nuclear safety regulations and required the imposition of penalties for violations of these regulations.

DOE's Sites Required to Identify Future Use Options

Operations office/location	Site location^a
Albuquerque/Kansas City, Mo.	Kansas City Plant, Mo.
Albuquerque/Los Alamos, N. Mex.	Los Alamos National Laboratory, N. Mex.
Albuquerque/Dayton, Ohio	Mound Plant, Ohio
Albuquerque/Amarillo, Tex.	Pantex Plant, Tex.
Albuquerque/Pinellas, Fla.	Pinellas Plant, Fla.
Albuquerque/Kirtland, N. Mex.	Sandia National Laboratory-Livermore, Calif.
Albuquerque/Kirtland, N. Mex.	Sandia National Laboratory-Albuquerque, N. Mex.
Albuquerque/Kirtland, N. Mex.	Inhalation Toxicology Research Institute, N. Mex.
Chicago/Argonne, Ill.	Argonne National Laboratory (East), Ill.
Chicago/Brookhaven, N.Y.	Brookhaven National Laboratory, N.Y.
Chicago, Ill.	Fermi National Accelerator Laboratory, Ill.
Idaho	Idaho National Engineering Laboratory
Nevada	Nevada Test Site
Oak Ridge/Fernald, Ohio	Fernald Environmental Management Project, Ohio
Oak Ridge, Tenn.	Oak Ridge Reservation (K-25, X-10, Y-12), Tenn.
Oak Ridge/Paducah, Ky.	Paducah Gaseous Diffusion Plant, Ky.
Oak Ridge/Portsmouth, Ohio	Portsmouth Gaseous Diffusion Plant, Ohio
Richland, Wash.	Hanford Reservation, Wash. ^b
Denver, Colo.	Rocky Flats Plant, Colo.
San Francisco, Calif.	Lawrence Livermore National Laboratory, Calif.
Savannah River, S.C.	Savannah River Site, S.C.

^aOther sites may be added as needed on a case-by-case basis.

^bFuture use options have already been identified for Hanford.

Objectives, Scope, and Methodology

The Chairman, Senate Committee on Governmental Affairs, asked us to examine DOE's and EPA's efforts to develop cleanup standards for radionuclides and relate expected land uses to cleanup levels. Specifically, we were asked to review (1) how cleanup levels are currently determined for DOE's sites, (2) the status and likelihood of success of EPA's efforts to develop cleanup standards for radionuclides, (3) the status of land use planning efforts at DOE, and (4) what hurdles would need to be overcome if land use planning were to be effectively implemented in determining cleanup levels.

To determine how cleanup levels are currently established for DOE's sites, we obtained guidance on determining cleanup levels under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and documentation of preliminary cleanup levels at several of DOE's sites. Our work concentrated primarily on how cleanup levels are established under CERCLA. To determine the status and prospects of efforts to develop cleanup standards for radionuclides, we interviewed EPA and DOE staff participating in the interagency work group for radionuclide standards and obtained documentation of the work group's efforts.

To determine the status of land use planning efforts at DOE, we interviewed DOE officials working to develop guidance for land use planning and obtained guidance drafts and records of the status of land use efforts at DOE's sites. We obtained information about the Hanford (Washington) future site uses study from DOE's Hanford officials, Westinghouse Hanford Corporation (a contractor to DOE), the Washington Department of Ecology, EPA Region X (Seattle), and several interest groups involved in the study.

To determine possible barriers to effectively implementing land use planning, we analyzed provisions of CERCLA and CERCLA regulations, reviewed CERCLA guidance documents, and interviewed attorneys with EPA's Office of General Counsel. In order to determine the advantages and disadvantages of a land use planning approach, we reviewed prior studies, attended a DOE-sponsored workshop on land use planning, and interviewed headquarters and field officials of DOE and EPA, representatives of several interest groups, and environmental officials for Ohio and Washington State.

This review included standards for radionuclides but not for hazardous chemicals in its scope. Our review concentrated primarily on activities regarding CERCLA. The scope was limited to cleanup standards for environmental media (soil, surface water, and groundwater). DOE's data on

Appendix IV
Objectives, Scope, and Methodology

established cleanup levels were not verified. DOE's data on costs associated with various cleanup levels were limited and preliminary; we did not independently verify the cost data. More detailed information was obtained about the Hanford and Fernald (Ohio) sites. Hanford was selected for study because it was the one DOE location that had completed a future land use study, while Fernald was studied because the process of identifying cleanup levels had proceeded further there than at many of DOE's sites.

Our review was conducted from January 1993 through June 1994 at DOE and EPA headquarters, Hanford, and Fernald. We collected data by phone from several other DOE field locations and from several states and EPA regions.

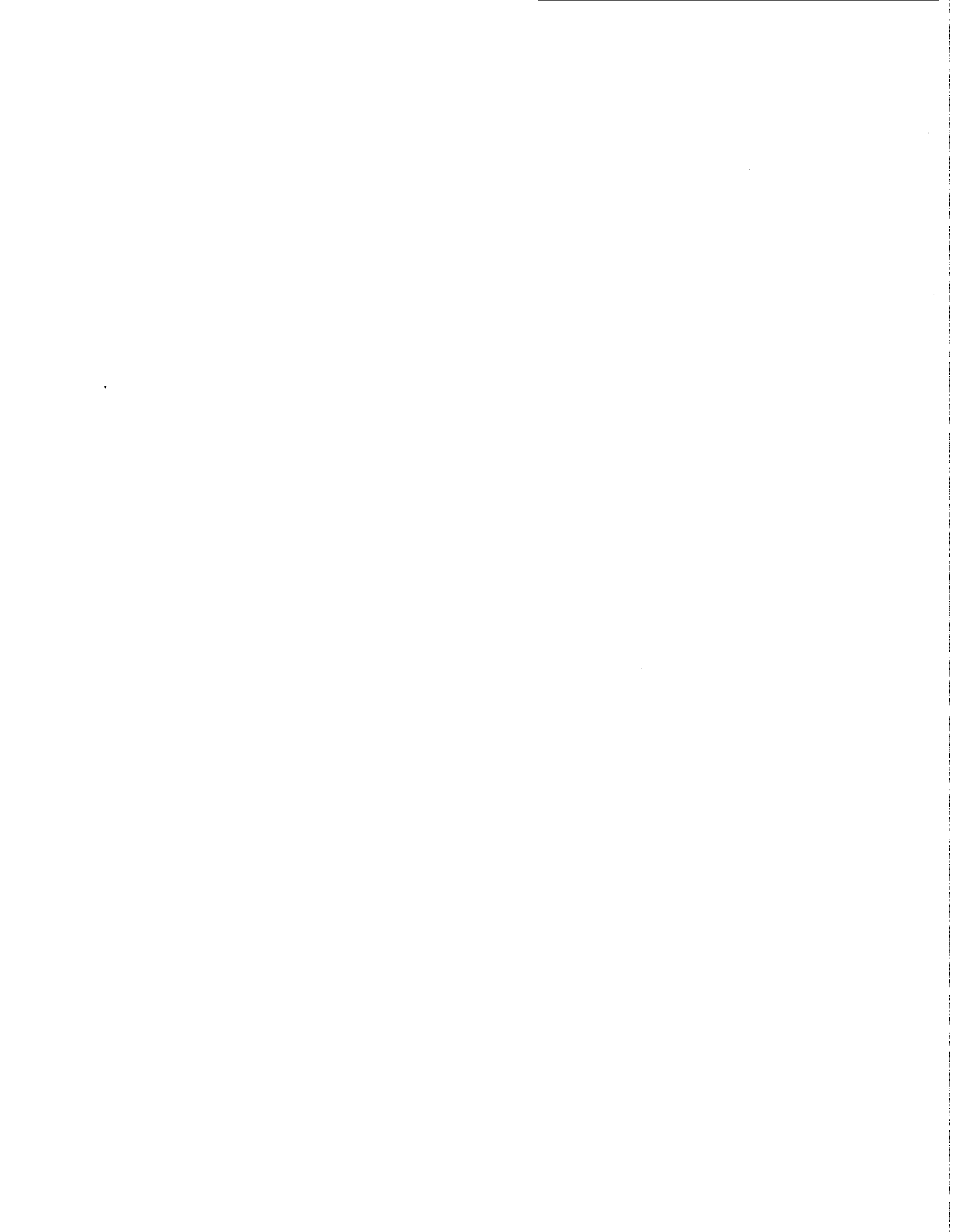
Major Contributors to This Report

**Resources,
Community, and
Economic
Development
Division, Washington,
D.C.**

Jim Wells, Associate Director
James Noël, Assistant Director
Rachel J. Hesselink, Evaluator-in-Charge
William M. Seay, Staff Evaluator

**Office of the General
Counsel**

Doreen Stolzenberg Feldman, Assistant General Counsel
Susan W. Irwin, Staff Attorney



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