

# Summary

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“Man is here only for a limited time, and he borrows the natural resources of water, land and air from his children who carry on his cultural heritage to the end of time. Indian people and non-Indians must have a responsibility to these resources for generations yet unborn. One must hand over the stewardship of his natural resources to the future generations in the same condition, if not as close to the one that existed when his generation was entrusted to be the caretaker. This is the challenge of highest order this nation faces today.”<sup>1</sup>

## INTRODUCTION

During World War II the Nation's scientific elite collaborated with the military to produce the first atomic bomb—a weapon of unprecedented destructive power that later became the key element of U.S. defense strategy. The development of nuclear weapons during and after the war required an enormous dedication of talent and resources, and was the focus of prodigious technical and scientific efforts. For decades the Nation's attention was directed toward producing such weapons to provide what military planners believed to be the necessary deterrent force to avoid a superpower war. The Department of Energy and its predecessor, the Atomic Energy Commission, diligently produced tens of thousands of warheads over the past five decades.

The success of this production system, however, came at a price that few who promoted this enterprise could have anticipated. Today, it is evident that the vast network of weapons facilities, located on thousands of square miles of Federal reservations in 13 States, has produced widespread contamination of the environment with toxic chemicals and radionuclides. Serious questions have been raised about the potential human health threats posed by such contamination.

Niels Bohr, a Nobel laureate and one of the century's greatest physicists, maintained in 1945 that an atom bomb could not be built without “turning the country into a gigantic factory.” A year later, as Bohr was being shown around secret sites of the Manhattan Project, Edward Teller wrote, “. . .when Bohr came to Los Alamos, I prepared to say, ‘You see. . .’ But before I could open my mouth, he said, ‘You see, I told you couldn't be done without turning the whole country into a factory. You have done just that.’ ”<sup>2</sup>

It is difficult to appreciate the scale of what is now known as the Nuclear Weapons Complex unless one has actually viewed the vast, tumbleweed-tossed plains of the Hanford Reservation; seen the tank farm at Savannah River where more than 50 underground tanks—each as big as the Capitol dome—house the high-level radioactive waste that inevitably results from plutonium production; or visited the area of east Tennessee, known as Site X during World War II, where the equivalent of the annual timber output of Minnesota was used to build what was then the largest roofed structure in the world. It is difficult, without seeing them, to imagine the huge concrete rooms known as “canyons” in which weapon-grade plutonium is chemically separated from other constituents in irradiated fuel elements behind thick protective walls, where the radioactivity is so intense that all work must be done by robotic manipulators.

The Nuclear Weapons Complex is an industrial empire—a collection of enormous factories devoted to metal fabrication, chemical separation processes, and electronic assembly. Like most industrial operations, these factories have generated waste, much of it toxic. The past 45 years of nuclear weapons production have resulted in the release of vast quantities of hazardous chemicals and radionuclides to the environment. There is evidence that air, groundwater, surface water, sediments, and soil, as well as vegetation and wildlife, have been contaminated at most, if not all, of the Department of Energy (DOE) nuclear weapons sites.

Although the Weapons Complex was developed in World War II as part of the Manhattan Project, major expansion occurred in the early 1950s. Today most of the operating facilities are more than 30 years old. Operations are in various stages of transition because of safety and environment

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<sup>1</sup>Delano Saluskin, Yakima Indian Nation, whose tribal lands are adjacent to the Hanford Reservation.

<sup>2</sup>R. Rhodes, *The Making of the Atomic Bomb* (New York, NY: Simon & Schuster, 1986), p. 500.

problems that have diverted attention from the production mission and because of uncertainty about the future of the entire enterprise.

Contamination of soil, sediments, surface water, and groundwater throughout the Nuclear Weapons Complex is extensive. At every facility the groundwater is contaminated with radionuclides or hazardous chemicals. Most sites in nonarid locations also have surface water contamination. Millions of cubic meters of radioactive and hazardous wastes have been buried throughout the complex, and there are few adequate records of burial site locations and contents. Contaminated soils and sediments of all categories are estimated to total billions of cubic meters.

Descriptions of vast quantities of old buried waste; of contaminants in pits, ponds, and lagoons; and of the migration of contamination into water supplies serve to dramatize the problem. However, so far very little quantitative characterization of each site has been accomplished.

Many factors have contributed to the current waste and contamination problems at the weapons sites: the nature of manufacturing processes, which are inherently waste producing; a long history of emphasizing the urgency of weapons production in the interest of national security, to the neglect of environmental considerations; a lack of knowledge about, or attention to, the consequences of environmental contamination; and an enterprise that has operated in secrecy for decades, without any independent oversight or meaningful public scrutiny.

Public concern about these problems has now reached major proportions, and current environmental laws have forced the direction of attention and resources toward the goals of environmental restoration and safe waste management. No one fully understands the public health and environmental effects of the waste and contamination at the weapons plants, but the consensus is that they are serious enough to devote tens of billions of dollars to cleanup efforts. Even the meaning of cleanup is not fully understood, but it is generally agreed that little has really begun and several decades will be required for an acceptable level of restoration to be reached. In addition, the extent of contamination has not been fully documented, and future investigations are expected to uncover additional problems. Finally, although no consensus has been reached on how or where to dispose of it, most of the waste

generated in the past and much of the waste generated in the future is clearly destined to remain at the site of generation—for decades to come.

## THE ENVIRONMENTAL PROBLEM

Even though nuclear weapons production entails unique processes such as plutonium recovery, and has thus created radioactive waste and contamination not found in any other setting, many more common environmental problems are also present at the weapons sites. These problems are similar to those found at non-Federal industrial sites and manufacturing plants that have released toxic waste. Thus, DOE is not alone in its struggle to deal with hazardous waste and environmental contamination. Private industry has been trying to cope with the same type of problems that DOE faces today ever since the enactment of hazardous waste legislation in the 1970s and 1980s. The national program to clean up hazardous waste sites, known as Superfund, has not provided a road map for success. Common problems are the technical difficulties inherent in detecting and mapping the contamination at specific sites, uncertainties regarding the effectiveness of cleanup technologies, lack of qualified personnel, and ambiguities within the regulatory system. However, the scope and complexity of the contamination throughout the Weapons Complex present unprecedented challenges.

Environmental problems resulting from nuclear weapons production at the Weapons Complex have been discussed and debated over the past few years. DOE has now directed its attention to these issues and has stated publicly that it recognizes their seriousness and extent, and that it intends to expend vast resources to remediate past contamination and establish sound waste management practices for the future.

DOE is thus faced with the enormous task of environmental restoration of sites within the Weapons Complex. That task has begun. Detailed plans addressing the size and scope of the problem, and the time and resources required, have been developed only recently. DOE has prepared a Five-Year Plan that describes its goals, strategies, and specific programs for assessment and cleanup of contaminated sites and facilities to meet standards prescribed in Federal and State laws. The first Five-Year Plan was issued in 1989 and covered fiscal

years 1991-95. The Five-Year Plan issued in 1990 updates the 1989 plan and covers fiscal years 1992-96. The 1990 Five-Year Plan calls for expenditures totaling more than \$30 billion on environmental restoration and waste management activities for fiscal years 1992 through 1996, but most believe that this represents only the discovery phase of a program that could require hundreds of billions of dollars to complete.

DOE Weapons Complex facilities-both large and small-are spread across the Nation, from South Carolina to Washington State, and are located in both remote and populated regions. The Feed Materials Production Center (Fernald), which has produced uranium metal for weapons, is a 1,450-acre site, a relatively small facility located 20 miles northwest of Cincinnati, OH, in a rural area with a number of farms. The Rocky Flats Plant in Colorado, which has been producing plutonium 'triggers' for weapons, is also a small facility situated close to densely populated suburbs of Denver.

Other sites are much larger than Fernald or Rocky Flats. The Hanford Reservation encompasses approximately 360,000 acres in the Columbia River Basin of southeastern Washington State. Hanford's primary mission has been to produce weapons-grade plutonium; it produced plutonium for the atom bomb dropped on Nagasaki during World War II. The Savannah River Site, built in the 1950s, produces tritium and plutonium. It consists of 192,000 acres on the north bank of the Savannah River. Most of the immediate plant environs are rural, and the surrounding area, which is heavily wooded, ranges from dry hilltops to swampland. More than 20,000 people are employed at Savannah River, making it the largest plant (in terms of employment) in the DOE Weapons Complex.

The Oak Ridge Reservation covers approximately 58,000 acres in eastern Tennessee. Oak Ridge carries out several activities including the production of weapons components. The area immediately around the reservation is predominantly rural except for the City of Oak Ridge. The City of Knoxville is about 15 miles away. The Idaho National Engineering Laboratory (INEL), where reactor fuel is reprocessed to recover uranium, has a number of facilities and conducts a variety of other activities. The largest site in terms of area, INEL covers 570,000 acres in southeastern Idaho. The site boundary is about 22 miles from the City of Idaho Falls.

Each of these sites has significant environmental contamination problems, but only in the last few years have meaningful efforts been initiated to understand the nature and extent of the contamination and to develop more effective approaches for managing waste and reducing future contamination. The application of these efforts is just beginning, and the results are not yet evident except at a few locations. At most of the sites, characterization programs-efforts to identify and quantitatively map the contamination-will continue for 5 years or more before the full extent and concentration of contaminants in the environment can be known and remediation measures can be selected. Technical, institutional, and regulatory factors will all contribute to the complexity of DOE environmental restoration and waste management programs for many years to come.

The cleanup of the Weapons Complex is framed by, and to a large extent being measured against, the goals and procedures established by a body of State and Federal environmental laws and regulations that have been developed during the past two decades. Over the last 5 years, DOE has gradually been required to acknowledge that cleanup of the Nuclear Weapons Complex is subject to regulation by the Environmental Protection Agency (EPA) and the States to the extent that hazardous materials are involved or a site is placed on the Superfund priority list.

The regulatory context within which cleanup must proceed is complicated. In some instances the applicable regulations are very precise and prescriptive; in other instances there is ambiguity about how to interpret the law. For some situations, there are yet no promulgated regulations to guide cleanup managers. EPA is attempting to use the interagency agreements negotiated with individual States and the DOE facilities to resolve jurisdictional overlaps and disputes about which statute to use and whose jurisdiction takes precedence. Three party agreements are in place at three of the Weapons Complex sites and are being negotiated at some others. Where applicable, they serve as a timetable for cleanup actions and an indication of priority concerns.

The possibility that historic releases of contaminants, and current or future exposure to contaminants in the environment, might contribute to adverse health effects among off-site populations if an issue of great concern to affected communities

Information about historic releases of contaminants that have long since decayed or dispersed is relevant to health impact assessments because past exposure may increase the risks associated with current or future exposure. DOE has historically avoided public notification of releases from the weapons plants and their possible health effects. This practice has created substantial public distrust of DOE's methods and motivation.

DOE has maintained that no current contamination scenarios pose an "imminent threat" to the public health. Information about the type, extent, and concentration of current contamination, and data describing the environmental transport pathways of known contaminants, are still quite limited, however. Information about off-site contamination or the potential for off-site human exposure is especially lacking. DOE's assertion that the contamination poses no imminent health risks may be correct but is not substantiated by scientific evidence. Further, the possibility of chronic public health impacts resulting from weapons site pollution has not been addressed, and there exists no comprehensive plan for evaluating such effects.

DOE is now committed to complying with all relevant environmental regulations and is devoting enormous resources to achieving this goal. Yet the present regulatory-driven approach to the cleanup of the Weapons Complex places far more emphasis on characterizing the contamination than on investigating health impacts and may prove ill-suited to identifying public health concerns, evaluating contamination scenarios according to their potential for adverse health effects, or establishing health-based cleanup priorities.

Responsibility for conducting site-specific health studies is scattered throughout several Federal and State agencies, and limited resources have been allocated for such efforts. The current approach to health investigations mandated by environmental laws and agreed to in interagency negotiations is likely to omit many important health objectives.

## **THE OFFICE OF TECHNOLOGY ASSESSMENT FINDINGS**

Over the past year the Office of Technology Assessment (OTA) has studied current and proposed approaches to waste management and environmental restoration at the Nuclear Weapons Com-

plex. OTA's analyses focused on the following areas: 1) evaluating immediate problems and needs that could benefit most in the near term from additional emphasis and resources, 2) assessing technologies for waste management and environmental restoration, and 3) investigating approaches for setting priorities and allocating resources. OTA has also evaluated institutional, management, and regulatory issues relating to these matters and has assessed prospects for the future and the opportunities for enhancing these prospects. Box A presents the key findings from this assessment.

The environmental restoration program underway at the Weapons Complex is in the very early stages, and little actual cleanup work has been done. At a few sites, some simple containment and stabilization activities have been performed by capping or by removing contaminated soil and storing it elsewhere in a more controlled form. Many remediation measures have limited capabilities; thus many sites may never be returned to a "contaminant-free" condition or a condition suitable for unrestricted public access. *OTA's analyses show that it may be impossible with current technology to remove contaminants from certain groundwater plumes and deeply buried soil or, even impossible, it may be extremely expensive or require prolonged periods of operation. In these cases, some aggressive efforts may be required to contain the materials and prevent further migration to the extent possible, while at the same time monitoring carefully any changes in conditions. In the future, much more containment technology and point-of-use monitoring and control will have to be applied to some sites.*

Technologies that could effectively remediate certain sites with extensive or complex contamination of soil, groundwater, sediments, and surface water either are not available or cannot be applied with the resources now contemplated. New technologies may be available in the future, but the most promising are still in the very early stages and will require many years of research, development, and testing at specific sites. *OTA's analysis shows that whereas investing in promising new technologies may be productive, it should not delay immediate efforts to contain contamination that has the potential for wider dispersion or rapid migration and to establish programs that continually monitor contaminant movements.*

### Box A—Key Findings

- The waste and contamination problems at the DOE Weapons Complex are serious and complicated, and many public concerns about potential health and environmental impacts have not yet been addressed.
- DOE, other Federal agencies, and the States are trying to carry out their legally mandated cleanup responsibilities, but they presently lack the necessary personnel and infrastructure, and they have yet to develop an effective process for public involvement in setting priorities and making important decisions. Despite recent laudable efforts at changing the DOE culture, substantial credibility and public acceptance problems continue to hinder progress.
- The environmental program now underway at the Weapons Complex is in the very early stages, and little actual cleanup has been done. It may be impossible with current technology to remove contaminants from many groundwater plumes and deeply buried soils within reasonable bounds of time and cost. Many sites may never be returned to a condition suitable for unrestricted public access.
- Despite DOE statements about the lack of imminent off-site health threats due to the contamination, possible public health effects have not been investigated adequately. The current regulatory process is not sufficient to effectively identify urgent health-based remediation needs or to comprehensively evaluate possible public health impacts. Among the missing elements are a coherent strategy for evaluating potential off-site human exposure to radioactive and hazardous contaminants, a coordinated and scientifically sophisticated approach for evaluating potential health impacts from contamination, and an open process for public involvement in identifying risks and setting priorities for reducing risks.
- Because of the limitations of existing cleanup technologies it is prudent to invest in promising new developments; however, such efforts should not delay addressing situations in which containment and monitoring are warranted now. OTA finds that a technology development program will be most beneficial if it is focused on the most serious contamination problems identified by possible health risks.
- DOE's stated goal—to clean up all weapons sites within 30 years—is unfounded because it is not based on meaningful estimates of work to be done, the level of cleanup to be accomplished, or the availability of technologies to achieve certain cleanup levels. Neither DOE nor any other agency has been able to prepare reliable cost estimates for the total cleanup.
- DOE currently has large quantities of radioactive and hazardous waste in storage at all sites, often under marginal conditions. There will be an increasing need to store waste safely on-site for fairly long periods until disposal alternatives are available. Adequate and workable standards and criteria for improved storage and treatment on-site are urgently needed.

OTA also finds that it may be more effective to invest substantial time and resources in the intensive development of a few technologies designed to address the most serious contamination problems than to make smaller investments in a range of potential innovations. In addition, conventional technologies require testing and evaluation at actual waste sites to confirm their effectiveness or understand their limitations.

OTA analysis indicates that the DOE goal stated in the Five-Year Plan and elsewhere—to clean up all weapons sites within 30 years—is unfounded because it is not based on meaningful estimates of the work to be done or the level of cleanup to be accomplished at the end of that time. The extent of environmental restoration work required at each site

by current regulations and cleanup standards will not be known until characterization activities and other studies are completed. Some situations could require investigation and remediation beyond that specified in current regulations. Furthermore, acceptable cleanup levels have yet to be determined for many DOE weapons sites. Without knowledge of the cleanup levels to be achieved by the end of 30 years, or the technologies required to achieve such levels, DOE cannot develop reliable cost estimates for the total cleanup. Thus, 30 years may prove too short a time to complete the cleanup to a reasonable degree, and the enormous resources required to clean up within that period may not be available. Some of the sites may never be restored to a condition permitting public access and use; thus, cleanup goals would need to be revised.

OTA has reviewed the current approach to waste management throughout the Weapons Complex, with particular attention to the disposal of some of the more hazardous and toxic materials in storage or being generated—specially high-level radioactive waste, transuranic waste, and mixed radioactive and hazardous waste. OTA has also reviewed the status of regulations and standards that are vital to major decisions on waste disposal. *Until safe geologic disposal capabilities are available, there will be an increasing need to store waste safely on-site for long periods (decades) and to provide more detailed and careful contingency plans for such storage. The prospects for improving operating and management practices and reducing the risk of future contamination are also discussed. If past problems are to be avoided, future waste management practices must meet stringent criteria for safe storage, treatment, and disposal.*

OTA has analyzed the environmental contamination and public health problems throughout the DOE Weapons Complex, as they are understood today. *The analysis shows that, despite some DOE statements about the lack of immediate health threats, public health concerns have still not been investigated adequately by DOE or by other government agencies.* Off-site health impacts are a plausible, but unproven, consequence of environmental contamination from the Nuclear Weapons Complex. Published reports and available data can neither demonstrate nor rule out the possibility that adverse public health impacts have occurred or will occur as a result of weapons site pollution. Investigations beyond those already completed or planned will be necessary to pursue questions about the occurrence of off-site health effects and to produce the information required to identify the most pressing cleanup priorities.

OTA has not attempted to conduct its own investigation of actual or potential public health threats. It has noted, however, that a more aggressive and coordinated investigatory process—conducted by qualified and independent parties, with early and continuous public involvement—that can assess public health issues and trace public concerns about health impacts to their possible sources is necessary to identify problems requiring immediate attention and to demonstrate more convincingly that public health is being protected. *OTA has concluded that current health assessment efforts are unlikely to efficiently produce the data necessary to set health-*

*based environmental restoration priorities.* OTA has also noted that research on the biological consequences of weapons site contamination has not received the attention or resources necessary to understand the potential health impacts of contamination and to establish appropriate cleanup goals.

OTA has reviewed the status of major cleanup efforts throughout the Weapons Complex and noted the objectives that those efforts must meet. At every major site in the complex, radioactive and hazardous contaminants are present in soil, sediments, waste burial grounds, groundwater, or surface water. In many cases, these contaminants are migrating toward nearby populations; in some cases, off-site contamination of groundwater, sediments, and surface water has been detected. Contaminants include a wide range of radionuclides, metals, organic compounds, and other substances that could have adverse health consequences if they reach human receptors in sufficiently large concentrations.

OTA has concluded that what is needed is an aggressive, scientifically sophisticated, site-specific, and open evaluation of possible off-site health effects by independent environmental health professionals. Identification of those situations that pose a significant threat of current or future off-site exposure, and hence have the potential for adverse health effects, might provide a manageable near-term focus for remediation. Exposure assessments could provide some immediate health-based priorities to guide environmental restoration and technology development, in addition to identifying the direction of—or possible lack of need for—further health investigations.

Although such an approach could divert certain functions from DOE to another agency, it would do so in an area where DOE has little capability and credibility—an area that is currently neglected and crucial to public support of the cleanup as a whole. There may be concerns that such a process would delay cleanup work now underway. In certain cases, however, a delay in remediation might be warranted and could lead to improved outcomes if actual health impacts are better understood. *Unless and until the contamination-related health issues of most concern to the public are recognized and addressed, the most ambitious, sophisticated, and well-meaning cleanup plans and activities will likely meet with skepticism, suspicion, and legal challenges.*

Finally, OTA notes that, despite recent laudable efforts, significant changes in DOE's practices are still necessary to develop credibility and public acceptance of its plans for waste management and environmental restoration. To achieve the needed changes, aggressive efforts are required in the following areas: substituting independent, external regulation for DOE self-regulation wherever feasible; providing long-term, capable, independent oversight in matters for which DOE continues to retain primary responsibility; making information openly available and easily accessible to the public; and promoting active and continuous public involvement—at the National, State, regional, and local levels—in decisions about waste management and environmental restoration objectives, priorities, and activities.

## POLICY INITIATIVES TO IMPROVE CLEANUP PROSPECTS

DOE, other Federal agencies, and the States are attempting to carry out their legally mandated responsibilities with respect to waste management and environmental restoration at the Weapons Complex. The cleanup effort is being hampered, however, by three fundamental problems. First, the technical and institutional resources and processes to make and implement sound, publicly acceptable decisions are not presently in place. Moreover, current agency plans do not adequately address these missing elements. Second, DOE's current decisions lack credibility because of past failures by DOE and its predecessor agencies to deal effectively with environmental contamination and to make full public disclosure regarding the contamination and its impact. Yet, the current decisionmaking process does not include adequate mechanisms for involving the public effectively in environmental restoration and waste management decisions. Third, the current approach to cleanup does not include a coherent and comprehensive strategy for evaluating potential off-site human exposure to Weapons Complex waste and contamination and for investigating potential health impacts due to the contamination. As a result, no reliable basis exists for understanding, identifying, and reducing potential public health risks; addressing community concerns about health impacts; and setting health-based funding priorities.

For these reasons, OTA finds that effective cleanup of the Weapons Complex in the next several decades

is unlikely and that significant policy initiatives are required if those prospects are to be improved. These initiatives should be directed toward improving the performance of DOE and other government entities involved in conducting or regulating waste management and environmental restoration activities, and enhancing the credibility and public acceptability of the decisionmaking processes for waste management and environmental restoration.

The policy initiatives outlined below, and summarized in box B, are aimed mainly at improving and strengthening the decisionmaking process for setting and meeting cleanup objectives. Congressional oversight could improve the performance and coordination of involved agencies and provide more effective approaches to safe waste storage and disposal, technological development, public access to information, and other aspects of the cleanup. The conduct of health assessments by independent entities with environmental health expertise could improve prospects for establishing health-based priorities to be used in the decisionmaking process. Establishing site-specific advisory bodies to provide independent public policy and technical oversight could improve prospects for open, credible, and cooperative decisionmaking processes on key aspects of the cleanup. Substituting independent regulatory authority for DOE's self-regulation in radioactive waste management activities could enhance the credibility and quality of current and future waste management decisions.

The following policy initiatives could improve cleanup prospects and provide better assurances that sound waste management practices will prevail in the future:

### *I. Increase congressional oversight of environmental restoration and waste management activities that require improved performance by the responsible agencies.*

Congress could increase its oversight of DOE, EPA, and other relevant Federal agencies to ensure that the agencies implement existing legislative authority to effectively conduct and properly coordinate waste management and environmental restoration activities. This oversight could usefully be directed toward the responsible agencies to improve their performance in the following areas that could benefit from prompt attention:

### **Box B—Policy Initiatives To Improve Cleanup Prospects**

#### **I. Increase congressional oversight of environmental restoration and waste management activities that require improved performance by the responsible agencies.**

Congress could increase its oversight of DOE, EPA, and other Federal agencies to develop and implement improved programs to deal promptly with the following matters:

- strengthen agency personnel,
- plan for safe waste storage,
- improve technology development,
- increase public access to information,
- coordinate and accelerate standard-setting, and
- strengthen site monitoring programs.

#### **II. Enhance the structure and process for assessing the public health impacts of Weapons Complex waste and contamination.**

Congress could establish the following institutional mechanisms to evaluate potential off-site health impacts:

- a new and separate health assessment office,
- health “Tiger Teams” to conduct exposure assessments at each site, and
- a national independent environmental health commission.

#### **III. Develop a structure and process to provide public participation in key cleanup policy and technical decisions.**

Congress could establish the following institutional mechanisms:

- advisory boards with technical staff at each site and
- a national coordinating and advisory board.

#### **IV. Establish a national mechanism to provide outside regulation of DOE radioactive waste management programs.**

Congress could authorize an institution to regulate those aspects of radioactive waste management activities now subject exclusively to DOE’s authority. These functions could be given to:

- a new national body or
- an existing body such as the Nuclear Regulatory Commission or EPA.

DOE, EPA, and other involved agencies in cooperation with the States, to prepare a coordinated plan that identifies personnel needs for the cleanup program and outlines a process for developing the cadre of professionals required.

#### *2. Plan for Safe Waste Storage*

Repository delays have affected key aspects of DOE HLW and TRU waste management strategies; regulations pertaining to mixed waste require changes in some of DOE’s earlier plans. To enhance prospects for safe on-site storage of waste, DOE could prepare a detailed plan for long-term storage of high-level and transuranic waste and for storing and treating mixed radioactive and hazardous waste.

#### *3. Improve Technology Development*

The procedure for developing and implementing more effective technologies could be improved by more focused analysis of the requirements and alternative solutions for the most important cleanup problems. DOE could accelerate efforts to structure a program clearly identifying immediate technological needs and timely solutions to the more urgent contamination problems.

#### *4. Increase Public Access to Information*

New procedures are needed to provide the public with all information relevant to waste management and environmental activities. DOE could accelerate its declassification efforts relevant to waste management and environmental restoration; promptly make requested material available; and notify interested parties of meetings, hearings, comment periods, and the availability of new materials.

#### *5. Coordinate and Accelerate Standard-Setting*

Adequate standards relevant to the cleanup, especially those for radioactive soils and sediments and for mixed waste, need to be developed in a timely manner. DOE, EPA, and other involved agencies could establish more effective coordination among and within agencies and assign appropriate staff to set, apply, and enforce health-based standards.

#### *6. Strengthen Site Monitoring Programs*

If some sites or portions of sites cannot be cleaned to the point of unrestricted use, institutional controls (including continuous monitoring and oversight, as well as notification and warnings) will be necessary to ensure that the public and the environment are not adversely affected. DOE could strengthen its pro-

#### *1. Strengthen Agency Personnel*

Agencies need to act as soon as possible to specify personnel requirements and develop strategies for meeting personnel needs. Congress could encourage

grams for monitoring and control of those sites that may continue to have contamination.

**II. *Enhance the structure and process for assessing the public health impacts from Weapons Complex waste and contamination.***

Congress could establish a structure and process to evaluate potential health impacts from the weapons facilities as a basis for setting cleanup priorities.

To implement this initiative, Congress could establish a new office within the Department of Health and Human Services (HHS), EPA, or other agency to coordinate and direct site-specific health assessments, and State-organized health studies. Congress could direct this office, as its first task, to establish health "Tiger Teams" to conduct comprehensive assessments of the potential for human exposure to contamination at each site. To provide the necessary expert advice to this office, Congress could further establish a national, independent environmental health commission reporting to Congress to provide guidance regarding exposure assessments, health effects evaluations, and health research needs related to the cleanup. Congress could require DOE to make information about past environmental releases and current contamination available to the Tiger Teams, the scientific community, and the public.

This policy initiative could strengthen the assessment of potential off-site health impacts and thus improve the prospects that health-based priorities will be established and implemented. The initiative could provide accelerated, scientifically rigorous exposure assessments to determine the most urgent health issues posed by the contaminants and establish a coordinated approach to site-specific assessments that efficiently and comprehensively evaluates the past, current, and potential public health impacts of contamination. Exposure assessments with broad public involvement could better equip the responsible agencies and the public to develop and implement health-based cleanup priorities in a timely manner. Finally, this initiative could improve the prospects that specific community concerns about off-site health effects are addressed.

**III. *Develop a structure and process to provide public participation in key cleanup policy and technical decisions.***

Congress could establish a structure and process to provide public participation in key cleanup policy and technical decisions.

To implement this policy initiative, Congress could establish advisory boards with full-time technical staff at each site to provide both policy and technical advice to DOE, EPA, HHS, and the States. These boards could consider issues relating to cleaning up past contamination, assessing and reducing public health risks, and safely storing and disposing of past waste. By having access to the information, technical support, and other resources needed to participate effectively in all aspects of the cleanup decisionmaking process, the boards could foster openness, trust, and cooperation among interested parties which is not being achieved at present. Congress could also establish a national board including representatives from the site-specific boards to coordinate the activities of the site-specific boards and provide advice to the headquarters level of involved Federal agencies regarding national policy and technical issues.

This policy initiative addresses the need for effective public involvement in environmental restoration decisions at each of the sites. OTA believes that those decisions could be improved by providing independent input to key policy and technical issues and by involving the public in the development of site-specific, health-based cleanup priorities.

**IV. *Establish a national mechanism to provide outside regulation of DOE radioactive waste management programs.***

Congress could authorize an institution other than DOE to regulate those aspects of the radioactive waste management activities now subject exclusively to DOE authority and over which no other agency now has such authority.

To implement this policy initiative, Congress could either establish a permanent, full-time, independent national commission having regulatory and enforcement authority with respect to radioactive waste management activities at the Weapons Complex or authorize an existing body such as the Nuclear Regulatory Commission or EPA to exercise these functions.

This policy initiative could improve the credibility and effectiveness of the decisionmaking process for waste management by limiting DOE self-regulation and providing appropriate independent

regulation of the treatment, storage, and disposal of radioactive waste.

## CONCLUSION

*Progress in cleaning up the waste and contamination at the Weapons Complex is being hampered by a paucity of data and qualified personnel, inadequate efforts to assess possible off-site health impacts, lack of ready technical solutions, and public skepticism about government agency decisions and activities relating to waste management and environmental restoration. The policy initiatives outlined above are aimed at improving and strengthening the decision-making process for setting and meeting cleanup objectives.*

Increased congressional oversight could improve prospects for enhancing the agency infrastructure, accelerating standard-setting, and providing more effective approaches to site characterization and remediation, waste storage and disposal, technological development, priority setting, and other aspects

of the cleanup. The direction and coordination of site-specific health assessments by an independent and authoritative entity could improve prospects for achieving scientifically sound and credible evaluations of possible off-site health impacts, resolving community health concerns and developing health-based cleanup priorities. Establishing site-specific advisory bodies to provide independent policy and technical advice could improve prospects for open, credible, and cooperative decisionmaking on key aspects of the cleanup. Substituting independent regulatory authority for DOE's self-regulation in radioactive waste management activities could enhance the credibility and quality of waste management decisions.

Although the cleanup will be a long and difficult task, OTA's analyses indicate that the policy initiatives outlined above could significantly improve the prospects that sound and credible cleanup decisions will be made.