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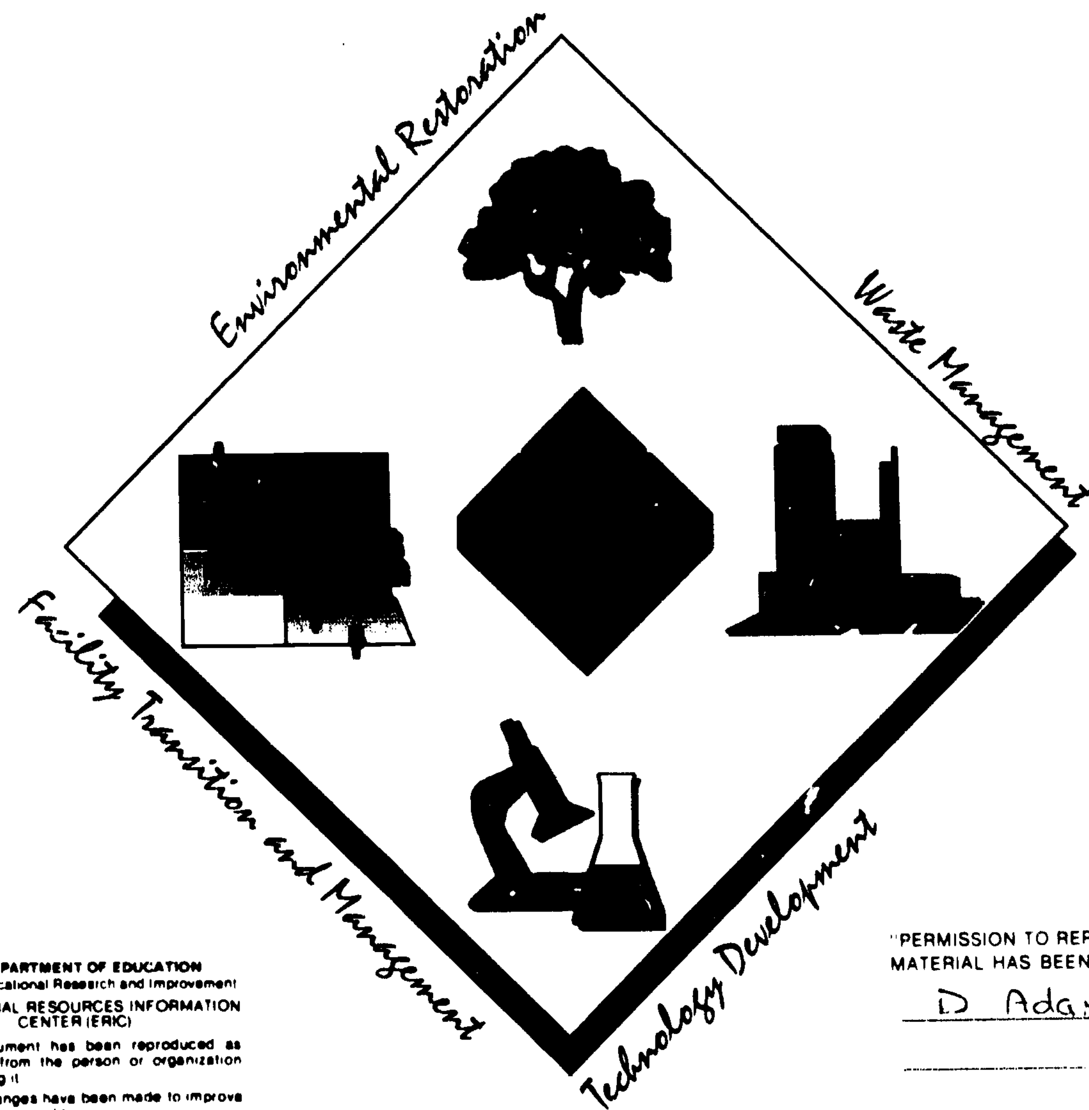
ABSTRACT

In recent years, the need for nuclear materials has decreased and the Department of Energy (DOE) has focused greater attention on cleaning up contamination left from past activities. The Office of Environmental Management (EM) within DOE is responsible for managing waste and cleaning up contamination at DOE sites across the nation. This collection of 40 EM Fact Sheets contains information on DOE and EM activities in technology development, facility transition and management, radiation in the environment, and related programs and activities. Three major sections contain fact sheets on laws and regulations, waste management, and environmental restoration. Regulations covered include the Resource Conservation and Recovery Act; the Comprehensive Environmental Response, Compensation, and Liability Act or "Superfund"; the National Environmental Policy Act; and additional statutes affecting DOE's Environmental Management Program. Other fact sheets contain definitions of waste management and environmental restoration and cover activities at DOE regional operations offices. Fact Sheets are a major component of EM's Public Participation Program, which attempts to educate stakeholders in DOE-related environmental issues. EM also sponsors educational programs, special topic workshops, and science units for schools. (LZ)

ENVIRONMENTAL MANAGEMENT

FACT SHEETS



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Environmental Management (EM) Fact Sheets

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For more information about the U.S. Department of Energy's Environmental Management Program, please call the Center for Environmental Management Information at 1-800-736-3282.

DOE Office of Environmental Management

- *Responsible for cleaning up DOE's contamination and managing DOE's waste*
- *Mission: to protect human health and the environment*

The U.S. Department of Energy (DOE) faces the nation's largest environmental, managerial, and technical challenge since the space race of the 1960's. For 50 years, the United States produced nuclear materials for weapons. In recent years, the need for these materials has decreased, and DOE has turned its attention to cleaning up contamination left from these past activities.

DOE is responsible for providing the scientific foundation, technology, and leadership to achieve efficiency in the nation's energy use, diversity in energy sources, improved environmental quality, and a secure national defense. In the past, DOE's approach was characterized by defense-oriented standards. Information was shared only on a need-to-know basis, and decision making was compartmentalized. Today, DOE is environment-oriented, has an integrated organization and an open, consensus-based decision making process that includes the public. DOE has initiated a collaborative total quality management strategy designed to improve its functioning.

The Office of Environmental Management (EM) within DOE is responsible for managing waste and cleaning up contamination at DOE sites across the nation. As the Department's biggest program, EM must safely minimize, handle, treat, store, transport, and dispose of DOE waste. EM must also ensure that risks to human health and safety and the environment posed by DOE facilities are eliminated or reduced to publicly acceptable levels. All EM activities must be conducted in compliance with federal, state, local, and Indian Nation environmental and health and safety laws and regulations. EM's responsibilities include public participation, environmental restoration, waste management, technology development, and facility transition and management.

Public participation is a new way of doing business that involves those who have a stake in DOE's activities in decisions and outcomes. EM has a public participation plan that goes beyond the requirements specified by law to include citizens, Congress, state and local governments, regulators, and Indian Nations in its planning and decision making activities.

Environmental restoration is the process of cleaning up contamination at inactive sites. Some areas have been contaminated by unwanted releases or spills into the environment, or by past practices believed safe and adequate at the time. Today's standards for protecting human health and the environment are much higher, and some old sites must be cleaned up again to meet these standards. Some facilities that were used to produce nuclear materials are no longer needed. These will be cleaned up and either demolished or reused for nonnuclear purposes.

Waste management is the minimization, treatment, storage, and disposal of waste at DOE sites. EM manages radioactive, hazardous, mixed (radioactive and hazardous waste combined), and sanitary waste as well as spent nuclear fuel.

Technology development activities are research, development, demonstration, testing, and evaluation projects to develop cleanup technologies that are safer and more time and cost-effective than those currently available.

Facility transition and management is the stabilization and transfer of old DOE facilities from production activities to environmental management activities.

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With a mission of protecting human health and the environment, EM aims to accomplish the following six goals:

- Eliminate and manage urgent risks in DOE's system,
- Provide a safe workplace and emphasize health and safety for both DOE workers and the public,
- Establish a system that is under control managerially and financially,
- Demonstrate tangible results by being more outcome oriented,
- Focus technology development program on DOE's major environmental management issues while involving the best talent in DOE and the national science and engineering communities.
- Develop a stronger partnership between DOE and its stakeholders.

EM must balance technical, financial, regulatory, and political challenges in accomplishing its goals. With responsibility for over 130 sites across the nation, EM must work with Congress, regulators, technical experts, the public, Indian Nations, and other stakeholders to develop solutions to complex problems. For example, there is a lack of national consensus about health and environmental risks. EM is investing in risk management research to address this problem. Future use of the public lands on which EM sites are located will determine, in some cases, the level of cleanup required for a site. Decisions about future uses will be made with public input. To meet regulatory requirements and begin cleanup activities sooner, EM is planning to negotiate or renegotiate compliance agreements to include technology improvements that allow accelerated cleanup activities and to find ways to speed up approval processes. To save money, EM is also working to minimize costs and increase efficiency in all activities by implementing new program and project management methods. Worker safety and health concerns are a top priority at DOE sites, and upgrades are planned at many sites by 1995. By the year 2000, EM hopes to serve as the model for public management of environmental protection activities.

EM's job is to shape a program that will withstand long-term pressures. A clear strategy followed by a strong commitment to results will gain the trust and confidence of Congress, the states, Indian Nations, and citizens. With a work force that includes some the most talented technical professionals in the nation and a clear mandate from citizens and government to move forward to clean up contamination and manage waste, EM will accomplish its goals.

EM is making progress in its public participation, environmental restoration, waste management, technology development, and facility transition and management programs. But the bulk of the work remains to be accomplished. DOE needs experts in technical and nontechnical fields to meet the challenge of cleaning up its sites across the nation. EM is retraining its production workers in skills needed for environmental cleanup and investing in education at all levels to encourage our nation's young people to pursue careers in science and technological fields.

The engineers and physicists involved with DOE predecessor agencies' nuclear programs were involved with some of the most exciting scientific work ever done—splitting the atom. Today's scientists have the equally vigorous challenge of closing the circle on the splitting of the atom and cleaning up and safely containing waste for thousands of years. Scientific, environmental, and technical professionals must work closely with managers, educators, lawyers, innovators, citizens, and communicators to find the best solutions for cleaning up the environment and safely managing waste now and in the future. EM's challenges present the opportunity to change the character of environmental restoration and waste management technology and preserve our environment for the future.

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DOE/EM-0063P
(Revised 9/28/94)

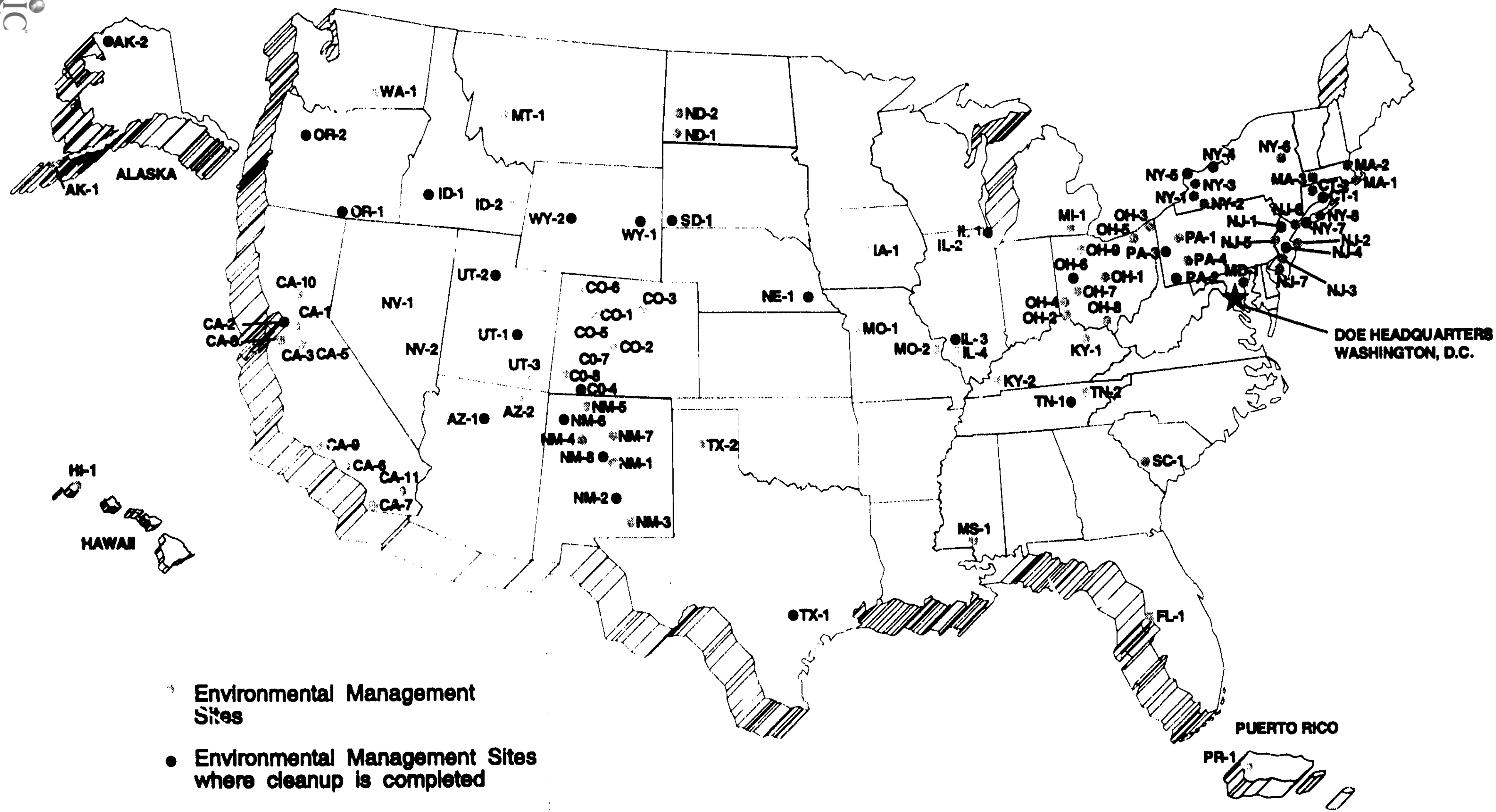
DOE EM SITES

ST #	Location	Installation/Site	*
AK-1	Amchitka Island	Amchitka Island Test Site	
AK-2	Cape Thompson	Project Chariot	C
AZ-1	Tuba City	Tuba City	U/C
AZ-2	Monument Valley	Monument Valley	U
CA-1	Berkeley	Lawrence Berkeley Laboratory	
CA-2	Berkeley	University of California	F/C
CA-3	**Livermore**	**Lawrence Livermore National Laboratory**	
CA-3	**Livermore**	**Sandia National Laboratories - Livermore**	
CA-5	Vallecitos	G E Vallecitos Nuclear Center	
CA-6	Canoga Park (L.A.)	Atomics International	
CA-7	San Diego	General Atomics	
CA-8	Palo Alto	Stanford Linear Accelerator Center	
CA-9	**Oxnard**	**Oxnard**	
CA-9	**Santa Susana**	**Santa Susana Field Laboratory**	
CA-9	**Santa Susana**	**Energy Technology Engineering Center**	
CA-10	Davis	Laboratory for Energy-Related Health Research at U.C. Davis	
CA-11	Imperial County	Salton Sea Test Base	
CO-1	**Grand Valley**	**Project Rulison Site**	
CO-1	**Rifle**	**Old Rifle**	U
CO-1	**Rifle**	**New Rifle**	U
CO-1	**Rifle**	**Project Rio Blanco Site**	
CO-2	Gunnison	Gunnison	U
CO-3	Jefferson County	Rocky Flats	
CO-4	Durango	Durango	U/C
CO-5	**Grand Junction**	**Grand Junction Projects Office Site**	
CO-5	**Grand Junction**	**Climax Mill Site**	U/C
CO-6	Maybell	Maybell	U
CO-7	Naturita	Naturita	U
CO-8	**Slick Rock**	**Union Carbide**	U
CO-8	**Slick Rock**	**Old North Continent**	U
CT-1	Seymour	Seymour Specialty Wire	F/C
CT-2	Windsor	Combustion Engineering Site	F
FL-1	**St. Petersburg**	**Pinellas Plant**	
FL-1	**St. Petersburg**	**4.5 Acre Site**	
FL-1	**Largo**	**Peak Oil Petroleum Refining Plant**	
HI-1	Kauai	Kauai Test Facility	
IA-1	Ames	Ames Laboratory	
ID-1	Lowman	Lowman	U/C
ID-2	**Idaho Falls**	**Idaho National Engineering Laboratory**	
ID-2	**Idaho Falls**	**Argonne National Laboratory - West**	
IL-1	**Chicago**	**University of Chicago**	F/C
IL-1	**Chicago**	**National Guard Armory**	F/C
IL-2	**Cook County**	**Site A/Plot M, Palos Forest Preserve**	
IL-2	**Batavia**	**Fermi National Accelerator Laboratory**	
IL-2	**Lemont**	**Argonne National Laboratory - East**	
IL-3	Granite City	Granite City Steel	F/C
IL-4	Madison	Madison	F
KY-1	Hillsboro	Maxey Flats Disposal Site	
KY-2	Paducah	Paducah Gaseous Diffusion Plant	
MA-1	Norton	Shpack Landfill	F
MA-2	Beverly	Ventron	F
MA-3	Indian Orchard	Chapman Valve	F
MD-1	Curtis Bay	W.R. Grace & Co.	F
MI-1	Adrian	General Motors	F
MO-1	Kansas City	Kansas City Plant	
MO-2	**Hazelwood**	**Latty Avenue Properties**	F
MO-2	**St. Charles County**	**Weldon Spring Site**	
MO-2	**St. Louis County**	**St. Louis Airport Vicinity Properties**	F
MO-2	**St. Louis County**	**St. Louis Airport Storage Site**	F
MO-2	**St. Louis**	**St. Louis Downtown Site**	F
MS-1	Hattiesburg	Salmon Test Site	
MT-1	Butte	Component Development & Integration	
ND-1	Bowman	Bowman	U
ND-2	Belfield	Belfield	U
NE-1	Lincoln	Hallam Nuclear Power Facility	C
NJ-1	Jersey City	Kellex/Pierpont	F/C
NJ-2	Maywood	Maywood Chemical Works	F
NJ-3	Princeton	Princeton Plasma Physics Laboratory	
NJ-4	Middlesex	Middlesex Municipal Landfill	F/C
NJ-5	**Middlesex**	**Middlesex Sampling Plant**	F
NJ-5	**New Brunswick**	**New Brunswick Laboratory**	F
NJ-6	Wayne	Wayne	F

ST #	Location	Installation/Site	*
NJ-7	Deepwater	Du Pont & Company	F
NM-1	**Albuquerque**	**South Valley Site**	
NM-1	**Albuquerque**	**Sandia National Laboratories - Albuquerque**	
NM-1	**Albuquerque**	**Inhalation Toxicology Research Institute**	
NM-1	**Albuquerque**	**Holloman Air Force Base**	
NM-1	**Los Lunas**	**Pagano Salvage Yard**	
NM-2	White Sands MR	Chupadera Mesa	F/C
NM-3	**Carlsbad**	**Project Gnome-Coach Site**	
NM-3	**Carlsbad**	**Waste Isolation Pilot Plant**	
NM-4	Ambrosia Lake	Ambrosia Lake	U
NM-5	Farmington	Project Gasbuggy Site	
NM-6	Shiprock	Shiprock	U/C
NM-7	Los Alamos	Los Alamos National Laboratory	
NM-8	**Los Alamos**	**Bayo Canyon**	F/C
NM-8	**Los Alamos**	**Acid/Pueblo Canyon**	F/C
NV-1	Fallon	Project Shoal Site	
NV-2	**Tonopah**	**Central Nevada Test Area**	
NV-2	**Nellis AFB**	**Tonopah Test Range**	
NV-2	**Mercury**	**Nevada Test Site**	
NY-1	Buffalo	B & L Steel	F
NY-2	West Valley	West Valley Demonstration Project	
NY-3	**Tonawanda**	**Seaway Industrial Park**	F
NY-3	**Tonawanda**	**Ashland Oil #1**	F
NY-3	**Tonawanda**	**Ashland Oil #2**	F
NY-3	**Tonawanda**	**Linde Air Products**	F
NY-4	Lewiston	Niagara Falls Storage Site Vicinity Property	F/C
NY-5	Niagara Falls	Niagara Falls Storage Site	F/C
NY-6	**Colonie**	**Colonie**	F
NY-6	**Schenectady**	**Knolls Atomic Power Laboratory**	
NY-7	Manhattan	Baker & Williams Warehouse	F/C
NY-8	Upton, LI	Brookhaven National Laboratory	
OH-1	**Columbus**	**Battelle Columbus Laboratories**	
OH-1	**Columbus**	**B & T Metals**	F
OH-2	Fernald	Fernald Environmental Management Project	
OH-3	Ashtabula	Reactive Metals Inc./Fields Brook Site	
OH-4	**Oxford**	**Alba Craft**	F
OH-4	**Fairfield**	**Associated Aircraft Tool & Manufacturing**	F
OH-4	**Hamilton**	**HHM Safe Site**	F
OH-5	Painesville	Painesville	F
OH-6	Piqua	Piqua Nuclear Power Facility	C
OH-7	Miamisburg	Mound Plant	
OH-8	Portsmouth	Portsmouth Gaseous Diffusion Plant	
OH-9	**Luckey**	**Luckey**	F
OH-9	**Toledo**	**Baker Brothers**	F
OR-1	Lakeview	Lakeview	U/C
OR-2	Albany	Albany Metallurgical Research Center	F/C
PA-1	Aliquippa	Aliquippa Forge	F
PA-2	Canonsburg	Canonsburg	U/C
PA-3	Shippingport	Shippingport Atomic Power Station	C
PA-4	**Springdale**	**C.H. Schnoor**	F
PA-4	**West Mifflin**	**Bettis Atomic Power Laboratory**	
PR-1	Mayaguez	Center for Energy & Environmental Research	
SC-1	Aiken	Savannah River Site	
SD-1	Edgemont	Edgemont Vicinity Properties	C
TN-1	Oak Ridge	Elza Gate	F/C
TN-2	**Oak Ridge**	**Y-12 Plant**	
TN-2	**Oak Ridge**	**Oak Ridge K-25 Site**	
TN-2	**Oak Ridge**	**Oak Ridge National Laboratory**	
TX-1	Falls City	Falls City	U/C
TX-2	Amarillo	Pantex Plant	
UT-1	Green River	Green River	U/C
UT-2	Salt Lake City	Salt Lake City	U/C
UT-3	**Mexican Hat**	**Mexican Hat**	U
UT-3	**Monticello**	**Monticello Millsite and Vicinity Properties**	
WA-1	Richland	Hanford Site	
WY-1	Spook	Spook	U/C
WY-2	Riverton	Riverton	U/C

NOTE: SHADED GROUPS OF SITES ARE SHOWN AS SINGLE SYMBOLS ON MAP
Numbers refer to dots on the map and do not indicate priority.

* U = UMTRA; F = FUSRAP; C = COMPLETED



Environmental Management Sites

• Environmental Management Sites where cleanup is completed

NOTE: MAP IS NOT TO SCALE

EM Public Participation Activities

- ***Seek public input early and often***
- ***Share information about cleanup activities and technologies***

In the past, national security concerns precluded the U.S. Department of Energy (DOE) from involving the public in its activities. Today, with the changes in the international arena, these security concerns have greatly diminished. As a result, DOE is at liberty to open its decision making processes to include the public. DOE recognizes its responsibility to the public and is finding that public input leads to decisions that better reflect public values. Increasing public participation has become an important effort throughout DOE. By working with the public, DOE can resolve issues and implement solutions more quickly to solve its environmental management problems.

Public participation is the process of seeking the views and concerns of stakeholders and including them in DOE's decision making process. It includes open information sharing, teaming with stakeholders, gaining public input, and solving problems jointly.

Although DOE is required by environmental laws to involve the public in many of its decisions, the Office of Environmental Management (EM) has its own plan and goals to exceed those requirements. Here are some of EM's goals:

- To be open and responsive to ideas from the public,
- To ask for help in identifying a full range of alternative approaches to addressing EM issues,
- To offer a range of public participation opportunities to meet the public's needs, and
- To tell the public how their comments and suggestions affected a decision.

EM must make decisions such as how to clean up contamination, how to manage waste, and how much money to spend on cleanup. Some decisions are constrained by limited funding or, in some cases, the lack of available technologies. Public input helps EM find solutions that satisfy a range of concerns.

Stakeholders

Stakeholders are any citizens or groups who have an interest or stake in the outcome of a DOE decision. Every taxpayer in the nation is a DOE stakeholder. EM teams with a wide variety of stakeholders, including the U.S. Environmental Protection Agency (EPA) and other federal agencies, state and local governments, environmental groups, labor organizations, citizen's groups, and community members near its sites. EM also works with Indian Nation governments in its public participation activities.

Gaining Public Input

EM encourages stakeholders to express their concerns and share their ideas by providing opportunities at each stage of the decision making process. EM frequently asks the public to share their views by responding to surveys and questionnaires. Attending public meetings and hearings is another way for the public to provide input. Many documents and processes are open to public comment, such as environmental impact statements, records of decision, and permit modification and closure actions. DOE also gains public input by setting up advisory groups where members voice public concerns and develop approaches to EM's challenges. Through listening to the public's issues, EM can set milestones and target dates that reflect the public's priorities, choose technology options the public will support, and make better budgets.

Providing Information

EM encourages stakeholders to explore its sites by providing information gathering opportunities. Information centers and reading rooms located at each site contain fact sheets,

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reports, and site-specific history materials. Many sites have mailing lists for newsletters and other information. EM representatives often give presentations ending with a question and answer period to community groups. Guided tours give stakeholders a firsthand view of the site. EM sponsors educational programs for all ages including **special topic workshops for adults** and science units for schools. EM sites also sponsor a variety of special events unique to their site and community.

Each site in the DOE complex includes public participation in their programs. Specific examples of public participation:

Headquarters

- An exhibit program including the EM Roadshow and other exhibits assists in the dissemination of material and directly interacts with audiences nationwide.
- An Environmental Management Information Center houses a library, distributes publications and videos, and answers questions on a toll-free telephone line 1-800-7EM-DATA (1-800-736-3283).

Albuquerque

- The Carlsbad-Loving Education Coordination Council gives schools an opportunity to express their needs to DOE and is soon to become a clearinghouse for educational resources.
- At the Mound Plant in Miamisburg, Ohio, DOE participants and stakeholders took a fresh look at budgeting by playing a board game called Priority.

Fernald

- A program called Science, Technology, the Environment, and the Public (STEP) encourages public participation.
- A centralized "newsroom" provides information to the public through monthly status reports, fact sheets on special topics, and news wire service to computer network users.

Hanford

- DOE, EPA, the State of Washington, and other stakeholders worked together to reach a consensus and signed a Tri-Party Agreement that specifies cleanup goals and methods for the site. 15 public meetings were held to gain input for this plan.

Oak Ridge

- A stakeholder group (East Fork Poplar Creek Citizens Working Group) actively responds to DOE policies and generates alternatives to proposed EM actions.
- Weldon Spring Site Remedial Action Project hosts one-day workshops as an interactive open forum for an open exchange of **information between the site and the** community.

Site tours provide citizens an opportunity to learn about activities conducted and ask questions about DOE's methods and plans. Many sites hold periodic open houses or workshops in addition to formal public hearings.

Rocky Flats

- The Rocky Flats Community Radiation Monitoring (ComRad) Program increases public awareness of the environmental monitoring program, provides opportunities for communication between the site and local communities, and conducts summer science camps and workshops for educators and interested adults.
- The Citizens Review Group (20 representatives selected by their community) attends briefings, panel discussions, and tours in order to keep their community informed and to give DOE feedback on community environmental concerns.

San Francisco

- To ensure information materials answer the public's questions, DOE conducted 2,500 surveys to find out community needs and set up the Community Review Panel for Site 300 Restoration to review communications materials.

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Technology Development

- *Researches new and innovative technologies to meet Environmental Management's technology needs*

The Office of Environmental Management (EM) faces technical challenges in meeting its cleanup and waste management goals and complying with environmental regulations. In some cases, proven technology is not yet available for cleaning up contamination. In other cases existing technology can be applied but doesn't comply with laws and regulations or doesn't satisfy public requirements for safety and risk management. To address these needs EM has a technology development program. Its goals are to develop technologies that make cleanup better, faster, cheaper, and safer, and make it possible to comply with existing regulatory requirements. In many cases, development of new technologies presents the best hope for ensuring a substantive reduction in risk to workers and the environment.

Technology development programs are designed to make new, innovative, and more effective technologies available for transfer to users through progressive development. Projects are demonstrated, tested, and evaluated to produce solutions to current problems. The transition of technologies into more advanced stages of development is based on technological, regulatory, economic, and institutional criteria. New technologies are made available for use in eliminating radioactive, hazardous, and other wastes in compliance with regulatory mandates. The primary goal is to protect human health and prevent further contamination.

Technology development programs are conducted to address five major remediation and waste management problem areas that have been identified to date within the U.S. Department of Energy (DOE) weapons complex. These problems have been targeted for action on the basis of risk, prevalence, or need for technology development to meet environmental requirements and regulations. In the future, additional areas may be added (or currently identified areas further partitioned) to ensure that research and technology development programs remain focused on EM's most pressing remediation and waste management needs. These major problem areas are termed focus areas:

Contaminant Plume Containment and Remediation

Uncontained hazardous and radioactive contaminants in soil and groundwater exist throughout the DOE weapons complex. There is insufficient information at most sites on the contaminants' distribution and concentration. The migration of some contaminants threatens water resources and, in some cases, has already had an adverse impact on the offsite environment. Many of the current characterization, containment, and treatment technologies are ineffective or too costly. Improvements are needed in characterization and data interpretation methods, containment systems, and in situ treatment.

On site analysis, data integration, and decision making expedite the entire characterization process. Technologies for expedited site characterization have been demonstrated that, compared to standard methods, are at least ten times faster and 50-75% less expensive.

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Mixed Waste Characterization, Treatment, and Disposal

DOE faces major technical challenges in the management of low-level radioactively contaminated mixed waste. Several conflicting regulations and lack of definitive mixed waste treatment standards hamper mixed waste activities. Disposal capacity for mixed waste is also expensive and severely limited. DOE now spends millions of dollars annually to store mixed waste because of the lack of accepted treatment technology and disposal capacity. Currently available waste management practices require extensive, and hence expensive, waste characterization before disposal. Therefore, DOE must pursue technology that leads to better and less expensive characterization, retrieval, handling, treatment, and disposal of mixed waste.

High-Level Waste Tank Remediation

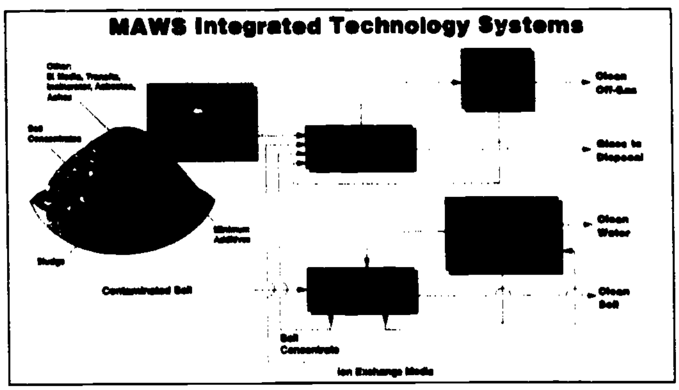
Across the complex, hundreds of large storage tanks containing hundreds of thousands of cubic meters of high-level mixed waste present a problem that has received much attention from both the public and DOE. Primary areas of concern are deteriorating tank structures and consequent leakage of their contents. Research and technology development activities must focus on the development of safe, reliable, cost-effective methods for characterization, retrieval, treatment, and final disposal of the wastes.

Landfill Stabilization

Numerous DOE landfills pose significant remediation challenges. Some existing landfills have contaminants that are migrating, requiring interim containment prior to final remediation. Materials buried in "retrievable" storage pose another problem—the development of retrieval systems that reduce worker exposure and reduce the quantity of secondary waste. Development of in situ methods for both containment and treatment is also a high priority.

Facility Transitioning, Decommissioning, and Final Disposition

The aging of DOE's weapons complex facilities, along with the reduction in nuclear weapons production, had resulted in a need to transition, decommission, deactivate, and dispose of numerous facilities contaminated with radionuclides and hazardous materials. While the building and scrap materials at the sites are a potential resource with a significant economic value, current regulations lack clear release standards, and thus indirectly discourage the recovery, recycling, and/or reuse of these resources. Development of enhanced technologies for the decontamination of these materials and effective communication of the low relative risks involved are promising avenues toward the recovery, recycle, and/or reuse of these resources. In addition, material removal, handling, and processing technologies must be improved to enhance worker safety and reduce cost.



The bench-scale feasibility of the Minimum Additive Waste Stablization (MAWS) approach to vitrification has been successfully demonstrated. MAWS uses various wastes in place of additives required using conventional vitrification processes, minimizing the use of purchased additives and also reducing the volume of the final waste material. This system shows the potential to save a minimum of $100 million for sites of 500,000 cubic meter size.

Facility Transition and Management

• *Transition facilities from production to environmental cleanup*

U.S. Department of Energy (DOE) sites, facilities, and materials with no further mission are transferred through a formal process to the Office of Environmental Management (EM). The Office of Facility Transition and Management manages the safe, orderly, and cost-effective transition of facilities from operating Program Offices to EM. Facility Transition and Management is responsible for planning, implementing, and managing the transition program, including developing policies and procedures to accept, deactivate, and determine the end use of surplus contaminated facilities. Surveillance and maintenance activities are conducted throughout the process.

Transition Process

The primary goal of the transition process is to put DOE's facilities in a deactivation state in a safe and timely manner, driving down the cost of maintaining them until their final disposition. The transition process involves notifying EM of an intent to transfer a facility, resource planning, deactivation, surveillance and maintenance, landlord, and final disposition. The transition process is initiated by the operating DOE program office (i.e., Defense Programs, Nuclear Energy, Energy Research) when it is determined a facility has no further mission and continues to the disposition phase. Disposition can be government reuse, commercial reuse, or complete dismantling. After the donor program notifies EM, transition plans are prepared in conjunction with the program office and onsite working groups. These transition management plans are site-specific and detail the goals, activities, and results in a Memorandum of Agreement (MOA) between the program office and EM. After approval of the MOA, the facility is formally transferred.

Deactivation and Disposition

For those facilities that have not been deactivated, this is the next step in the process. Deactivation brings a facility to a condition requiring minimum maintenance and surveillance. Following deactivation, EM conducts surveillance and maintenance activities necessary to prevent further deterioration of the facility and to maintain the facility in a safe condition. Maintaining the integrity of the facility infrastructure is an integral component of facility maintenance and landlord responsibilities. While many facilities are projected to be dismantled, final disposition may occur with the transfer of deactivated facilities to federal, state, Indian Nation, or local governments or to private sector organizations for other uses.

The Rocky Flats Plant in Colorado was used to recover plutonium, fabricate alloy, and operate conventional metal production processes. As part of its transition activities, the facility is undergoing consolidation and deactivation.

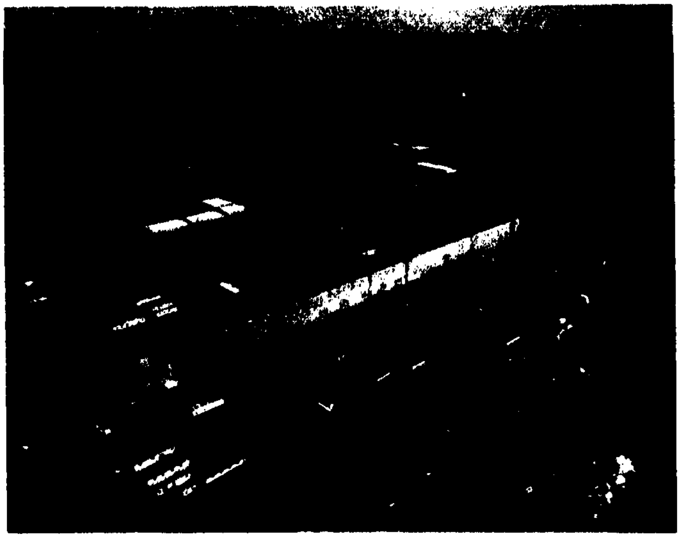
Landlord Program

At selected sites, the Office of Facility Transition and Management has been assigned landlord responsibilities. The Landlord Program manages a site's infrastructure, much like a city manager oversees a city. A site's infrastructure may consist of roads, utilities, fire prevention and safety, safeguards and security, medical dispensaries, and a motor pool. The Landlord Program also formulates, validates, and executes a site's operating budget.

The Office of Facility Transition and Management currently is the landlord at the Rocky Flats Office, the Idaho National Engineering Laboratory, and the Hanford Site.

The Disposition of Facilities/Sites

There are potential uses for many transitioning facilities. The challenge before DOE and the local community is to work together to explore alternative uses, including transfer of facilities to other parts of DOE, other Federal agencies, or private industry. Many DOE advanced industrial facilities, including their work force, may be useful to other Federal agencies or private industry. If alternative uses are realized, changes to a local economy can be reduced.



At the Hanford Site in Washington State, this facility was used to recover uranium and plutonium from used reactor fuel elements. The building is over 1,000 feet long. There are hundreds of other facilities at the site that will also be transitioned to environmental management.

Workforce Restructuring

With the change in mission, many facilities will be transitioned to EM through 1999 and beyond, possibly affecting up to 8,000 workers across the complex. The Defense Authorization Act of 1993 included a requirement for DOE to develop work force restructuring plans including retirement incentives, retraining, preference in hiring at other facilities, relocation assistance, and consultation with various government and nongovernmental groups. The Secretary has also established a Task Force on Worker and Community Transition to coordinate these planning activities. Where possible, existing workers affected by the transition will be retrained, reemployed, or relocated. It is anticipated that some of the current employees within the complex can be retrained and reemployed to assist in the new mission operations at each facility.

Economic Development

DOE's economic development initiatives are designed to explore the economic potential of DOE facilities, technologies, and human resources to stimulate economic growth in the region, thereby reducing the impact to workers and the local communities and lowering the cost to DOE and the federal government. Facility Transition and Management is attempting to make these facilities attractive and viable for future use. If alternative uses are pursued and developed, local economies can maintain stability. These efforts could help diversify the local and regional economies, lead to increased employment, and reduce long-term facility maintenance costs.

Radiation in the Environment

- *Natural radiation*
- *Artificial radiation*
- *Units of Measure*
- *Common Sources*

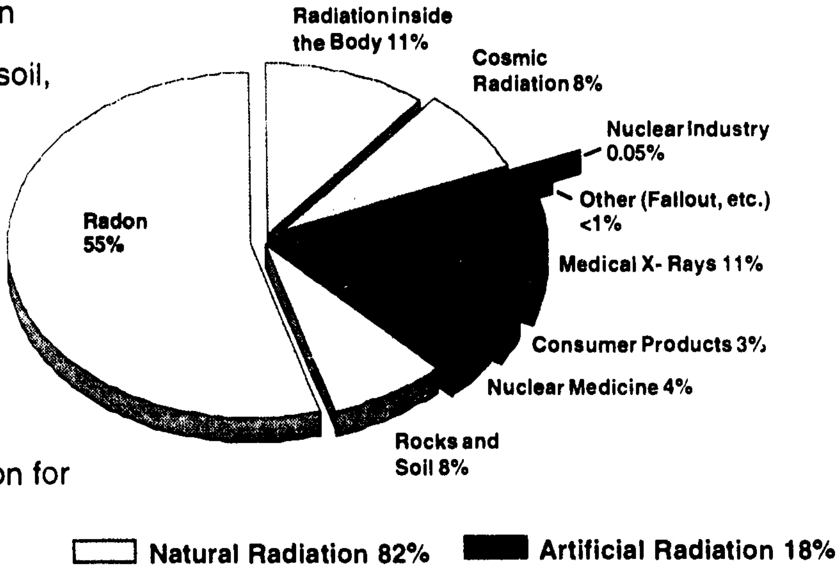
Radiation is a natural part of our environment. Humans have always lived on earth in the presence of radiation. Natural radiation reaches earth from outer space and continuously radiates from the rocks, soil, and water on the earth.

Many materials, natural and artificial, are radioactive. These materials are composed of atoms that release energetic particles or waves as they change (decay) into more stable forms. Particles and waves are referred to as radiation and their emission as radioactivity.

Scientists have been studying radiation for centuries. Even though invisible, radiation can be detected, measured, and controlled. During the last century, humankind discovered how to use radioactivity to strengthen products, improve medical treatments, and produce energy.

As the pie chart shows, most radiation (82%) people are exposed to comes from natural sources. By far the largest source is radon, an odorless, colorless gas given off by natural radium in the Earth's crust. Artificial radiation, mostly from medical uses and consumer products, accounts for about eighteen percent of our total exposure. The nuclear industry is responsible for less than one percent.

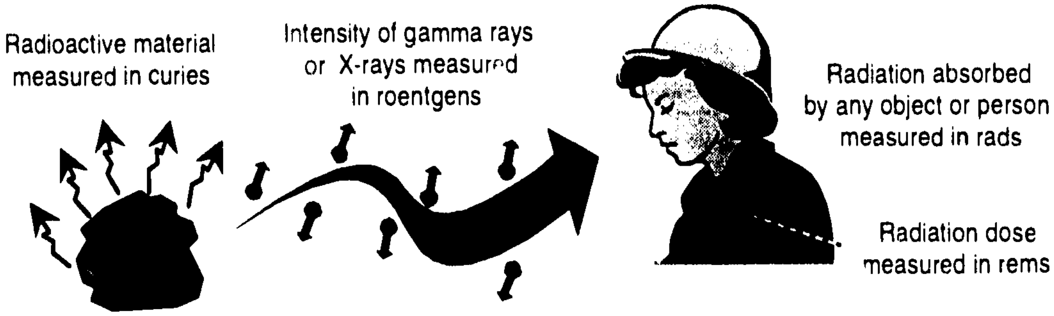
Common Sources of Radiation Exposure



Units of Measure

Radiation can be measured in a variety of ways. Typically, units of measure show either the radioactivity present in a substance or the radiation being given off.

The radioactivity of a substance is measured in terms of the decay per unit of time. The curie is the standard unit for this measurement and is based on the amount of radioactivity contained in one gram of radium. Numerically, one curie is equal to 37 billion disintegrations per second. The amounts of radioactivity that people normally work with are in the millicurie (one-thousandth of a curie) or microcurie (one-millionth of a curie) range. Levels of



For most purposes, one roentgen of exposure equals one rad or one rem of dose.

U.S. Department of Energy
Office of Environmental Management
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radioactivity in the environment from both natural and man-made sources are in the picocurie (one-trillionth of a curie) range.

Radiation that has enough energy to cause a change in the atomic balance of substances it passes through is called ionizing radiation. There are three basic forms of ionizing radiation. Large, slow moving alpha particles are easily stopped by a sheet of paper or the skin. Smaller, faster beta particles pass through paper or skin but can be stopped by a thin shielding such as a sheet of aluminum foil. Stopping gamma radiation (which travels at the speed of light) takes a thick shield of steel, lead, or concrete. X-rays and cosmic rays are examples of gamma radiation.

Common Sources of Radiation

Radiation both natural and artificial is a part of our everyday environment. The sources listed below contribute to an average American's yearly exposure of 360 mrem.

mrem = millirem
pCi = picocurie

Cosmic Radiation

Cosmic radiation is high-energy gamma radiation that originates in other space and filters through our atmosphere.

Sea Level . . . . 26 mrem/year
(Increases about 1/2 mrem for each additional 100 feet in elevation)
Atlanta, Georgia . . . . 31 mrem/year (1,050 feet)
Denver, Colorado . . . . . . 50 mrem/year (5,300 feet)
Minneapolis, Minnesota . . 30 mrem/year (815 feet)
Salt Lake City, Utah . . . . 46 mrem/year (4,400 feet)

Terrestrial Radiation

Terrestrial sources are naturally radioactive elements in the soil and water such as uranium, radium, and thorium. Average levels of these elements are 1 pCi/gram of soil.

United States (avg.) . . . . 26 mrem/year
Denver, Colorado. . . . . . 63 mrem/year
Nile Delta, Egypt . . . . . 350 mrem/year
Paris, France . . . . 350 mrem/year
Coast of Kerala, India . . 400 mrem/year
McAipe, Brazil . . . . . . 2,558 mrem/year
Pacos De Caldas Brazil . . . . 7,000 mrem/year

Buildings

Many building materials, especially granite, contain naturally radioactive elements.

U.S. Capitol Building . . . . . 85 mrem/year
Base of Statue of Liberty . . . . 325 mrem/year
Grand Central Station. . . . . 525 mrem/year
The Vatican . . . . 800 mrem/year

Radon

Radon levels in buildings vary, depending on geographic location, from 0.1 to 200 pCi/liter.

Average Indoor Radon Level . . . . 1.5 pCi/liter
Occupational Working Limit . . . . 17 pCi/liter

Food

Food contributes an average of 20 mrem/year, mostly from potassium-40, carbon-14, hydrogen-3, radium-226, and thorium-232.

Beer . . . . 390 pCi/liter
Tap Water. . . . . 20 pCi/liter
Milk . . . . 1,400 pCi/liter
Salad Oil . . . . 4,900 pCi/liter
Whiskey . . . . 1,200 pCi/liter
Brazil Nuts . . . . 14 pCi/g
Bananas . . . . 3 pCi/g
Flour . . . . 0.14 pCi/g
Peanuts & Peanut Butter . . . . . 0.12 pCi/g
Tea . . . . 0.40 pCi/g

Medical Treatment

The exposures from medical diagnosis vary widely according to the required procedure, the equipment and film used for X-rays, and the skill of the operator.

Chest X-Ray . . . . 10 mrem
Dental X-Ray, Each . . . . 100 mrem

Nuclear Medicine

Diagnostic study, Each . . . . . . 200 mrem
Therapeutic, Each . . . . 6,000 mrem
Annual occupational dose to radiology technician . . . . 300 mrem/yea.

Consumer Goods

Cigarettes - two packs/day (polonium-210) . . . . . . 8,000 mrem/year
Color Television . . . . <1 mrem/year
Gas Lantern Mantle (thorium-232) . . . . 2 mrem/year
Highway Construction . . . . 4 mrem/year
Airplane Travel at 39,000 feet (cosmic) . . . . 0.5 mrem/hour
Natural Gas Heating and Cooking (radon-222) . . . . 2 mrem/year
Phosphate Fertilizers . . . . . 4 mrem/year
Porcelain Dentures (uranium) . . . . 1,500 mrem/year
Radioluminescent Clock (promethium-147) . . . . . . <1 mrem/year
Smoke Detector (americium-241) . . . . . . 0.01 mrem/year

International Nuclear Weapons Test Fallout from pre-1980 atmospheric tests average for a U.S. citizen . . . . 1 mrem/year

Note: Because the radioactivity of individual samples varies, the numbers given here are approximate or represent an average. They are intended to provide a perspective for concentrations and levels of radioactivity rather than dose.

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Related Programs and Activities

- *U.S. Enrichment Corporation*
- *Nuclear Waste Policy Act*
- *National Low Level Waste Program*

The U.S. Department of Energy (DOE) Office of Environmental Management has certain programmatic responsibilities in connection with the following programs and activities as mandated by authorizing legislation.

U.S. Enrichment Corporation

To allow U.S. uranium enrichment activities to be more globally competitive, the President signed the National Energy Policy Act in October 1992, which established a government corporation, the U.S. Enrichment Corporation (USEC), to manage DOE's uranium enrichment facilities as a business. As of July 1993, the USEC is leasing DOE's uranium enrichment facilities in Portsmouth, Ohio and Paducah, Kentucky for six years, with the opportunity to completely transfer ownership to private investors. Effective October 1994, these facilities are subject to Nuclear Regulatory Commission (NRC) certification.

DOE is responsible for cleaning up contamination that existed before turning over the facilities to USEC. In June 1993, DOE and the U.S. Environmental Protection Agency completed an environmental audit to determine the extent of DOE's liability for cleanup. Environmental restoration of contamination happening after July 1993 will be funded by a user fee on domestic utilities and congressional appropriations.

Nuclear Waste Policy Act

To provide for the safe and permanent disposal of spent nuclear fuel from commercial reactors and high-level radioactive waste from national defense activities, Congress passed the Nuclear Waste Policy Act of 1982. The Act created the Office of Civilian Radioactive Waste Management within DOE and authorized it to oversee interim storage, transport, and ultimate geologic disposal of this waste. DOE is currently studying Yucca Mountain, Nevada to determine whether it is suitable as a possible site for a geologic repository for spent nuclear fuel and high-level radioactive waste. The Nuclear Waste Policy Act, as amended, requires DOE to provide relevant and timely information about radioactive waste management program plans to interested parties and affected units of local government. DOE consults regularly with state, local, and Indian Nation officials to better understand their concerns and informational needs and to provide opportunities for input.

Yucca Mountain is on the southwest boundary of DOE's Nevada Test Site in one of the most arid and sparsely populated regions in the country. DOE is conducting research in cooperation with state, local, and Indian Nation officials to determine the site's suitability as a potential location for high-level radioactive waste and spent fuel disposal.

National Low-level Waste Management Program

Low-level waste is radioactive waste not classified as high-level waste, transuranic waste, spent fuel, or by-product material. Most low-level waste contains small amounts of short-lived radioactivity in large amounts of material. Commercial low-level radioactive waste results from such diverse sources as nuclear reactors, medical, or biotechnological research, medical examinations and treatment, nuclear medicine and research, and the manufacturing sector.

Until the early 1960's, commercial low-level waste was disposed of in federal disposal facilities. When the federal government closed its facilities to commercial waste, private companies were prompted to assume disposal responsibility. By the 1970's, all commercial low-level waste in the United States was being shipped for disposal to only Nevada, South Carolina, and Washington. To ensure that other states shared the disposal burden, Congress passed the Low-Level Radioactive Waste Policy Act of 1980.

This Act established two major national policies:

- Each state is responsible for assuring adequate licensed disposal capacity for commercial low-level waste generated within its own borders.
- Regional groupings of states allied through interstate agreements called compacts could be formed to provide the mandated disposal facilities and could refuse acceptance of waste from outside their regional borders after January 1, 1986.

The process of reaching agreements on compacts, determining host states, and siting facilities proved slower than Congress had anticipated, and, by 1984, it became evident that no new disposal capacity would be available by the 1986 deadline. Generators of waste were also growing concerned about access to disposal sites. As a result, Congress passed the Low-Level Radioactive Waste Policy Amendments Act in December 1985. It established a strict timetable for developing commercial low-level waste disposal facilities, required states and compacts to comply with this timetable, and provided for rewards if the timetable was met and penalties if the timetable was not met.

To facilitate the establishment of a reliable nationwide low-level radioactive waste management system, Congress assigned specific responsibilities to DOE, including the provision of technical and financial assistance to states or compacts in meeting their responsibilities under the Act. The Act provided financial incentives for states and/or compacts to establish low-level radioactive waste management capabilities by specific dates. These incentives are in the form of user's fees paid by low-level radioactive waste generators for access to the currently operating disposal facility in Barnwell, South Carolina. DOE manages the administration of the payment system and provides an annual report to Congress on the overall national commercial low-level radioactive waste management system and progress being made by states in meeting their responsibilities.

The Act also gave DOE responsibility for ensuring the safe disposal of Greater-than-Class-C (GTCC) low-level radioactive waste. GTCC low-level radioactive waste, as classified by the Nuclear Regulatory Commission (NRC), is waste that has a higher level of radioactivity than concentrations listed in Title 10 of the Code of Federal Regulations, Part 61 and must be disposed in a NRC-licensed facility. Since some waste generators may be unable to provide safe storage for these wastes while disposal capacity is being developed, DOE plans to provide interim storage capabilities at an existing DOE facility if, in the judgement of the regulatory authority, continued onsite storage constitutes a threat to public health and safety.

Disposal of GTCC low-level radioactive waste will be provided as early as possible. Some of this waste is assumed to be disposed in a high-level waste deep geologic repository and some is assumed to be acceptable for near-surface or intermediate-depth disposal

Resource Conservation and Recovery Act

- *Regulates active government and industry hazardous waste generators and treatment, storage, and disposal facilities*

Introduction

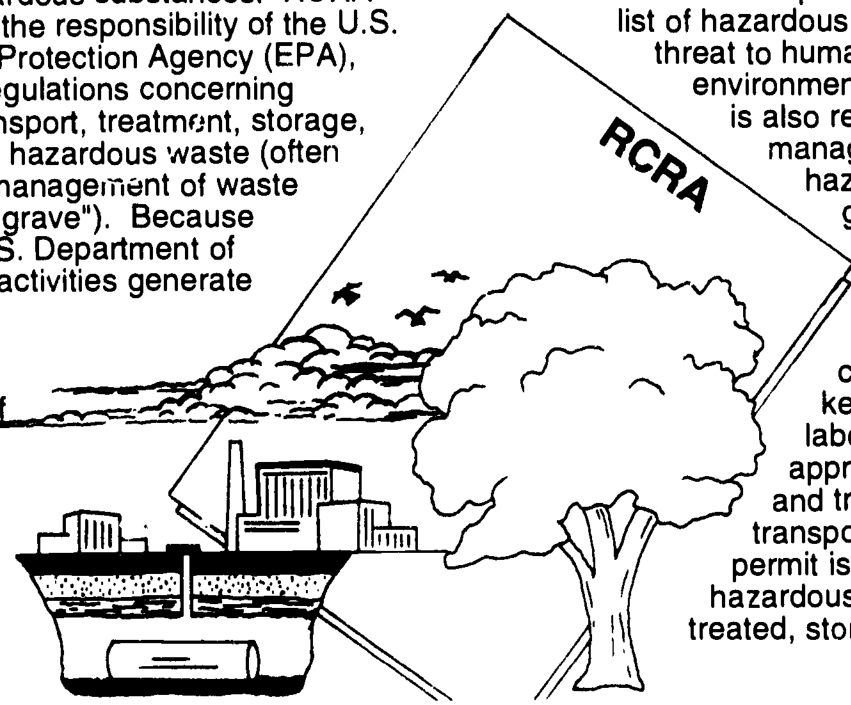
Congress passed the Resource Conservation and Recovery Act (RCRA) in 1976. RCRA substantially revamped federal regulation of solid waste disposal and created the first comprehensive federal regulatory program for the systematic control of hazardous waste. RCRA originally amended the Solid Waste Disposal Act (1965). RCRA was reauthorized in 1984 with the Hazardous and Solid Waste Amendments and was amended in 1988 to include the management of infectious waste.

In general, RCRA regulates solid waste, which includes both the ordinary garbage generated in our households and offices and the more hazardous chemical wastes produced by industrial processes. RCRA also regulates medical wastes and underground storage tanks containing hazardous substances. RCRA enforcement is the responsibility of the U.S. Environmental Protection Agency (EPA), which issues regulations concerning generation, transport, treatment, storage, and disposal of hazardous waste (often referred to as management of waste from "cradle to grave"). Because some of the U.S. Department of Energy (DOE) activities generate waste regulated under RCRA, DOE's Office of Environmental Management must comply with RCRA requirements.

RCRA Requirements

RCRA is made up of four distinct yet interrelated programs—solid waste (subtitle D), hazardous waste (subtitle C), underground storage tanks (subtitle I), and medical waste (subtitle J). Subtitle D of RCRA encourages states to develop comprehensive plans to manage primarily nonhazardous solid wastes, e.g., household waste. These plans, among other things, are intended to promote recycling of solid wastes and require closing and upgrading of all environmentally unsound sanitary landfills. DOE's sanitary landfills must also meet RCRA requirements.

RCRA's Subtitle C established a system for regulating hazardous waste from the time it is generated until its ultimate disposal (i.e., the "cradle to grave" management approach). This subtitle requires EPA to identify a list of hazardous materials that pose a threat to human health and the environment based on risk. EPA is also required to set management standards for hazardous waste generators and treatment, storage, and disposal facilities. These standards require certain types of record-keeping, reporting, labeling, use of appropriate containers, and tracking in transportation. In addition, a permit is required before hazardous waste can be treated, stored or disposed.



RCRA governs the management of solid waste, underground petroleum storage tank waste, and hazardous waste primarily at active facilities. DOE must comply with RCRA to manage its hazardous waste or face legal prosecution.

Controlling Waste from Generation to Disposal

RCRA's step-by-step approach enables EPA and the states to monitor and control hazardous waste at every point in the waste management cycle and links treatment, storage, and disposal responsibility with the waste generators. The approach has two key elements: a permitting system and a tracking system.

Facilities that treat, store, or dispose of hazardous waste must obtain a RCRA permit issued by EPA or by an authorized state. Permits identify the administrative and technical performance standards hazardous waste facilities must meet. Permits also contain requirements specific to the individual facility. An important component of the 1984 amendments was a shift from land disposal to treatment alternatives for hazardous waste. RCRA disposal permits are only granted if the operator can demonstrate the hazardous waste will not migrate from its location, especially into groundwater, or has been pretreated according to land disposal restrictions.

Hazardous waste generators are required to document and report waste production and ensure that waste is properly identified, tracked, and safely transported to a RCRA-permitted facility for treatment or disposal. The 1984 amendments require hazardous waste generators (except those who generate very small amounts) to comply with RCRA requirements and implement programs to reduce the volume of waste generated or

At the Fernald Environmental Management Project in Ohio, hazardous waste is being moved from outdoor pads into RCRA-permitted storage buildings.

reduce the waste's hazardous constituents. Because all DOE facilities are subject to RCRA regulations, all are examining ways to minimize waste through methods including recycling, material substitution, and source reduction.

Making RCRA Work

RCRA and its amendments provide opportunities for public participation in all phases of the RCRA program. RCRA requires that: (1) citizens have access to information obtained by EPA or the states during a facility inspection; (2) citizens are allowed to participate in the permitting process from the beginning; (3) citizens may bring suits against anyone whose hazardous waste management activities may constitute an imminent hazard, risk, or substantial endangerment either in the past or the present; (4) citizens may bring suits against anyone who may be in violation of a RCRA permit, standard, or requirement; and (5) EPA or the state must notify local officials and post signs at sites that pose imminent and substantial threats to human health and the environment.

RCRA enforcement may include orders to correct any violation, civil and criminal penalties, fines, and/or imprisonment. Whenever noncompliance is detected, legal action may follow. To ensure compliance, RCRA program personnel inspect and monitor facilities. Inspectors particularly check for compliance with groundwater monitoring requirements and proper handling and labeling of hazardous waste containers/storage units.

Federal Facility Compliance Act (FFCA)

Signed in October 1992, FFCA is an amendment to RCRA designed to bring all federal facilities into compliance with applicable federal and state hazardous waste laws. FFCA requires DOE to develop treatment plans for mixed hazardous and radioactive waste. The Act waives federal immunity for violation of hazardous waste requirements to allow the imposition of fines and penalties for noncompliance with storage. By October of 1995, DOE's regulators must issue compliance orders to implement the treatment plans.

Reference

RCRA regulations are located in Title 40 of the Code of Federal Regulations, Parts 240-280.

DOE/EM-0038P (Revision 1)

Comprehensive Environmental Response, Compensation, and Liability Act or "Superfund"

- *Regulates government and industry response to hazardous waste spills*
- *Ensures responsible parties pay for any cleanup required*

Introduction

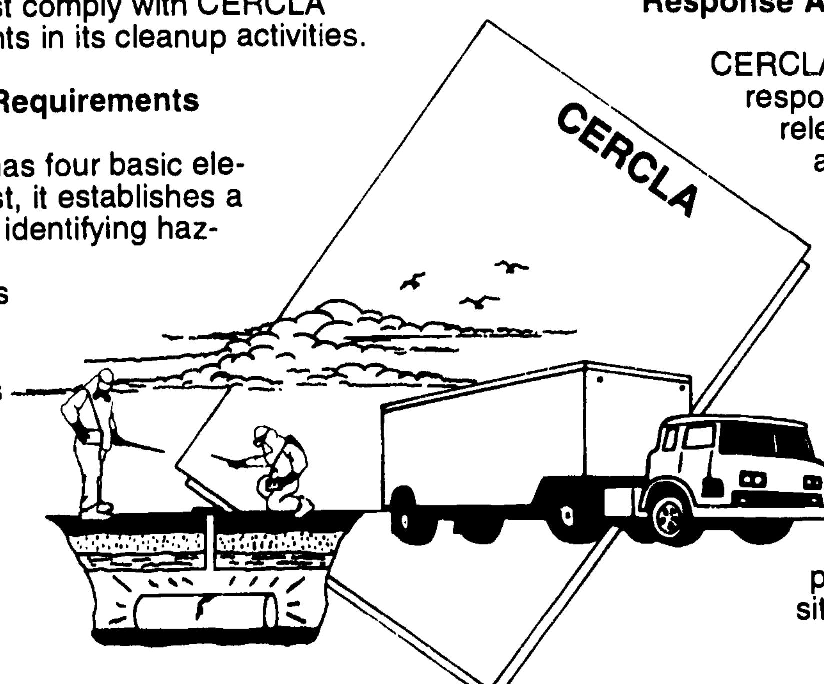
The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as Superfund, was passed by Congress in December 1980 and revised by the Superfund Amendments and Reauthorization Act (SARA) of 1986. Its principal purpose is to regulate the cleanup of leaking hazardous waste disposal sites. CERCLA was developed in part from a recognition that the Resource Conservation and Recovery Act (RCRA) did not provide for responses to inactive or abandoned hazardous waste disposal sites. Rather than outlining extensive regulation, CERCLA imposes reporting and cleanup requirements on the owners and operators—responsible parties—of facilities from which there is a release of hazardous substances. Some CERCLA responsibilities overlap with RCRA, the Clean Water Act, and the Safe Drinking Water Act. The U.S. Department of Energy (DOE) must comply with CERCLA requirements in its cleanup activities.

CERCLA Requirements

CERCLA has four basic elements. First, it establishes a system for identifying hazardous substances and listing contaminated sites on the U.S Environmental Protection Agency's (EPA's) National Priorities List. Sites that are placed on this list must be cleaned up quickly to protect people and the environment. EPA is required to designate substances as hazardous, and owners and operators of hazardous waste sites must report to EPA what substances they have and if there is any known, suspected, or likely releases of these substances to the environment. Second, the act provides federal authority for cleaning up a site if the owner or operator cannot be found or doesn't do it themselves. Third, CERCLA creates a trust fund to pay for these cleanup activities. The trust fund is derived from various sources including taxes on polluting industries and recovered cleanup costs from responsible parties. Fourth, CERCLA makes persons who are responsible for hazardous releases liable for cleanup costs as well as damage to states' or Indian Nations' natural resources resulting from the hazardous substances.

Response Actions and Authority

CERCLA authorizes cleanup responses when there is a release or threat of a release of a hazardous substance into the environment. Two types of response actions are authorized: removal and remedial actions. In the event of an emergency situation, for example to avert an explosion or to clean up a hazardous waste spill, removal actions are undertaken to address the problem at the surface of the site. Such events concern not



CERCLA, or Superfund, focuses primarily on inactive hazardous waste facilities and sets requirements for responses to unwanted releases of hazardous materials. DOE must comply with CERCLA in its cleanup activities.

only hazardous substances on EPA's lists but also any pollutants or contaminants with the exception of petroleum and gas. Remedial actions provide a more permanent solution to hazardous substance threats.

EPA attempts to identify the party(ies) responsible for the contamination before taking any response actions itself. Responsible parties can be any of the following: past and present site owners; generators of hazardous substances found at the site; or transporters of hazardous substances to the site. If these parties are able and willing to undertake the response task, the EPA either negotiates a legal agreement with them or unilaterally orders them to do so. Should they be unable, due to bankruptcy, or refuse to comply with the order altogether, the EPA can undertake the response actions itself.

Superfund Amendments and Reauthorization Act (SARA)

The Superfund Amendments and Reauthorization Act (SARA) of 1986 was the first major revision of CERCLA since its inception. One year prior, the National Contingency Plan had been created to establish a blueprint for cleanup of hazardous releases to the water, land, or air. SARA expanded the 1985 National Contingency Plan to include the provision that remedial actions must at least attain applicable or relevant and appropriate requirements (ARARs).

ARARs determine the technical standards for cleanup activities but apply only to onsite CERCLA actions. The applicable requirements are federal or state environmental or public health laws and regulations on cleanup standards specific to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. If a requirement is not directly applicable, it may still be relevant and appropriate. A situation sufficiently similar to an applicable CERCLA site may be deemed relevant to the cleanup. A relevant requirement, however, may or may not be considered appropriate.

Another important element is the increased involvement of the states. The states' roles are now to join the EPA in all stages of identifying National Priorities List sites and determining the appropriate cleanup remedy.

SARA also made federal facilities subject to the requirements of CERCLA. However, federal facilities are not permitted to use Superfund money to conduct cleanups.

Community Right-to-Know

SARA contains the Emergency Planning and Community Right-to-Know Act. The Right-to-Know Act creates emergency planning, reporting, and notification requirements intended to protect the public in the event of a release of a hazardous substance. Facilities are required to report the presence of hazardous chemical substances in addition to those listed as extremely hazardous.

Emergency release notice is only required by the Act if the release is of an EPA-listed substance exceeding the substance's reportable quantity and extending beyond the facility's boundaries. The Right-to-Know Act also includes a system of administrative, civil, and criminal penalties to enforce notification requirements. Both EPA and private individuals may order DOE and commercial facilities into compliance or bring civil action against them and impose monetary and prison penalties for violations.

Reference

CERCLA regulations are located in Title 40 of the Code of Federal Regulations, Parts 300-373.

National Environmental Policy Act

- *Requires consideration and public review of environmental impacts before action is taken*

Introduction

The National Environmental Policy Act (NEPA), of 1969 established national environmental policy and goals for the protection, maintenance, and enhancement of the environment. NEPA requires *all* federal agencies, including the U.S. Department of Energy (DOE), to examine the environmental consequences of major proposed actions, such as building a new facility, and to conduct a decision making process that incorporates public input.

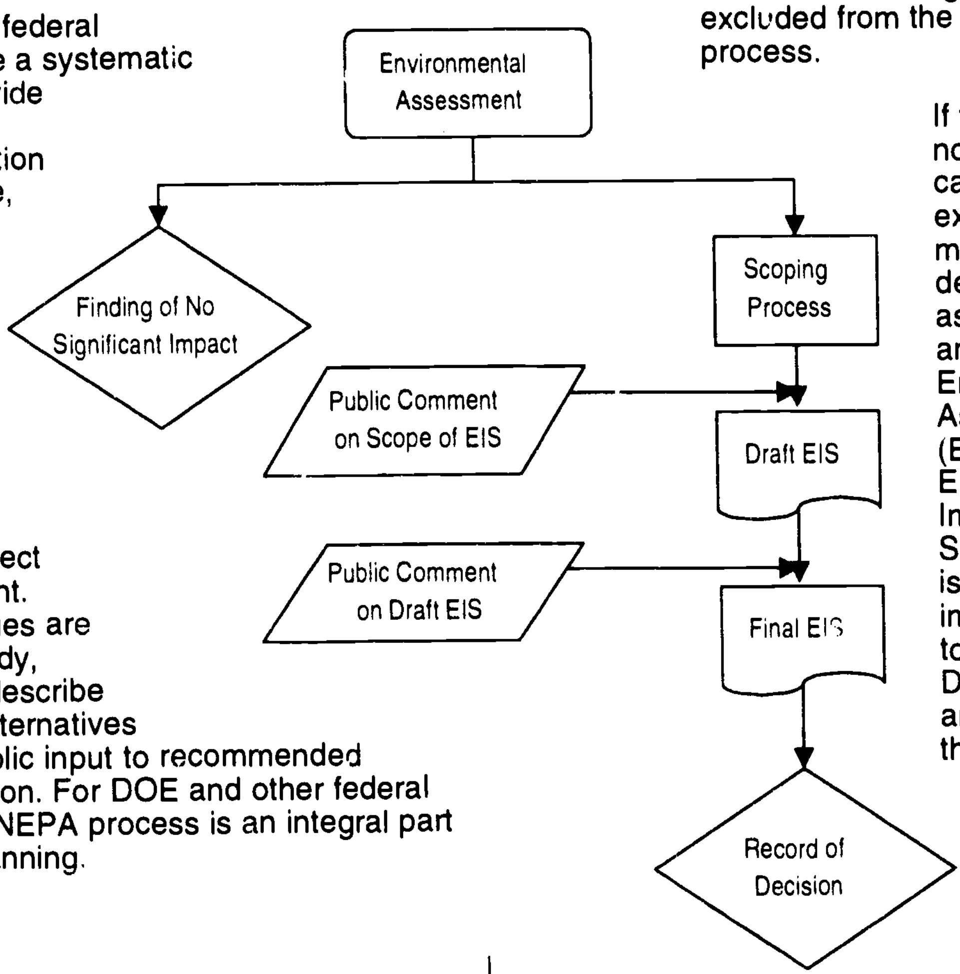
NEPA requires federal agencies to use a systematic process to provide environmental impact information to federal, state, local, and Indian Nation officials as well as citizens before decisions are made to take major actions that may significantly affect the environment. Federal agencies are required to study, develop, and describe impacts and alternatives and obtain public input to recommended courses of action. For DOE and other federal agencies, the NEPA process is an integral part of program planning.

NEPA Process

DOE and other federal agencies follow a systematic process when an action that could affect the environment is proposed. If the proposed action meets certain criteria that DOE has previously determined as having no significant environmental impact, the project may qualify for a categorical exclusion. A categorical exclusion exempts the project from further environmental evaluation under NEPA. Certain categories of routine actions, such as maintenance of roads and buildings, are excluded from the NEPA process.

If the action is not granted a categorical exclusion, DOE makes an initial determination as to whether an Environmental Assessment (EA) or an Environmental Impact Statement (EIS) is required. If impacts appear to be significant, DOE prepares an EA to study the impacts of the proposed action, alternatives to the action,

THE NEPA PROCESS



and whether the action will create an environmental impact significant enough to warrant an EIS. If the EA shows the proposed action would not significantly affect the environment, a Finding of No Significant Impact (FONSI) is issued. On the other hand, if the EA shows the action has the potential to significantly affect the environment an EIS must be prepared. Sometimes EISs are immediately prepared for large projects from which environmental impacts are anticipated.

When an EIS is required, DOE publishes a Notice of Intent (NOI) announcing the scoping process. The NOI is usually published in the Federal Register and a local newspaper. The scoping process includes holding at least one public meeting and requesting written comments on what issues and environmental concerns an EIS should address. The scoping process allows citizens, states, Indian Nations, federal agencies and other interest groups to comment on the scope of the EIS. An EIS should always include the proposed action's purpose, need, alternatives, effects on the environment, consequences, and involved organizations.

Based on the scoping process, DOE prepares a Draft EIS which addresses the environmental impact of a proposed action and alternatives to the action, outlines any unavoidable adverse environmental effects, identifies the relationship between short- and long-term uses and impacts, addresses the cumulative effects of the action, and describes resources that would be used. Another public comment period follows including public hearings and requests for written comments. Considering all oral and written comments, DOE prepares and publishes the Final EIS, which includes responses to comments made on the Draft EIS. Finally, DOE issues a Record of Decision (ROD) announcing the course of action to be taken. The ROD addresses the EIS findings, alternatives, and mitigation measures.

The NEPA review process has enabled DOE and other federal agencies to address compliance with many environmental laws under a single review process rather than separate reviews under each law—reducing paperwork, time, and effort.

Council on Environmental Quality

NEPA created the Council on Environmental Quality (CEQ), which reports on environmental quality to the President. In turn, the President, with the assistance of the CEQ, gives Congress an annual Environmental Quality Report on the state of the nation's environment and progress made in implementing NEPA. Other responsibilities include gathering information on conditions and trends in environmental quality, evaluating federal programs under NEPA, developing and promoting national policies to improve environmental quality, and conducting research and analyses related to environmental quality. The CEQ sets some requirements for implementing NEPA, including a format for public scoping meetings and hearings that prevents federal officials from responding to input during the meeting. This is intended to ensure they gather the input and provide a thoughtful response in the EIS.

Reference

NEPA is regulation number 42 USC 4321 for reference purposes. CEQ guidelines for preparing an EIS are found in Title 40 of the Code of Federal Regulations, 1500-1508. DOE has issued additional guidance to implement NEPA in Title 10 of the Code of Federal Regulations, 1021.

Additional Statutes Affecting DOE's Environmental Management Program

- AEA
- CAA
- OSHA
- TSCA
- CWA
- SDWA
- UMTRCA
- NWPA

Introduction

Until the 1980's, the U.S. Department of Energy (DOE) and the agencies it replaced were almost exclusively self-regulating, in part due to national security interests. Today, DOE's environmental management activities are subject to federal, state, local, and Indian Nation environmental laws and worker health and safety regulations, as well as laws governing the use of nuclear materials. Some of these laws are described below. Various federal and state agencies have enforcement authority for these laws.

Atomic Energy Act (AEA)

AEA, enacted in 1946 and amended in 1954, outlines roles and responsibilities for the control of nuclear materials. Its primary objective is to assure safe and proper management of nuclear materials. DOE has authority to manage and regulate all the nuclear materials generated or managed at its facilities. The Nuclear Regulatory Commission regulates these materials when generated or managed by private or commercial organizations.

Clean Air Act (CAA)

CAA was enacted in 1963 and last amended in 1990. The objective of CAA is to protect and enhance the quality of the nation's air resource and protect public health and welfare, while fostering a beneficial productive capacity. Under CAA, standards are set for air pollutants. Facilities that generate and release pollutants to the air are required to obtain an operating permit and comply with these standards. This may require process modification or some form of treatment before emissions are released to the environment. The U.S. Environmental Protection Agency (EPA) and the states enforce CAA.

Occupational Safety and Health Act (OSHA)

OSHA, enacted in 1970 is enforced by the Occupational Safety and Health Administration, a federal agency under the U.S. Department of Labor. As Congress stated, the purpose of the Act is "...to assure so far as possible every working man and woman in the nation safe and healthful working conditions and to preserve our human resources...." Recognizing workplace design is the key to safety and health protection, Congress established the legal responsibility of each employer to identify possible hazards and correct them before they lead to injuries. OSHA encourages employers to consult closely with workers, change the workplace or work practices, and use training and education as part of the safety and health effort.

Toxic Substances Control Act (TSCA)

TSCA was enacted in 1976 and is enforced by EPA. It requires that specific chemicals be tested and their processing and use restricted to protect human health and the environment from unreasonable risk from exposure. TSCA's objectives include the development of adequate data to determine the health and environmental effects of chemicals and the control of chemicals that present an unreasonable risk of injury. TSCA specifically regulates the control of any waste materials that contain more than 50 parts per million of polychlorinated biphenyls (PCBs).

Clean Water Act (CWA)

CWA was enacted in 1972 and established a federal/state scheme for controlling the introduction of pollutants into the nation's navigable surface water. The objectives of CWA include protection of fish and wildlife

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and availability of federal funds for public waste treatment works. All facilities that discharge waste waters to either a surface water body (i.e., not ground water) or a publicly-owned treatment system must ensure compliance with CWA. Facilities that directly discharge wastewaters must obtain a National Pollutant Discharge Elimination System permit. This permit specifies the discharge standards and monitoring requirements that the facility must achieve. CWA is enforced by the EPA and the states.

Safe Drinking Water Act (SDWA)

SDWA was enacted in 1974 with the primary purpose of protecting drinking water resources. Primary drinking water standards set by the SDWA apply to drinking water "at the tap" as delivered by public water supply systems. Of equal significance, drinking water standards are used to determine ground water protection regulations under a number of other statutes, including CERCLA. SDWA states each federal agency having jurisdiction over a federally-owned or operated public water system must comply with all federal, state, local requirements for the provision of safe drinking water. EPA monitors compliance with the SDWA.

Nuclear Waste Policy Act (NWPA)

Passed in 1982 and amended in 1987, the NWPA directs DOE to design, site, and construct a geologic repository for the disposal of DOE's high-level radioactive waste and spent nuclear fuel from civilian nuclear reactors.

Uranium Mill Tailings Radiation Control Act (UMTRCA)

Passed in 1978, this Act directs DOE to provide for stabilization and control of the uranium mill tailings from inactive sites in a safe and environmentally sound manner to minimize radon hazards to the public. DOE is cleaning up 24 sites and over 5,000 vicinity properties under the authority of this Act. See the Uranium Mill Tailings Remedial Action Project Fact sheet for more information.

Examples of additional Environmental, Safety, and Health Legislation DOE must comply with, listed by Regulatory Agency

U.S. Environmental Protection Agency

- Noise Control Act, 1973
- Federal Land Policy and Management Act, 1976
- Oil Pollution Act, 1990

Nuclear Regulatory Commission

- Low-Level Radioactive Waste Policy Act, 1980 (1986)

U.S. Department of Transportation

- Hazardous Materials Transportation Act, 1975

U.S. Department of the Interior

- National Historic Preservation Act, 1966
- Endangered Species Act, 1973
- Archaeological Resource Protection Act, 1979

Note: Dates in parentheses are reauthorizations of the original act.

See fact sheets on the Resource Conservation and Recovery Act, the Comprehensive Environmental Response, Compensation, and Liability Act, and the National Environmental Policy Act for additional information.

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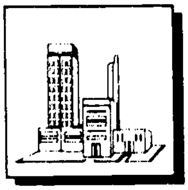


What is Waste Management?

- *Management of radioactive, hazardous, mixed, and sanitary waste*
- *Treatment, storage, disposal*

The U.S. Department of Energy's (DOE's) Waste Management Program directs the safe treatment, storage, and disposal of waste generated by DOE's nuclear-related activities. Radioactive, hazardous, mixed, and sanitary waste have been generated from weapons production, defense materials processing, manufacturing, research, site cleanup, and ordinary working activities. Waste is managed from generation through treatment and storage to disposal. DOE works to carry out waste management activities in compliance with all applicable laws and regulations.

Treatment

Treatment methods are selected based on the quantity and form of the waste. Incineration, compaction, and solidification are examples of waste treatment methods commonly used by DOE.

Waste treatment techniques reduce the volume or toxicity of radioactive and hazardous waste for safer handling. Reducing waste volume to extend the life of storage and disposal facilities is also desirable. Incineration is an example of a treatment technology that accomplishes both of these objectives. For example, incineration of mixed waste destroys hazardous toxic chemicals in waste, leaving a smaller volume of radioactive ash which can be safely stored or disposed of in existing facilities.

DOE's high-efficiency incinerators are designed to control harmful effluents and comply with all environmental and regulatory laws. Airborne emissions are carefully processed and monitored for compliance with environmental regulations and permit conditions to ensure safety. Incinerator ash is packaged and stored or disposed of using much less space than the original waste volume would have required.

Compaction is a means of reducing the volume of noncombustible waste by compressing it into a smaller, denser waste form. Mechanical shredding of noncombustible waste also reduces waste size.

Some waste treatment facilities are able to achieve a ratio of 300 to 1 in their waste reduction activities. Reducing waste volume is a vital function of waste treatment. Noncombustible waste can be shredded, size-reduced, or compacted. Shown here is a waste compactor in an open position with packages of low-level waste ready for compaction. Other methods of volume reduction include melting, evaporation, and incineration.

Solidification can be used to treat liquid waste and sludges. DOE solidification facilities convert the wastes to a structurally stable, uniform waste form ready for disposal. Such waste forms can include grout, glass, or other solid material.

Grout is low-level liquid waste mixed with cement and allowed to harden prior to safe storage. High-level liquid waste can be solidified in two ways. Vitrification converts high-level liquid waste to a stable, solid form by mixing it with glass, thereby preventing or slowing its migration to the environment. The high-level liquid and sludge waste is mixed with molten glass and placed in sealed stainless steel canisters where it solidifies. Calcination converts high-level liquid waste into a granular substance that is also sealed in stainless-steel bins.

Storage

Many DOE sites and installations store radioactive, hazardous, and mixed waste temporarily until disposal sites are available and acceptance criteria can be met. Waste storage is an interim measure.

Waste is sometimes stored before treatment in anticipation of better treatment processes or while awaiting the availability of treatment facilities. For example, DOE stores high-level liquid waste in underground steel tanks. When vitrification facilities are constructed and tested, this waste will be moved from the tanks and treated. After treatment, DOE will again store the solidified waste until a disposal facility is developed, licensed, and approved.

DOE stores most transuranic waste both before and after treatment. In dry areas of the country, transuranic waste contained in metal drums and boxes is stored in trenches to allow easy retrieval. To avoid groundwater contamination in humid areas, waste containers are placed on asphalt pads on the surface and covered with protective vinyl and soil.

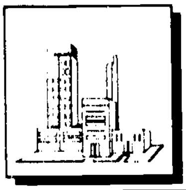
These underground double-wall carbon steel tanks (shown here under construction) store high-level liquid waste and sludge at the Hanford Site in Washington. Future plans are to treat this waste in a vitrification facility.

Although DOE disposes of most low-level solid waste, some low-level liquid waste is stored in tanks and will be immobilized in glass for onsite disposal. Solidified low-level waste is disposed of in concrete vaults. Most hazardous waste is sent to permitted commercial facilities for treatment and disposal. Some hazardous waste is packaged in drums and stored in permitted facilities either in buildings or on concrete pads awaiting the development of treatment and disposal facilities. Mixed waste is stored awaiting the development of treatment and disposal facilities.

Disposal

Disposal is the permanent isolation of waste from humans and the environment. DOE has conducted extensive research into disposal methods and has concluded that deep geologic isolation is the best alternative for disposing of the most long-lived hazardous types of radioactive waste. Deep geologic disposal will be used to dispose of high-level waste and transuranic waste. In New Mexico, the Waste Isolation Pilot Plant, constructed 2,150 feet underground in a salt bed, should demonstrate safe geologic disposal of transuranic waste. In Nevada, tests are ongoing to determine if Yucca Mountain is a safe site for a high-level waste disposal facility.

DOE disposes of low-level waste in engineered trenches, concrete vaults, or shallow land burial. Cement is used as a foundation for trenches and land burial with plastic and dirt in layers on top. The dirt is then graded to allow rain to drain off.



Definitions of Environmental Management Managed Wastes and Spent Nuclear Fuel

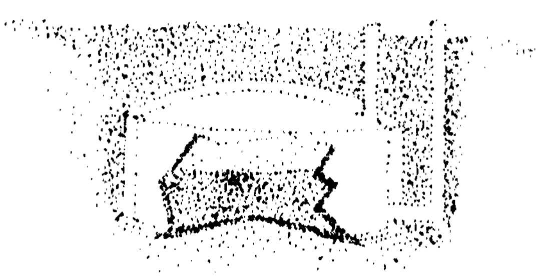
- *High-level waste*
- *Uranium mill tailings*
- *Transuranic waste*
- *Hazardous waste*
- *Low-level waste*
- *Mixed waste*
- *Spent Fuel*

A variety of waste types were produced during the approximately 50 years of the U.S. Department of Energy's (DOE's) nuclear materials production and energy research activities. To better manage and clean up the waste, DOE handles the waste according to regulatory and scientific definitions. Wastes are categorized according to their toxicity and hazard, as well as chemical or radioactive nature. Waste types are defined by federal environmental regulations. Some regulations outline methods of waste handling to protect workers and the public. DOE manages radioactive, hazardous, mixed, and sanitary waste and spent nuclear fuel.

Radioactive Waste

Radioactive waste is solid, liquid, or gaseous waste that contains radionuclides. DOE manages four categories of radioactive waste. high-level waste, transuranic waste, low-level waste, and uranium mill tailings.

- **High-level waste (HLW)** is highly radioactive material from the reprocessing of spent nuclear fuel. HLW includes spent nuclear fuel, liquid waste, and solid waste derived from the liquid. HLW contains elements that decay slowly and remain radioactive for hundreds or thousands of years. HLW must be handled by remote-control from behind protective shielding to protect workers.



High-level waste is stored in underground tanks surrounded by concrete vaults at three DOE sites: the Savannah River Site in South Carolina, the Hanford Site in Washington, and the West Valley Demonstration Project in New York. At the Idaho National Engineering Laboratory, high-level liquid waste is stored in stainless steel tanks until it is converted to a granular solid and then stored in shielded stainless steel bins.

Transuranic (TRU) waste is typically protective clothing, equipment, and tools contaminated with transuranic radionuclides. The contaminated materials are sometimes treated to reduce their volume, and then placed in drums for storage, as shown in this drawing. DOE's long term goal is to dispose of TRU waste in a geologic repository.

- **Transuranic (TRU) waste** contains human-made elements heavier than uranium that emit alpha radiation. TRU waste is produced during reactor fuel assembly, weapons fabrication, and chemical processing operations. It decays slowly and requires long-term isolation. TRU waste can include protective clothing, equipment, and tools.

- **Low-level waste (LLW)** is any radioactive waste not classified as high-level waste, transuranic waste, or uranium mill tailings. LLW often contains small amounts of radioactivity dispersed in large amounts of material. It is generated by uranium enrichment processes, reactor operations, isotope production, medical procedures, and research and development activities. LLW is usually made up of rags, papers, filters, tools, equipment, discarded protective clothing, dirt, and construction rubble contaminated with radionuclides.

- **Uranium mill tailings** are by-products of uranium mining and milling operations. Tailings are radioactive rock and soil containing small amounts of radium and other radioactive materials. When radium decays, it emits radon, a colorless, odorless radioactive gas. Released into the

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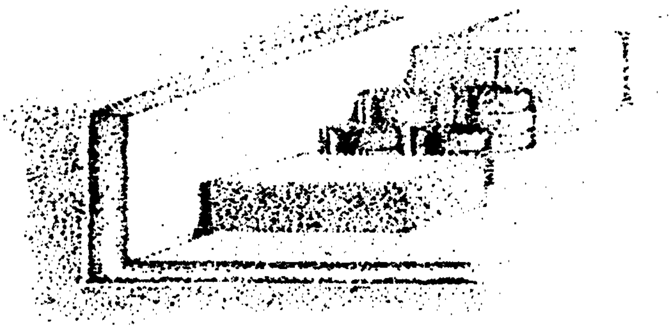
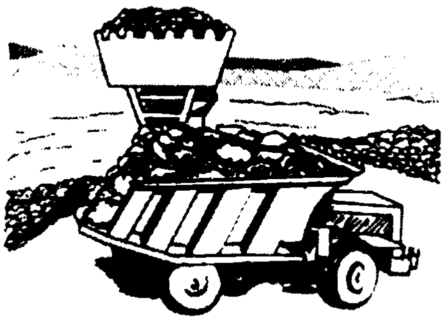


Most of DOE's low-level waste will continue to be disposed of using engineered techniques such as shallow trench burial in dry areas and disposal on concrete pads above ground in more humid areas. Some low-level waste, such as liquids or large machinery, must be treated by solidification or size reduction before disposal.

atmosphere, radon gas disperses harmlessly, but the gas is harmful if a person is exposed to high concentrations for long periods of time under conditions of limited air circulation.

Hazardous Waste

Hazardous wastes are chemicals and nonradioactive materials that exhibit one or more of the following characteristics: toxic, corrosive, reactive, ignitable, or listed. Some environmental laws list specific materials as hazardous waste. For example, hazardous waste can exist in the form of a solid, liquid, or sludge and can include materials such as polychlorinated biphenyls (PCBs), chemicals, explosives, gasoline, diesel fuel, organic solvents, asbestos, acid, metals, and pesticides. Environmental laws also list materials that must be treated and managed as hazardous.



Uranium Mill Tailings come from past uranium mining and milling activities. Uranium is not mined in the U.S. anymore. Sites where mining or uranium ore processing (milling), as well as sites where fill dirt from these locations was used, must be cleaned up to protect people from the effects of radon.

DOE hazardous waste is strictly characterized to ensure it contains no radionuclides. Some hazardous waste is stored at DOE sites in buildings that have been issued a permit through the Resource Conservation and Recovery Act. If hazardous waste has no added radioactivity, it can be shipped off site to commercially owned and operated disposal facilities. Some hazardous wastes can be reused instead of disposed, saving money and disposal site resources.

Mixed Waste

Mixed waste is defined as radioactive waste contaminated with hazardous waste regulated by the Resource Conservation and Recovery Act (RCRA). A large portion of DOE's mixed waste is mixed low-level waste found in soils. No mixed waste can be disposed of without complying with RCRA's requirements for hazardous waste and meeting RCRA's Land Disposal Restrictions, which require waste to be treated before disposal in appropriate landfills. Meeting regulatory requirements and resolving mixed waste questions related to different regulations is one of DOE's most significant waste management challenges.

Spent Nuclear Fuel

Nuclear reactors burn uranium fuel creating a chain reaction that produces energy. Over time, as the uranium fuel is burned, it reaches the point where it no longer contributes efficiently to the chain reaction. Once the fuel reaches that point it is considered spent. Spent nuclear fuel is thermally hot and highly radioactive.

Sanitary Waste

Like any industry, DOE generates solid and liquid sanitary waste from normal housekeeping activities. Solid sanitary waste or garbage is disposed in sanitary landfills; liquid sanitary waste (or sewage) undergoes a wastewater treatment process before being discharged through the sewage system. DOE owns and operates treatment facilities and sanitary landfills at many of its sites.

Pollution Prevention

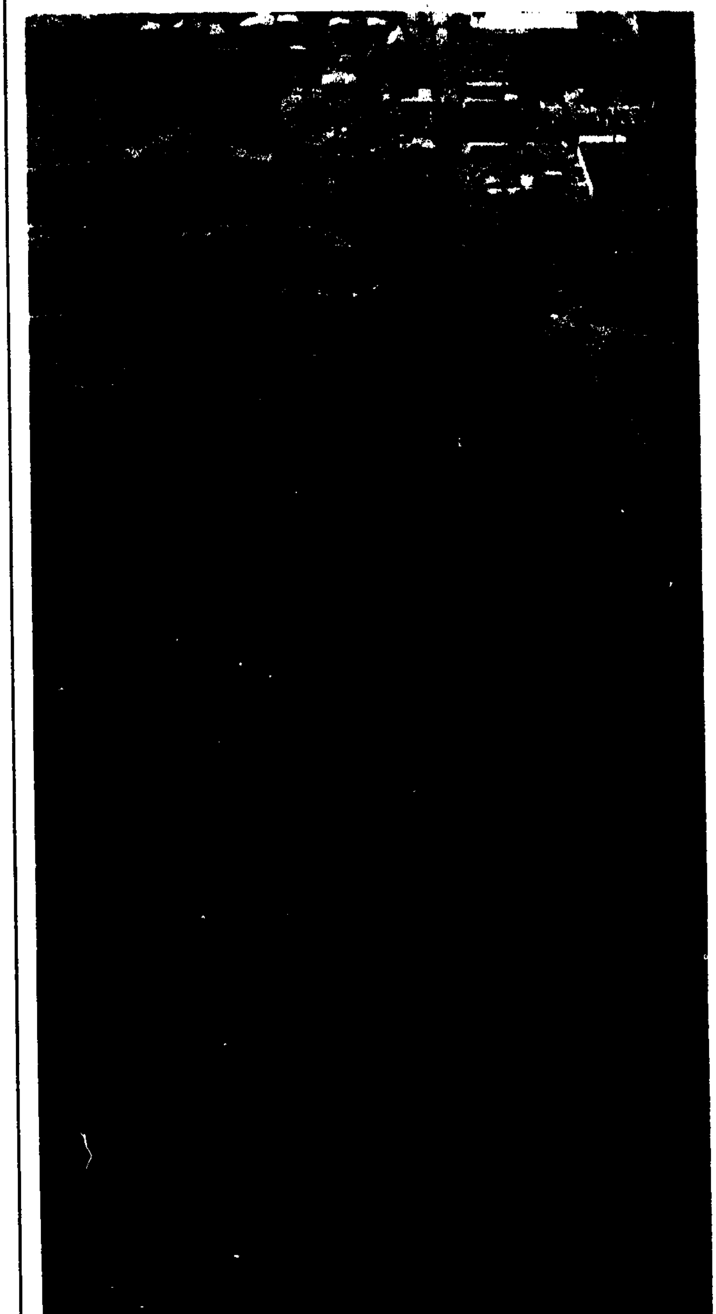
- *Avoid waste generation*
- *Reduce, recycle, and reuse*

Reduction of all types of waste is an integral part of DOE's environmental management program. Pollution prevention (also known as waste minimization) is avoiding the generation of radioactive, hazardous, mixed, and sanitary waste.

It includes activities that involve source reduction (reducing waste generated at the source) and recycling of all waste and pollutants. It includes any practice that reduces the use of hazardous materials, nonhazardous materials, energy, water, or other resources through changing processes, recycling, or using products that contain recycled materials. It also includes practices that protect natural resources through either conservation or more efficient use of materials. For example, hazardous solvents can be replaced with nonhazardous detergents, or waste water discharges can be eliminated. Also, paper, scrap metal, and other materials can be recycled.

Pollution prevention technology is the most interdisciplinary of the waste management tools, affecting all current and proposed DOE operations. A comprehensive pollution prevention program contributes to savings in waste treatment, storage, and disposal costs, and lowers health risks to workers and the public. Pollution prevention can be applied to all pollution-generating activities, such as research and development, weapons dismantlement, remedial actions, decontamination and dismantlement, maintenance, and normal office practices.

DOE sites across the country have programs in place to reduce waste production. An integrated pollution prevention program coupled with technology development has become integral to all of DOE's production, processing, laboratory, and waste operations activities. DOE is making pollution prevention a



To reduce the amount of clean water that got into this process trench at the Hanford Site in Washington state, closed-loop cooling and plugging drains were installed. A total of 260 million gallons of water are saved each year as a result.

key objective, not only in process and facility modification, but also in the procurement of goods and services. DOE sets standards for its sites and establishes goals for reducing the release of toxic chemicals and generation of all types of wastes and pollutants.

While pollution prevention will significantly reduce the amount of waste generated, existing and new waste must be managed more effectively than it has been in the past. This will require new and better ways to treat, store, and dispose of it.

Pollution prevention benefits include risk reduction, enhanced environmental quality, reduced compliance costs, greater production efficiency, and resource conservation.

Pollution prevention techniques are also being used to recycle and minimize waste generated from nuclear weapons dismantlement. Other examples of techniques to prevent pollution include developing soldering materials that are less hazardous, testing less toxic solvents for use in metal cleaning and paint stripping, and developing acid treatment facilities that will separate useful acids from waste.

This researcher is conducting tests on a technology to prevent pollution by minimizing the volume of waste acid requiring disposal.

Significant pollution prevention activities include:

- Non-plutonium operations at the Rocky Flats Plant in Colorado have eliminated the use of carbon tetrachloride.
- Mercury waste recycling operations are underway at the Savannah River Site in South Carolina.
- Antifreeze is being recycled at several sites, including the Hanford Site in Washington, and the Idaho National Engineering Laboratory in Idaho.
- Chlorinated hydrocarbons have been eliminated at the Y-12 Plant on the Oak Ridge Reservation in Tennessee.
- An Environmentally Conscious Manufacturing Program is underway at the Sandia National Laboratories in New Mexico and California, the Pinellas Plant in Florida, and the Kansas City Plant in Missouri. Techniques such as solvent substitution, process modification, and improved soldering techniques have been implemented.

Spent Nuclear Fuel

- *DOE-owned spent nuclear fuel*
- *Commercial power reactor fuel*

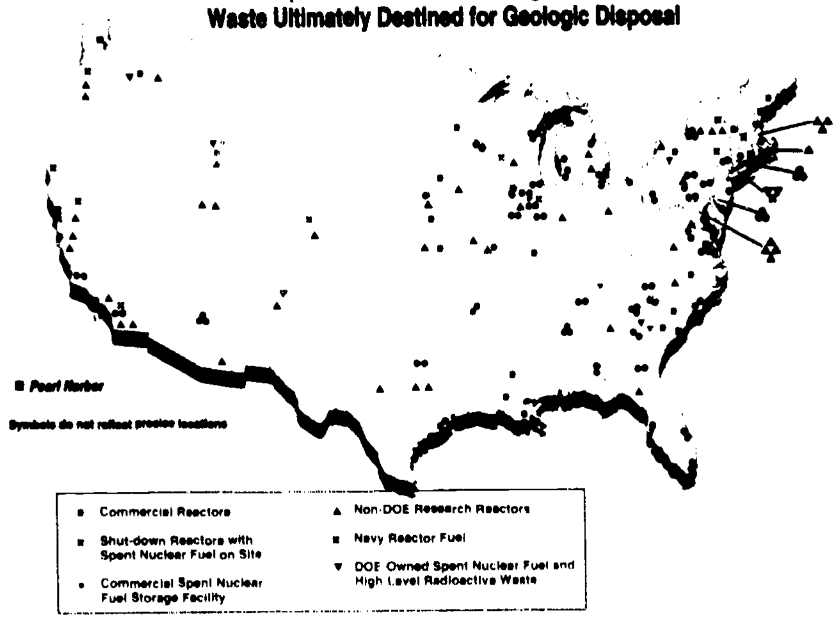
The U.S. Department of Energy (DOE) and its predecessors have provided nuclear fuel over the years to others as well as using it in DOE nuclear reactors.

Nuclear reactors use uranium fuel to generate heat through a process called fission. Fission occurs when atomic particles called neutrons strike the nuclei, causing the atom to split into two or more smaller atoms. When an atom splits, it releases energy in the form of radiation and heat. Neutrons released during fission go on to split other atoms, maintaining a chain reaction. After the uranium fuel is used for a period of time and no longer contributes efficiently to the nuclear reaction, it is considered spent.

DOE has categorized the spent nuclear fuel for which it is responsible into two categories: DOE-owned spent nuclear fuel and commercial power reactor fuel. Management of DOE-owned spent nuclear fuel is coordinated by the Office of Environmental Management. DOE production reactors, non-DOE U.S. government reactors, and the U.S. university research reactor are all sources of DOE owned spent nuclear fuel. Some privately owned U.S. reactor spent nuclear fuel as well as some foreign research reactor spent nuclear fuel is also managed is in this category. The Office of Civilian Radioactive Waste Management has ultimate responsibility for managing and disposing of commercial power reactor fuel.

In 1992, DOE decided to phase out reprocessing of DOE-owned spent nuclear fuel for the purpose of recovering material for nuclear weapons. This decision has resulted in a growing inventory of spent nuclear fuel in a national system originally designed to actively process it into usable products.

Locations of Spent Nuclear Fuel and High-Level Radioactive Waste Ultimately Destined for Geologic Disposal



Spent nuclear fuel is stored in water pools and other storage facilities throughout the nation. The need for greater and improved storage capacity exists, as do concerns about the chemical, metallurgical, and physical status of the currently stored spent nuclear fuel and the adequacy of existing spent nuclear fuel storage facilities.

It is estimated that the inventory of DOE-owned spent nuclear fuel will increase by approximately three percent over the next 40 years. This increase will come from the Naval Nuclear Propulsion Program and from DOE research reactors. Additional quantities of spent nuclear fuel exist at research reactors located at U.S. universities and a number of foreign countries. The nuclear fuels in foreign countries were made available under the "Atoms for Peace" program during the early days of the Atomic Energy Commission. These fuels were provided to universities and other research establishments to help in education programs and research projects throughout the world. As these spent nuclear fuels are returned for storage at DOE facilities, the United States needs to ensure their continued safe storage until they are prepared for permanent disposal.

These new demands parallel the existing challenges facing DOE in determining how to dispose of this nation's commercial spent nuclear fuel. Even though some of the spent fuel in these two groups differs greatly in size and composition, many of the disposal decisions are similar. To benefit from the commonality with the already existing commercial program, DOE is coordinating its spent fuel programs to address common concerns.

DOE plans to safely store its spent nuclear fuel for a long interim period in a manner that will ensure protection of the environment, workers, and the public. This storage may require some treatment and packaging of spent fuel to meet interim storage and permanent disposal facility criteria.

DOE recently completed an itemized inventory of DOE-owned spent nuclear fuel and an assessment of the environmental, safety, and health vulnerabilities associated with the current storage and handling of these materials. DOE is in the process of developing an Environmental Impact Statement that will examine the environmental impacts of the management of DOE-owned spent nuclear fuel.

Waste Management Activities at Albuquerque Operations Office

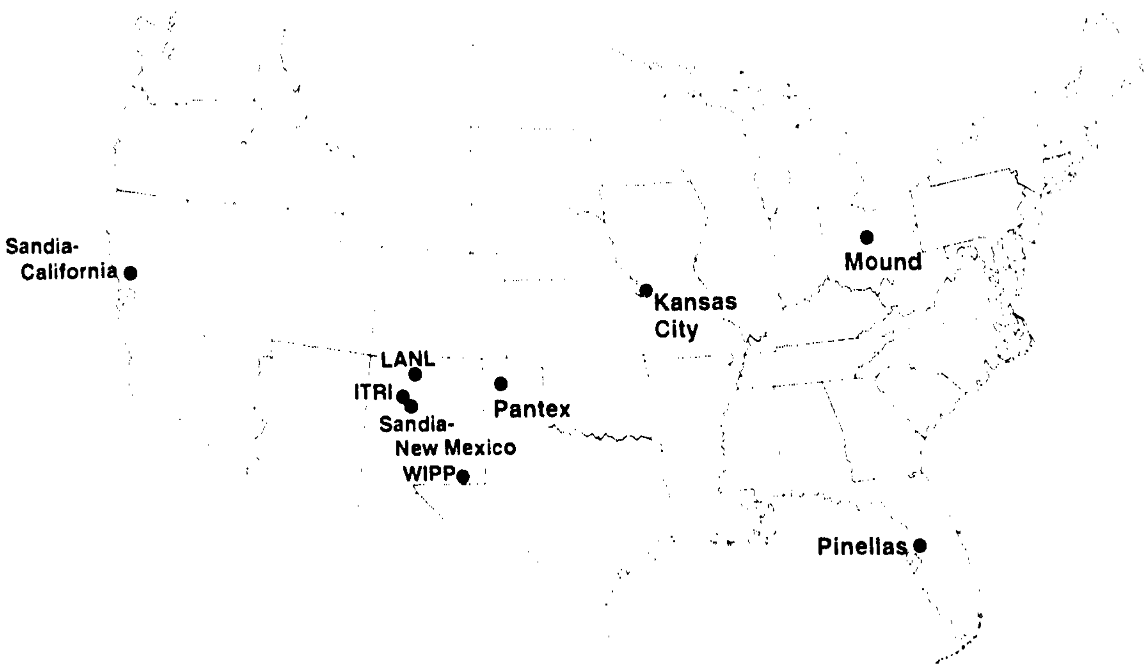
- *Waste Isolation Pilot Plant (WIPP)*
- *8 other waste management sites in 6 states*

The Albuquerque Operations Office oversees waste management activities at nine sites. Past operations in support of defense programs nuclear materials production at these sites have generated transuranic waste, low-level waste, hazardous waste, and mixed waste (radioactive and hazardous combined).

The Albuquerque sites are: the Inhalation Toxicology Research Institute (ITRI) in Albuquerque, New Mexico; the Kansas City Plant near Kansas City, Missouri; the Los Alamos National Laboratory (LANL) northwest of Santa Fe, New Mexico; the Mound Plant in Miamisburg, Ohio; the Pantex Plant near Amarillo, Texas; the Pinellas Plant near St. Petersburg, Florida; the Sandia National Laboratories - New Mexico south of Albuquerque; the Sandia National Laboratories - California east of San Francisco; and the Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico. Activities at these sites include research and development in nuclear energy and safety, weapons manufacturing, assembly, and testing, and waste management.

Transuranic Waste

The Los Alamos National Laboratory and the Mound Plant are the only significant transuranic waste generators under the Albuquerque Operations Office oversight. Plans are to dispose of transuranic waste in the Waste Isolation Pilot Plant (WIPP) if WIPP is determined suitable to safely contain the waste. Transuranic waste must be certified to meet specific acceptance criteria before it can be sent to WIPP. The criteria ensure that only safely packaged transuranic waste will be placed in the facility. The Mound Plant certifies all of its transuranic waste and stores it on site. The Los Alamos National Laboratory certifies



The Albuquerque Operations Office oversees waste management at nine sites in six states across the nation. There is no high-level radioactive waste at any of these locations.

and stores its newly-generated transuranic waste on site and is retrieving and processing previously stored transuranic waste for certification. Before certification, some of this existing stored waste is treated to make it safer and easier to handle. Other transuranic waste will be size reduced or compacted.

Low-level Waste

Although all the Albuquerque Operations Office sites generate low-level waste, the Los Alamos National Laboratory is the only site that currently disposes of low-level waste in onsite burial facilities. The remaining sites treat, package, and ship or are preparing to ship their low-level waste to other U.S. Department of Energy (DOE) disposal facilities.

Hazardous and Mixed Waste

Most hazardous waste generated at the Albuquerque Operations Office sites is shipped to permitted commercial facilities for treatment and disposal. The Los Alamos National Laboratory treats some hazardous waste on site, and design has begun on a hazardous waste treatment facility. Mixed waste is stored on site at all the Albuquerque sites pending the identification and development of treatment and disposal techniques. Waste management facilities and equipment are being continually designed, constructed, or enhanced at all the Albuquerque sites. For example, the new Mixed Waste Facility at the Sandia National Laboratories-Albuquerque will stabilize mixed waste for storage and eventual disposal.

As part of a DOE-wide commitment to reduce the amount of waste generated, all the Albuquerque sites are engaged in active waste minimization programs.

Specific waste management activities include:

Inhalation Toxicology Research Institute
- Construct waste treatment and storage facility upgrade.

Kansas City Plant
- Upgrade hazardous waste storage facilities.

Los Alamos National Laboratory
- Upgrade and restart the Controlled Air Incinerator.

This controlled air incinerator at the Los Alamos National Laboratory will be used for destruction of hazardous components of mixed waste. It has been demonstrated to safely process waste during 10 years of testing.

Mound Plant
- Construct the Radioactive Waste Storage Building.

Pantex Plant
- Construct mixed waste storage facilities.

Pinellas Plant
- Construct the Neutralization Facility Upgrade.

Sandia National Laboratories - New Mexico
- Complete design and begin construction of waste assay facility.

Sandia National Laboratories - California
- Upgrade the Hazardous Waste Emergency Tracking System.

Waste Isolation Pilot Plant - New Mexico
- Begin Test Program.

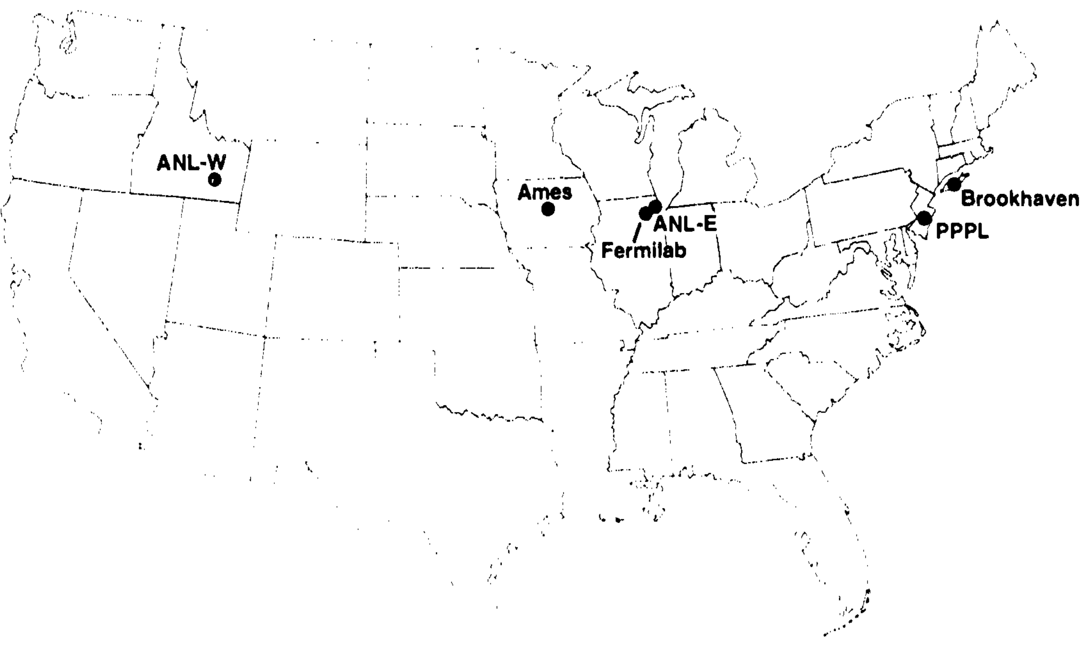
Waste Management Activities at Chicago Operations Office

- *Research, development, and demonstration laboratories*
- *6 waste management sites in 5 states*

The Chicago Operations Office sites conduct basic and applied research in various areas of interest to the U.S. Department of Energy (DOE) and the public. This research includes: support of the nation's advanced reactor program; research on the fundamental properties of matter; research on the physical, life, and environmental sciences; and research on magnetic confinement fusion and high-energy physics.

The Chicago Operations Office oversees waste management activities at six sites: the Ames Laboratory in Ames, Iowa; the Argonne National Laboratory - East (ANL-E) near Chicago, Illinois; the Argonne National Laboratory - West (ANL-W) in Idaho Falls, Idaho; the Brookhaven National Laboratory on Long Island, New York; the Fermi National Laboratory (Fermilab) west of Chicago, Illinois; and the Princeton Plasma Physics Laboratory (PPPL) in Princeton, New Jersey.

The research, development, and demonstration activities conducted at these laboratories are the principle sources of radioactive transuranic and low-level waste, hazardous waste, and mixed waste (radioactive and hazardous combined). Radioactive waste generated as a result of laboratory activities is disposed of at the Hanford Site in Washington State. Hazardous waste is disposed of at licensed commercial vendors. Treatment of mixed waste is being addressed in Site Treatment Plans currently being developed at the sites.



The Chicago Operations Office manages U.S. Department of Energy sites involved in research and development of nuclear reactor technology and basic science.

The Ames Laboratory, at Iowa State University, conducts basic research in materials sciences and reliability and chemical sciences. The Laboratory can prepare high-purity metals, alloys, compounds, and single crystals.

The Argonne National Laboratory - East researches energy-related technologies including nuclear reactor design, synchrotron radiation accelerator design, and environmental research. The Argonne National Laboratory - West conducts research and development in the advanced reactor program. Reactor complexes include the Experimental Breeder Reactor and the Zero Power Physics Reactor.

The Brookhaven National Laboratory researches low- and high-energy physics and life sciences, and nuclear medicine. Facilities include the Alternating Gradient Synchrotron and the High-Flux Beam Reactor.

The Fermi National Laboratory (Fermilab) explores the fundamental structure of matter and operates the Tevatron, the world's highest energy particle accelerator in both fixed target and colliding beams modes.

At the Princeton Plasma Physics Laboratory (PPPL), plasma physics and magnetic confinement fusion are researched. These activities include experimenting with demonstrating economical fusion power.

The Chicago Operations Office is conducting an active program of waste minimization research and activities as part of DOE's commitment to reducing the amount of waste it generates.

Specific waste management activities include:

Argonne National Laboratory - East

- Upgrade Sanitary and Laboratory Wastewater Treatment Plants.

- Completed waste shipments to offsite disposal facilities safely and without incident.

Argonne National Laboratory - West

- Completed test plan on high-level waste leaching studies.

- Upgrade and cathodically protect liners at the Radioactive Scrap and Waste Facility.

Brookhaven National Laboratory

- Continue sewage system upgrades. Completed construction of the automatic diversion system and reconnected industrial cesspool to sewer system.

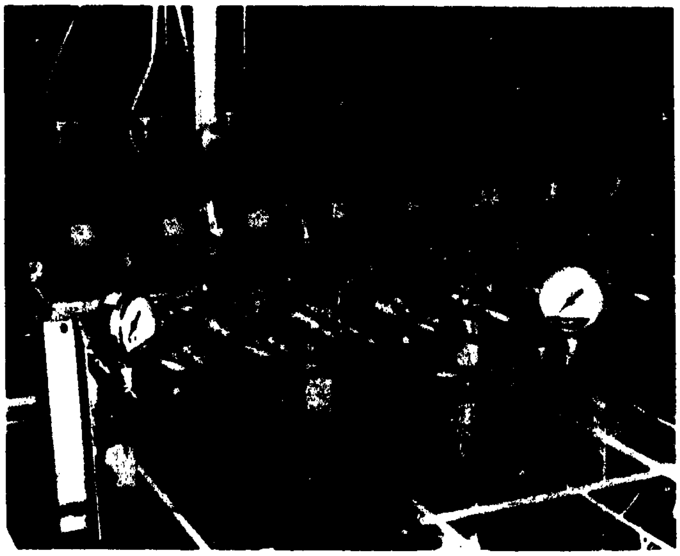
- Design and construct a Hazardous Waste Management Facility.

Other Labs (Fermilab, PPPL, Ames)

- Design and construct low-level radioactive waste storage facilities at the Fermilab and PPPL.

- Completed shipments from all three facilities to offsite waste disposal sites, safely and without incident.

- Prepared waste minimization plans for all three facilities.



This centrifugal contractor has been used to reduce liquid waste volumes in remote-handled operations at the Argonne National Laboratory.

Waste Management Activities at Idaho Operations Office

- *High-level waste calcining*
- *Transuranic waste storage*
- *Low-level waste treatment and disposal*

The Idaho Operations Office oversees waste management activities at the Idaho National Engineering Laboratory near Idaho Falls, Idaho and at the West Valley Demonstration Project near West Valley, New York. The Idaho National Engineering Laboratory facilities were originally dedicated to development, testing, and processing of nuclear fuel in conjunction with nuclear reactor development and reactor safety system testing. More recently, programs at the site became more diversified to include research and development in environmental, material, and computer sciences. In addition to pursuing an aggressive waste minimization program, the Idaho Operations Office is researching and developing new techniques and methods for nondestructive examination of waste and treatment, storage, and disposal in a safe and effective manner that protects the general public, plant employees, and the environment.

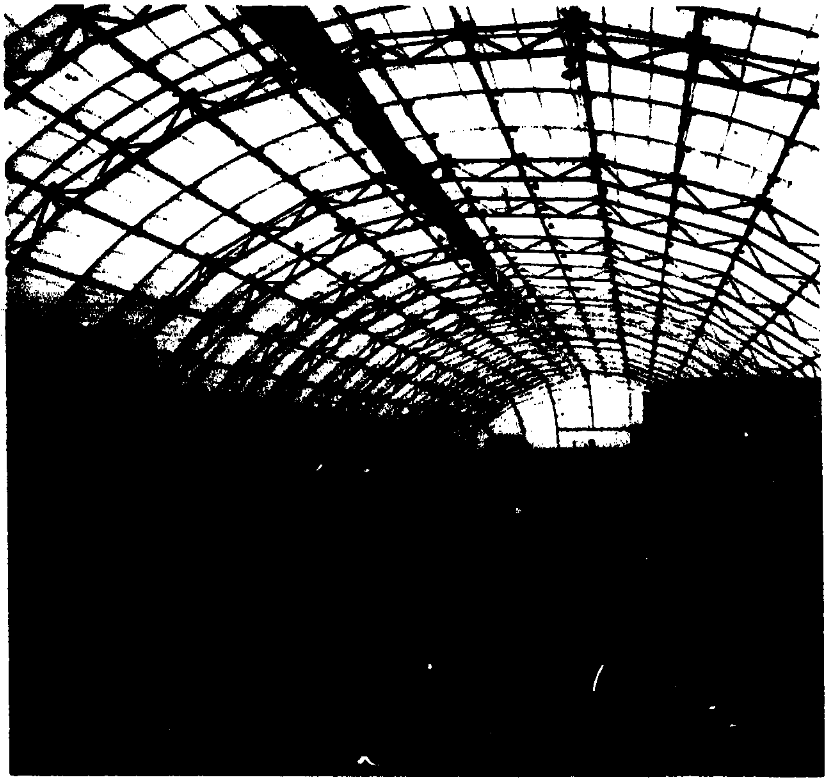
As a result of the Idaho National Engineering Laboratory operations, a variety of radioactive waste, hazardous waste, and mixed waste (radioactive and hazardous combined) is generated and must be safely treated, stored, and eventually disposed. High-level liquid waste generated at the Idaho National Engineering Laboratory is stored in underground stainless steel tanks. It is then calcined (converted to a dry, granular solid) at the New Waste Calcining Facility and stored in stainless steel bins (resembling large silos) within concrete vaults pending development of a final disposal facility. Most high-level waste produced at the Idaho National Engineering Laboratory over the past 40+ years has already been calcined and is stored in bins with a 500-year design life.

Transuranic waste is stored on concrete pads and covered with soil to insulate it from the weather. After it is certified regarding content and packaging, it is stored in an air-supported building at the Radioactive Waste Management Complex. Plans are to ship the certified waste to the Waste Isolation Pilot Plant in New Mexico for disposal once it can be demonstrated that the facility can safely contain the waste. Some transuranic waste from the Idaho National Engineering Laboratory will be used during the predisposal phase.

Approximately one-half of the low-level waste generated at the Idaho National Engineering Laboratory can be processed by incineration, compaction, or size reduction and stabilization at the Waste Experimental Reduction Facility (WERF) before onsite disposal. This treatment is accompanied by the upgrading of disposal facilities to meet current regulatory requirements. The WERF suspended operations in February 1991 to update operating and safety procedures and to repair and improve equipment and systems.

Mixed waste is stored on site until treatment

Several long-term campaigns for high-level liquid waste stabilization and volume reduction are planned in the 1990's at the New Waste Calcining Facility at the Idaho National Engineering Laboratory.



Certified transuranic waste is currently stored in an air-supported building at the Radioactive Waste Management Complex at the Idaho National Engineering Laboratory. New buildings that comply with environmental requirements are being constructed. The waste will be moved from the air-supported buildings to the new Transuranic Waste Characterization and Storage Facility.

methods are developed or offsite disposal becomes available. Hazardous waste is treated and disposed of at licensed commercial facilities. A small portion of the mixed low-level waste generated at the Idaho National Engineering Laboratory is volume reduced at the Waste Experimental Reduction Facility.

The main purpose of the West Valley Demonstration Project waste management program is to demonstrate high-level waste immobilization using a method called vitrification. In this process, high-level liquid waste is converted into glass. Construction and equipment installation for a vitrification facility are underway. Fifty percent of the high-level liquid waste inventory has been reduced in volume by separating the low-level waste from it. Ten thousand drums of low-level waste are being processed for disposal.

Additional waste management activities at the Idaho National Engineering Laboratory and the West Valley Demonstration Project include waste minimization, treatment, storage, and future shipment of high-level waste to a geologic repository.

Specific waste management activities include:

- Resume waste processing at the New Waste Calcining Facility at the Idaho National Engineering Laboratory to reduce high-level waste volume and produce stable calcine.

- Complete construction of the new Transuranic Waste Characterization and Storage Facility at the Idaho National Engineering Laboratory.

- Complete construction and replace incinerator combustion chambers at the Waste Experimental Reduction Facility at the Idaho National Engineering Laboratory.

- Prepare for start-up of the West Valley Demonstration Project.

- Receive and handle spent nuclear fuel and store it until it can be sent offsite for permanent disposal.

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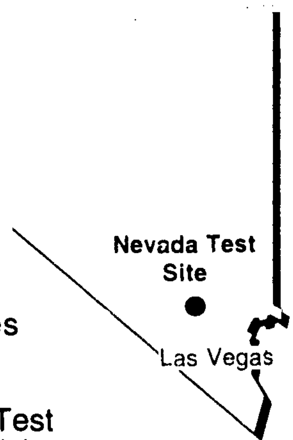
Waste Management Activities at Nevada Operations Office

- *Manage waste from nuclear weapons testing*
- *Waste disposal for offsite generators*

The Nevada Operations Office waste management mission is to dispose of radioactive waste and mixed waste (radioactive and hazardous combined) resulting from operations at the Nevada Test Site and at other U.S. Department of Energy (DOE) sites. The Nevada Test Site covers approximately 1,350 square miles of desert. Located about 65 miles northwest of Las Vegas, Nevada, it is an active site for the development and testing of nuclear weapons. Testing activities are currently suspended.

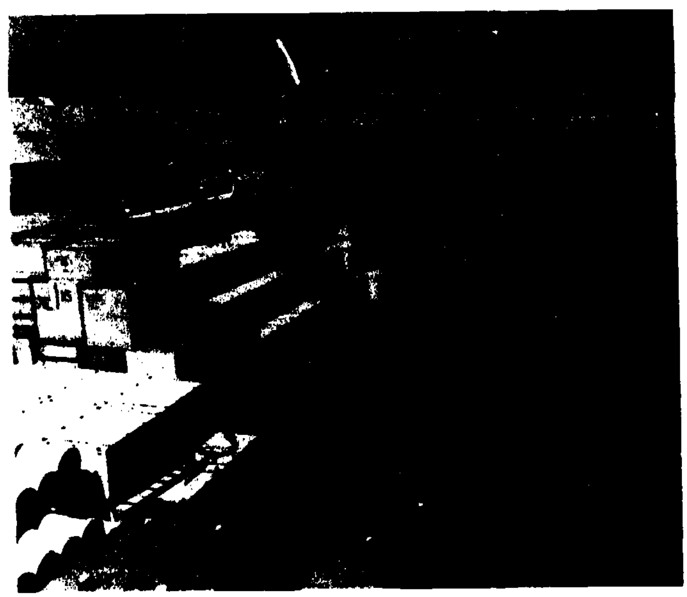


Prior to the signing of the Limited Test Ban Treaty on August 5, 1963, which banned testing of nuclear weapons in the atmosphere, DOE and its predecessors conducted more than 300 nuclear tests above and below ground at the Nevada Test Site and seven other locations outside the State of Nevada. Since 1963, all U.S. nuclear weapons tests at the Nevada Test Site have been conducted underground. As of September 1991, more than 600 nuclear weapons tests have been conducted at the Nevada Test Site.

Waste Management

Since 1978, the Nevada Test Site has served as a major disposal facility for low-level waste generated on site and at other DOE sites. In addition to these low-level waste disposal activities, the Nevada Test Site stores small volumes of transuranic waste from several other DOE sites. Transuranic waste is stored in containers on asphalt pads at the Radioactive Waste Management Site. The

At the Nevada Test Site, subsidence craters are used to bury packaged scrap metal and other large debris contaminated with low-level radioactivity. Craters were formed when cavities created by underground nuclear detonations collapsed.



Solid low level radioactive waste from U.S. nuclear weapons laboratories and production facilities are buried in pits at the Radioactive Waste Management Site.

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Nevada Test Site is in the process of certifying this waste and preparing it for future disposal in the Waste Isolation Pilot Plant in New Mexico.

Onsite low-level waste is generated from three primary sources: onsite laboratories, weapons testing activities, and the cleanup of retired test sites. Low-level waste from other DOE sites is packaged before shipment to Nevada. Both on site and off site waste is placed in shallow pits and trenches for disposal. Waste requiring greater confinement disposal has been placed in augured shafts. While the majority of the waste from other sites is unclassified, the Nevada Test Site offers secure disposal facilities for small amounts of classified low-level waste.

The Nevada Test Site is developing a Mixed Waste Management Facility for disposal of low-level mixed waste (low-level radioactive and hazardous combined). Nonradioactive hazardous waste is shipped off site to a licensed commercial operator for treatment and disposal.

The Nevada Test Site has finalized a waste minimization plan. Activities to date have included replacement of hazardous materials with nonhazardous ones, the sale or transfer of unused products, recycling of certain materials, and installation of oil change systems.

Hazardous waste is collected at this accumulation pad before being shipped to an offsite commercial facility. This pad consists of an impervious concrete pad with six-inch curbs and a roof to protect the area from precipitation. All waste containers are checked to verify their contents. Waste is stored at the pad for less than 90 days.

Specific waste management activities include:

- The Nevada Test Site has disposed of an estimated 339,000 cubic feet of low-level waste and 202,000 cubic feet of mixed waste to date.

- The Nevada Test Site has disposed of over 600,000 cubic feet of waste from the Atmospheric Test Debris Disposal Program to date.

- Over 1,300 containers of hazardous waste have been located, analyzed, and disposed of at offsite Resource Conservation and Recovery Act-permitted commercial facilities to date.

- The Nevada Test Site issued a Waste Minimization and Pollution Prevention Awareness Plan. As part of the Plan, 50 percent of hazardous materials has been replaced with nonhazardous solvents.

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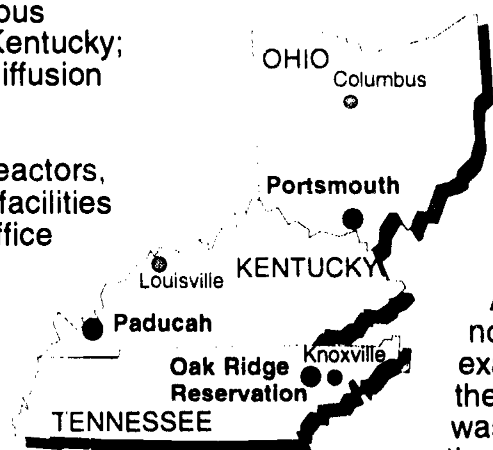
Waste Management Activities at Oak Ridge Operations Office

- *Greater confinement disposal demonstrated*
- *5 sites in 3 states*

The Oak Ridge Operations Office oversees waste management activities at five sites: the Oak Ridge National Laboratory, the K-25 Site, and the Y-12 Plant, all located on the Oak Ridge Reservation in Oak Ridge, Tennessee; the Paducah Gaseous Diffusion Plant near Paducah, Kentucky; and the Portsmouth Gaseous Diffusion Plant in Piketon, Ohio.

Routine operations of the test reactors, laboratories, and other nuclear facilities at the Oak Ridge Operations Office sites result in the generation of transuranic waste, low-level waste, hazardous waste, and mixed waste (radioactive and hazardous combined).



The Oak Ridge National Laboratory (ORNL) covers about 2,900 acres. ORNL conducts applied research and development in fusion, fission, conservation, fossil, and other energy technologies for the U.S. Department of Energy (DOE). ORNL also conducts basic scientific research in the physical and life sciences. The K-25 Site occupies 1,500 acres adjacent to the Clinch River. It originally produced uranium hexafluoride, but due to a declining need for enriched uranium, it was shut down in 1987 and now serves as a center for applied technology and operates waste treatment and storage facilities. The Y-12 Plant, located on 811 acres in the Bear Creek Valley, also produced enriched uranium in the past. Now, the Plant's role is manufacturing and developmental engineering, and waste treatment, storage, and disposal. These three sites are all within 15 miles of the city of Oak Ridge. Under the U.S. Enrichment Corporation (USEC) both Portsmouth and Paducah produce enriched uranium and manage the resulting waste. Waste generated and areas contaminated prior to July 1, 1993, are managed by DOE under the authority of the Energy Policy Act of 1992.

Transuranic Waste

The Oak Ridge Operations Office plans to dispose of transuranic waste in the Waste Isolation Pilot Plant (WIPP) if is determined suitable to safely contain the waste. Before transuranic waste can be sent to WIPP, it must be certified to meet specific criteria. At the Oak Ridge National Laboratory, waste is examined in the Waste Examination and Assay Facility using nondestructive assay and examination techniques. Some of the waste is found to be low-level waste and is disposed of on site; the transuranic waste is separated

At the Waste Examination and Assay Facility, this radiography unit X-rays drums to ensure they contain only transuranic waste. A passive-active neutron unit in an assay chamber is also used at the facility.

from other types of waste and certified for future shipment to WIPP. If it can't be certified it is retreivably stored to await treatment. A plant to process this waste from all the Oak Ridge Operations Office sites for eventual shipment to WIPP is in the planning stages. There currently is no treatment capability for transuranic waste at Oak Ridge.

Low-Level and Mixed Waste

Low-level waste and mixed waste generated by the Oak Ridge Operations Office sites are managed through a combination of waste minimization techniques, retrievable storage, treatment (e.g. incineration, denitrification, stabilization), and onsite disposal.

Greater confinement disposal technologies are being demonstrated at the Oak Ridge National Laboratory. These include underground concrete silos, auger holes, and hillside tumulus disposal units. These alternative disposal techniques provide much greater isolation of low-level waste from the environment.

Specific waste management activities include:

Oak Ridge National Laboratory

- Began operation of the Non-Radiological Wastewater Treatment Plant.

- Begin construction of the Mixed Waste Storage Upgrade in Building 7507.

- Operate facilities around the clock to treat liquid and gaseous radioactive and nonradioactive waste.

K-25 Site

- Operate the Toxic Substances Control Act (TSCA) incinerator, which treats hazardous and mixed waste in compliance with TSCA. Processed 2.1 million pounds of waste in 1991, 2.8 million pounds in 1992, and 3.6 million pounds in 1993.

- Operate the Central Neutralization Facility to treat wastewater from the TSCA incinerator in compliance with environmental laws.

The Nonradiological Wastewater Treatment Plant at Oak Ridge National Laboratory (ORNL) replaced four unlined sedimentation ponds. The plant meets the requirements of ORNL's National Pollutant Discharge Elimination System permit.

Y-12 Plant

- Plan treatment facilities for hazardous, mixed, and low-level waste.

- Now operating five onsite wastewater treatment facilities.

Paducah Gaseous Diffusion Plant

- Complete design and construction of a New Storage Facility.

- Develop an alternate facility or system to reduce or eliminate the use of chlorinated solvents. Operate waste minimization activities to reduce the amount of waste landfilled on site by 40 percent.

Portsmouth Gaseous Diffusion Plant

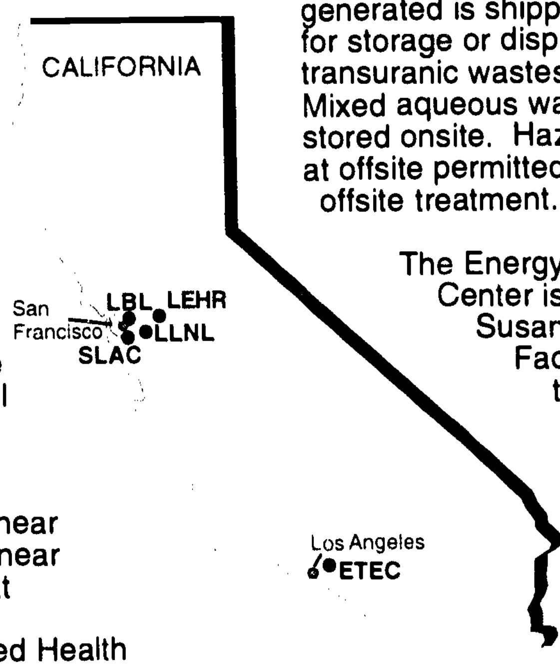
- Complete construction of the Mixed Waste Storage Facility.

- Replace polychlorinated biphenyl (PCB) transformers to reduce risk of a hazardous release in the event of fire.

Waste Management Activities at Oakland Operations Office

- *Ongoing waste treatment, storage, and disposal*
- *5 sites in California*

The primary missions of the facilities under the Oakland Operations Office are nuclear energy and defense research. By-products of these missions include transuranic and low-level radioactive waste, hazardous waste, and mixed waste (radioactive and hazardous combined).



The Oakland Operations Office oversees waste management activities at four sites: the Lawrence Berkeley Laboratory (LBL) near Berkeley, California; the Lawrence Livermore National Laboratory (LLNL) located southeast of San Francisco; the Energy Technology Engineering Center (ETEC) near Los Angeles; the Stanford Linear Accelerator Center (SLAC) at Stanford University; and the Laboratory for Energy-Related Health Research (LEHR) adjacent to the University of California at Davis.

Waste Management Activities

The Lawrence Berkeley Laboratory is located on 130 acres in an urban environment on land leased to the U.S. Department of Energy (DOE) from the University of California. It is the oldest of nine DOE national laboratories. Its research activities include managing chemistry and biomedical laboratories and operating particle accelerators. The Laboratory presently ships low-level and mixed low-level waste to the Hanford Site in Washington State for disposal and interim storage; the small quantity of transuranic waste it generates is stored on site.

The Lawrence Livermore National Laboratory, an energy and defense research facility, is the Oakland Operations Office's largest generator of waste. The Laboratory's facilities include laser research, weapon system development, and high-explosive testing. Radioactive waste generated is shipped to the Nevada Test Site for storage or disposal. Pure and mixed transuranic wastes are currently stored onsite. Mixed aqueous wastes are treated and/or stored onsite. Hazardous waste is disposed of at offsite permitted facilities following onsite or offsite treatment.

The Energy Technology Engineering Center is located at the Santa Susanna Field Laboratory. Facilities at the lab were used to test systems and components for use in energy, power conversion, and liquid metal development programs. ETEC strives to identify users for surplus materials rather than having to dispose a usable product as a waste. ETEC ships low-level and mixed waste to the Hanford Site in Washington State for interim storage or disposal and ships the remaining hazardous waste offsite for treatment and disposal.

The Laboratory for Energy-Related Health Research is located south of the main campus of the University of California at Davis. Research activities at the laboratory focused on determining the health effects of low-level radiation exposure until facilities were closed in 1988. The laboratory is currently being decontaminated and dismantled. A waste management program has been initiated to assist with characterization, packaging, and transporting hazardous and mixed wastes and chemical offsite for storage, use, treatment or disposal.

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The Stanford Linear Accelerator Center researches techniques in high energy accelerators and high energy particle physics. The Center primarily generates low-level waste and hazardous waste. Low-level waste is shipped to the Hanford Site for disposal. Hazardous waste is shipped to licensed commercial disposal facilities for disposal.

Specific waste management activities include:

Lawrence Berkeley Laboratory

- Construction of a new, consolidated Hazardous Waste Handling Facility.

Energy Technology Engineering Center

- Continued efforts to identify technologies to convert excess sodium materials into a usable and saleable product as a waste avoidance measure.

Laboratory for Energy-Related Health Research

- Began waste management program to assist environmental restoration with characterizing, packaging, and transporting excess chemicals and hazardous and mixed wastes to acceptable facilities for treatment, storage, or disposal to ensure compliance with applicable regulations.

Stanford Linear Accelerator Center

- Design of a new facility to consolidate radioactive and mixed waste storage areas onsite.

- Began planning efforts to assume ownership of centralized waste accumulation areas to allow implementation of all waste management requirements in FY 1995.

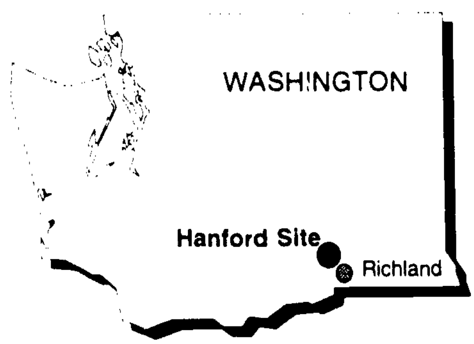
Lawrence Livermore National Laboratory

- Design of a pilot scale facility to demonstrate an integrated system for the treatment of mixed, low-level wastes using alternatives to incineration and a Decontamination and Waste Treatment Facility for processing and treatment of radioactive, hazardous, and mixed waste to replace a number of outmoded, decentralized facilities.

Waste Management Activities at Richland Operations Office

- *Tank waste vitrification*
- *Transuranic waste storage*
- *Spent nuclear fuel and mixed waste management*
- *Low-level waste disposal*

The Richland Operations Office oversees waste management activities at the Hanford Site near Richland, Washington. The Hanford Site occupies 560 square miles within the Columbia River Basin in the southeastern part of the state. Since the early 1940's, nuclear materials were produced at this site. The Hanford Site's activities once included plutonium production and separations, advanced reactor design and testing, basic scientific research, and renewable energy technologies development. Now activities are entirely focused on environmental restoration and waste management.



Mixed waste from both onsite and offsite generators is received and stored at the Hanford Site. Treatment and disposal facilities for these types of waste are currently being constructed. Spent nuclear fuel is to be managed in a safe and compliant manner that stages it for final disposition.

Waste Management

During its past production activities, the Hanford Site generated high-level waste, transuranic waste, low-level waste, and mixed waste (radioactive and hazardous combined) and spent nuclear fuel. High-level waste will be immobilized in glass for future disposal in a planned federal high-level waste repository. The majority of transuranic waste is certified for future shipment to the Waste Isolation Pilot Plant in New Mexico. Low-level solid waste is treated as appropriate and disposed of on site. Low-level liquid waste will be immobilized in glass for onsite disposal.

High-Level Waste

The majority of high-level waste at the Hanford Site is currently stored in underground tanks. The Tank Waste Remediation System Program was established to handle all activities for receiving, safely storing, maintaining, treating, packaging for disposal of all highly radioactive tank waste. Tank waste includes the contents of 149 single-shell tanks, 28 double-shell tanks, plus any new waste added to these facilities, and all cesium and strontium capsules currently stored onsite.

The program plan is to retrieve all waste from the single-shell tanks and place it in newer double-shell tanks. The single-shell tanks will then be isolated to ensure no additional liquid can enter them, thus reducing the potential for tanks to leak to the soil. The waste will be treated to separate low-level waste and high-level waste fractions. The high-level waste then will be immobilized using a process called vitrification. In this process waste will be mixed with glass-forming ingredients and heated to molten temperatures. The mixture will then be poured into stainless steel canisters where it will cool into a borosilicate glass form. Vitrifying the high-level waste traps radionuclides in the glass form and prevents the waste from leaching into the soil or groundwater.

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Transuranic Waste

Waste is currently stored in onsite facilities designed to meet radioactive and/or Resource Conservation and Recovery Act storage requirements. Newly generated transuranic waste is being certified to meet acceptance and safety criteria in the Transuranic Storage and Assay Facility. Newly generated transuranic waste, as well as retrieved waste that is currently stored, will also be processed and certified at the future Waste Receiving and Processing Facility. Plans are to dispose of transuranic waste at the Waste Isolation Pilot Plant if it can be demonstrated that the facility can safely contain the waste.

Low-Level Waste

Plans are to vitrify the low-level liquid waste resulting from the pretreatment of tank wastes. Technology development and evaluation are underway to form the basis for design and construction of the pretreatment and vitrification facilities. The vitrification facility will be similar to the facility for high-level waste, but will have much larger capacity. Solid low-level waste from onsite and offsite generators is packaged and disposed of in engineered, near-surface trenches.

Specific waste management activities include:

- Operate the 242-A Evaporator and the Liquid Effluent Retention Facility.
- Construct and operate the 200 Area Effluent Treatment Facility, the 300 Area Effluent Treatment Facility, and the 200 Area Treated Effluent Disposal Facility.
- Construct and operate Waste Receiving and Processing Facility modules for transuranic and mixed low-level solid waste.
- Continue waste management activities in accordance with the Hanford Federal Facility Agreement and Compliance Order (Tri-Party Agreement) schedule and milestones.
- Maintain and upgrade tank farms to support ongoing high-level waste management activities and the tank waste remediation program.
- Characterize and encapsulate K-Basin spent nuclear fuel and sludge and prepare a Hanford spent nuclear fuel environmental impact statement to arrive at a record of decision for long-term spent nuclear fuel management.

After high-level liquid waste is removed from a storage tank, high-level sludges and saltcake remain (shown here in an underground tank). Ninety-nine percent or more of this waste will be retrievable for treatment.

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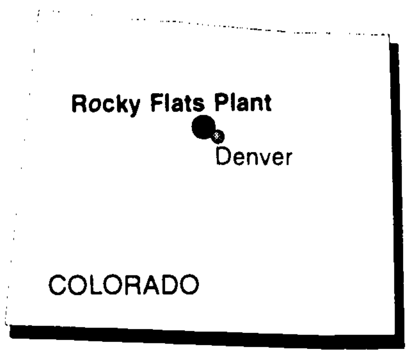
Waste Management Activities at Rocky Flats Office

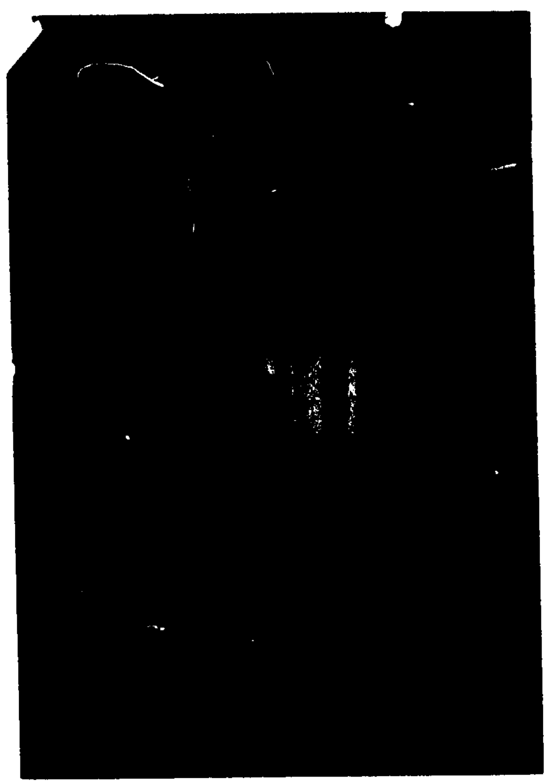
- *Transuranic waste storage*
- *Planned disposal in the Waste Isolation Pilot Plant*

The Rocky Flats Plant is located near Denver, Colorado, on about 11 square miles at the base of the Rocky Mountains. Its primary mission has been to shape components from plutonium and other metals for the U.S. Department of Energy (DOE). The current mission is to manage waste and materials, clean up waste, and convert the Rocky Flats site to beneficial use in a manner that is safe, environmentally and socially responsible, physically secure, and cost effective. The Plant is now operated under the Rocky Flats Office.



Waste Management

Rocky Flats Plant activities generated transuranic and mixed transuranic waste (transuranic and hazardous combined), low level and mixed low level waste, hazardous waste, and sanitary waste. Current waste management practices involve onsite and offsite recycling of waste materials, onsite storage of hazardous and mixed waste, and treatment of aqueous waste. Nitrate salts are formed from the treatment of aqueous waste. The salts are mixed with cement to form saltcrete, which will be shipped for disposal as soon as a disposal site becomes available.



Microwave technology is being investigated as a possible method of reducing waste volume. Wastes are treated in the drums they are stored in. The drums are exposed to 6,000 watt microwaves. The waste inside melts, reducing volume up to 80 percent. Then more waste can be placed in the drum and the process repeated until the drum is full.

Transuranic Waste

The Rocky Flats Plant was DOE's largest generator of transuranic waste. This waste will be disposed of in the Waste Isolation Pilot Plant (WIPP) in New Mexico if it can be demonstrated a safe disposal site. Storage capacity at the Rocky Flats Plant for mixed transuranic waste is limited to 1,601 cubic yards by DOE's permit with the State of Colorado. To maximize the use of authorized storage at Rocky Flats, aggressive efforts are being made to minimize the amount of waste produced. Better waste characterization is being performed to improve waste segregation. A supercompactor will be used to reduce the volume of the waste by about one-half.

Until 1989, when Idaho closed its borders to waste produced outside the state, the Rocky Flats Office transuranic waste had been shipped to the DOE's Idaho National Engineering Laboratory for retrievable storage. Until the Waste Isolation Pilot Plant is ready to receive transuranic waste, Rocky Flats continues to ensure storage limits are not exceeded.

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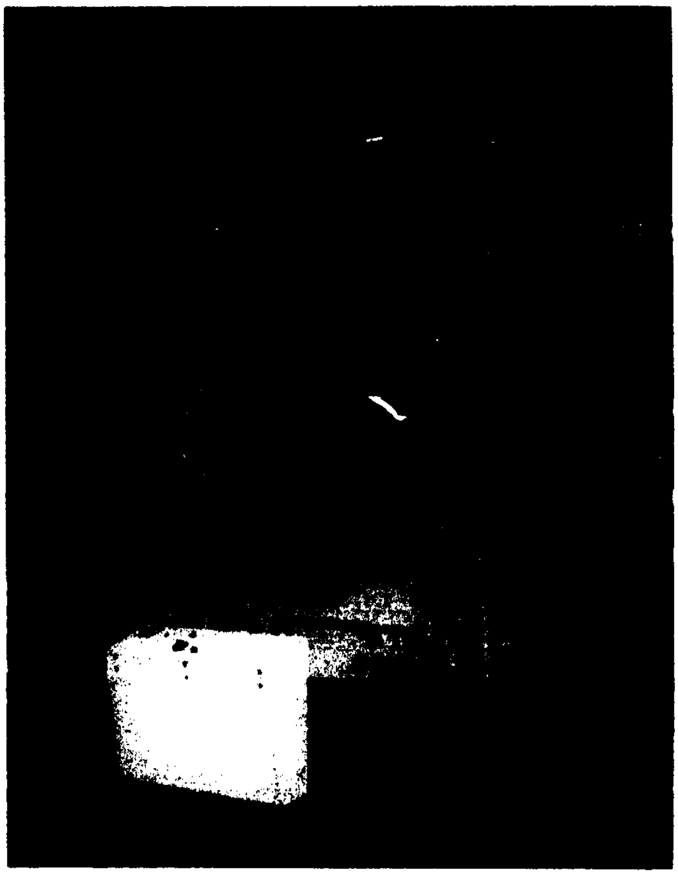
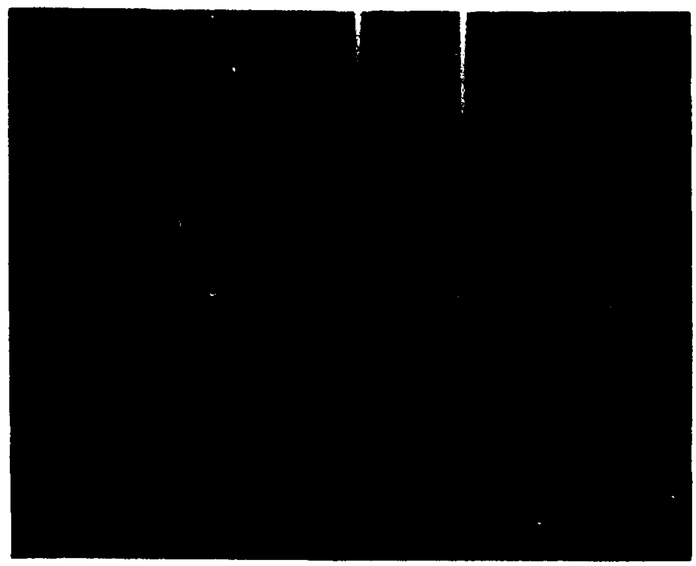
Specific waste management activities include:

- Processing aqueous waste through evaporation; currently processing 10 million gallons per year.
- Upgrade facilities, including the Sewage Treatment Plant, Building 374 (Liquid Waste Treatment Facility), and others.



- Opened a public reading room to provide public access to all waste permitting documents, plans, assessments, deliverables, etc.
- Use of carbon dioxide cleaning for metals decontamination resulted in the recycle of approximately 4,000 pounds of metal in 1992.

The Supercompactor and Repackaging Facility (right) is designed to provide volume reduction of Rocky Flats Office waste. Supercompaction consists of enclosing a 35-gallon drum into a mold and compressing the drum with a piston exerting 2,200 tons of force. Shown below is a drum being compacted.



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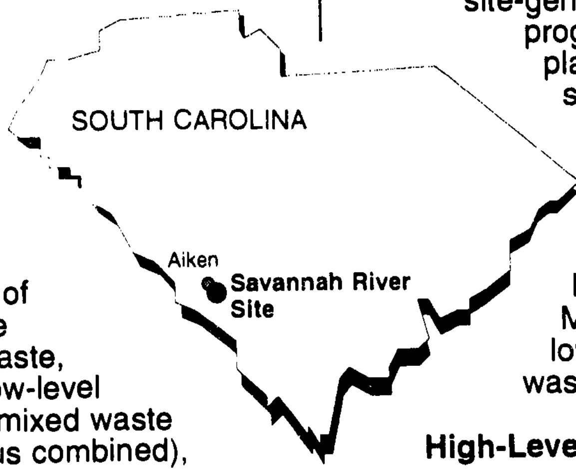
Waste Management Activities at Savannah River Operations Office

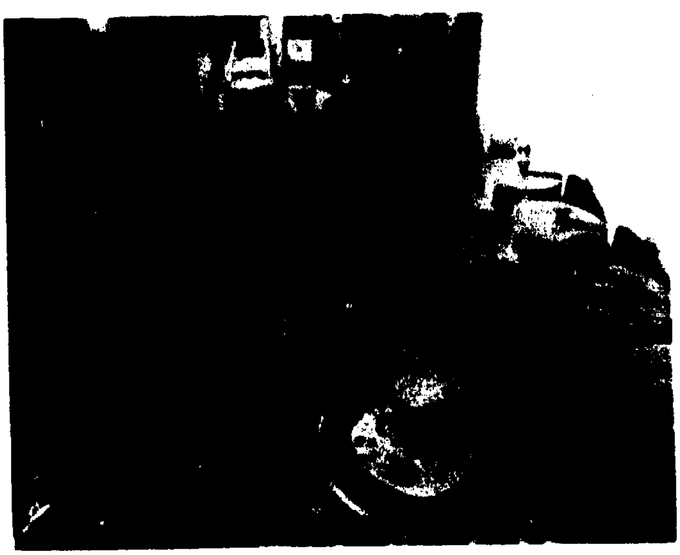
- *High-level waste treatment and storage*
- *Low-level waste disposal*

The Savannah River Operations Office oversees waste management at the Savannah River Site, located on 325 square miles along the Savannah River near Aiken, South Carolina. Its historical mission of supporting national defense efforts through the production of nuclear materials has resulted in the generation of waste by-products. These include high-level liquid waste, solid transuranic waste, low-level waste, hazardous waste, mixed waste (radioactive and hazardous combined), and sanitary waste.



Waste Management

In fulfilling the U.S. Department of Energy's (DOE's) waste management program objectives at the Savannah River Site, an integrated approach was developed to address the treatment, storage, and/or disposal of all site-generated waste. Near-term program emphasis has been placed on the construction and start-up of new facilities for the solidification of high-level waste, the treatment of stored transuranic waste in preparation for future shipment to the Waste Isolation Pilot Plant in New Mexico, and the incineration of low-level, hazardous, and mixed waste.



The Defense Waste Processing Facility will process high-level liquid waste into a solid form suitable for disposal. Shown here is the inside of the facility during final stages of construction.

High-Level Waste

About 34 million gallons of high-level waste, containing about 600 million curies of radioactivity, is currently stored in underground tanks at the Savannah River Site. This waste will be pretreated in order to concentrate all

Solidified low-activity waste, known as saltstone, will be disposed of in these concrete vaults.

but a small amount of the radioactivity into a fraction (roughly 10 percent) of the original volume. This high-activity fraction will undergo the vitrification process in the Defense Waste Processing Facility, the U.S.'s first such high-level waste treatment facility. The waste will be mixed with molten borosilicate glass, poured into protective stainless steel canisters, and stored in natural-convection air-cooled buildings to await transport to a federal geologic repository for disposal. As a result of the pretreatment process, the high-level waste is separated into high-activity and low-activity fractions. Most of the volume of high-level waste is in the low-activity fraction which is considered low-level waste after separation. This low-level waste will be processed in the Saltstone Facility, by mixing it with Portland cement, boiler slag, and fly ash, and pumped into aboveground concrete vaults where it will cure to form a concrete-like material called saltstone.

Transuranic Waste

Newly generated transuranic waste is being precertified at the Waste Certification Facility and stored on site awaiting future transport to the Waste Isolation Pilot Plant in New Mexico. The waste certification criteria ensure that only safely packaged transuranic waste will be placed in this facility. About five percent of the newly-generated precertified transuranic waste will require treatment at the future Transuranic Waste Facility before it can be certified for future shipment to the Waste Isolation Pilot Plant.

Low-Level and Mixed Waste

Disposal of solid low-level waste is transitioning from shallow land burial to near-surface, engineered vaults that ensure compliance with groundwater protection standards. Construction of the Low-Level Waste disposal vault began in 1990, and a Consolidated Incinerator Facility is being developed and permitted for treatment of hazardous and mixed waste. The Consolidated Incinerator Facility should eliminate the current backlog of burnable mixed waste within its first three years of operation.

Shown here is a robotic device used at Savannah River Site to assist in the handling, storage, and disposal of hazardous waste.

Hazardous Waste

Nonradioactive hazardous waste is being shipped off site for treatment, incineration, or recovery. More than 2,500 drums have now been safely shipped off site for disposal at a commercial site.

Specific waste management activities include:

- Complete start-up testing and begin radioactive operations at the Defense Waste Processing Facility.

- Continue construction on the Replacement High-Level Waste Evaporator.

- Begin operating the Consolidated Incinerator Facility to treat hazardous and mixed waste.

- Begin operation of high-level waste pretreatment facilities to prepare the waste for processing in the Defense Waste Processing Facility.

Vitrification Processes

- *Borosilicate glass*
- *West Valley Demonstration Project*
- *Defense Waste Processing Facility*
- *Hanford vitrification processes*
- *In situ vitrification*

After testing and research in its own laboratories, as well as through international technology exchange, the U.S. Department of Energy (DOE) has selected vitrification processes to solidify and stabilize certain forms of radioactive and hazardous waste. Although it does not reduce radioactivity or hazard, vitrification changes the form of waste from a leachable sludge into an immobile solid—trapping radionuclides and preventing waste from contaminating soil, ground water, and surface water.

Borosilicate Glass

Borosilicate glass is the material DOE will use to immobilize its high-level radioactive waste. Borosilicate glass is a tough, impermeable, and durable material that is highly resistant to water. Its density and stability are not damaged by high temperatures. Borosilicate glass can withstand rapid temperature changes and dissolve radioactive materials without deteriorating.

Borosilicate glass has a relatively low melting point compared to other materials tested for nuclear waste treatment. Highly radioactive waste must be solidified without generating additional hazardous materials. At very high temperatures, some radionuclides could turn into a gas. The temperature of the molten borosilicate glass dissolves the waste but doesn't cause the waste to become gaseous. Using borosilicate glass minimizes the need for off-gas containment and ensures that the most highly radioactive elements are immobilized as a solid. The waste is not encapsulated or surrounded by the glass; it becomes part of the glass. Each waste atom is separately bound in the glass structure by a chemical bond. The solidified material is expected to stay stable for at least one million years.

West Valley Demonstration Project

DOE first demonstrated vitrification technology at the West Valley Demonstration Project (WVDP) in New York state. WVDP was originally a commercial nuclear fuel reprocessing facility. Congress assigned DOE responsibility for cleaning up the site and the high-level liquid radioactive waste from these activities. About 600,000 gallons of high-level waste was stored at WVDP initially in underground tanks. Waste in the tanks is made up of liquids and solids. To date, 80 percent of the radioactivity has been removed from the liquid portion of the waste by passing it through a synthetic clay material. The clay and solids left in the tanks will be vitrified together.

DOE built a facility at WVDP to test a vitrification process that uses a 52-ton ceramic melter. Testing for the facility was completed in 1989, and conversion for radioactive operation is in progress.

Defense Waste Processing Facility

The Defense Waste Processing Facility (DWPF) at the Savannah River Site in South Carolina will be used to treat the 34 million gallons of high-level liquid waste stored there in underground tanks. The waste is made up of highly radioactive liquid waste, sludge, saltcake, and salt solution. Less radioactive materials will be separated out and treated in the saltstone facility at DWPF. Sludge and saltcake, which contains most of the radionuclides and long-lived radioactivity, will be treated in DWPF's vitrification facility.

DWPF's vitrification facility will mix high-level waste sludge with small particles of borosilicate glass, melted at approximately

1200º C. The molten mixture will be poured into stainless steel canisters. As the waste/glass mixture cools, it will harden into a stable glass inside the canisters.

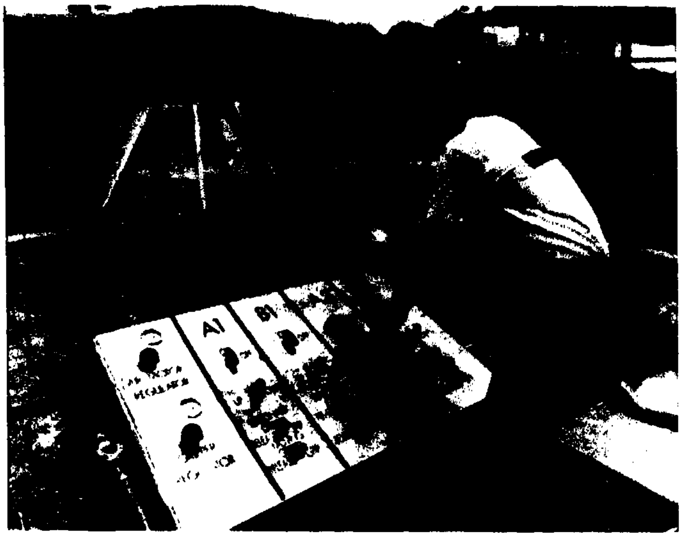
The saltstone facility will treat liquid waste containing only small amounts of radioactivity. This low-activity waste is mixed with a cement slurry and other additives and allowed to solidify. The solid material, known as saltstone or saltcrete, is disposed of on site in above ground concrete vaults.

Hanford Site Vitrification Processes

In October 1993, the Hanford Site in Washington State, the U.S. Environmental Protection Agency (EPA), and local parties signed an amendment to the Hanford Tri-Party Agreement outlining a plan to use vitrification to solidify high-level and low-level waste stored there. High-level waste is stored on site in underground double-wall and single-wall tanks. The waste includes highly-radioactive sludge and less radioactive liquids. The low-activity waste comprises approximately 90 percent of the volume of waste stored in underground tanks at the site. In the past, this waste was treated by mixing it with a cement-like solid to make a grout. In response to public concern, the agreement states the grout technology will no longer be used, but instead a vitrification process will be used which will allow Hanford to remove waste from single shell tanks sooner. A facility to treat both low-level and high level waste will be built at Hanford. Testing for low-level waste vitrification is scheduled to begin as early as September 1994, with facility construction starting by December 1997. Construction of a high-activity waste treatment facility is scheduled to start in 2002.

In Situ Vitrification

The Oak Ridge National Laboratory in Tennessee has decided to use in situ (or in place) vitrification (ISV) to treat its buried low-level radioactive waste on site. Old methods usually focused on either digging up buried waste and putting it somewhere else, or capping burial areas and monitoring leaks. ISV offers several advantages over these methods: 1) it is a "noncontact" technology—workers are not exposed to any waste, because the waste is not exhumed, pretreated, or moved and workers are not exposed to waste during off gas treatment since it is contained within one of the trailers used; 2) it is easily maintained—waste is immobilized for about a million years; 3) redisposal is never required; 4) treatment costs are significantly less than other options; 5) it is versatile and mobile—using three trailers and electricity, the process can go anywhere to treat widely varying mixtures of wastes.



A portable hood placed over the vitrification site reduces heat loss and contains any volatile gases from the process. In situ vitrification treats only the problem, producing virtually no secondary wastes.

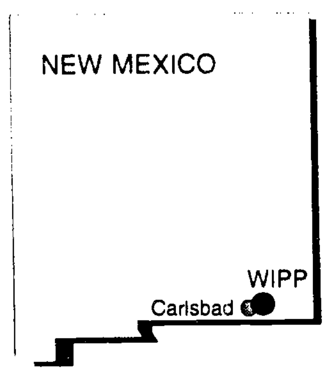
In situ vitrification begins when an electric current is passed between electrodes placed a few inches into the ground surrounding the buried waste. The power from the electric current heats the soil to 2000ºC. The heat from the electric current melts the soil and wastes and decomposes the organic materials. During the process, heavy metals, low-level radioactive waste, and other inorganic materials are dissolved in the vitrified mass. As the molten material cools it forms a solid glass block.

Oak Ridge plans to use ISV on an old liquid waste seepage pit to stabilize the waste in place. To evaluate this technology, in 1991 a scale-model of the pit was constructed and ISV technology tested.

Waste Isolation Pilot Plant (WIPP)

- *Research and development facility for transuranic waste disposal*
- *Deep geologic disposal*
- *Experimental Program*

The Waste Isolation Pilot Plant (WIPP) is a research and development facility designed to demonstrate the safe disposal of defense-related transuranic waste. Transuranic waste decays slowly and requires long-term isolation from humans and the environment. Transuranic waste typically includes metal tools, gloves, lab coats, rags, scrap, equipment, debris, etc. contaminated with plutonium during laboratory and facility operations. The WIPP facility is an integral part of the U.S. Department of Energy's (DOE's) long-term planning for radioactive waste disposal.



WIPP is located in the New Mexico desert, 26 miles east of Carlsbad. It is designed to store transuranic waste in vast salt deposits 2,150 feet beneath the desert surface. These deep salt deposits are found primarily in stable geologic areas with an absence of fresh water. The easily mined salt formations self-seal around voids, such as the storage rooms created by mining. Thus, waste stored there will be naturally encapsulated over time. The impermeable nature of the salt structure prevents waste from leaching into the groundwater.

Public Law 102-579, the WIPP Land Withdrawal Act, was signed on October 30, 1992. The Act provided legislative withdrawal of public lands, established a new regulatory framework involving oversight by seven federal agencies, and established oversight roles and responsibilities for the State of New Mexico, the National Academy of Sciences, and the Environmental Evaluation Group. The Act also instituted broad authority for the U.S. Environmental Protection Agency (EPA) to review, approve, and certify that DOE activities are proceeding in accordance with the Act and environmental laws.

Development of WIPP Phases

Since 1979, WIPP's development has progressed in sequential phases. Altogether there are seven phases: the Site Phase, the Site Preliminary Design and Validation Phase, the construction Phase, the Predisposal Phase, the Disposal Phase, the Decommissioning Phase, and the Post-Decommissioning Phase. The current Predisposal Phase includes an experimental program to determine the short-term and long-term performance of WIPP. This program includes experiments planned to collect data to support performance assessment activities for demonstrating compliance with EPA's disposal standards, and EPA's No Migration Determination requirements. The experimental program consists of scientific and engineering investigations in the

Extensive tests have been conducted at WIPP in rooms like this one to test the stability of waste forms in salt, and the thermal and structural effects the waste might have on the salt. The experimental program will demonstrate if the facility can comply with regulatory requirements in the long term.

WIPP is constructed in a salt bed over 2,000 feet underground. This continuous mining machine removes salt at a rate of 300 tons per hour to form passages and storage rooms.

underground excavation, laboratory studies with and without transuranic waste, and model development. These efforts are underway at both the WIPP site and at various laboratories throughout the nation. Once sufficient data has been collected for DOE to demonstrate WIPP's compliance with environmental laws, and EPA certification is obtained, the Disposal Phase will begin. During this phase WIPP will operate as a repository receiving waste for approximately 20 years. At the end of that time, DOE will backfill and permanently seal the facility as WIPP enters the Decommissioning and Post-Decommissioning Phases.

Waste Handling

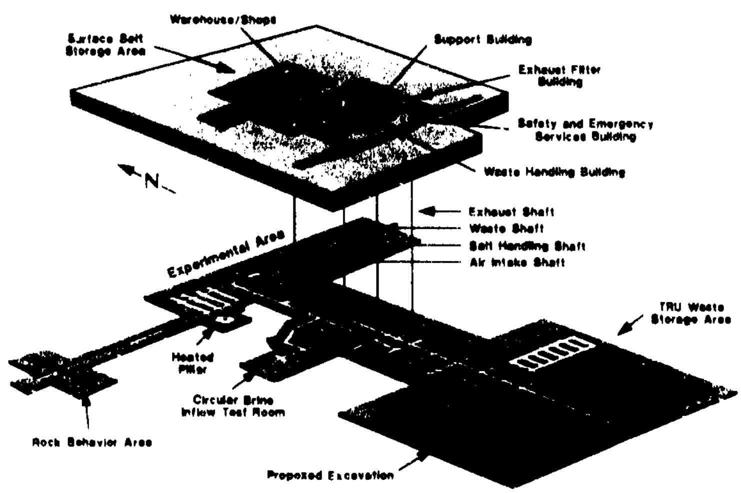
There are two types of transuranic (TRU) waste: contact-handled (CH) and remote-handled (RH). CH-TRU waste containers can be safely handled by workers without special protective clothing. Ninety-seven percent of the waste scheduled for WIPP disposal will be CH-TRU waste. RH-TRU waste is handled and transported in specially shielded containers because of its higher level of radioactivity. Three percent of the waste scheduled for WIPP disposal is RH-TRU waste. All shipments must be certified according to WIPP Waste Acceptance Criteria before being accepted for emplacement at the facility.

CH-TRU waste will be shipped via trucks in Transuranic Packaging Transporters (TRUPACTs), containers designed to hold 14 55-gallon drums. This transporter, known as TRUPACT II, has been rigorously tested for its ability to withstand tests such as 30-foot drops, punctures, and fires. Shipments will be received at the WIPP Waste Handling Building.

Environmental Monitoring

WIPP research and development activities also include monitoring the surrounding environment before, during, and after WIPP construction and operations to ensure protection of human health and the environment. The scientific knowledge that results from the use of WIPP will improve U.S. technology for safe handling and permanent disposal of radioactively contaminated waste.

WIPP LAYOUT



If deemed suitable, WIPP will become a disposal site for transuranic waste. In the figure above, darkened areas show rooms that are completed; areas not darkened are rooms that would be constructed to support future operations.

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What is Environmental Restoration?

- *Remedial actions*
- *Decontamination and dismantlement*

The U.S. Department of Energy's (DOE's) Environmental Restoration Program directs the assessment and cleanup of its sites and facilities contaminated with waste from defense-related activities. All cleanup activities must comply with federal, state, Indian Nation, and local laws and regulations. In completing its environmental restoration activities, DOE is committed to working with stakeholders to understand technical issues and evaluate alternatives. Two important goals include stabilizing urgent contamination problems to protect human health and safety and the environment, and investing in technology research to solve contamination problems now and in the future. Environmental Restoration activities are either remedial actions or decontamination and dismantlement.

Remedial Actions

Remedial actions are taken to identify and contain contamination to prevent it from spreading. Remedial actions are conducted at inactive waste sites or operating facilities where releases or spills have occurred and contamination has been released into the environment.

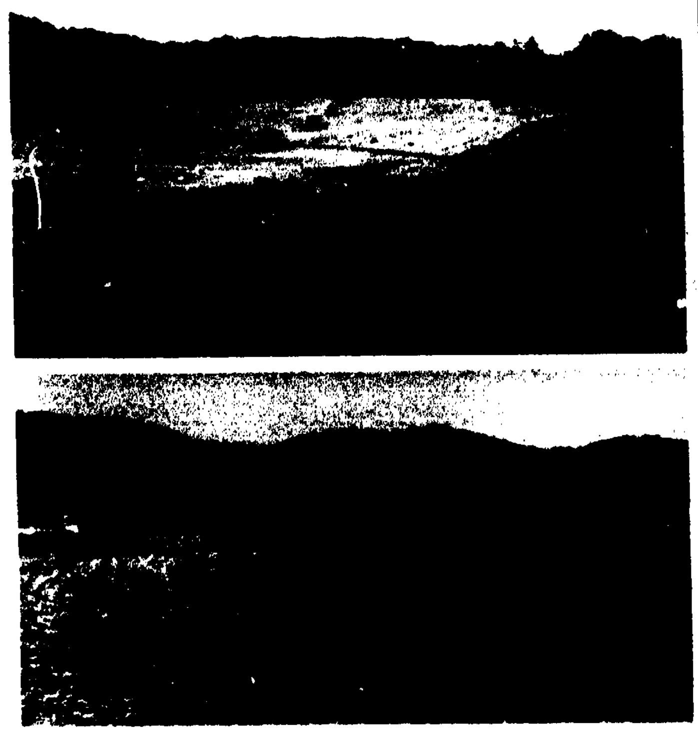
Remedial actions involve four tasks:

- site discovery, preliminary assessment, and site inspection;
- site assessment, including characterization, evaluation of cleanup alternatives, and selection of remedy;
- cleanup and site closure; and
- site compliance monitoring.

A site discovery, preliminary assessment, or site inspection is conducted to quickly determine if there is a contamination problem. This involves taking samples, analyzing them for contaminants, reviewing historical records on plant operations, interviewing past and present operations personnel, and preparing a plan for in-depth characterization of the waste site.

Site assessment is a methodical scientific process that determines the type and extent of contamination. Contamination detection is achieved through analyzing soil, biota, flora, fauna, and water samples. These analyses are evaluated to determine potential environmental and human health risks. Cleanup alternatives are then evaluated. Cleanup remedies are selected based on the type and extent of contamination, environmental, physical, and geologic site characteristics, available technology, resource requirements, and compliance with federal and state laws.

Specific cleanup activities include the actual waste treatment, removal, and/or ultimate disposal of the contaminated materials.



Since the 1950's, various hazardous solid and liquid waste was disposed at this site at the Oak Ridge Operations Office's Y-12 Plant. Assessment revealed oil, beryllium, and some enriched uranium was present. The site was cleaned up and has been certified as a closed area since 1990.

Site closure and site compliance monitoring, the final steps, ensure that waste problems have been adequately addressed and that any unanticipated problems are detected.

Decontamination and Dismantlement (D&D)

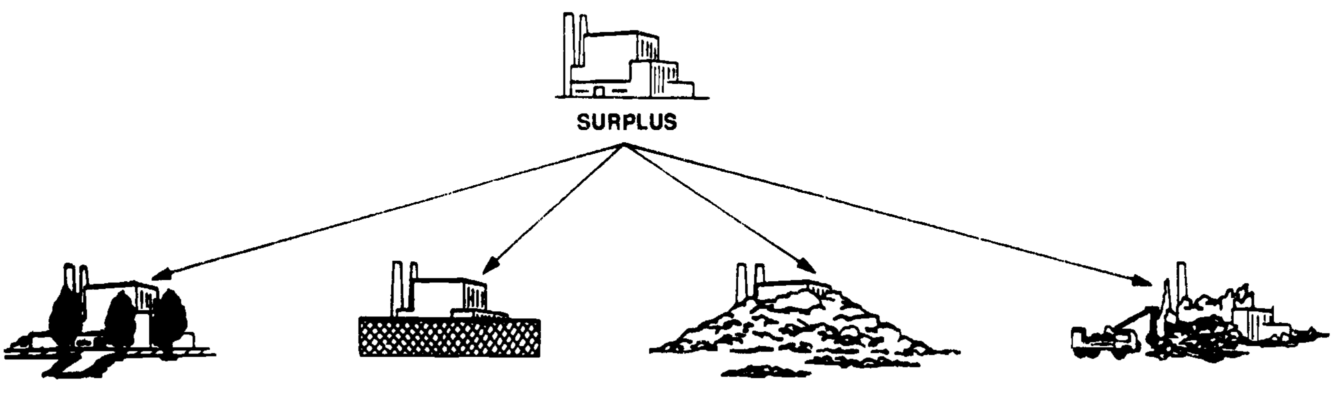
D&D is the safe decontamination, dismantlement and/or removal of nuclear facilities that are no longer active. Many government-owned facilities that supported early defense programs nuclear weapons and energy research have no current use and have been retired and declared surplus. In many cases, these facilities have contamination present and must be safely monitored. For example, reactors, hot cells, processing plants, and chemical or waste storage tanks will undergo D&D. DOE maintains surplus facilities in a safe and secure state and ultimately completes dismantlement activities.

D&D tasks include:
- surveillance and maintenance,
- assessment and characterization,
- environmental review,
- engineering design,
- D&D operations,
- waste disposal, and
- closeout.

Surveillance and maintenance activities monitor facilities awaiting D&D to prevent worker, public, and environmental exposure to potential hazards. Assessment determines the extent of these hazards and the type, extent, and nature of contamination. Chemical and radiological sensors can be used for facility characterization to help select the appropriate D&D cleanup techniques. In addition, automated and robotic samplers help characterize facilities where entry would be hazardous to workers. DOE conducts an environmental review to assure D&D operations comply with approved health and safety standards and environmental laws.

D&D operations range from minimum cleanup activities to complete dismantling. Decontamination of some facilities requires that the entire facility be packaged and disposed. Contaminated materials must be removed using methods that minimize generation of additional waste. For example, in situ (in place) D&D has the significant advantage of reducing personnel exposure to hazards, avoiding transportation expenses, and deferring the need to develop new disposal areas. DOE works with its stakeholders to seek the best decontamination processes. When necessary, demolition of existing structures follows decontamination.

DOE disposes of waste found or generated during the D&D process according to its form and toxicity. In some cases, all hazardous material is removed from the D&D site so it can be reused for other nonnuclear activities.



Some facilities used to support defense programs are no longer useful and must be cleaned up and demolished or restored for future nonnuclear reuse. D&D methods include safe storage, if a cleanup alternative has not been selected, entombment, in-place disposal, or dismantlement.

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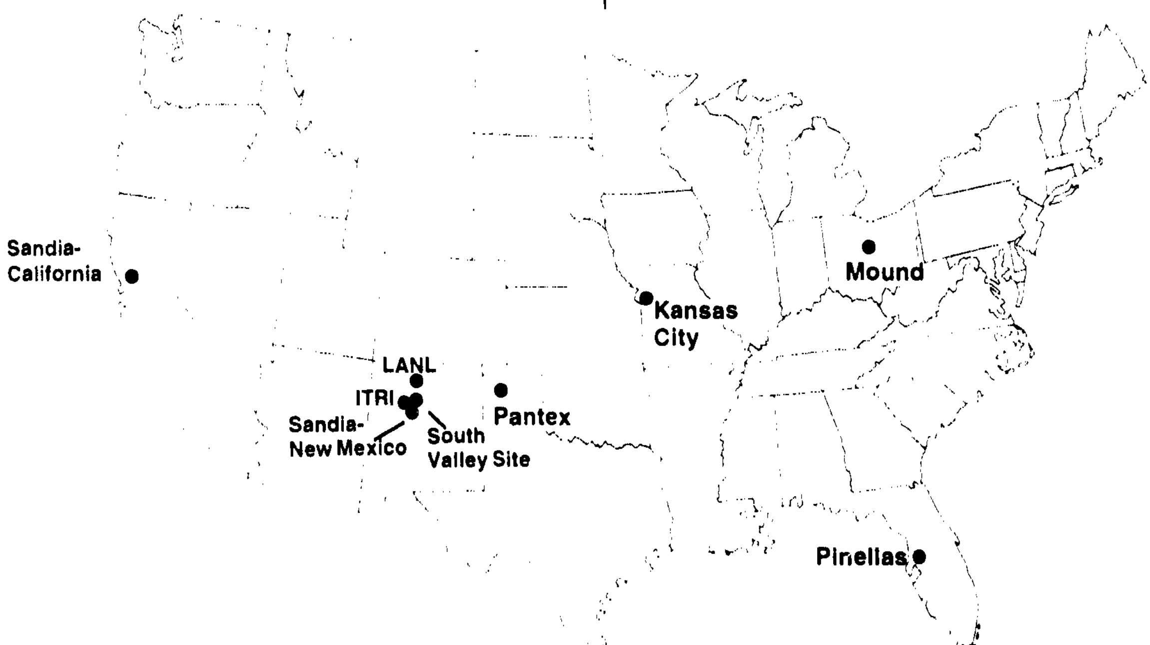
Environmental Restoration Activities at Albuquerque Operations Office

- *2,500 remedial action sites in six states*
- *20+ decontamination and dismantlement sites*

The Albuquerque Operations Office oversees environmental restoration activities at four production plants and four laboratory facilities. The production plants are the Mound Plant in Miamisburg, Ohio; the Pantex Plant near Amarillo, Texas; the Pinellas Plant near St. Petersburg, Florida; and the Kansas City Plant near Kansas City, Missouri. The laboratories are the Los Alamos National Laboratory (LANL) northwest of Santa Fe, New Mexico; the Inhalation Toxicology Research Institute (ITRI) in Albuquerque; the Sandia National Laboratories - New Mexico south of Albuquerque; and the Sandia National Laboratories - California east of San Francisco. Albuquerque Operations Office responsibilities also include the South Valley Site near Albuquerque and the Uranium Mill Tailings Remedial Action (UMTRA) Project.

The primary objective of the environmental restoration program at the Albuquerque Operations Office is to identify and clean up contaminated areas at its sites and safely maintain facilities for decontamination and dismantlement (D&D). Approximately 2,500 remedial action sites across the Albuquerque Operations Office complex have been identified as needing assessment and/or cleanup. Over 20 surplus or inactive facilities are included in the D&D program for surveillance and maintenance or final disposition.

The types and extent of contamination vary from one site to another. Many contamination problems are the result of past waste management practices that, although considered acceptable at the time, no longer meet today's higher standards for the protection of human health and safety and the environment. In general, the types of waste and contamination found include radionuclides, solvents, gasoline, organics, metals, high-explosive residues, and uranium mill tailings. These materials are present in soil, groundwater, surface water, buildings, structures, and equipment. In many cases,



Past operations at the Albuquerque Operations Office's sites have created waste and contaminated sites that must be cleaned up. There is no high-level radioactive waste at these locations. Cleanup actions will address transuranic radioactive waste, low-level radioactive waste, hazardous waste, and mixed waste.

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hazardous and radioactive contaminants are found together as mixed waste. Albuquerque Operations Office is committed to fulfilling the requirements of all applicable federal, state, Indian Nation, and local environmental and worker health and safety laws and regulations in cleaning up these contaminants.

Environmental restoration activities include active surveillance and maintenance programs to ensure contaminated sites do not pose risks to employees and the public and remedial actions that comply with legal requirements and meet high technical standards for protecting people and the environment.

Albuquerque Operations Office is responsible for the Uranium Mill Tailings Remedial Action (UMTRA) Project. The UMTRA Project manages the cleanup of 24 sites and 5,000 vicinity properties contaminated with uranium mill tailings. In the past, before their potential health hazard was recognized, uranium mill tailings were used extensively to provide fill materials for nearby construction projects, including residential homes. Uranium mill tailings emit radon, a naturally occurring, colorless, odorless, radioactive gas. Albuquerque Operations Office is cleaning up 311,000 tons of soil and structures through the Grand Junction Projects Office in Colorado and 1.6 million cubic yards of soil at the Monticello Millsite and vicinity properties in Utah through the UMTRA Project. The Monticello Millsite and vicinity properties have been placed on the U.S. Environmental Protection Agency's National Priorities List which requires cleanup on a rigorous schedule. See the UMTRA Fact Sheet for more information.

Specific environmental restoration activities include:

Inhalation Toxicology Research Institute
- Complete hot pond and diesel oil release cleanups.
- Complete assessments for sanitary lagoons and nitrates in groundwater.

Kansas City Plant
- Complete corrective measure study reports for release sites.
- Completed remediation on Abandoned Indian Creek Outfall.

Los Alamos National Laboratory
- Removed 10 underground storage tanks.
- Continue D&D of formerly utilized uranium processing building and plutonium contaminated structures.

Mound Plant
- Special Metallurgical Building decontamination activities in progress.
- Completed D&D of formerly utilized Plutonium Processing Building and associated plutonium contaminated soils and Waste Transfer System.

Pantex Plant
- Completed two Resource Conversation and Recovery Act (RCRA) Remedial Feasibility Investigation reports requesting "no further action."
- Completed 14 RCRA Work Plans for Solid Waste Management Units.

Pinellas Plant
- Completed closing out of 12 Solid Waste Management Units.
- Continue Remedial Action on 4.5 Acre Site and Northeast Site.

Sandia National Laboratory - New Mexico
- Site characterization and contamination assessment on 133 potential remedial action sites underway.
- Install groundwater detection monitoring at two shallow land burial sites.

Sandia National Laboratory - California
- Perform pilot scale in situ bioremediation for Fuel Oil Spill site.
- Completed assessment of Navy Landfill site for remediation.

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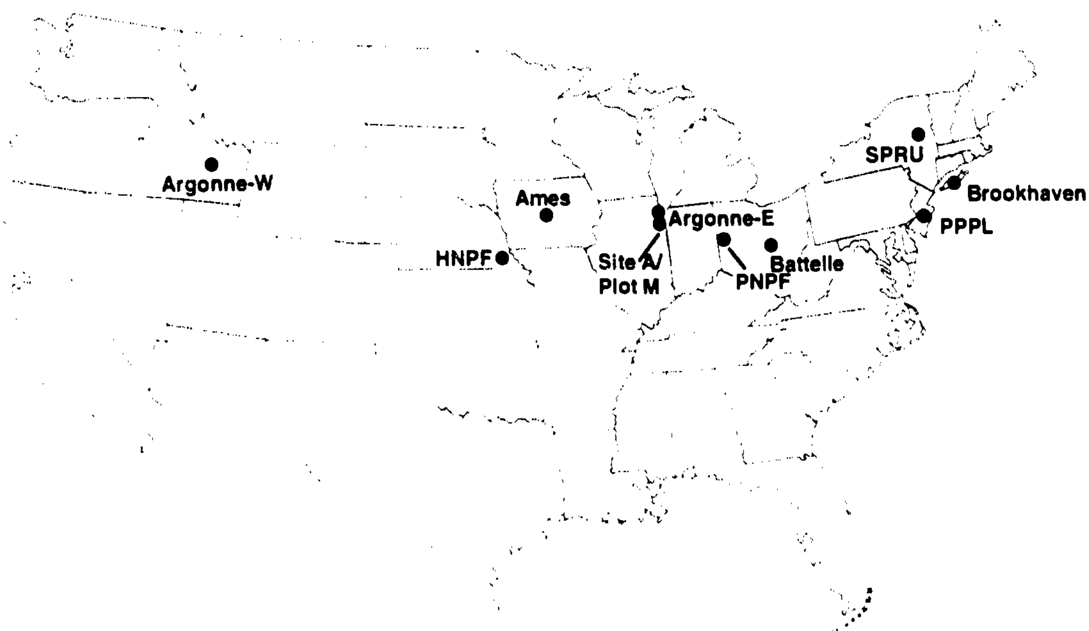
Environmental Restoration Activities at Chicago Operations Office

- *Research, development, and demonstration laboratories*
- *10 sites in 7 states*

The primary mission of the facilities under the Chicago Operations Office is research, development, and demonstration for U.S. Department of Energy (DOE) nuclear programs. This includes support of the nation's advanced reactor program and research on: the fundamental properties of matter; physical, life, environmental sciences; magnetic confinement fusion and high-energy physics. By-products of this mission include transuranic waste, low-level waste, hazardous waste, and mixed waste (radioactive and hazardous combined). The Chicago Operations Office's facilities are aging, and many include former waste disposal sites that need to be assessed according to today's standards to determine the extent of environmental contamination.

The Chicago Operations Office oversees environmental restoration activities at six laboratories: the Ames Laboratory at Iowa State University, Ames, Iowa; the Argonne National Laboratory - East southwest of Chicago, Illinois; the Argonne National Laboratory - West near Idaho Falls, Idaho; the Battelle Columbus Laboratories in Columbus, Ohio; the Brookhaven National Laboratory on Long Island, New York; and the Princeton Plasma Physics Laboratory (PPPL) in Princeton, New Jersey. The Chicago Operations Office is also responsible for environmental restoration activities at four inactive sites: the Hallam Nuclear Power Facility (HNPF) in Hallam, Nebraska; the Piqua Nuclear Power Facility (PNPF) in Piqua, Ohio; Site A/Plot M at the Palos Forest Preserve, Cook County, Illinois; and the Separations Process Research Unit (SPRU) in Schenectady, New York.

Activities at some of the Chicago Operations Office sites are focusing on preventing or



The Chicago Operations Office manages environmental restoration activities at sites involved in research and development of nuclear reactor technology, environmental sciences, and high-energy physics.

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cleaning up groundwater contamination that may pose a health threat either on or off site. For example, the Brookhaven National Laboratory is located over an U.S. Environmental Protection Agency (EPA) designated sole source drinking water aquifer and was put on the EPA National Priorities List in 1989. To protect this water source, Brookhaven monitors the groundwater using wells and chemical analysis.

Other remedial actions for Chicago Operations Office inactive storage and disposal sites include:

- Replacement of underground storage tanks to comply with regulations;
- Removal of mixed waste from landfills or storage/disposal sites and transfer of this waste to facilities and sites that meet current environmental regulations and standards; and
- Cleanup of minor onsite spills of oils, solvents, and other chemicals, including polychlorinated biphenyl (PCB) leaks from transformers.

Potential health risks associated with these activities include possible exposure to organic and inorganic chemicals, radiation, and other contaminants that could have migrated into surface waters and groundwaters near the installations. These potential risks are being addressed by cleanup and assessment tasks guided by environmental laws and regulations, and appropriate state and local regulations, including enforceable agreements with the EPA and the states. Federal Facility and Interagency Agreements have been negotiated between the Environmental Protection Agency, the sites, and the states at the Brookhaven National Laboratory and the Argonne National Laboratory-West.

Specific environmental restoration activities include:

Ames National Laboratory
- Clean up the Chemical Disposal Site.
- Clean up contamination from a diesel fuel tank leak.

Argonne National Laboratory - East
- Assess status and conduct any necessary cleanup on a sewage treatment plant, nearby holding pond, and adjacent Sawmill Creek.
- Remove and decontaminate and dismantle the Experimental Boiling Water Reactor and the CP-5 Reactor.

Argonne National Laboratory - West
- Clean up a historical PCB spill in the transformer yard.
- Conduct D&D activities at the Central Liquid Waste Processing Area.

Battelle Columbus Laboratories
- Complete decontamination and dismantlement on King/West Jefferson sites.

Brookhaven National Laboratory
- Installed, sampled, and analyzed more than 57 new groundwater monitoring wells since 1988.

Princeton Plasma Physics Laboratory
- Continue remediation of underground storage tanks and groundwater.

Inactive Sites
- Continue ongoing surveillance and monitoring programs for the Piqua Nuclear Power Facility, the Hallam Nuclear Power Facility, and the Separations Process Research Unit.
- Conduct characterization and stabilization activities at Site A/Plot M.

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Environmental Restoration Activities at Fernald Environmental Management Project

- *Production activities ceased in 1989 to focus efforts on cleanup*

The Fernald Environmental Management Project (FEMP), previously known as the Feed Materials Production Center (FMPC), in Fernald, Ohio, once had a mission to produce uranium feed materials for nuclear reactor fuel as part of the nation's defense program. Since defense production began in 1953, waste generated as by-products of operations at this facility was stored and disposed of onsite. Many of the storage and disposal methods used, although believed to be safe and efficient at the time, have proven to be neither.

In July 1989, production activities ceased to focus all efforts on environmental restoration and waste management issues. The mission is now solely one of environmental management. The FEMP environmental restoration program also includes cleanup at the Reactive Metals, Inc. Extrusion Plant in Ashtabula, Ohio, and the adjacent Fields Brook site.

At FEMP, waste includes residues containing uranium and radium, wastewaters and various solid waste contaminated with uranium and thorium materials, reactive chemicals, oils contaminated with uranium, and organic solvents. More than 20 release sites and an estimated 900,000 cubic yards of waste have been identified. FEMP was placed on the U.S. Environmental Protection Agency's (EPA's) National Priorities List in 1989, which requires environmental restoration planning and implementation on a rigorous schedule.

The U.S. Department of Energy (DOE) and the EPA entered into a Federal Facility Compliance Agreement in 1986 which guides environmental remediation and cleanup efforts at the FEMP site in accordance with environmental regulations. In 1991, DOE and the EPA signed a Consent Agreement to address the releases and threats of releases of hazardous substances and identify appropriate remedial actions. Environmental restoration efforts are divided into five Operable Units. A separate site-wide Remedial Investigation and Feasibility Study is being conducted for each of the operable units to formulate, assess, and recommend remedial action alternatives.

The dredging machine pictured above was used to submerge dried radioactive waste to below the water line in one of Fernald's waste pits. This eliminated the possibility of airborne emissions.

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Operable Unit 1, the storage area, includes Waste Pits 1-6, the Burn Pit, and the Clearwell. Operable Unit 2, the other waste units, includes the sanitary landfill, lime sludge ponds, inactive fly ash disposal area, active fly ash pile, and the South Field Area. Operable Unit 3, the former production area, encompasses the 136-acre production area including all former process buildings, structures and equipment, inventoried hazardous materials, scrap metal piles, and the fire training area. Operable Unit 4 includes K-65 Silos 1 and 2 which contain radium-bearing wastes, Silo 3 which contains dried uranium-bearing wastes, and Silo 4 which is empty. Operable Unit 5, environmental media, includes groundwater, surface water, soil, sediments, air, vegetation and wildlife throughout FEMP and surrounding areas.

Waste materials at FEMP are stored in six waste storage pits, three silos, and thousands of 55-gallon drums and other containers. Large tent-like structures are being constructed to store drummed waste. In addition, idle production buildings are being used as indoor storage facilities for radioactive waste pending final disposition. Before being moved indoors, all the waste drums are inspected and repackaged as necessary to minimize drum deterioration and leakage.

At the Reactive Metals, Inc. Extrusion Plant, onsite and offsite surface soil is contaminated, and groundwater contains above background concentrations of uranium. The adjacent Fields Brook site contains polychlorinated biphenyls (PCB's), chlorinated solvents, toxic metals, and trichloroethylene. The Reactive Metals, Inc. may be liable for part of the assessment and cleanup costs.

Although much is known about the past activities and contamination at the site, significant uncertainties remain, as FEMP is in the preliminary phase of the cleanup process. Until the total extent of the contamination is known, the planning, schedules, and costs associated with the site's cleanup will be subject to this uncertainty. FEMP is working diligently to accomplish site cleanup.

Public involvement is important at the Fernald Environmental Management Project. The site is opened regularly for citizen tours. In this photo, a Fernald employee demonstrates a standard shipment of drummed waste to a local citizen during an evening environmental education course. Fernald's advisory group, the Fernald Citizens Task Force, is involved in recommending future uses for the site.

Specific environmental restoration activities include:

- Pump and treat contaminated groundwater under several of FEMP Plant Buildings.

- Remove uranium from the contaminated South Groundwater Plume at FEMP and provide an alternate water supply to offsite industrial landowners.

- Continue cleanup actions at the Fields Brook Site adjacent to the Reaction Metals, Inc. Extrusion Plant.

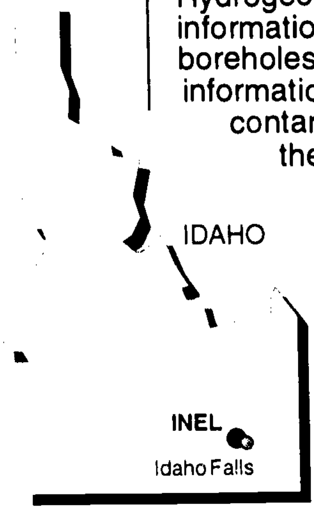
- Conduct removal action from the Waste Pit Area Stormwater Runoff Control at FEMP to prevent contaminated stormwater from entering Paddy's Run, a tributary of the Great Miami River.

Environmental Restoration Activities at Idaho Operations Office

- *Groundwater cleanup*
- *10 Waste Area Groups*

The Idaho Operations Office oversees environmental restoration activities at the Idaho National Engineering Laboratory (INEL) near Idaho Falls, Idaho.

INEL is a multipurpose laboratory supporting the engineering and operations efforts of the U.S. Department of Energy (DOE) and other federal agencies in areas of nuclear safety, reactor development, reactor operations and training, waste management and technology development, and energy technology/conversion programs.



INEL activities have resulted in the generation of radioactive waste, hazardous waste, and mixed waste. This waste includes radioactive high-level waste, transuranic waste, and low-level waste, acids, solvents, asbestos, polychlorinated biphenyls (PCB's), and heavy metals. Past treatment, storage, and disposal of this waste has resulted in contamination of structures, ground and surface water, and surrounding soils at several locations.

INEL has been placed on the National Priorities List, which requires expedited cleanup because of severe volatile organic compounds and chromium contamination at three sites. First, carbon tetrachloride was detected in groundwater at the Radioactive Waste Management Complex at concentrations slightly above drinking water standards. Second, chromium was found to exceed regulatory limits in groundwater beneath the Test Reactor Area. Third, traces of volatile organics were detected in local drinking water at the Test Area North. The use of one supply well was discontinued in 1989 to mitigate the immediate hazard, and cleanup of the groundwater is ongoing.

Hydrogeologic ecologic and water quality information is being collected and several boreholes are being drilled to collect information on the extent of groundwater contamination. At the Test Area North at the Idaho National Engineering Laboratory, an injection well was used from 1953 to 1972 for disposal of various liquid waste streams. Complete remediation of the resulting contaminated groundwater plume, which covers approximately 150 acres, is projected for 1996.

To better manage the environmental restoration activities at the Idaho National Engineering Laboratory, some 350 waste management units have been combined into 10 Waste Area Groups. Eight of these Waste Area Groups are managed by the Idaho Environmental Restoration Program. The major emphasis for these groups now is onsite characterization and remediation.

In addition, a Decontamination and Dismantlement (D&D) program is underway at numerous inactive or surplus facilities and will extend beyond 1997. D&D efforts are scheduled to begin at 14 facilities at the Idaho National Engineering Laboratory during the next five years. Eight of these projects have been started and are currently in the assessment or dismantlement phase. These projects include the disposal of radioactive sodium-potassium at the Army Reentry Vehicle Facility Site, cleanup and demolition of the Boiling Reactor Experiment-V turbine and

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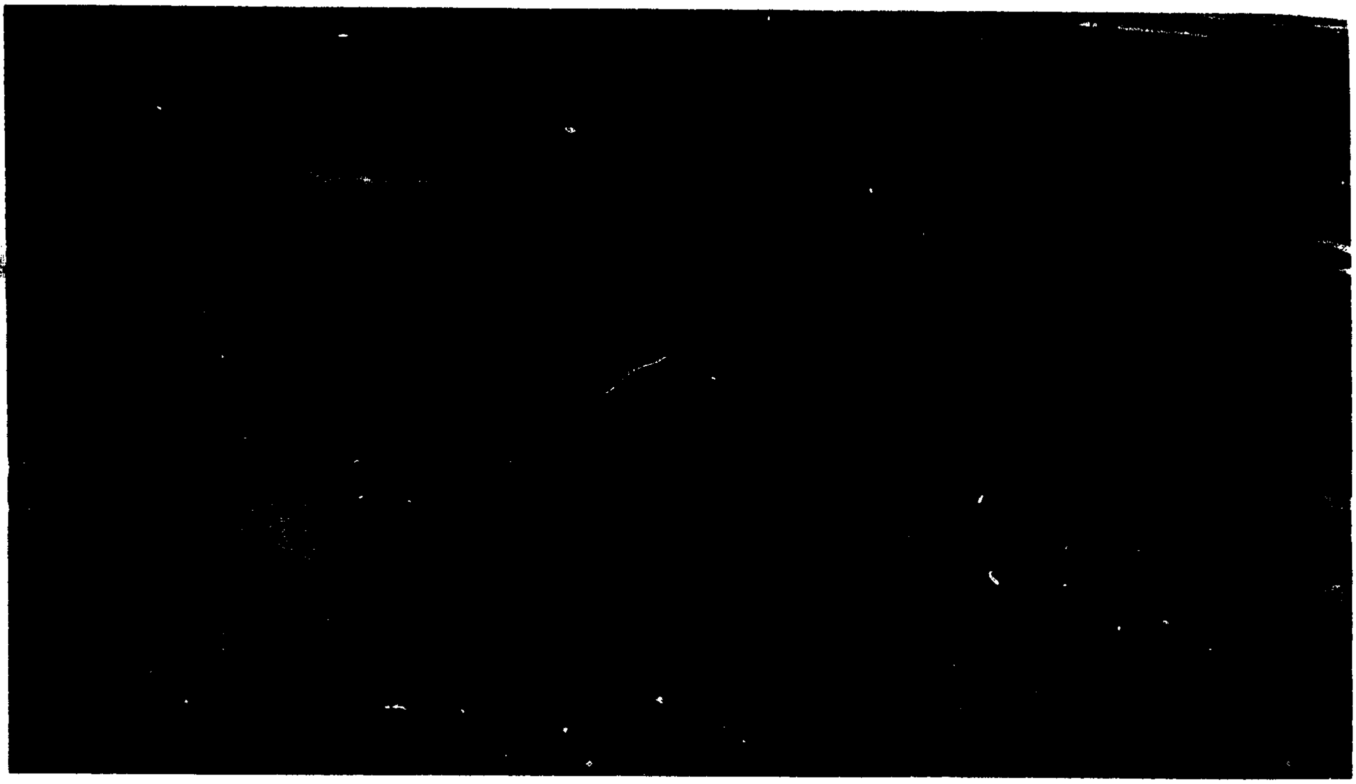


The Idaho Chemical Processing Plant, shown here, was used to recover uranium from nuclear navy fuel. The processing building is over 1,000 feet long. Because of the reduced need for nuclear materials for defense activities, this facility has been shut down and is being prepared for stable, long-term storage. Assessment and monitoring of contamination is ongoing.

reactor buildings, and assessment and cleanup of several surplus facilities at the Idaho Chemical Processing Plant. The remaining projects for the planning period include the cleanup of two major reactor complexes, the Engineering Test Reactor and the Materials Test Reactor.

In accordance with DOE and federally mandated environmental restoration programs, the Idaho National Engineering Laboratory has established a long-term surveillance and maintenance program to monitor approximately 30 disposal facilities. Long-term care will be required on these sites until the radioactively contaminated waste reaches an acceptable (nonhazardous) level.

Specific environmental restoration activities include:

INEL

- Negotiated an Interagency Agreement between INEL, the U.S. Environmental Protection Agency Region 10, and the State of Idaho.

- Continue assessments and cleanup at eight DOE Environmental Restoration Waste Area Groups.

- 45 INEL facilities have been identified for D&D. Work is complete on 24 facilities and is progressing on three other facilities.

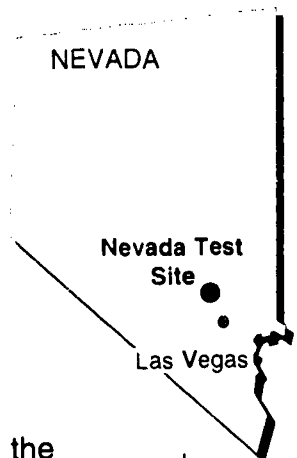
- Evaluate long-term impacts of previously disposed waste at the radioactive waste management complex.

- Conduct interim action to remediate the groundwater contamination source at the Test Area North.

Environmental Restoration Activities at Nevada Operations Office

• Cleanup from nuclear weapons testing contamination

The Nevada Operations Office operates facilities on the Nevada Test Site (including the Tonopah Test Range and the Nellis Air Force Range), which covers approximately 1,350 square miles of desert about 65 miles northwest of Las Vegas, Nevada. In addition, the Nevada Operations Office manages off-site test areas where nuclear tests have been conducted or where radiological contamination occurred. These include: Amchitka Island and the Project Chariot Site, Alaska; the Rio Blanco and the Rulison Gas Stimulation Sites in Colorado; the Gasbuggy Gas Stimulation and the Gnome Coach Sites in New Mexico; the Salmon Test Site in Mississippi; and the Kauai Site in Hawaii.



Prior to the signing of the Limited Test Ban Treaty on August 5, 1963, which effectively banned testing of nuclear weapons in the atmosphere, the U.S. Department of Energy (DOE) and its predecessors had conducted more than 300 nuclear tests above and below ground at the Nevada Test Site and seven other locations outside the State of Nevada. Since 1963, all U.S. nuclear weapons tests at the Nevada Test Site have been conducted underground. More than 800 nuclear weapons tests have been conducted at the Nevada Test Site.

Sites at the Nevada Test Site from nuclear weapons testing will be assessed, and contamination will be cleaned up.

The Nevada Operations Office environmental restoration program addresses over 1,800 release sites. Of these, over 800 sites are related to underground testing, and over 100 are related to above-ground nuclear testing at the Nevada Test Site; 16 are underground test release sites at off-site locations, and the remaining ones on the Nevada Test Site are classified as industrial sites and include above and below-ground storage tanks, leachfields, landfills, injection wells, and ponds.

The contaminants of concern are the result of nuclear tests, waste disposal, and nuclear rocket experiments. They include radionuclides, metals (such as beryllium, lead, and iron), hydrocarbons, organic compounds, and various residues used during test boring, drilling, and instrumentation.

The primary pathways for the migration of contamination at the Nevada Operations Office sites are through the disturbance of contaminated soils, the flow of contaminated groundwater, and the resuspension of surface materials. The remoteness of the Nevada Test Site and the rigidly controlled access prevent inadvertent public exposure, and the Nevada Operations Office has taken special precautions to reduce risks to workers. The potential for off-site migration of contaminants,

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although considered very small, will be thoroughly evaluated as part of the environmental restoration program.

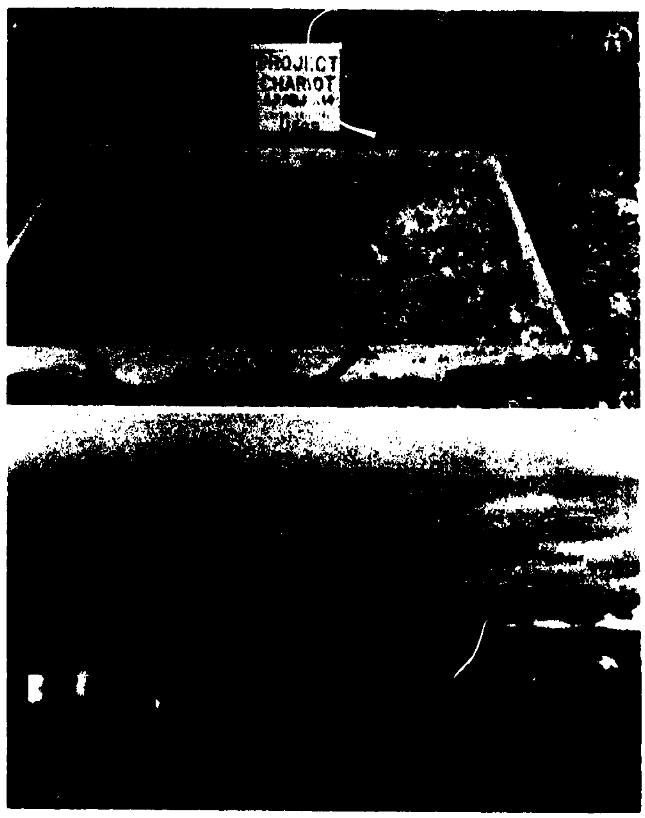
The Nevada Operations Office is working closely with state and federal representatives to ensure full compliance with all applicable regulations. Environmental restoration activities include: development and implementation of closure plans for numerous sites where hazardous and/or mixed waste were disposed of; the installation of groundwater characterization wells; the conduct of remedial investigations and feasibility studies of waste area groups; the cleanup of large surface areas contaminated with small amounts of radioactive materials; the remediation of industrial sites as required; and the evaluation and restoration of offsite locations. Eight facilities at the Nevada Test Site are scheduled for decontamination and dismantlement.

By the end of Fiscal Year 1997 all the major areas of concern will have begun to be addressed for the Nevada Test Site and the offsite locations. Cleanup will be underway for contaminated soils, inactive storage tanks, leachfields, sumps, and injection wells. Planning assessment will begin for inactive tunnel ponds and muck piles. In addition, monitoring programs for the underground testing areas will be underway.

Samples of the subsurface are taken through drilling to evaluate an area for potential contamination. Based on sample results, the area could be cleaned up or used for a disposal site.

Specific environmental restoration activities include:

- Continue groundwater characterization at the Nevada Test Site.
- Continue development and testing of enhanced cleanup techniques for large surface areas at the Nevada Test Site contaminated by radionuclides.
- Completed closure of the Area 23 Hazardous Waste Trench at the Nevada Test Site.
- Signed Agreements-in-Principle with the states of Nevada and Mississippi authorities.
- Negotiating a Federal Facility Agreement with the State of Nevada.
- Completed removal of all contamination at the Project Chariot site in Alaska.



DOE responded to local resident's concerned and committed to removing some very low-level radioactive soil from this location in Alaska. The material was placed there in the 1950's as part of Project Chariot. All the soil was packaged and removed form the area.

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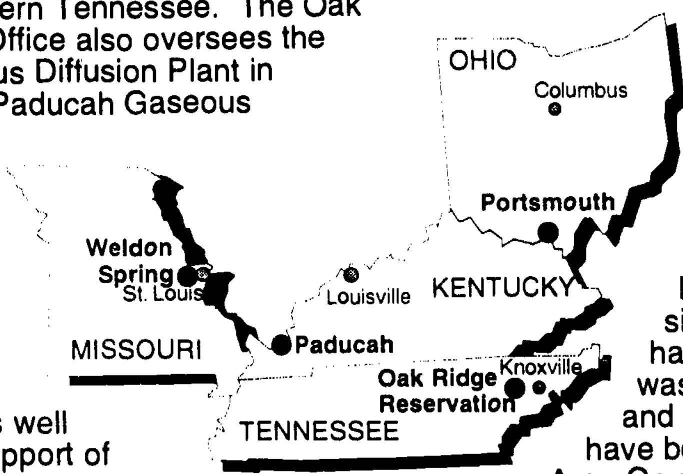
Environmental Restoration Activities at Oak Ridge Operations Office

- *Groundwater cleanup*
- *Federal Facility Agreement with the State of Tennessee*

The Oak Ridge Operations Office oversees environmental restoration activities at the Oak Ridge National Laboratory, the K-25 Plant, and the Y-12 Plant, all located on the Oak Ridge Reservation in eastern Tennessee. The Oak Ridge Operations Office also oversees the Portsmouth Gaseous Diffusion Plant in Piketon, Ohio, the Paducah Gaseous Diffusion Plant near Paducah, Kentucky, and the Weldon Spring Site near St. Louis, Missouri.

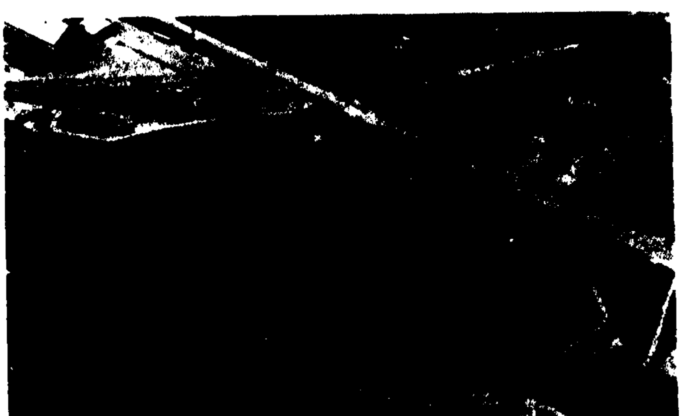


Routine operations of the test reactors and laboratories as well as operations in support of defense programs at these facilities have left a legacy of radioactive and hazardous waste problems that must be rectified. These sites also have a large number of inactive facilities. Inactive and surplus facilities will be decontaminated and decommissioned.

The types and extent of contamination vary from one location to another. In general, the types of waste found include low-level radioactive material (primarily uranium), organic solvents, corrosive waste, polychlorinated biphenyls (PCB's), and heavy metals (primarily mercury). This waste is present in soils, ground water, surface waters, buildings, structures, and equipment. In some cases, hazardous and radioactive contaminants are found together as mixed waste.

The Oak Ridge National Laboratory has more than 200 sites contaminated with hazardous waste, transuranic waste, liquid and solid low-level, and mixed waste. These sites have been grouped into 20 Waste Area Groups for assessment and cleanup.

The K-25 Site was formerly the Oak Ridge Gaseous Diffusion Plant and produced uranium hexafluoride. Due to the declining need for enriched uranium, the Gaseous Diffusion Plant was shut down and now serves as a center for applied technology and waste cleanup. Planning for decontamination and decommissioning of the Gaseous Diffusion



The New Hope Pond at the Y-12 Plant was an unlined, man-made settling basin designed to remove suspended sediments from the East Fork Poplar Creek, contain spills, and modify fluctuating pH levels.

Lake Reality replaced New Hope Pond to protect ground water and East Fork Poplar Creek from accumulated contaminants.

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Plant and cleanup of PCB contamination is underway. Cleanup sites in need of assessment and remedial action include burial grounds, waste storage facilities, underground tanks, surface impoundments, and waste treatment facilities.

Cleanup of the Y-12 Plant includes assessment and corrective actions for mercury contaminants in the East Fork Poplar Creek that runs through the Plant area and the city of Oak Ridge. In addition, old disposal sites, waste storage tanks, and spill sites are scheduled for assessment and cleanup.

The Paducah and Portsmouth Gaseous Diffusion Plants produce enriched uranium. At the Paducah Plant, current cleanup activities are focused on the investigation of ground water and surface water, soil, and sediment contamination on site and off site. The Portsmouth Plant has no offsite contamination, and cleanup assessment and corrective activities are underway.

The Weldon Spring Site, a former U. S. Army site used to process uranium and thorium in the 1950's and 1960's, is undergoing extensive assessment and cleanup. Cleanup sites include a 9-acre quarry and contaminated ground water on and off site, waste ponds, and a number of buildings.

The Oak Ridge Operations Office is also responsible for the Formerly Utilized Sites Remedial Action Program, designed to cleanup sites formerly used for various defense related activities across the nation.

The contaminated sites are being remediated in compliance with all applicable federal, state, and local laws and regulations. The Environmental Restoration activities for the sites under the Oak Ridge management have been prioritized. Activities required to prevent the further spread of contamination and ensure that immediate risks to workers the public, and the environment are given highest priority.

Specific environmental restoration activities include:

Oak Ridge National Laboratory

- Continue groundwater soil sampling and analysis program to detect, isolate, and quantify the extent of contamination and potential for human health risk.
- Continue remediation of inactive liquid Low-Level Waste tank system.

K-25 Site

- Continue planning the remedial investigations at two sites to evaluate risks and determine appropriate cleanup remedies.
- Dedicated as the site for the Center for Environmental Technology and the Center for Waste Management.

Y-12 Plant

- Completed removal of approximately 19,000 potentially reactive items from Kerr Hollow Quarry and dispositioned debris removed from the quarry closure into the Walk-in-Pits closure.
- Planned remediation of groundwater contaminated with volatile organic compounds, nitrates, uranium, and metals.

Portsmouth Gaseous Diffusion Plant

- Continue site characterization for 103 potential release sites.
- Operated three groundwater treatment systems, treating approximately 12 million gallons of water.

Paducah Gaseous Diffusion Plant

- Obtained EPA approval and planned interim remedial action for containing contamination in an onsite groundwater plume.
- Continued sampling and monitoring potentially affected residential wells.

Offsite - City of Oak Ridge

- Completed Oak Ridge Girls Club, Inc. removal action by placing a cover over contamination at a proposed recreational field site.

Weldon Spring Site

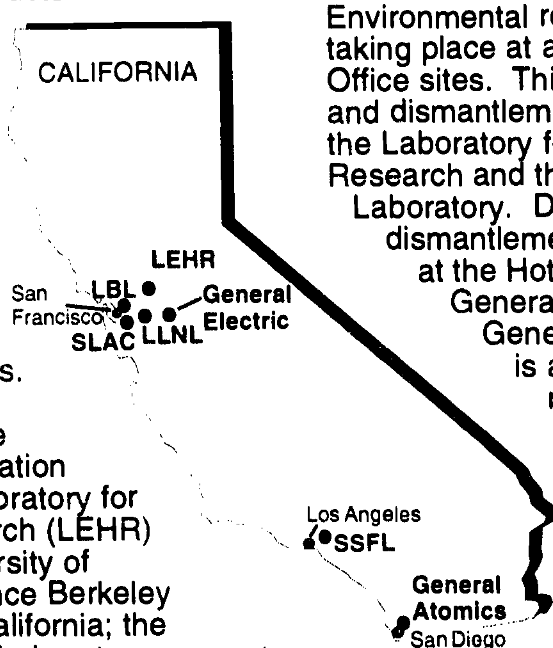
- Issued Record of Decision for Chemical Plant Site.
- Continue treatment and disposal of contaminated water at the quarry and Chemical Plant Site.

DOE/EM-0049P (Revision 1)

Environmental Restoration Activities at Oakland Operations Office

- *Nuclear energy and defense research laboratories*
- *7 sites in California*

The primary mission of the facilities under the Oakland Operations Office is nuclear energy and defense research. By-products of this mission include transuranic and low-level radioactive waste, hazardous waste, and mixed waste (radioactive and hazardous combined). The contamination that has resulted from operations at these sites includes a wide variety of radionuclides, polychlorinated biphenyls, and volatile organic compounds.



The Oakland Operations Office oversees environmental restoration activities at five sites: the Laboratory for Energy-Related Health Research (LEHR) (no longer active) at the University of California at Davis; the Lawrence Berkeley Laboratory (LBL), Berkeley, California; the Lawrence Livermore National Laboratory (LLNL), located 50 miles southeast of San Francisco; the Santa Susana Field Laboratory (SSFL) near Los Angeles; and the Stanford Linear Accelerator Center (SLAC) at Stanford University. The Oakland Operations Office is also responsible for cleanup of two commercially-owned sites, the General Atomics facility near San Diego, and the General Electric facility near San Francisco.

At the Lawrence Livermore National Laboratory Main Site and Site 300, the largest of San Francisco's Operations Office facilities, contaminated groundwater has spread to offsite locations. However, no members of the public are being exposed to groundwater contaminants from the facility, and the Laboratory is taking action to clean up the contaminants. No immediate or short-term on- or offsite health risks have been identified at the other Oakland Operations Office sites.

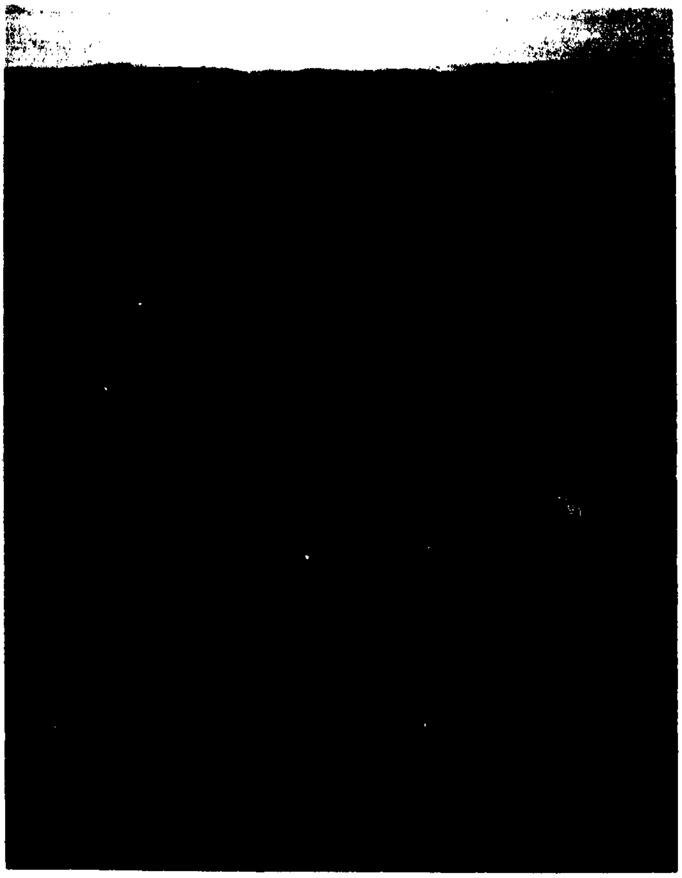
Environmental restoration activities are taking place at all the Oakland Operations Office sites. This includes decontamination and dismantlement of surplus facilities at the Laboratory for Energy-Related Health Research and the Santa Susana Field Laboratory. Decontamination and dismantlement activities will soon begin at the Hot Cell Facilities at the General Atomics facility and the General Electric facility. There is a new environmental restoration program at the Stanford Linear Accelerator Center. Monitoring and analysis is ongoing, and cleanup is scheduled to begin in 1993.

Site assessments are underway at all the U.S. Department of Energy (DOE) sites to determine whether groundwater contamination is present and to define the nature and extent of any contamination discovered. All the sites must interact with a large number of regulatory agencies. In addition to the U.S. Environmental Protection Agency's Regional Office in San Francisco, a number of state, regional, district, and local agencies have jurisdiction over the Oakland Operations Office environmental restoration activities. Although the degree of regulatory interaction varies greatly among sites, all work is being performed in a cooperative manner.

The most formal regulatory relationship exists at the Lawrence Livermore National Laboratory. In October 1988, a Federal

Facility Agreement was signed by DOE, the EPA, and state agencies for the Main Site. Site 300 entered the Federal Facility Agreement in July 1992. The Federal Facility Agreements include all the remedial assessment and cleanup activities at the Lawrence Livermore National Laboratory. Mandatory schedules for the performance of specific activities are also delineated in the agreement.

The Lawrence Livermore National Laboratory sites are listed on the Environmental Protection Agency's National Priorities List because of the proximity of contaminants to municipal drinking water supplies. The Laboratory for Energy-Related Health Research is currently being considered for listing this year. Being listed on the National Priorities List requires sites to clean up contaminated areas quickly, as dictated by statute-driven schedules.



Although groundwater near the Lawrence Livermore National Laboratory has been contaminated, cleanup is a high priority and is currently in progress.

Specific environmental restoration activities include:

Lawrence Livermore National Laboratory
- Continue remediation of contaminant source areas and groundwater through proposed pump and treat facilities.
- Conduct closure on inactive surplus hazardous waste facilities.

Lawrence Berkeley Laboratory
- Continue soil and groundwater assessment activities.
- Close the hazardous waste handling facilities.

Stanford Linear Accelerator Center
- Continue assessment activities.
- Design and implement remediation measures.

General Atomics
- Conduct surveillance, maintenance, and facility characterization activities for decontamination and dismantlement.

Laboratory for Energy-Related Health Research
- Continue characterization of soil and groundwater.
- Characterize for decontamination and dismantlement and complete final survey of surplus structures.

General Electric
- Continue surveillance and maintenance activities for decontamination and dismantlement.

Santa Susana Field Laboratory
- Perform soil and groundwater characterization.
- Perform decontamination and dismantlement activities.

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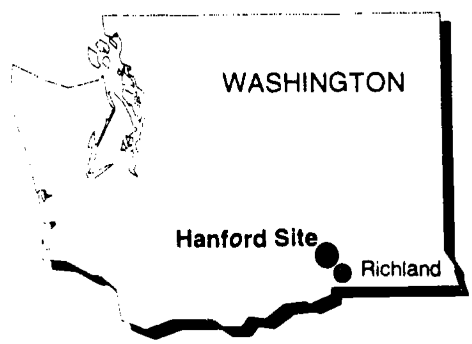
Environmental Restoration Activities At Richland Operations Office

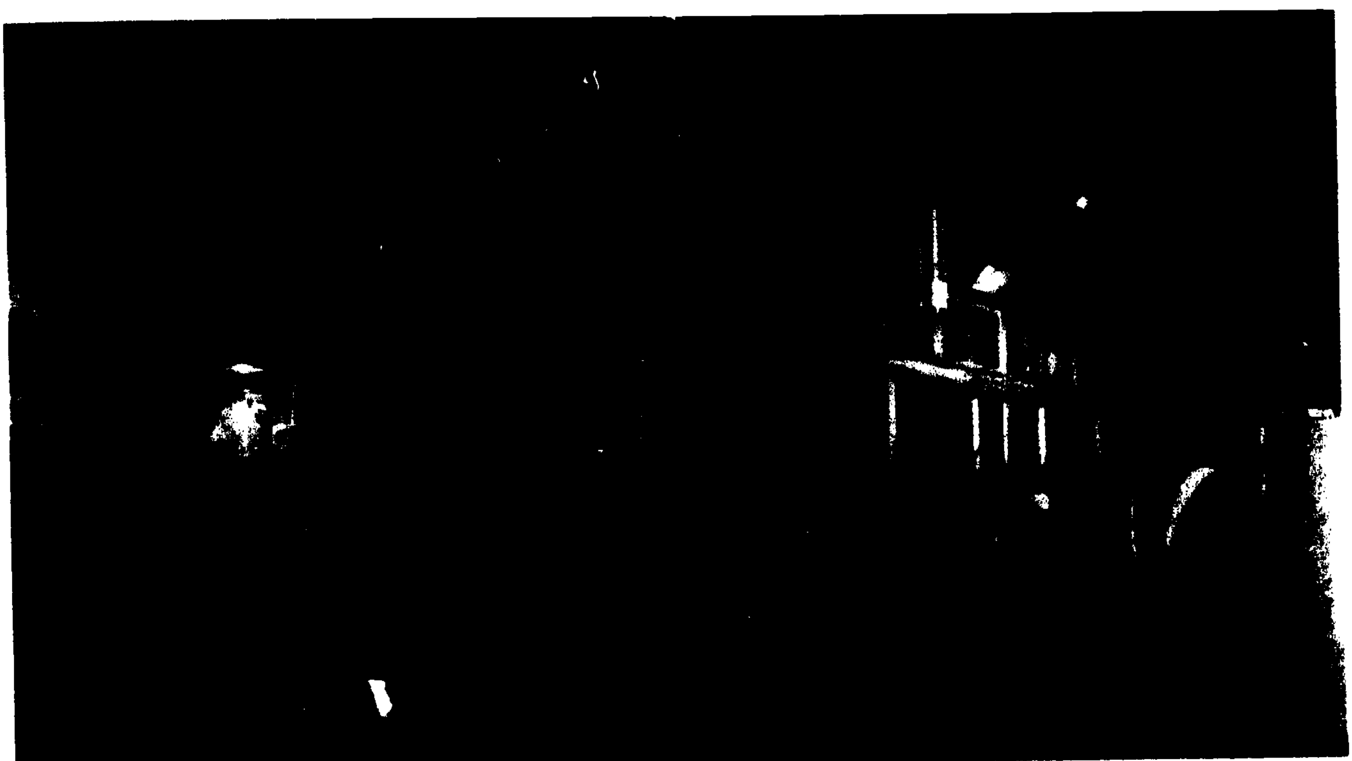
- *1,100 waste sites*
- *Tri-Party Agreement*

The Richland Operations Office oversees environmental restoration activities at the Hanford Site near Richland, Washington. Since the early 1940's, nuclear materials were produced at this site. The Hanford Site missions once included plutonium production and separation, advanced reactor design and testing, basic scientific research, and renewable energy technologies development. Today, the Hanford Site's missions have shifted focus from the activities listed above to environmental restoration and waste management activities to protect the workers, the public, and the environment.



Activities at the Hanford Site have generated high level, transuranic, low-level, and mixed wastes (radioactive and hazardous wastes combined). Most of the Hanford Site's 1,100 inactive waste sites originated from onsite storage or soil column disposal of wastes in the past.

The approximately 1,100 individual waste sites, ranging in size from one square foot to 1,800 acres, have been grouped into 78 operable units according to similar characteristics in waste type or remediation activity. These units have been further organized into four large areas based primarily



Hanford workers use a mobile vapor extraction system to extract carbon tetrachloride (an organic solvent) from the ground in the 200 West Area at Hanford. This vapor extraction project, in operation since January 1992, is designed to recover the contaminant before it spreads into the groundwater. About 125,000 gallons of carbon tetrachloride were discharged at 200 West Area from 1955-1973.

on their geographic location on the 560 square mile Hanford Site. These four areas have been included on the U.S. Environmental Protection Agency's (EPA's) National Priorities List, requiring rigorous and speedy cleanup. The areas are: 100 Area (reactor area), 200 Area (chemical processing area), 300 Area (fuel fabrication and research and development area), and 1100 Area (vehicle maintenance area). Nine of the 78 operable units have been grouped to characterize and remediate the contaminated groundwater under the waste sites.

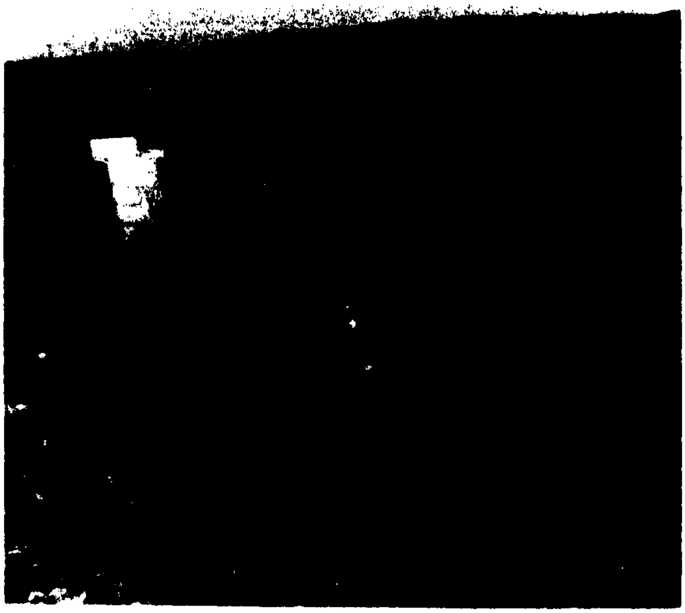
Due to the types and large volumes of waste at the Hanford Site, characterization and assessment are underway to determine current and future health risks and to identify remedial activities needed to offset unacceptable risks.

The Hanford Site has a Tri-Party Agreement with the U.S. Department of Energy (DOE), the EPA, and the State of Washington Department of Ecology. This agreement provides for the cleanup of the Hanford Site in a timely manner and in compliance with regulatory requirements. It also provides for public involvement in decisions dealing with the cleanup and proper prioritization of cleanup projects. In accordance with the Tri-Party Agreement, 21 work plans for operable units have been submitted. At the end of 1993, 14 plans had been approved and seven were awaiting approval.

More than 200 surplus inactive facilities at the Hanford Site are part of DOE's Decontamination and Dismantlement Program. These include eight former reactors, chemical processing buildings, and other structures such as exhaust stacks, storage tanks, and river outfall structures. A Record of Decision was issued in 1993 to dismantle and decontaminate the eight surplus reactors. The preferred alternative for this action is one-piece removal of the reactors and subsequent burial onsite.

Specific Environmental Restoration Program activities include:

- Nine surplus buildings demolished in 1993; another 12 facilities scheduled for demolition in 1994.
- Planning, design, and construction for environmental restoration disposal facility for waste generated from Comprehensive Environmental Response, Compensation, and Liability Act operable units and Resource Conservation and Recovery Act past practice remedial activities.
- North Slope and the Arid Lands Ecology study area targeted for cleanup for the end of 1994 (resulting in the cleanup of 46% of the site).
- Accelerate site remediation along the Columbia River.
- Accelerate groundwater remediation projects with pilot scale pump and treatment operations.

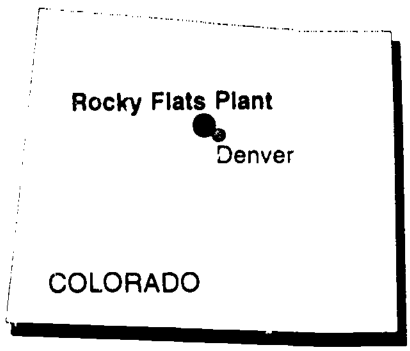


A Hanford employee operates a backhoe to remove sediments contaminated with uranium and other metals in a trench used for the discharge of liquids. The sediment removal was performed as an expedited action and resulted in the removal of some 7,000 cubic yards of contaminated soil.

Environmental Restoration Activities at Rocky Flats Office

- *Interagency agreement*
- *16 operable units*

The Rocky Flats Plant, near Denver, Colorado, once produced plutonium components. The office is now in transition to the new mission: cleaning up contamination and waste from its past activities and transitioning its facilities to cleanup. The Plant site covers approximately 6,550 acres at the foot of the Rocky Mountains, of which 350 acres is used for actual operations.



An Interagency Agreement between the Colorado Department of Health, the U.S. Environmental Protection Agency, and U.S. Department of Energy (DOE) was signed in January 1991 and provides the primary means of coordination for all environmental restoration activities at the Rocky Flats Plant.

Preliminary assessments under the environmental restoration program identified some of the past onsite waste storage and disposal locations as potential sources of environmental contamination. A total of 178 individual hazardous substance sites have been identified at the Rocky Flats Plant, including three offsite reservoirs and one land area located off DOE property. The offsite areas have received contaminated effluent and sediments originating from the plant. All 178 sites have been grouped into 16 operable units to help coordinate assessment and remediation.

Based on recommendations from regulators, Rocky Flats is planning to add 28 potential areas of concern, two potential incidents of concern, and 12 under-building contamination sites to existing operable units.

Surface Water Management

The Rocky Flats Office has committed to several on and offsite surface water projects as a result of a stakeholder group that includes DOE, regulators, and the public. The offsite projects include funding replacement of the municipal water supply for the nearby city of Broomfield and construction of a catch basin in the Woman Creek drainage area for the city of Westminster. Onsite projects focus on upgrading the ponds that collect and treat potentially contaminated surface water runoff from the plant along Walnut Creek. Water monitoring stations will be constructed, and the South Interceptor Ditch (SID) will be upgraded. SID has collected and treated over two million gallons of contaminated groundwater in the 881 Hillside Area.

Revised Approach to Cleanup

Investigation began in 1993 to assess ways to accelerate the environmental restoration program at Rocky Flats. Two working groups identified problems and suggested ways to streamline the investigation and cleanup process. Some of the options they have examined include integrating Operable Unit boundaries, deferring decontamination and dismantlement work, and reducing or eliminating treatment of surface water which has been uncontaminated in recent years. This approach has been submitted to the U.S. Environmental Protection Agency and the Colorado Department of Health for comment. Citizen input will also be gathered before any final decisions are made. Working with regulators and the public, Rocky Flats is also attempting to expedite and streamline the investigation and cleanup process through several interim remedial actions designed to prevent contaminant migration at high risk Operable Units.

Significant environmental restoration activities include:

The Rocky Flats Office has initiated interim remedial actions, closure actions, and other initiatives at the four highest priority operable units in order to minimize or preclude future impacts of contaminant migration.

- 881 Hillside (Operable Unit 1) - Soil and groundwater in this operable unit were contaminated in the 1960's and 1970's. As an interim remedial action, an underground drainage system was installed to intercept and contain contaminated groundwater. Intercepted water is pumped to a treatment facility where it is treated and released. Over two million gallons of groundwater have been collected and treated.

- 903 Pad, Mound and East Trenches Areas (Operable Unit 2) - Contamination here is largely attributable to storage in the 1950's and 1960's of waste drums that corroded over time, allowing contaminants to leak into the surrounding soil. A system to intercept, collect, and treat contaminated groundwater emanating from hillside seeps was installed and has handled over 18 million gallons of groundwater to date.

- Offsite Areas (Operable Unit 3) - This unit consists of contaminated land surfaces and reservoirs east of the plant. Current remediation activities involve the plowing and revegetation of about 350 acres of the Rocky Flats Plant. The reservoirs were contaminated with small amounts of sediment and effluent in the late 1960's. DOE is committed to a plan to provide a long-term solution to surface water management at the Rocky Flats Plant and in the surrounding communities. The plan includes evaluation and improvement of onsite surface water management and the construction of a system, both on site and off site, to control and treat surface water flows and pollutants which could potentially be transported off site to drinking water reservoirs.

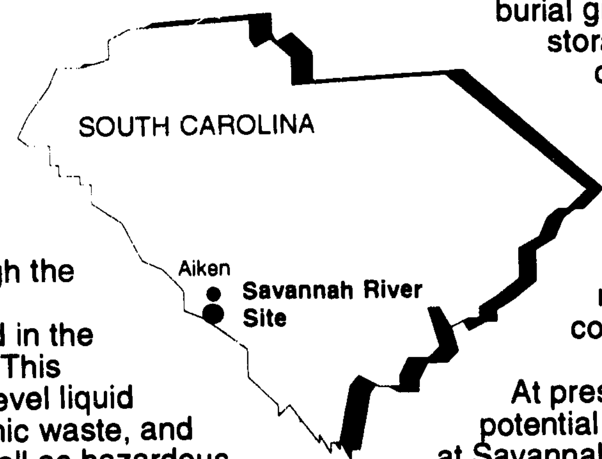
- Solar Ponds (Operable Unit 4) - The five solar evaporation ponds that make up this unit were constructed in the 1950's to accept mixed process waste containing nitrates and treated acidic waste. Contaminated groundwater nearby has been attributed to pond leakage. Plans are being developed to close the ponds. A system to intercept contaminated groundwater, completed in 1981, returns intercepted water to the ponds. As part of the closure process, sludges from the Solar Ponds are being collected and stored in tri-wall containers at the site. Rocky Flats is evaluating remedial alternatives for treating and disposing of these wastes as well as stabilizing and reprocessing pondcreted sludges produced from earlier remediation efforts.

At 881 Hillside, contaminated groundwater is being treated to remove volatile organic compounds, radionuclides, and metals.

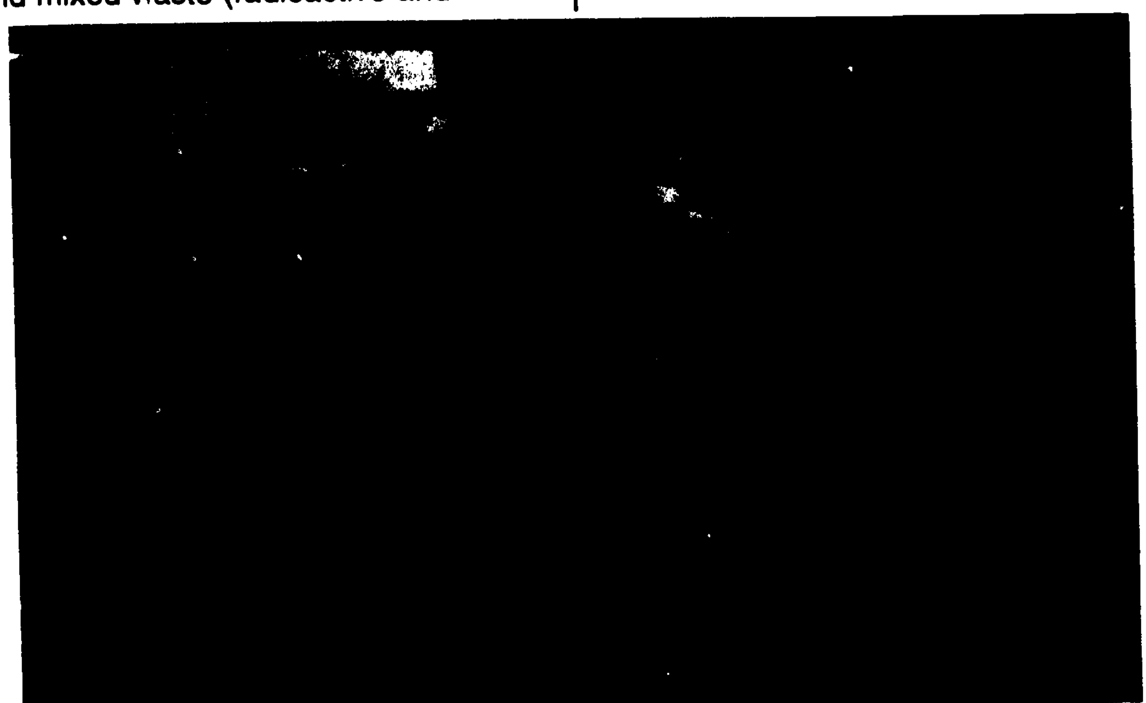
Environmental Restoration Activities at Savannah River Operations Office

- *Seepage basins*
- *Waste piles*
- *Storage tank cleanup*

The Savannah River Operations Office oversees environmental restoration activities at the Savannah River Site (SRS). The SRS is located on 325 square miles along the Savannah River near Aiken, South Carolina. Its historical mission of supporting national defense efforts through the production of nuclear materials has resulted in the generation of waste. This waste includes high-level liquid waste, solid transuranic waste, and low-level waste, as well as hazardous waste and mixed waste (radioactive and hazardous combined). The migration of contaminants from seepage and settling basins, unlined disposal pits, waste piles, burial grounds, and underground storage tanks has resulted in the contamination of soil and groundwater at several areas on the Site. The Savannah River Site has an active environmental restoration program focusing on compliance with environmental regulations and cleanup of contaminated sites.



At present, over 400 waste units and potential waste units have been identified at Savannah River Site. The waste types found in the units include nonhazardous



In the past, seepage basins were used to collect waste water from nuclear materials production processes. Remedial actions included stabilizing the waste and capping the area. In this photo, granite is being placed on the basin bottoms to stabilize the sludge and prevent airborne releases of radionuclides. Other actions taken to close the basins included: chemically stabilizing the material in the basins with limestone and blast furnace slag, backfilling the basins with soil, and placing a two-foot thick clay cap over the basins. Finally, the areas were covered with top soil and seeded.

nonradioactive waste, radioactive waste, hazardous waste, and mixed waste. The waste units have been categorized into 82 settling/seepage basins, 99 burning/rubble pits and piles, six groundwater units, nine burial grounds/tanks, 139 spills, and 85 miscellaneous units. Some waste units include the contamination of surrounding subsurface soils and groundwater. The contaminants identified at various units include volatile organic compounds, heavy metals, pesticides, and radionuclides.

In 1994, the U.S. Department of Energy (DOE), Region IV of the U.S. Environmental Protection Agency (EPA), and the South Carolina Department of Health and Environmental Control (SCDHEC) signed a Federal Facility Agreement (FFA) for the Savannah River Site. The FFA establishes the framework for cleaning up Savannah River Site waste sites and acknowledges the regulatory oversight and enforcement authorities of EPA and SCDHEC. Under this agreement, the three agencies will work together to streamline cleanup activities and ensure compliance with applicable environmental regulations. Those regulations include but are not limited to the Resource Conservation and Recovery Act and Comprehensive Environmental Response, Compensation, and Liability Act.

Shown here are the tritium facilities at Savannah River Site. Plans are underway to decontaminate and dismantle these structures, as well as others on the site.

Restoration options for the waste sites are varied and will be determined on a site specific basis. Most combine some aspects of waste stabilization, site capping, waste removal, and grading. Groundwater remediation activities are being conducted in several areas in accordance with consent orders and agreements. These include groundwater monitoring and periodic groundwater quality assessments. Remediation activities also include innovative technologies, such as horizontal wells vapor vacuum extraction and air strippers.

Decontamination and dismantlement (D&D) of inactive and surplus facilities is also ongoing. The Savannah River Site has 14 facilities scheduled for D&D activities. Surveillance and maintenance activities will continue at a number of these facilities.

Specific environmental restoration activities include:

- Completed closure of the M-Area Settling Basin/Lost Lake.
- Completed closure of the Mixed Waste Management facility.
- Plan decontamination and dismantlement of the Heavy Water Component Test Reactor, the old HB Line, the 232-F Tritium Facility, and the Reactor Support Facilities.
- Start construction of F&H-Area groundwater remediation.

DOE/EM-0052P (Revision 1)

Formerly Utilized Sites Remedial Action Program

- *Oak Ridge Operations Office oversight*
- *15 sites completed; 16 more underway*
- *45 sites in 14 states*

Mission and Background

In the 1940's and 1950's, the federal government contracted with private firms to develop processes and perform research projects on radioactive materials. Many of these programs included storage and processing of uranium and thorium. The sites where this work was done were cleaned up according to the standards of that time. Since then, more stringent standards have been developed. Where necessary, additional cleanup is being performed to bring these sites into compliance with today's higher environmental standards. The U.S. Department of Energy (DOE) is responsible for the cleanup of some of these sites.

The Formerly Utilized Sites Remedial Action Program (FUSRAP) was established in 1974 to identify sites previously used by the Manhattan Engineer District and the Atomic Energy Commission (DOE predecessor agencies) and to evaluate environmental conditions at the sites.

FUSRAP cleanup at this site in Pennsylvania included removing contamination from a concrete floor.

This facility, the National Guard Armory in Chicago, was used in the 1940's by the Manhattan Engineer District for storage and limited metallurgical work. Cleanup of all contamination and waste was completed in 1988.

Records are reviewed to compile a list of formerly utilized sites and to assess DOE's authority for cleanup of any residual contamination. Where appropriate, radiological surveys are performed to assess conditions at the sites. Survey data are used to decide whether the sites should be designated for cleanup or be eliminated from the program because they already meet today's environmental guidelines.

At the sites designated for cleanup, either the contaminated material is stabilized in place and site use is restricted or the material is removed for disposal at another location.

DOE's Oak Ridge Operations Office in Tennessee manages FUSRAP, coordinating activities with federal, state, and local authorities, and has an active program to communicate with the regulators and the public.

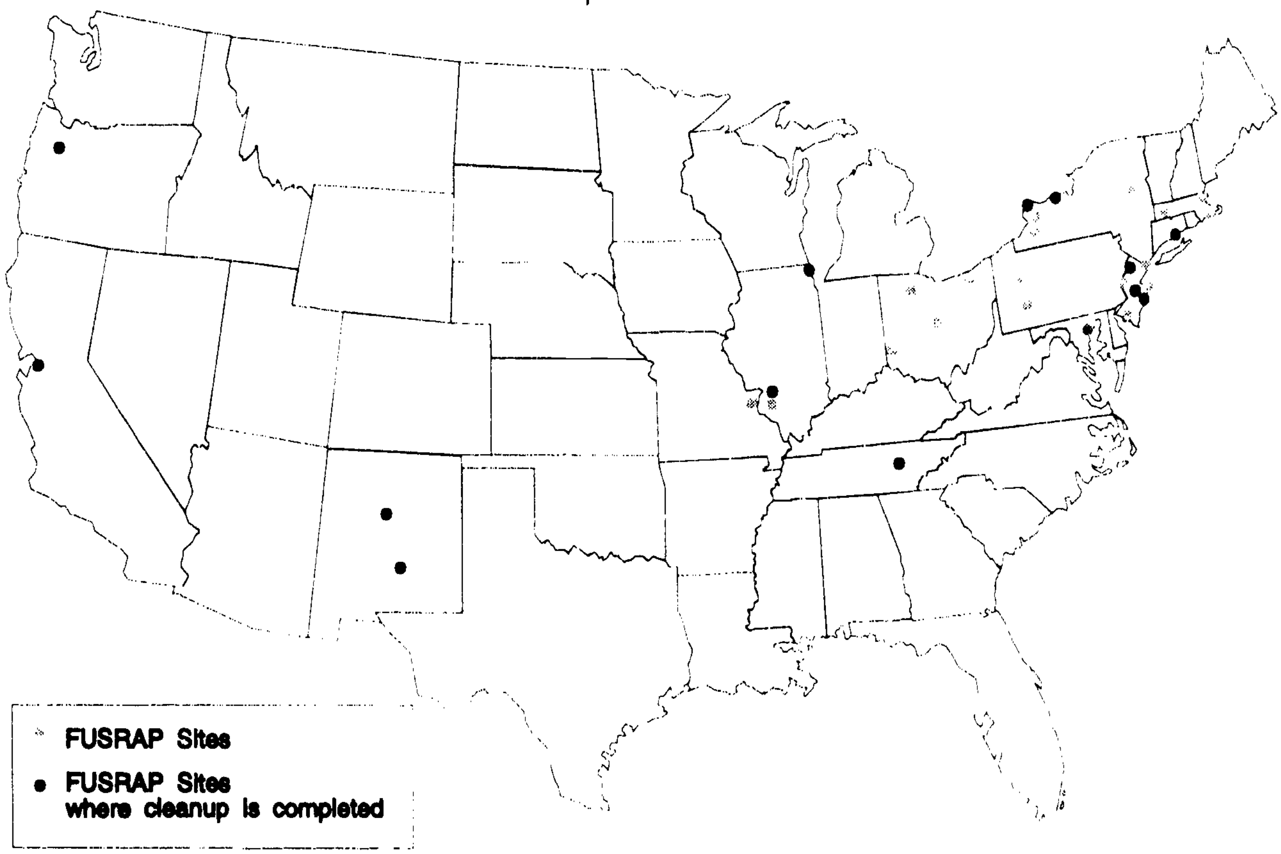
Appropriations Acts of 1984 and 1985 specifically gave DOE responsibility for five non-DOE sites. In cases where property in the vicinity of a site was contaminated by site activities, it is also included in FUSRAP.

Facilities are being evaluated for disposal of
Facilities are being evaluated for disposal of FUSRAP wastes in New York, New Jersey, Missouri, and Maryland and at commercial disposal sites. The cooperation of members of Congress and federal, state, and local officials is required to determine the appropriate disposal sites.

In some cases, industrial activities at FUSRAP sites produced mixed waste. Guidelines for the disposal of this type of waste are established by a DOE and Environmental Protection Agency group working together.

Status

Currently there are 45 sites in 14 states that have been designated for cleanup under FUSRAP. These sites are being cleaned up to today's strict standards to protect the safety of the public and the environment. Work has been completed at 15 sites and cleanup is underway at another 16. FUSRAP is expected to be completed by the year 2019.



The FUSRAP program is cleaning up previously used sites across the country. Some dots represent more than one site.

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Uranium Mill Tailings Remedial Action Project

- *Albuquerque Operations Office oversight*
- *More than 5,000 vicinity properties*
- *24 sites in 10 states*

Mission and Background

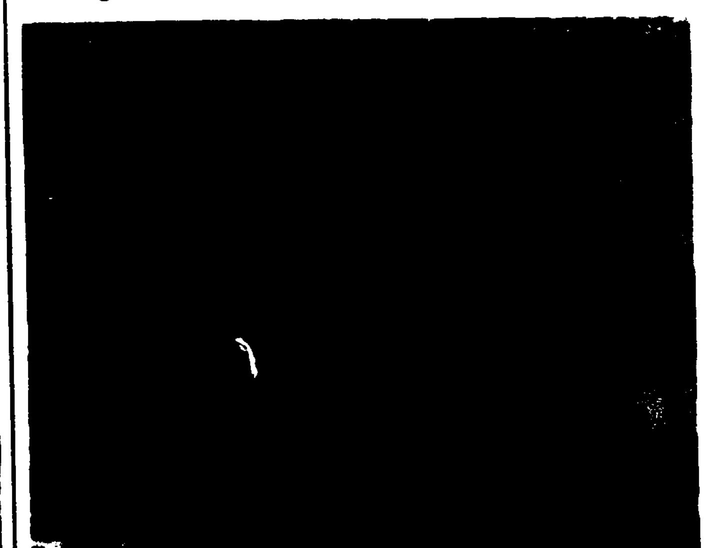
Most uranium ore mined in the United States in the 1960's was processed by private firms for the Atomic Energy Commission, the U.S. Department of Energy's (DOE's) predecessor, for national defense and research activities. Subsequently, most of these processing plants were shut down, and the uranium mills and tailings piles were abandoned. Uranium tailings are the naturally radioactive rock and soil resulting from uranium mining and milling. When present in populated areas, the tailings present a potential long-term health hazard because they emit small amounts of radon gas and contain other radioactive and nonradioactive contaminants that can pollute groundwater. The Uranium Mill Tailings Remedial Action (UMTRA) Project was created to manage the cleanup of this waste. The Albuquerque Operations Office manages the UMTRA Project.

The UMTRA Project evaluates and cleans up sites contaminated with, for example, fill dirt from uranium mining sites.

The UMTRA Project is in the process of cleaning up about 24 million tons of uranium tailings at 24 inactive sites in 10 states and more than 5,000 vicinity properties (residences, businesses, and open lands where the tailings were used as fill dirt or other uses that contaminated the area). The remedial actions (cleanup) consist of stabilizing the tailings piles or, in some cases, relocating the piles to more remote locations. The remote piles are covered with soil and rock to prevent radon release, control erosion, and minimize infiltration of rain and snow that could leach contaminants through the pile into groundwater. After sites are cleaned up or stabilized, they are monitored and maintained over time to ensure the integrity and containment of the waste.

Regulatory Issues

In 1978, Congress passed the Uranium Mill Tailings Radiation Control Act (the Act)



This site in Canonsburg, Pennsylvania, required complete removal of all buildings and fill dirt.

U.S. Department of Energy
Office of Environmental Management
August 1994

directing DOE to stabilize, dispose, and control the uranium mill tailings in a safe and environmentally sound manner.

The U.S. Environmental Protection Agency, in compliance with the Act, set standards for remedial action and groundwater restoration with which DOE must comply.

The Nuclear Regulatory Commission, states, and Indian Nations are charged with providing consultation and concurrence on proposed remedial action plans and licensing DOE to perform long-term surveillance and maintenance. Remedial action costs are shared: 90 percent federal/10 percent state. Sites on Indian lands are 100 percent federally-funded. Cooperative agreements are in place with 10 states and two tribes.

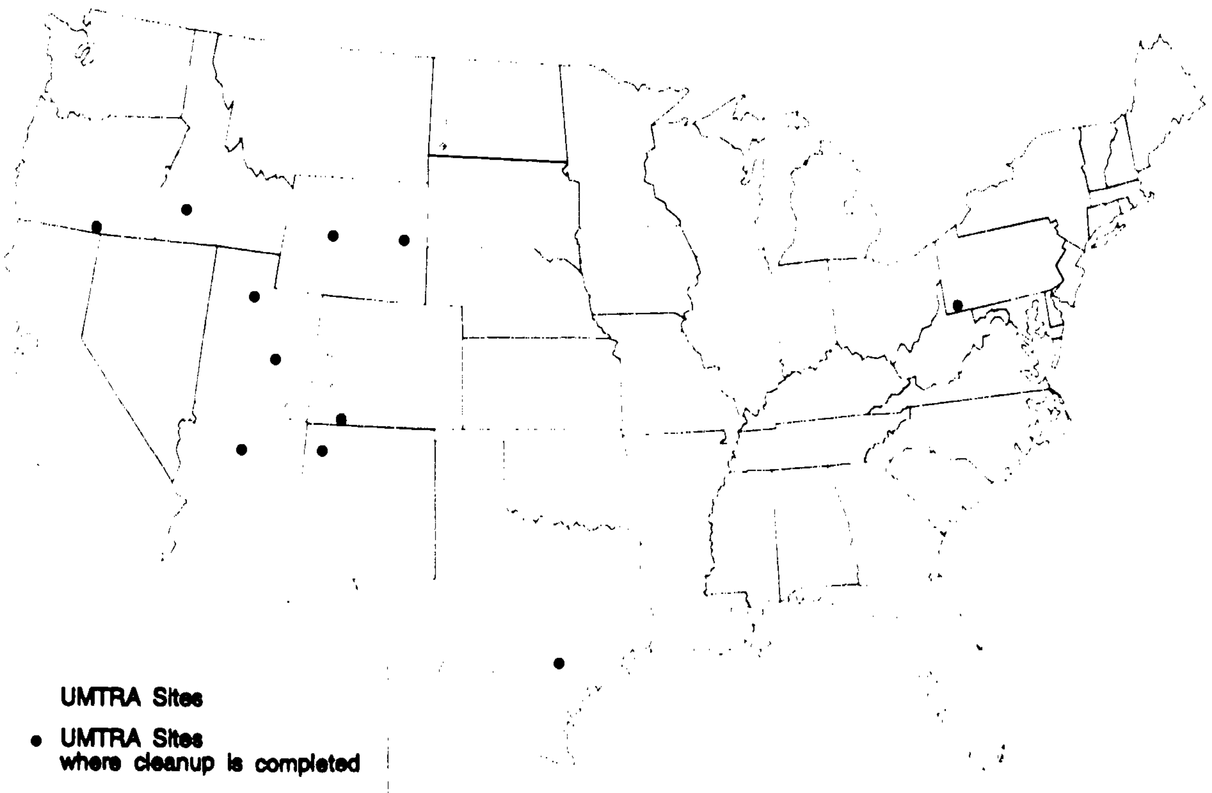
Status

By the end of 1993, remedial actions were completed or in progress at 18 of the 24 sites. Of these, 11 sites are completed and 7 sites are under construction. Cleanup at the remaining 6 sites is scheduled to begin in the next two fiscal years.

Over 13,555 potential vicinity properties across the nation were originally surveyed to determine if they were contaminated. Over 5,000 of the 5,199 vicinity properties found to be contaminated had been remediated by the end of 1993.

Tailings at several of the sites will be moved to disposal sites on public lands administered by the Department of Interior's Bureau of Land Management. During 1989, DOE and the Department of the Interior developed a Memorandum of Understanding for the transfer of lands to be used for permanent disposal sites for the uranium mill tailings.

Planning activities continue for all of the remaining sites, including preparation of documents to demonstrate compliance with the National Environmental Policy Act, preparation of Remedial Action Plans (which require Nuclear Regulatory Commission concurrence to proceed with remedial actions), and detailed engineering for all remaining sites.



The UMTRA Program is cleaning up uranium mill tailings remedial action sites across the nation. Some dots on the map may represent more than one site.

How do you reach someone at a U.S. Department of Energy site?

PUBLIC INFORMATION OFFICES

DOE Headquarters	(202) 586-5575
Albuquerque Operations Office	(505) 845-6202
Chicago Operations Office	(708) 252-2010
Fernald Operations Office	(513) 648-3131
Idaho Operations Office	(208) 526-1317
Nevada Operations Office	(702) 295-3521
Oak Ridge Operations Office	(615) 576-0888
Oakland Operations Office	(510) 637-1809
Richland Operations Office	(509) 376-7501
Rocky Flats Office	(303) 966-5993
Savannah River Operations Office	(803) 725-2889

PERSONNEL LOCATOR NUMBERS

DOE Headquarters	(202) 586-5000
Albuquerque Operations Office	(505) 845-4154
Chicago Operations Office	(708) 252-2001
Fernald Operations Office	(513) 738-6319
Idaho Operations Office	(208) 526-0111
Nevada Operations Office	(702) 295-1212
Oak Ridge Operations Office	(615) 576-5454
Oakland Operations Office	(510) 637-1825
Richland Operations Office	(509) 376-7411
Rocky Flats Office	(303) 966-7000
Savannah River Operations Office	(803) 725-621[illegible]

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