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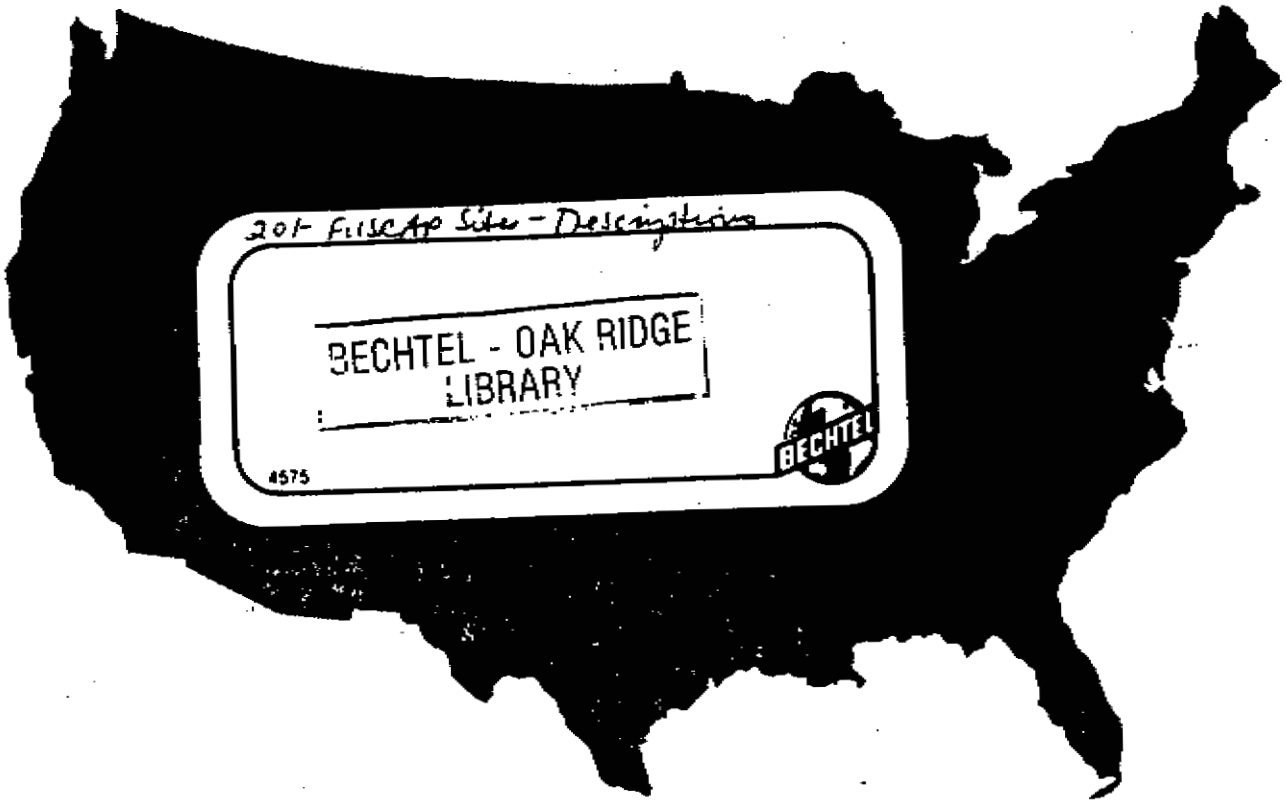

Description of the Formerly Utilized Sites Remedial Action Program

United States
Department of Energy

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U.S. DEPARTMENT OF ENERGY
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DESCRIPTION OF THE FORMERLY UTILIZED SITES REMEDIAL ACTION PROGRAM*

1.0 Introduction

The background and the results to date of the Department of Energy program to identify and evaluate the radiological conditions at sites formerly utilized by the Corps of Engineers' Manhattan Engineer District (MED) and the U.S. Atomic Energy Commission (AEC) are summarized in section 2.0. The sites of concern were federally, privately, and institutionally owned and were used primarily for research, processing, and storage of uranium and thorium ores, concentrates, or residues. Some sites were subsequently released for other purposes without radiological restriction. Surveys have been conducted since 1974 to document radiological conditions at such sites. Based on radiological surveys, sites are identified in this document that require, or are projected to require, remedial action to remove potential restrictions on the use of the property due to the presence of residual low-level radioactive contamination. Specific recommendations for each site will result from more detailed environmental and engineering surveys to be conducted at those sites and, if necessary, an environmental impact assessment or environmental impact statement will be prepared. Section 3.0 describes the current standards and guidelines now being used to conduct remedial actions. Current authority of the U.S. Department of Energy (DOE) to proceed with remedial actions and the new authority required are summarized in section 4.0. A plan to implement the Formerly Utilized Sites Remedial Action Program (FUSRAP) in accordance with the new authority is presented in section 5.0, including the objectives, scope, general approach, and a summary schedule. Key issues affecting schedule and cost are discussed in section 6.0.

2.0 Background

Historical Records Review

The original program for the development and use of atomic energy, established under the MED and later continued by the AEC, involved the development of technology and the production of nuclear materials for national defense and security. The program was conducted under very stringent security restrictions and, at contract termination of the MED/AEC activities, the sites involved were decontaminated according to the health and safety criteria and guidelines then in use and applied on a site-specific basis. However, radiological criteria for releasing these sites for unrestricted use have changed and some criteria are still being developed. Therefore, to define the radiological condition of these sites in light of the changing environmental criteria and standards, a records search was begun in 1974.

In many instances, documentation of the MED/AEC activities at these sites was destroyed in compliance with Government Records Management practices. Many of the radiological records covering the extent of cleanup actions are incomplete. Also, many of the sites have changed ownership and are presently used for other purposes. In some cases, buildings have been modified or the earlier MED/AEC facilities no longer exist.

*Much of the information presented in this document was extracted from a draft of "A Background Report for the Formerly Utilized MED/AEC Sites Remedial Action Program," prepared for the Environmental Control Technology Division, Assistant Secretary for Environment, U.S. Department of Energy, by the Aerospace Corporation, March 1980.

AEC/ERDA/DOE Site Survey Program

In early 1974, the AEC initiated a survey program to identify all formerly utilized sites involved with nuclear materials and to determine their radiological status. The responsibility for this survey was assigned to the Division of Operational Safety. At that time, all divisions and field offices of the AEC were required to search their files to identify any such former government-owned or leased sites and facilities that had been used in the research or production activities of the MED and the AEC. In addition, the files were searched for records identifying the radiological conditions at the termination of the MED/AEC activities and/or the transfer of custodial responsibility for such sites, the current radiological condition of the sites, and the land-use and ownership data. This effort identified many additional sites for which pertinent information was lacking or was insufficient to determine their radiological conditions.

On January 19, 1975, the AEC was abolished and its programmatic responsibilities transferred to the Energy Research and Development Administration (ERDA) which continued the activities of the survey program. Contacts were made with former and current owners and site visits were conducted under the direction of the ERDA field offices to determine the need for radiological surveys. If radiological surveys were determined to be necessary, the permission of the site owners was obtained and a press release was issued to inform the public of the survey work. Subsequent survey results were also issued in a public press release and were published in a radiological survey report that analyzed the significance of the findings with respect to the potential risks to the public health.

Pursuant to the DOE Organization Act of 1977, the functions and authority of the ERDA were transferred to the DOE. In the DOE, the Assistant Secretary for the Environment (ASEV) was assigned the responsibility for the site-survey program. The results of several site surveys clearly indicated that some remedial action would be needed, not only on the former sites, but also on adjacent or remote properties that had become contaminated from the original processing site. Due to the importance of this effort, the ASEV initiated the FUSRAP and drafted a generic plan to identify all formerly utilized sites and to resolve any site radiological problems. Using this generic plan as a guide, in mid-1979 responsibility for the FUSRAP activities was divided between the ASEV and the Assistant Secretary for Energy Technology (now Assistant Secretary for Nuclear Energy [ASNE]). The ASEV is responsible for identifying the sites, characterizing the radiological condition, determining the need for remedial action at the sites, and ultimately for certifying the post-remedial action radiological condition of the FUSRAP sites. The ASNE is responsible for implementing the required remedial actions, including suitable disposal or stabilization of residual material.

Overview of MED/AEC Activities

In 1942, under the jurisdiction of the U.S. Army, the MED was established as the agency responsible for the development of nuclear materials for national defense and security. The authority for process development, engineering design, procurement of materials, and site selection associated with the nuclear materials program was transferred to the MED from the Office of Scientific Research and Development, Department of the Army. The headquarters for the MED, originally established in New York, was transferred to Oak Ridge, Tennessee, in 1943.

On December 31, 1946, the MED was deactivated and its responsibilities were transferred to the newly constituted AEC. During the 1942 to 1946 time period, there

were more than 10 contractors and several hundred subcontractors involved in the production, research, and development operations. These contractors included industrial concerns, universities, and other scientific organizations. In contrast to the highly centralized operation of the MED, the AEC decentralized and established five major centers of operation (New York City, New York; Santa Fe, New Mexico; Oak Ridge, Tennessee; Hanford, Washington; and Chicago, Illinois). The AEC continued the MED practice of contracting with industrial concerns and academic institutions to perform the actual operations.

The most readily available source of historical information on the early activities of the MED/AEC is A History of the United States Atomic Energy Commission, Volume I - The New World and Volume II - Forging the Atomic Shield. A synopsis of the procurement, storage, and processing of the raw materials containing uranium is presented here to give the reader a general overview of the MED/AEC activities.

Uranium Procurement. The MED relied on three sources of uranium during the war years. About two-thirds came from mines in the Belgian Congo, slightly more than one-sixth from mines near Great Bear Lake in Canada, and the remainder from American ores, which in reality were tailings from vanadium refinery operations.

African Sources. At the beginning of the nuclear program in the late 1930s and early 1940s, it was determined that, while there were significant quantities of uranium ore available in Czechoslovakia and Canada, the most important sources, by far, were in the mines of the Belgian Congo. The supplies of ore in the United States were not considered extensive and, with the growing interest in uranium, Germany ceased all sales of the Czechoslovakian ores. As a result of this, plus the German takeover of Belgium and the increased German activity in Africa, the United States, Great Britian, and Canada made an all-out effort to obtain as much of the Belgian Congo ore (pitchblende) as quickly as possible to guarantee adequate supplies of uranium for the war period. Through activities that began in September 1942, the United States was able to purchase all of the above-ground supplies of uranium ore from the Belgian Congo. This included 1,200 tons of ore (65 percent uranium) from African Metals' predecessor, Union Miniere, that had been imported to the United States in 1940 and stored in the Archer-Daniels Midland Company warehouse, Port Richmond, Staten Island, New York, and some 3,000 tons of similar ore still in the Congo. By the end of 1944, the U.S. Army had received approximately 3,700 tons of Congo ore.* The amount of ore being received far exceeded the processing capacity in North America at that time, and the ores had to be stored. The MED used three primary storage areas: Seneca Ordnance Depot, Romulus, New York; Clinton Engineer Works (now Oak Ridge National Laboratory), Clinton, Tennesssee; and Perry Warehouse (Middlesex Sampling Plant), Middlesex, New Jersey. The Perry Warehouse also became a sampling, weighing, and assaying facility.

The MED contracts with African Metals, Inc., involved only the recoverable uranium oxide (U_3O_8 black oxide**) in the ore. African Metals maintained ownership of the residue or tailings that contained radium and other precious metals. As a result, it was necessary for the MED to establish weighing and assaying operations. Initially, the weighing and assaying were performed at contractor facilities; however, in November 1943, the MED set up a separate sampling program at the Perry Warehouse.

*By the end of 1946, MED had contracted for approximately 3,800 tons of U_3O_8 from over 29,000 tons of African ore containing from 5 to 65 percent uranium oxide.

**The various steps of the uranium recovery and refining process produced various concentrations and compounds of uranium oxide, which were generally referred to by their color and chemical state.

The weighing and assaying of the ore samples were performed for the Federal Government by Lucius Pitkin, New York, New York; Frick Chemical Laboratory, Princeton University, Princeton, New Jersey; and the National Bureau of Standards (NBS), Washington, D.C. Weighing and assaying for African Metals, Inc., were performed by Ledoux and Company, New York, New York.

Following weighing and assaying, the ore was shipped to the various refineries to be processed to black oxide or sodium diuranate concentrates. Because the tailings were owned by African Metals, Inc., the MED was required to store the residues from these operations until they could be returned to the owner. These residues from ores containing greater than 10 percent U_3O_8 were stored at the Clinton Engineer Works or the Perry Warehouse before return shipment. Residues from ores containing less than 10 percent U_3O_8 were stored at the Lake Ontario Ordnance Works (LOOW). Some of this residue was returned to African Metals and some is still at U.S. storage sites.*

Canadian Sources. Negotiations to obtain Canadian ore were begun in 1942 with Eldorado Gold Mines, Ltd., (later Eldorado Mining and Refining, Ltd.). The Eldorado Gold Mines, Ltd., mined uranium ore at their Great Bear Lake mine and refined the Canadian ore at their facility at Port Hope, Ontario. By 1944, about 400 tons of the oxide had been produced and enough Canadian ore had been mined to produce an additional 500 tons of the oxide. By 1946, over 4,000 tons of ore concentrate containing over 1,100 tons of U_3O_8 in the form of black oxide had been delivered to the MED. Because the Canadian ore was processed to black oxide at the Eldorado facility and the entire concentrate was sold to the MED, no weighing and assaying program was set up for the Canadian ore.

Domestic Sources. Most of the uranium in the United States was in carnotite ores on the Colorado plateau, but the high-grade deposits had already been mined earlier primarily for the radium content. The heavy demand for vanadium during the war also created the potential for a practical source of uranium oxide as a by-product of the vanadium processing. However, the tailings from vanadium processing were of such low uranium content that it was necessary to concentrate them at or near the mine prior to their shipment to the processing facilities. The United States Vanadium Corporation's concentrated vanadium tailings were stockpiled at Uravan, Colorado, to produce a sludge containing 15 to 20 percent black uranium oxide. This sludge was transported directly to the Linde Refinery in Tonawanda, New York. The U.S. Vanadium Corporation also had a plant at Durango, Colorado, for processing vanadium tailings and sands to produce a sludge. The output from the Durango and Uravan facilities went to Grand Junction, Colorado,** for processing to "yellow cake" (10 to 15 percent U_3O_8) that, in turn, went to the Linde refinery at Tonawanda, New York.

Concurrent with the U.S. Vanadium Corporation operation, the Vanadium Corporation of America processed American ores for vanadium at its plants in Naturita, Colorado, and Monticello, Utah.** Most of the slimes (50 percent U_3O_8 by weight) from these plants went directly to Vitro Manufacturing Company, Canonsburg, Pennsylvania,

*Some of the African Metals residue that is still in the United States is currently stored at the Feed Materials Production Center, Fernald, Ohio.

**Uranium mills which produced concentrates for MED/AEC programs that are inactive are covered under the Uranium Mill Tailings Radiation Control Act of 1978.

for processing. A portion of the 50-percent slime tailings were sold to the government and processed at the Uravan facility. By the end of 1944, domestic ore production had yielded less than 800 tons of uranium oxide, and, by the end of 1946, over 1,300 tons of uranium oxide had been produced in various concentrations from the domestic sources.

Uranium Processing Operations and End Use. The initial refining operations consisted of mechanical grinding and crushing of the ores to a sandy material. Acid was used to dissolve and, hence, extract the uranium. The acid extract was treated with other chemicals to precipitate the majority of impurities, and the product was further treated to precipitate the uranium. A final roasting and drying operation produced a black oxide (U_3O_8) or sodium diuranate ($Na_2U_2O_7$) concentrate.

During World War II, the ores were refined to black oxides at the facilities of Linde and Eldorado. Vitro (at Canonsburg) refined the ores to produce sodium diuranate. Following the war, Mallinckrodt Chemical Co., Inc., also produced black oxide at its facilities in St. Louis, Missouri, and later at the AEC Weldon Spring Chemical Plant.

Black oxide and sodium diuranate were further refined to orange oxide (UO_3) at the Mallinckrodt Chemical Company plant, St. Louis, Missouri, and by E.I. du Pont de Nemours and Company, Deepwater, New Jersey.

At the du Pont plant, brown oxide (UO_2) was made from black oxide and from uranium peroxide ($UO_4 2H_2O$) obtained from uranium scrap processing. About one-half of the du Pont output was from scrap and by-product material. Brown oxide was also produced by Harshaw Chemical Company (Cleveland, Ohio), Linde, and Mallinckrodt. Brown and orange oxide were in turn refined into green salt (UF_4) by du Pont, Harshaw, Mallinckrodt, and Linde.*

Harshaw made uranium hexafluoride for the thermal diffusion and gaseous diffusion uranium-235 separation projects. The green salt was used mainly in metal manufacturing by du Pont; Mallinckrodt; Iowa State College (now University), Ames, Iowa; Westinghouse, Bloomfield, New Jersey; Brush Laboratories, Cleveland, Ohio; and Electromet, Niagara Falls, New York. Scrap metal recovery operations were conducted at Metal Hydrides, Inc., Beverly, Massachusetts, and Iowa State College.

Uranium metals in the form of powder were also produced directly from uranium oxides instead of green salt by Metal Hydrides. The metals manufactured by these various companies were then shipped to the Hanford Site at Richland, Washington, for use in plutonium production. The plutonium produced at Hanford was then shipped to Los Alamos for use in the weapons development program.

Quality control of various processes in the ore/metal production chain was performed by the University of Chicago, Metallurgy Laboratory, Chicago, Illinois; Princeton University, Princeton, New Jersey; Massachusetts Institute of Technology, Cambridge, Massachusetts; and the National Bureau of Standards, Washington, D.C.

*Following the war and after the construction of the Weldon Spring Chemical Plant, much of the AEC uranium-conversion operations were centralized and transferred to Weldon Spring under Mallinckrodt and the Feed Materials Processing Center at Fernald, Ohio, under the National Lead Company of Ohio. The latter is currently the center for uranium-conversion operations.

Activities following World War II broadened in scope. The AEC entered into a number of research, development, and production contracts to recover uranium as by-products of certain industrial processes such as phosphoric acid production. In addition, contracts were terminated or established as product needs and research needs varied.

In addition to the actual contractor-owned facilities, a number of offsite storage locations were used such as landfills for disposal of low-level contaminated soil and waste from the uranium-ore-handling operations. Examples include the St. Louis Airport Storage Site, where residue from the Mallinckrodt AEC Operations were deposited; the former Haist property, Tonawanda, New York, where material from the Linde AEC operations was deposited; the Burrell Township-Pennsylvania Railroad Landfill, where Vitro Corporation deposited residues from Canonsburg; and the Middlesex Municipal Landfill, Middlesex, New Jersey, where residues were deposited during construction activities at the Middlesex Sampling Plant. Some private properties in Middlesex also became contaminated inadvertently as a result of radionuclide migration.

The companies and locations discussed in this report were identified during the records review of the MED history conducted under the FUSRAP activities.

Thorium Operations. Operations with thorium after the war were similar to the uranium operations, but were conducted on a smaller scale. The first major research for the MED on thorium was begun early in 1946 with the procurement of thorium salt for a research project at Iowa State College. The thorium salts were supplied by Lindsay Light and Chemical Company, which was the major supplier through most of the early years of the program.* Lindsay Light and Chemical Company first received thorium from Germany and later processed monazite ores from India and Brazil. In later years, processing of monazite and other ores for the AEC was accomplished by other industrial firms such as the Davison Chemical Division of the W. R. Grace Company, Curtis Bay, Maryland; Dow Chemical Company, Walnut Creek, California; and by Iowa State College. Extractive research, metal production and handling, and research and development for both uranium and thorium was conducted at a number of companies including Mallinckrodt, Simonds Saw and Steel, Lockport, New York; Sylvania Corning Nuclear Corporation, Bayside, New York; Battelle Columbus Division, Columbus, Ohio; Brush Beryllium Company, Cleveland, Ohio; and Horizons Metal Inc., Cleveland, Ohio.

The National Bureau of Standards was involved in quality control for the thorium programs, and the Middlesex Sampling Plant was used for storage of some thorium. A major objective of the DOE FUSRAP effort currently underway is to ensure that all of the thorium sites have been identified and surveyed for radiological conditions. More in-depth record searches and personal communications with former AEC employees are also being conducted.

3.0 Current Standards

Throughout this report and in the site summary reports in Appendix A, reference is made to "established standards" and current guidelines for contamination and exposure levels. These standards/guidelines are as follows:

*Lindsay Light and Chemical Company was using thorium for gas mantles, catalysts, and electron tube cathodes prior to nuclear applications. Remedial action activities at this site and associated properties are being undertaken by the State of Illinois and Kerr-McGee Chemical Corporation, with assistance from the Nuclear Regulatory Commission (NRC).

- Surface Contamination

  "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for By-product, Source or Special Nuclear Material," by the USNRC, November 1976.

  The NRC Decontamination Guidelines present alpha and beta-gamma limits for surface contamination for both fixed and transferable contamination, dependent on the mixture of nuclides present.

- Radon Daughter Products and External Gamma Radiation Exposure

  A regulation based on the Surgeon General's Guidelines, "Grand Junction Remedial Action Criteria," 41FR56, 777-56, 778, December 30, 1976.

  In 1972, Congress passed P.L. 92-314 that provided remedial action in the community of Grand Junction, Colorado. Regulations implementing that law were issued by the AEC, then ERDA, as 10CFR712. P.L. 92-314 was later extended by P.L. 95-236.

  In all cases, the most restrictive guideline (that for schools or dwellings) has been used. However, it should be noted that on several of the sites where the contamination is associated with an industrial building rather than with the soil, little likelihood exists of the site being used for these more restrictive purposes.

- Air and Water Concentrations

  10CFR20, Appendix B, Table II presents, by nuclide, concentration limits in both water and air for the general public. The value of the most restrictive form, either soluble or insoluble, has been used.

The EPA has proposed regulations for private uranium mill tailing sites: 40CFR192, "Interim Cleanup Standards" and "Final Cleanup Standards for Inactive Uranium Mill Tailing Sites," 45FR27366. These standards cover cleanup of open lands and contaminated buildings associated with these sites.

4.0 Legislative Authority

Current Authority

Pursuant to the First War Powers Act of 1941 and the Atomic Energy Acts of 1946 and 1954, as amended the MED and its successor, the AEC, conducted during the 1940s and 1950s a program involving research, development, processing, and production of uranium and thorium. This program also included the storage of radioactive ores and processing residues, e.g., mill tailings. Virtually all of this work was performed by private contractors for the government on land that was either federally, privately, or institutionally owned.

Due to the urgency and magnitude of the early nuclear materials programs and the limited knowledge available regarding the radioactive characteristics of uranium ore and residual material from its processing, many of these sites became contaminated with radioactivity as a result of work done for the government.

In several western states, uranium mill tailings (a waste product of the uranium mill processing operations that was not subject to regulation by the government) accumulated in large piles and contaminated private adjacent and vicinity properties by migration. In some instances, these tailings were also used as fill and construction material in various construction work in the communities. The presence of these tailings containing radium caused radon gas to collect in dwellings and in many cases produced unacceptable exposure to occupants. The government had no statutory authority to take remedial action; however, out of a sense of moral responsibility toward the affected homeowners, the Congress in 1972 passed P.L. 92-314 that provided for remedial action in the community of Grand Junction, Colorado. Regulations implementing that law were issued by the AEC and then by ERDA as 10 CFR 712. P.L. 92-314 was later extended by P.L. 95-236. Additional extensions of this program have been authorized and will be sought as needed in the annual DOE budget authorization and appropriation requests.

In 1978, Congress passed the Uranium Mill Tailings Radiation Control Act (P.L. 95-604) under which the DOE was authorized to enter into cooperative agreements with various states for undertaking remedial actions at certain designated inactive former uranium mill processing facilities in the United States. The scope of this Act was very narrowly drawn to cover, under section 101(6), the sites designated in the Act and any other former processing sites and contaminated nearby properties at which substantially all of the uranium was produced for sale to the United States Government. None of the FUSRAP sites could qualify under this definition because the uranium and thorium processed at these sites were generally owned by the government. Excluded from coverage under the Act are those sites owned or controlled as of January 1, 1978 or thereafter by a Federal agency, or under active NRC or Agreement-State license. The legislative history made it clear that this Act was not to set a precedent for the DOE to undertake other waste management remedial action programs. Pursuant to that Act, the EPA Administrator was authorized and directed to develop environmental and health standards for uranium mill tailings contamination covered by the Act.

The FUSRAP program formally began in 1974. Radiological surveys and other research work have been conducted by the AEC and its successors, the ERDA and the DOE, under the implied authority of the Atomic Energy Act of 1954, as amended. The intent of Congress, as expressed in the FY 1978 DOE Authorization Act was that, at the completion of this program, the DOE would seek additional legislative authority, pursuant to a Congressional review of findings, for the undertaking of any required remedial action work.

A survey of existing statutory authority shows that pursuant to the Atomic Energy Act of 1954, as amended, the AEC was directed to protect public health and safety during the research and production operations. In the case of those operations over which the government exercised ownership or control, the DOE's existing authority has been interpreted to include the implied authority to decontaminate such sites through remedial actions undertaken at the conclusion of contract work. Accordingly, the DOE has undertaken remedial action efforts at the Kellex site in Jersey City, New Jersey, and in Middlesex, New Jersey. However, the absence of sufficient contractual, property, or other historical records (as a result of records retention schedules and limitations) has prevented final determination of the extent of government involvement in, and implied remedial action authority over, many of the sites. In addition, explicit contractual language and/or notations in deeds under which the United States is relieved from all contractual liability raises the issue as to whether, without the proposed legislation, the government has any continuing financial or other responsibility with respect to these properties.

Existing statutory authority has been reviewed by the DOE, in addition to all available contract, property records and other files, to determine the extent to which the DOE could exercise its existing authority under the Atomic Energy Act of 1954, as amended, to perform remedial action work under the FUSRAP program. As part of this study, consideration was given to the extent to which the MED and the AEC would have been contractually responsible for the costs of decontamination, and whether the contractors and/or property transferees involved recognized the presence of the contamination when they closed out their contracts with the United States Government. This review has shown that authorization exists for remedial action at 10 sites.

Unlike the uranium mill tailings sites, none of the FUSRAP facilities were at any time licensed for conducting the MED/AEC activities because many were either in operation before licensing requirements were established or were excluded from the licensing requirements pursuant to Section 110 of the Atomic Energy Act of 1954, as amended. Three sites, Gilman Hall at the University of California, Berkeley, California; Linde Air Products at Tonawanda, New York; and the University of Chicago, are currently licensed under the NRC or the Agreement State provisions of the Atomic Energy Act of 1954, as amended, and are excluded from the FUSRAP remedial action because the NRC or the Agreement State has sufficient licensing authority to protect public health and safety.

Legislative authority will be required to clarify the DOE's authority for remedial action at 18 of the FUSRAP sites discussed in this report and for the location and acquisition of disposal sites.

The EPA is responsible for establishing radiological standards of general applicability for properties released for unrestricted use; the NRC has responsibility for establishing criteria and standards for restricted use sites that would be licensed. The NRC criteria would be basically modeled after 10CFR40 Appendix A, proposed regulations for licensed active uranium mill tailings sites.

New Authority Needed

Broader authority is needed to conduct remedial action at the formerly utilized MED/AEC sites that are determined by established criteria to pose a potential threat to the public or to the environment because of their radiological contamination. The new authority should include any location where the MED or the AEC activities resulted in residual contamination exceeding established standards, including associated properties that became contaminated from these activities. Sites that are licensed by the NRC or by an Agreement State under Section 274 of the Atomic Energy Act of 1954, as amended, should be excluded from the authorization.

The authority would not include sites currently owned or leased by the DOE since no clarification of authority is needed for these sites. However, new authority is needed for the DOE to perform remedial actions at three properties that were formerly owned or leased by the Federal Government. These properties* were transferred to the present owners by quitclaim deeds or other documents under which the present owners released the Federal government from all responsibility for claims relating to the presence of the residual radioactive material. These sites are being included in the scope of the FUSRAP in order to expedite cleanup and to provide for the long-term

*St. Louis Airport storage site, Palos Park Forest Preserve, and Ashland Oil Company.

Federal management at the site, or at new federally owned disposal sites. This approach is consistent with the recommendations of the Interagency Review Group on Nuclear Waste Management.

In addition to the formerly utilized MED/AEC sites, there are other contaminated sites that were used for processing and using of radium-containing ores. At some of these sites, work was performed for the Federal Government. Authority is needed to identify and conduct radiological surveys at all such sites known to contain radioactive material above background levels that resulted from the processing of uranium or thorium ores and/or their daughter products, including radium, for the purpose of informing Congress of the extent of contamination and of the estimated cost for remedial action.

Under the existing and proposed new authority, radiological conditions at the MED/AEC sites would be assessed, relative priorities established on the basis of the potential health hazard, and determination made to conduct remedial action if present site conditions or possible unrestricted future use would constitute a risk to the public. Restitution to the Federal Government for the costs of remedial action would be provided for if the identity of any person having legal responsibility to clean up a site could be determined. Currently, the DOE is contacting those parties it has reason to believe could be shown to be legally responsible for remedial action at a site, to secure their agreement to undertake clean-up operations, or for the reimbursement of expenses that may be incurred by the DOE for remedial actions.

For the states containing MED/AEC sites, the DOE Secretary would consult with the state to determine whether it is unreasonable to remove sufficient contaminated material from the site to release it for unrestricted use, or whether residual radioactive material could be stabilized onsite as a permanent disposition action. Initially, the DOE would acquire the MED/AEC sites for remedial action purposes and to minimize health effects or to prevent windfall profits. Any property acquired or dedicated for use as a permanent disposal site would be licensed by the NRC. Affected states in which radioactive contaminated sites are located would be responsible for locating suitable disposal sites for the residual radioactive material; initially, the DOE would acquire this property. The disposal sites could be transferred to the state by agreement to accept ownership and custodial responsibilities. The DOE would have authority to provide financial support to the state in carrying out the custodial responsibilities.

The EPA Administrator would be authorized, in consultation with the DOE Secretary, to develop health and environmental standards of general applicability for residual radioactive materials at formerly utilized sites that are to be released for unrestricted use. These general standards would supplement and be consistent with standards established by the Administrator under the Uranium Mill Tailings Radiation Control Act of 1978. Where such standards do not exist, the Administrator would be required to promulgate the needed standards within a specified time.

The DOE Secretary, in consultation with the EPA Administrator, could promulgate remedial action standards for each site at which the Secretary determines it is necessary to begin remedial action before the Administrator promulgates standards of general application.

The DOE has proposed legislation to provide the needed authority. This proposed legislation is under review by other Federal agencies and the Office of Management and Budget.

5.0 FUSRAP Program Description

Objectives of Remedial Action

The objectives of the FUSRAP are to:

- Identify former MED/AEC sites
- Characterize their radiological condition
- Decontaminate sites as required and pursuant to authorization and appropriation by Congress
- Develop acceptable disposal and stabilization sites in consultation with the affected states, and ultimately
- Certify the acceptability of the sites for future use.

The effort to accomplish the first two of these objectives has been initiated. The authority sought under the legislation proposed by the DOE is necessary in most cases to accomplish the remaining objectives.

Scope and Problem Definition

The scope of the FUSRAP program is confined to those MED/AEC sites that were formerly under contract to, or owned by, the government and were involved in the handling, processing, and storage of radioactive materials. The materials processed consisted primarily of pitchblende and carnotite ores, and other materials from which uranium and thorium were recovered as products. The products of the processing included uranium and thorium metals and compounds. Waste by-products were also produced that generally contained low levels of radioactivity due to residual quantities of uranium, thorium, and their radioactive decay products. In some cases, these contaminants have migrated offsite. Radium contamination is a major concern because it decays to a radioactive gas, radon, that diffuses into the air and can be inhaled. Furthermore, the radon decays to radioactive solid materials that can also be inhaled or ingested.

Also included in the sites discussed in this report are Palos Park, Illinois, where the remains of two research reactors are buried; Chupadera Mesa, New Mexico, which is near the location of the Trinity atom bomb test; and two other sites at Los Alamos, New Mexico, involved in the nuclear weapons development program. At the Palos Park site, the primary contaminant of concern appears to be tritium. At the sites involved in weapons development, plutonium and other nuclides such as uranium-235 and strontium-90 are of concern.

Approach to Remedial Action

Consistent with the objectives of the FUSRAP, sites are being identified by searching through the MED/AEC records and by publishing press releases asking for public assistance in identifying the sites. After a site has been identified, it is assigned to one of the DOE national laboratories whose responsibility is to assess the site's radiological condition. This is accomplished by performing a records search, reviewing old radiological survey documents, and performing radiological surveys as required. A series of engineering studies and environmental reports, including those prescribed by the National Environmental Policy Act (NEPA), will be prepared to evaluate remedial action alternatives. After the evaluation of the alternatives, appropriate measures (remedial actions) will be selected and implemented, and the resulting contaminated wastes will be disposed of in a manner that ensures public safety and compliance with

the provisions of the Atomic Energy Act of 1954, as amended, and related NRC or Agreement State licensing requirements. In some cases, the residual radioactivity will be stabilized onsite in accordance with the provisions of a license from the NRC or Agreement State. When a site is decontaminated sufficiently to comply with the EPA standards for unrestricted use, it will be certified for release by the DOE. During the course of the investigation, the public will be informed, through press releases for example, of the nature of the MED/AEC work done at the site, the contamination potential, survey results, and remedial actions undertaken. Detailed reports of the survey findings will also be published by the DOE and, upon request, will be available to the public for a nominal fee.

The approach to identification and eventual correction of radiological contamination at the MED/AEC sites or adjacent properties is dependent upon institutional issues which, in turn, impact the steps of the generic program plan for the FUSRAP.

Institutional Issues. Three paramount issues must be addressed and solutions defined before remedial actions as outlined in the generic FUSRAP plan can be implemented:

- Legislative authority must be established by which the Federal Government (DOE) can act to correct problems of radiological contamination at formerly utilized sites. Although the DOE has implied authority at some sites, a large number of sites will require additional legislative authority.

- Radiological criteria must be developed for use as guidelines to determine the extent of decontamination required at each site, to determine if a radiological problem exists, and to establish standards for unrestricted use.

- Disposal sites must be developed for ultimate disposal of contaminated material that is removed from the MED/AEC sites.

Sequence of Events Leading to Remedial Action. Although each formerly utilized site will have certain site-specific characteristics, a general sequence of events can be outlined leading to the ultimate program objective, which is to preclude any future radiological problems at formerly utilized sites from previous MED/AEC activities.

Figure 1 is a schematic presentation of the basic steps involved in the remedial action program. Step 2 determines which sites need remedial action. Sites needing remedial action must be addressed in each of the following steps. If no remedial action is necessary, only Steps 1, 2, and 8 are required. A brief discussion of each step follows.

Step 1, Site Identification - The overall objective of this step is to identify and locate all candidate sites and to determine if any actions are required under the FUSRAP.

The activities include a records search and review of information submitted by the public or industry in response to specific requests. When a site is identified as having been exposed to radioactive materials under the MED/AEC activities, a records search will be initiated to determine the radiological condition of the site. If there is adequate documentation that indicates the site is not contaminated, the site will be certified as clean and no further action will be required. If the documentation or records are inadequate or indicate the site may be contaminated, survey efforts to determine or verify the radiological condition of the site will be initiated. These activities will be performed by the ASEV.

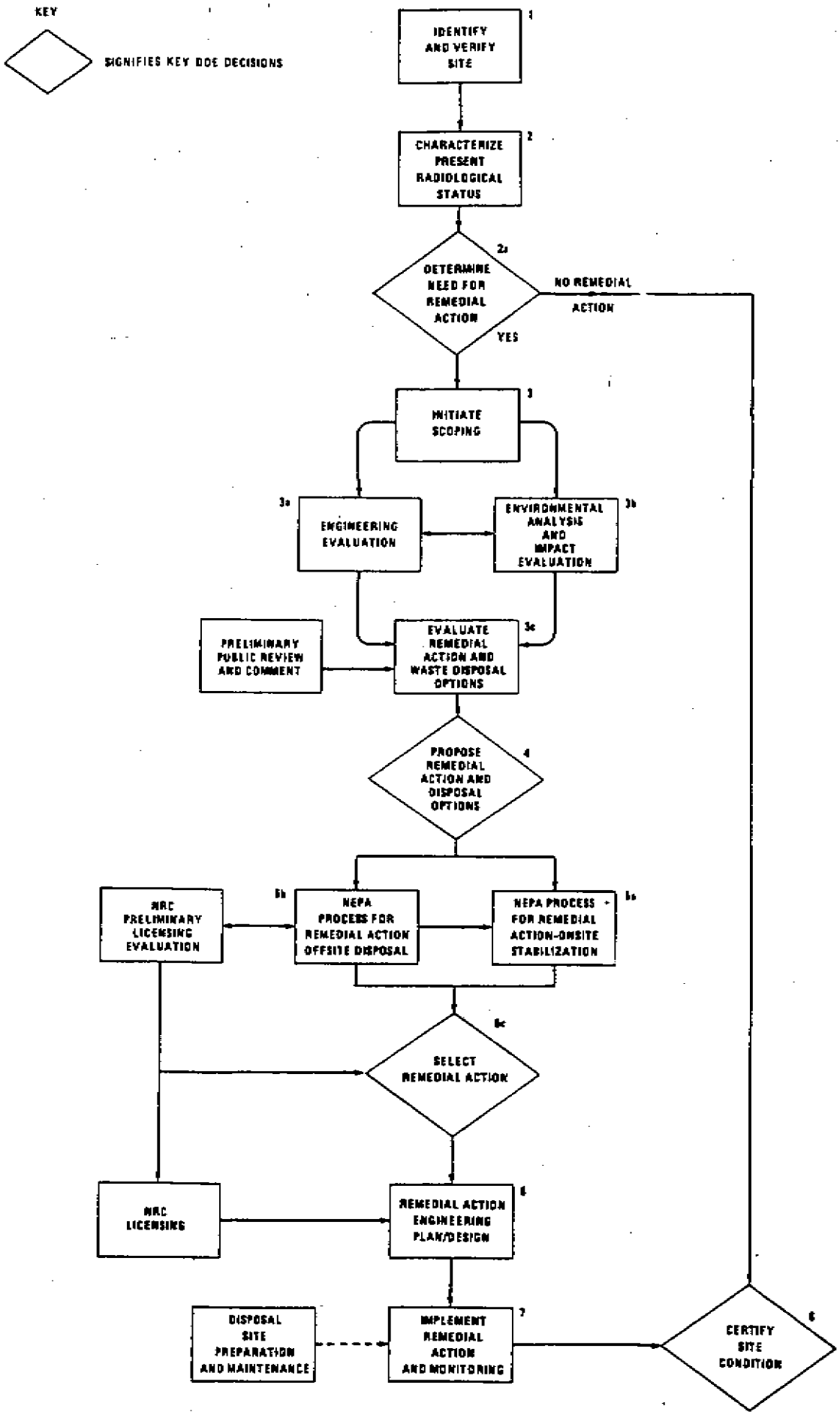


Figure 1. Formerly Utilized Sites — Basic Steps Involved in the Remedial Action Program

A large portion of this step in the FUSRAP is complete. An effort has also been initiated to identify the disposition of equipment that may have been removed from the FUSRAP sites and also to identify the subcontractors to the MED/AEC contractors. One concern is the location of material and equipment that was removed as part of the earlier AEC decontamination efforts.

Step 2, Radiological Survey - The purpose of this step is to characterize the current radiological condition of those sites determined in the preceding step to require a radiological survey. A plan for the radiological survey of a specific site will be prepared, taking into account the past and current activities at the site and associated radioactive material and potential contamination. The extent of the effort associated with a specific site survey will depend on the data available. In some cases, earlier survey reports exist and only supplemental information is required to characterize the site; in other cases, no data are available and a radiological survey is required. The elements that make up the complete radiological survey include the following:

- Measurements of fixed and transferable alpha and beta-gamma radiation on buildings and equipment surfaces
- Gamma-ray exposure rates
- Beta-gamma exposure rates
- Alpha exposure rates
- Radionuclide contamination in surface water and groundwater
- Radionuclide contamination in building drains and associated components
- Radionuclide contamination in underground drains and surface drainageways
- Surface and subsurface deposits of radioactive material
- Radionuclide concentrations in air
- Radionuclide concentrations in vegetation samples.

These activities will be performed by the ASEV.

In order to place all measurements and results in the proper perspective with the surrounding area, measurements of a similar nature will be performed in areas not affected by the former MED/AEC activities. These results will be used to represent the natural background radiation of the area. Aerial radiometric surveys will also be performed in support of the radiological assessment, independent of the ground-level radiological survey. The most important result from this effort will be the identification of any unknown offsite contamination. If the aerial survey indicates the presence of contamination not previously detected, the new area will be surveyed from the ground.

When the field work is complete, a survey report that characterizes the radiological condition of the site will be prepared. The report or report supplement will also include, for contaminated sites, an evaluation of radiation exposures to man from known radiation exposure pathways at the site. This evaluation will outline the levels of radioactivity and extent to which humans could be exposed in the course of normal site activity. These levels will be compared to levels of exposure received from normal background sources of radiation to place the exposure in perspective. The evaluations will be prepared on the basis of the conditions at the site during the radiological survey. In cases where the possibility of radiation exposure above background levels is identified, either summaries or the complete report will be submitted to appropriate state regulatory authorities, the EPA, and the NRC.

Upon public release of the report, or before, meetings will be held with affected property owners and concerned agencies to explain the results of the survey and the future DOE plans for action. Press releases will also be used to inform the public and provide an accurate basis for understanding the results of the radiological survey.

Step 2a, Determine the Need for Remedial Action - The radiological status report will be reviewed and will provide the basis for a determination by the DOE as to whether remedial action is required to remove or reduce residual radioactive materials to levels that conform to the applicable EPA, NRC, or DOE standards, including those to be developed pursuant to the proposed legislation. This determination will be performed by the ASEV and provided to the ASNE, who will be responsible for accomplishing the remedial action.

Step 3, Initiate Scoping - The purpose of this step is to begin the process of identifying the specific alternative remedial actions to be examined and, as appropriate, the candidate disposal sites. This step will involve interactions with the affected state and local authorities, the EPA, the NRC, and other appropriate agencies. The principle issues to be examined will be identified, and the responsibilities, schedule, and appropriate interfaces for conducting the necessary studies will be agreed upon. A key output is for the state to identify candidate disposal sites for subsequent study during the engineering and environmental evaluation. To obtain this information, the DOE would work with the states and support screening studies. Two disposal options will generally be evaluated: a permanent disposal site within the state where the wastes are generated, and a regional disposal site for remedial action wastes from states within the region. Regional sites that could satisfy the needs of several states is a preferred option to minimize the number of disposal sites.

Step 3a, Engineering Evaluation - Engineering evaluations will be required only for those sites for which radioactivity is found to exceed the established health and safety guidelines (e.g., see section 3.0) and/or the standards to be developed. The engineering evaluation will include assessment of existing conditions for the site as well as surrounding properties. The scope of the effort will include the following:

- Verification of property ownership
- Preparation of descriptive maps and site plans
- Analysis of radiological surveys to determine decontamination requirements and identify and collect any supplemental data needed for a sound engineering evaluation of remedial action options
- Performance of an engineering assessment of the decontamination or demolition of structures
- Engineering evaluation of removal, transport, interim storage, and permanent disposal options for contaminated soil, structures, debris, and other materials
- Evaluation of suitable means of stabilizing residual radioactivity, where appropriate, including investigation of pertinent aspects of site geology, hydrology, and meteorology
- Analysis of alternative remedial action options including preliminary project plans for the remedial action and disposal sites, specifications, and cost estimates
- Preparation of summary reports.

Step 3b, Environmental Analysis - The objective of the environmental analysis is to provide an environmental evaluation of the remedial action options covered by the engineering evaluation. The analysis will discuss the environmental impacts of the

present condition of the site, stabilization of the material onsite and/or decontamination of the site, and removal of the material to a temporary storage or to a disposal site. This analysis will provide a basis for determining whether a major Federal action is involved that may require the preparation of an environmental impact assessment or impact statement conforming to the requirements of the NEPA. Environmental analysis and comments on the analysis will be used as input to support decisions regarding the need for the NEPA process. The analysis will include a review of the impacts of the options during and after any remedial action and will cover the full scope of environmental concerns as well as radiological effects.

Step 3c, Evaluate Remedial Action and Waste Disposal Options - The engineering evaluation and environmental analysis produced in Steps 3a and 3b above will be evaluated by the DOE to identify the preferred option and reasonable alternatives. In this step, the DOE will advise the appropriate Federal, state, local agencies, and the public of the results of the preliminary engineering evaluation, the environmental analysis, and the DOE conclusions regarding the preferred option and reasonable alternatives. The DOE will seek their preliminary reviews and comments.

The risks, benefits, and costs of each remedial action and disposal option will be considered in the selection of the proposed remedial action. Factors affecting the remedial action, including environmental issues, technical issues, and public opinion, will be considered in the risk, benefit, and cost analyses. In selecting or proposing remedial action, emphasis will be given to determining the most practical and expedient means to eliminate or limit exposure to the public. If it is determined that material must be moved and no permanent disposal site is available at the time of the implementation of an action, the alternative of moving the contaminated material and stabilizing it at an interim storage site located at or near the contaminated site will be examined. It is assumed that the DOE will have ownership and maintenance responsibilities for all stabilized sites, interim storage sites, and permanent disposal sites except where the affected states agree to accept ownership and custodial responsibilities. It is also assumed that the stabilized sites, temporary storage sites, and the permanent disposal sites will be licensed by the NRC and will meet the relevant criteria of the proposed NRC regulations (basically modeled after 10 CFR 40 Appendix A). On the basis of this interagency and public review, the DOE will develop its proposals for remedial action and waste disposal options.

Step 4, Propose Remedial Action and Disposal Options - The remedial action and disposal option proposed by the DOE Secretary, and the reasonable alternatives will be identified and documented for the conduct of the NEPA process in Steps 5a, 5b, and 5c.

Step 5a, NEPA Process for Remedial Action - Onsite Stabilization - When the remedial action is proposed, the available data will be reviewed to determine if the proposed action is a major Federal action that will have a significant impact on the environment and what NEPA documentation is required. This review will also ensure that the data collected in the environmental analysis cover all environmental issues.

If required, the data developed during the environmental analysis step, along with any additional data required, will be used in the preparation of an environmental impact assessment (EIA) or an environmental impact statement (EIS). The NEPA documentation will be prepared as outlined in the CEQ NEPA Regulations (Title 40 CFR, Parts 1500-1508), the DOE NEPA guidelines (45 FR 20,594-20,701, March 28, 1980), and the DOE Order 5440.1. As noted in Figure 1 and discussed below, the NRC licensing process will be initiated in parallel with this step.

Step 5b, NEPA Process for Remedial Action - Offsite Disposal Options - In this step, the MED/AEC site and the candidate disposal sites that were identified in Step 3 by the affected state in consultation with the DOE, will be evaluated in parallel through the NEPA process to provide the basis for selecting the disposal site. The NEPA process will be conducted as outlined in the CEQ NEPA Regulations (Step 5a). As noted in Figure 1 and discussed below, the NRC licensing process will be initiated in parallel with this step.

Step 5c, Selected Remedial Action - At the conclusion of the NEPA process for both onsite remedial action or offsite disposal, the DOE will issue a Record of Decision announcing the selected remedial action and a decision as to how the radioactive materials will be permanently diposed.

The selection of the disposal site option will take into consideration the preliminary NRC licensing evaluation of the site, as appropriate.

Step 6, Remedial Action Engineering Plan - An engineering plan for the proposed action will be prepared, containing detailed plans and specifications for implementation of the selected remedial action alternative including, as appropriate, at the disposal site. The engineering plan will present detailed cost estimates, work plans, and schedules that define the engineering aspects of the remedial action and will be used to contract for the remedial action.

During this step, a license application for either stabilizing onsite or for offsite disposal will be prepared and submitted to the NRC.

Step 7, Implement Remedial Action and Monitoring - The remedial action contractor will conduct the action in accordance with the contract and as outlined in the engineering plan. Part of this step, where appropriate, will be the preparation of a disposal site. It will also include initiation of the operation, surveillance, and/or maintenance step that will continue as long as the site is used as a repository for these wastes. Independent monitoring by the DOE-ASEV will be conducted during the remedial action, and periodic status reports will be prepared.

Step 8, Certify Site Condition - During and upon completion of the remedial action, radiological surveys will be performed by the DOE-ASEV to verify the effectiveness of the remedial action, and the radiological condition of the site requiring remedial action will be documented. If the surveys verify that the levels of residual radioactive materials meet the established standards for unrestricted use, the site will be released for use without restrictions. If the surveys do not verify that the residual radioactivity meets the levels within the standards for unrestricted use, then further remedial action measures will be prescribed.

To assure control and enforcement of restrictions on "stabilized" sites, ownership by the Federal Government or the state will be required and the sites will be licensed by the NRC or the state. Disposal sites will be treated in a similar fashion. Such controls may permit some beneficial land use, such as making the area into a park where no permanent structures may be constructed, or possibly continuing the use of the site for other regulated nuclear activities. In any case, upon completion of the remedial action, a final report will be prepared documenting the entire remedial action effort and the radiological condition of the site. The final report will also note the quantity of material removed from the site and its disposition. The final report and all supporting documentation will be stored in permanent Federal Government

archives and copies or summary material will be placed in the records of appropriate local and state agencies and recorders offices.

Status of Sites

As a result of the DOE efforts to identify the former MED/AEC sites, investigations to determine the radiological status of over 70 sites were or are being completed. Based on data collected to date, the DOE has determined that 18 sites will require some form of remedial action (as identified in Table 1) and 13 other sites are likely to require remedial action by the DOE.

Table 2 lists the 31 sites being considered and the current status of remedial action as of January 31, 1980. Figure 2 shows the location of these 31 sites. Radiological surveys of uniform character have been conducted at 20 sites, of which 19 reports have been issued in draft and 13 in final form. The remaining 11 sites have been surveyed with less rigor and will require more detailed surveys that are scheduled to be undertaken. Conceptual engineering evaluations have been initiated at five sites with final reports completed for two of those sites. Detailed engineering plans have been initiated at two sites. Remedial action has begun at a number of sites where there is existing DOE authority to conduct such actions. Implied authority for the undertaking of remedial action exists at 13 sites and must be clarified at 18 sites.

Appendix A to this document provides brief information summaries for each site.

6.0 Estimated Costs for Remedial Action Program

Preliminary cost estimates have been developed for remedial action for each MED/AEC site* and are summarized in Table 3, excluding those sites that are licensed by the NRC or Agreement States (Gilman Hall, University of Chicago, and Linde). These estimates are considered to be the upper bound of costs as explained below. Estimated costs for the remedial action program by work phase and by fiscal year are presented in Figure 3. Estimated costs of remedial action by site and by state are presented in Figure 4. The basis for the estimates are decontamination and restoration to unconditional public use using containers for waste transport, rather than bulk carriers and transportation of 500 miles to regional disposal sites.

Key Issues Affecting Costs and Schedule. Major factors influencing the cost of remedial action at the MED/AEC sites are:

- The option chosen for remedial action, either removal of contamination and restoration for unrestricted use by the public or permanent stabilization of existing contamination on the formerly utilized site to minimize exposure of the public with appropriate controls
- Criteria and standards for decontamination or stabilization

*"Formerly Utilized Sites Remedial Action Program - Preliminary Cost Estimates" prepared for USDOE Oak Ridge Operations Office Technical Services Division by Ford, Bacon & Davis Utah Inc., October 1979; and radiological survey, environmental monitoring, and certification cost estimates from the ASEV.

Table 1

MED/AEC SITES FOR WHICH A DETERMINATION
HAS BEEN MADE THAT REMEDIAL ACTION IS REQUIRED*

Site	Health Priority
Ashland Oil Company, Tonawanda, New York	TBD
Bayo Canyon Area, Los Alamos, New Mexico	L
Clecon Metals, Inc., Cleveland, Ohio	M/H
Gilman Hall, University of California, Berkeley, California**	L
Conserv Inc., Nichols, Florida	L/M
E. I. du Pont de Nemours and Company, Deepwater, New Jersey	L
Gardinier, Inc., Tampa, Florida	M
Guterl Special Steel Corporation, Lockport, New York	L
Kellex Research Facility, Jersey City, New Jersey	H
Lake Ontario Ordnance Works Associated Properties, Lewiston, New York	TBD
Linde Air Products, Tonawanda, New York**	L
Mallinckrodt, Inc., St. Louis, Missouri	H
Middlesex Municipal Landfill, Middlesex, New Jersey	L
Middlesex Sampling Plant, Middlesex and Piscataway, New Jersey	H
Palos Park Forest Preserve, Cook County, Illinois	M
St. Louis Airport, St. Louis, Missouri	TBD
Seaway Industrial Park, Tonawanda, New York	TBD
Seneca Army Depot, Romulus, New York	L

Key: L = Low
M = Medium
H = High
TBD = To be determined

*Based upon DOE determinations completed through March 1980; determinations on 13 additional sites are in progress.

**Licensed by Agreement State provisions of the Atomic Energy Act of 1954, as amended, and excluded from FUSRAP; these licenses provide for site decontamination.

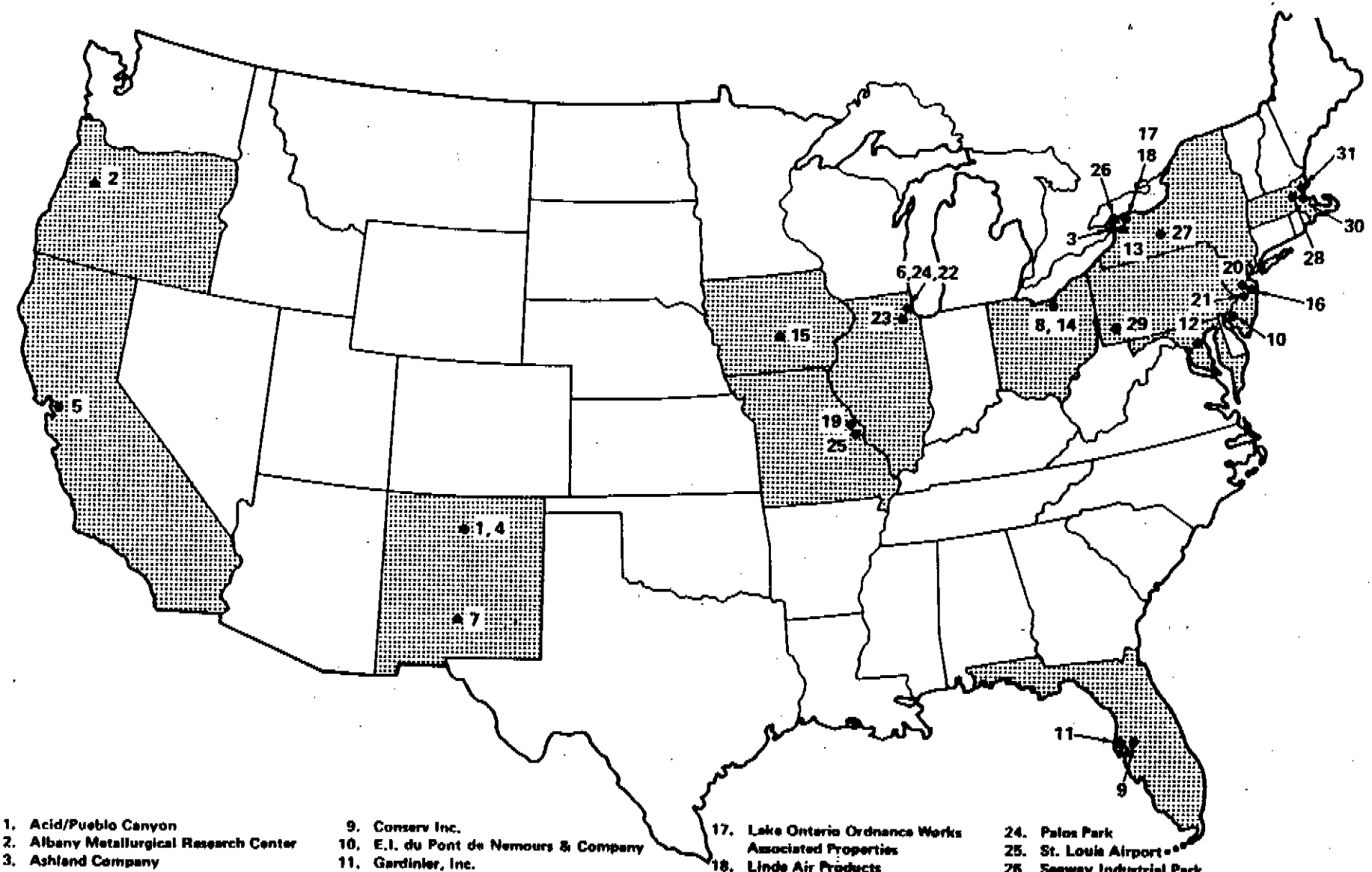
Table 2
Status of Remedial Action at MED/AEC Sites

Name	State	Radiological Survey	Report Draft	Report Final	Title I Eng'r'g Initiated	Title I Eng'r'g Draft	Title I Eng'r'g Final	Title II Eng'r'g Initiated	Title II Eng'r'g Draft	Title II Eng'r'g Final	EIS	Remedial Action Req'd	Remedial Action Underway	Remedial Action Authority Req'd	Remedial Action Authority Exists **
1 Acid Pueblo Canyon	NM				●										●
2 Albany Metallurgical Research Center	OR														●
3 Ashland Oil Company	NY	●	●	●								●		●	
4 Bayo Canyon	NM	●	●	●	●							●			●
5 Gilman Hall, University of California	CA	●										●			*
6 University of Chicago	IL														*
7 Chupadera Mesa	NM				●										●
8 Cleeon Metals, Inc.	OH	●	●	●								●		●	
9 Convery Inc.	FL	●	●	●								●		●	
10 E.I. du Pont de Nemours & Company	NJ	●	●	●								●			●
11 Gardinier, Inc.	FL	●	●									●		●	
12 W. R. Grace & Company	MD													***	
13 Guterl Steel Corp.	NY	●	●	●								●		●	
14 Harshaw Chemical Company	OH													●	
15 Iowa State University	IA													●	
16 Kellex	NJ	●	●					●				●	●		●
17 Lake Ontario Ordnance Works Associated Properties	NY											●			●
18 Linde Air Products	NY	●	●	●								●			*
19 Mallinckrodt, Inc.	MO	●	●									●		●	
20 Middlesex Landfill	NJ	●	●		●	●	●					●			●
21 Middlesex Sampling Plant	NJ	●	●	●	●	●	●	●				●			●
22 National Guard Armory	IL	●	●											●	
23 Olin Chemical Company	IL	●	●	●										●	
24 Palos Park	IL	●	●	●								●		●	
25 St. Louis Airport	MO	●	●	●								●		●	
26 Seaway Industrial Park	NY	●	●	●								●		●	
27 Seneca Army Depot	NY	●	●	●								●			●
28 Shpack Landfill	MA													***	
29 Universal Cyclops, Inc.	PA	●	●											●	
30 Ventron Corporation	MA													●	
31 Watertown Arsenal	MA													●	
Totals		20	19	13	5	2	2	2				18	1	18	13

* These sites have been deleted from the FUSRAP because the NRC or Agreements States have sufficent licensing authority to protect public health and safety.

** Remedial Action authority exists where such action is required to protect public health and safety.

*** determination as to whether additional authority is required to implement remedial action rently underway.



1. Acid/Pueblo Canyon
2. Albany Metallurgical Research Center
3. Ashland Company
4. Bayo Canyon
5. University of California
6. University of Chicago
7. Chupadera Mesa
8. Cleon Metals, Inc.
9. Conserv Inc.
10. E.I. du Pont de Nemours & Company
11. Gardinier, Inc.
12. W. R. Grace & Company
13. Guterl Steel Corp.
14. Harshaw Chemical Company
15. Iowa State University
16. Kellex
17. Lake Ontario Ordnance Works Associated Properties
18. Linde Air Products
19. Mallinckrodt, Inc.
20. Middlesex Landfill
21. Middlesex Sampling Plant
22. National Guard Armory
23. Olin Chemical Company
24. Palos Park
25. St. Louis Airport
26. Seaway Industrial Park
27. Seneca Army Depot
28. Shpak Landfill
29. Universal Cyclops, Inc.
30. Ventron Corporation
31. Watertown Arsenal

Figure 2 Location of Sites Requiring or that May Require Remedial Action

Table 3
ESTIMATES OF REMEDIAL ACTION COSTS BY MED/AEC SITE*

Acid/Pueblo Canyon Area, Los Alamos, New Mexico	$ 1,900,000
Albany Metallurgical Research Center, Albany, Oregon	3,000,000
Ashland Oil Company, Tonawanda, New York	29,000,000
Bayo Canyon Area, Los Alamos, New Mexico	2,800,000
Chupadera Mesa Area, White Sands Missile Range, New Mexico	180,000
Clecon Metals, Inc., Cleveland, Ohio	2,400,000
Conserv Inc., Nichols, Florida	660,000
E. I. du Pont de Nemours and Company, Deepwater, New Jersey	3,000,000
Gardinier, Inc., Tampa, Florida	2,300,000
W. R. Grace & Company, Curtis Bay, Maryland	17,000,000
Guterl Special Steel Corporation, Lockport, New York	1,100,000
Harshaw Chemical Company, Cleveland, Ohio	9,000,000
Iowa State University, Ames, Iowa	570,000
Kellex Research Facility, Jersey City, New Jersey	1,400,000
Lake Ontario Ordnance Works Associated Properties, Lewiston, New York	3,000,000
Mallinckrodt, Inc., St. Louis, Missouri	26,000,000
Middlesex Municipal Landfill, Middlesex, New Jersey	50,000,000
Middlesex Sampling Plant, Middlesex and Piscataway, New Jersey	48,000,000
National Guard Armory, Chicago, Illinois	710,000
Olin Corporation, Joliet, Illinois	680,000
Palos Park Forest Preserve, Cook County, Illinois	7,100,000
St. Louis Airport, St. Louis, Missouri	98,000,000
Seaway Industrial Park, Tonawanda, New York	24,000,000
Seneca Army Depot, Romulus, New York	860,000
Shpack Landfill, Norton, Massachusetts	2,200,000
Universal Cyclops, Inc., Aliquippa, Pennsylvania	1,000,000
Ventron Corporation, Beverly, Massachusetts	880,000
Watertown Arsenal, Watertown, Massachusetts	630,000
	$338,000,000

*Upper boundary of costs for removal and disposal option.

Figure 3 Work Schedule and Funding Requirements for Remedial Action at MED/AEC Sites

Work Activities	Work Schedule by Fiscal Year										Estimated Costs
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	
1. Radiological Characterization, Environmental Monitoring, Certification & Overview											$ 22,700,000
2. Engineering Analyses, Design, and Support											12,200,000
3. Environmental Analyses, Assessments, and Support											13,100,000
4. Decontamination and Residue Retrieval											49,000,000
5. Containerization of Residues											60,900,000
6. Transportation of Residues											48,000,000
7. Disposal of Residues											91,000,000
8. Contingency (15% of Sum of Items 2-7)											41,100,000
Total											$338,000,000

NOTE: Estimate based on retrieving containerizing, transporting, and disposal of an estimated 500,000 cubic yards of soil and rubble at the following average unit costs ($/cubic yard) in FY 1981 dollars:

	$/Cubic Yard
Contaminated residue retrieval	112
Containerization of residues	138
Transportation of residues (500 miles to regional disposal site)	110
Disposal of residues	208

Estimates of Annual Budget Authorization Requests in FY 1981 Dollars

Fiscal Year	Amount	Fiscal Year	Amount
1980	$ 9,400,000	1985	$ 46,200,000
1981	13,800,000	1986	48,000,000
1982	21,300,000	1987	50,800,000
1983	32,600,000	1988	42,600,000
1984	38,000,000	1989	35,300,000
			$338,000,000

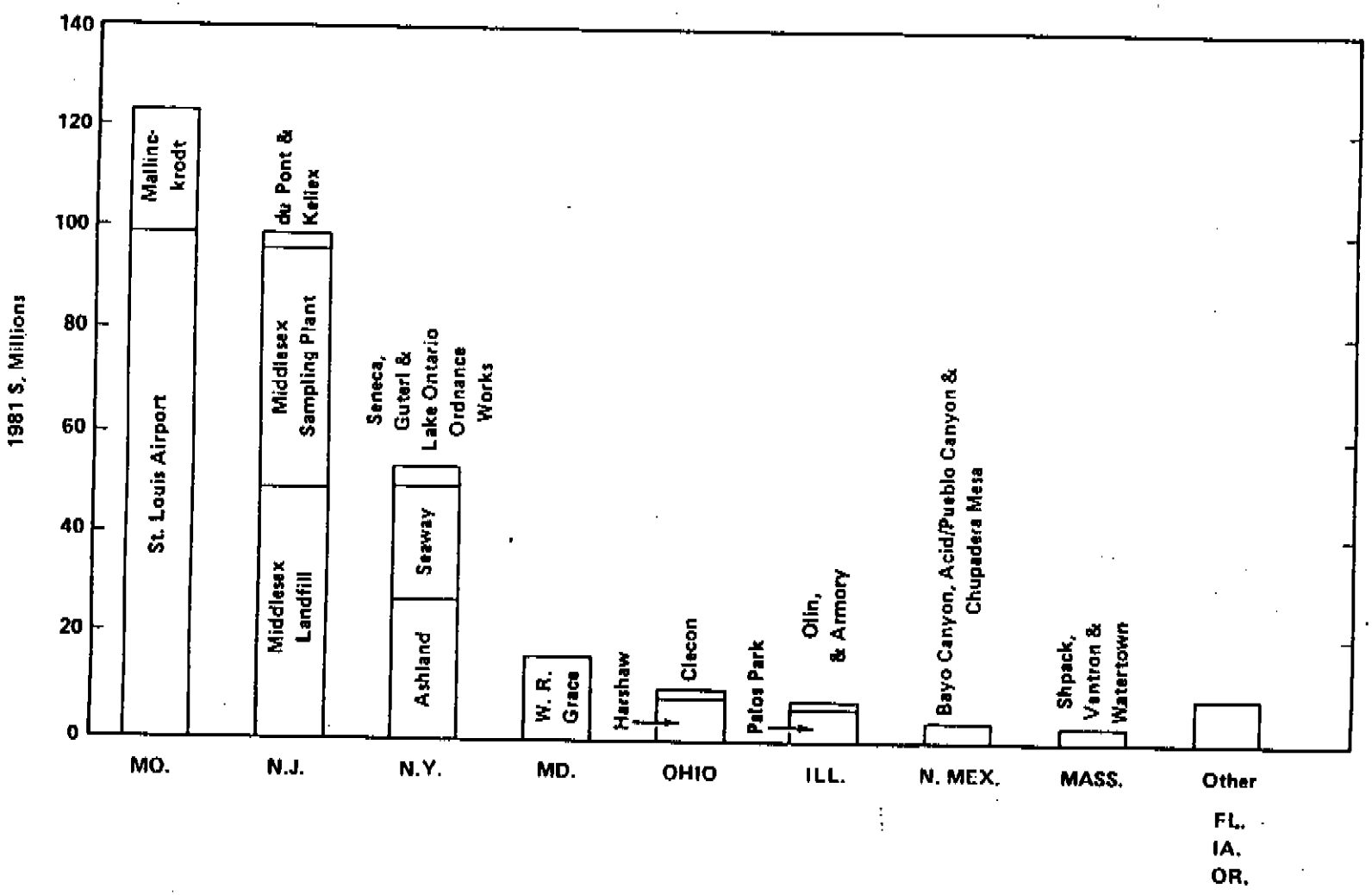


Figure 4. FUSRAP Costs by State and Site

- The method of packaging of materials for transport generated by decontamination, generally, either containerized or bulk
- Location of disposal site, either in-state or regional
- Type of disposal-site ownership (based on either government financing or commercial rates)

Remedial Action Options. Options available for remedial action at a contaminated site are either removal of contamination and restoration of the site to permit unrestricted public use, or permanent stabilization of the radioactive material on the remedial action site and restoration for restricted use. Because of the long time period required to locate and develop a disposal site, temporary remedial actions may be taken to reduce health impacts. Stabilization involves fixing of the contamination on the soil or structures such that transport offsite through such mechanisms as erosion, leaching into water supplies and aquifers, or through up-take in the biosphere does not occur and will not occur in the long term. Criteria and standards for stabilized sites will meet the intent of those criteria and standards used for the disposal sites, e.g., 10 CFR 40 Appendix A, the criteria proposed by NRC for privately owned mill tailing sites. Institutional controls have to be imposed at the stabilized site to prevent disturbance of the buried material and its subsequent release. Removal of contamination from structures, dismantling and removal of structures, and removal of soil and other contaminated material, followed by site restoration for unrestricted use by the public, is the most extensive remedial action that can be taken at a site. The costs for permanent stabilization might be a factor of 5 to 10 less than for decontamination and removal. For the purposes of providing a bounding cost of the proposed legislation, cost estimates were based upon decontamination of all the 29 MED/AEC sites and restoration for unlimited public use.

Criteria and Standards for Remedial Actions. The basis of the cost estimates provided for remedial action assumes contamination would be reduced to 5 picocuries of radium-226 per gram of soil (or comparable levels for other radionuclides), which is in the range of 2 to 10 times that of naturally occurring radium levels in the soil. If a lower value of acceptable contamination were to be imposed, substantially higher costs may result. For stabilized sites, another factor affecting cost is the depth of ground cover material that will be required by the NRC. In this cost estimate, no sites were considered for stabilization. Because the stabilization and disposal sites will be licensed by the NRC, the final criteria and standards established by the NRC will impact costs. The NRC has proposed criteria for licensed uranium mill tailings sites (10 CFR 40, Appendix A) and is developing criteria for large-volume, low-activity waste that are expected to be generally consistent with the mill tailings criteria. These criteria may be applied to the formerly utilized sites that are stabilized and to the disposal sites. In addition, the EPA has issued interim and proposed final criteria for remedial action at inactive mill tailings sites.

Method of Packaging. The packaging of contaminated material generated in the remedial action of decontaminating the MED/AEC sites can be accomplished either by use of containers such as 55-gallon drums, or bulk transporters such as large-volume trucks or railroad cars. The relative costs for the handling and transport of small containers is three to four times greater for the small containers versus bulk shipment. For the purposes of the proposed legislation, cost estimates were based upon containerization of waste residues.

Location of Disposal Sites. Transportation to a site for disposal of the contaminated material removed from the MED/AEC sites may be a significant factor in the cost of remedial action. The major factor in cost is the distance for transport of either containerized material or bulk quantities via truck or rail. Depending upon the location of the sites requiring decontamination and restoration, a suitable regional disposal site may be found that could satisfy the needs of more than one state. Cooperative efforts between states will be encouraged to jointly solve this common problem. The DOE will cooperate and support the states in this site selection activity. Cost estimates were based upon transportation costs associated with shipment of 500 miles to a regional disposal site.

Type of Disposal Sites. Sites for disposal of residues contaminated from the former MED/AEC use may be federally owned or state-owned. To ensure long-term institutional control of the disposal site, privately owned sites are not acceptable. This approach is consistent with that used in the Uranium Mill Tailings Radiation Control Act of 1978, and the criteria proposed by the NRC for the privately owned uranium mill tailings sites. Restriction of access to the site, and monitoring and surveillance requirements, will require administrative control that can be accomplished by either Federal or state ownership and custody of the site. Costs of operation of a disposal site for contaminated residues must reflect the quantities of wastes to be handled and the time period of active and passive controls.

These costs will be affected by whether the site is a single-use site or a multiple-use site.

APPENDIX A

MED/AEC SITE SUMMARY REPORTS

CONTENTS

SITE SUMMARY REPORTS

SITE SUMMARY REPORTS

INTRODUCTION

The information contained in the following MED/AEC site summary reports represents the current knowledge of radiological conditions at, and former government use of, each site. In some cases, additional work necessary for complete characterization of a site is underway or planned.

Throughout the summary reports, reference is made to "current guidelines" for contamination and exposure levels. The guidelines discussed in section 3.0 Appendix A provides brief information on each site as follows:

- Owner history - from the MED/AEC period to the present
- Site location
- Site utilization during the MED/AEC period
- Use of site since the MED/AEC period
- Radiological history - results of surveys conducted and relative contamination levels
- Remedial action options and costs
- Project status - current status of surveys, engineering studies, recommendations for remedial action, and existing or implied authority for future remedial action.

ACID/PUEBLO CANYON AREA
LOS ALAMOS, NEW MEXICO

OWNER HISTORY

1943-1967: U.S. Government
1967-Present: Los Alamos County and U.S. Government (upper Canyon)

SITE LOCATION

Acid and Pueblo Canyons are located adjacent to the townsite of Los Alamos in north central New Mexico, about 25 miles northwest of Santa Fe. These canyons are two of many canyons cut into the Pajarito Plateau. Acid Canyon is a tributary of Pueblo Canyon.

MED/AEC SITE USE

These deep canyons were the discharge area for untreated radioactive liquid wastes between 1943 and 1951 resulting from research and processing at the Los Alamos Scientific Laboratory. Starting in 1951, treated radioactive effluents were discharged into the canyon from a liquid-waste-treatment facility which operated until 1964.

POST MED/AEC SITE USE

The area is unrestricted to public access and is used on a limited basis for recreational purposes.

RADIOLOGICAL HISTORY

Plutonium, americium, and fission products were discharged into the canyons in liquid effluents during the years 1943 to 1964. The first survey of Acid Canyon, for purposes of cleanup, was made on August 31, 1965. On October 4, 1966, work commenced on removing the waste-treatment-facility structures. Five-hundred truckloads of demolition debris and dirt from this location were removed. Ninety-four loads of debris from Acid Canyon were placed in a solid-waste disposal area within the currently operational Los Alamos Scientific Laboratory site. This decontamination activity included the removal of all drain pipes, wires, rocks, tuff, and other debris found contaminated in Acid and Pueblo Canyons. This work was completed in 1967, and it was reported that a small amount of contamination remains in inaccessible places.

In November 1973, it was reported that plutonium concentrations in filtered surface waters in Acid Canyon and the adjacent portions of Pueblo Canyon generally averaged about 20 picocuries/liter. A limited number of samples of the alluvium taken in 1970 indicated plutonium concentrations of 27 picocuries/gram in lower Acid Canyon, 4.6 picocuries/gram in Pueblo Canyon 1 mile below the Acid Canyon outlet, and 1.1 picocuries/gram 2 miles below Acid Canyon.

Some radiological and environmental surveillance evaluations have been completed and documented for Pueblo Canyon. Several hundred soil and sediment samples were collected for the present detailed radiological survey during 1977. Data show some limited areas in the canyons that exceed the EPA-proposed soil screening guides for plutonium concentrations. Measurements of penetrating radiation showed no areas that exceed radiation protection standards.

REMEDIAL ACTION OPTIONS AND COSTS

Some form of remedial action may be required and could include stabilization and/or decontamination by excavation of the cliff face, outfall area, cliff base and channel, and the Acid Canyon stream bed. Seventeen-hundred cubic yards of contaminated material would be produced. The estimated cost is $1,900,000.

PROJECT STATUS

Following the completion of the radiological survey report, the Assistant Secretary for Environment will determine whether the site requires remedial action. Work has been initiated on an Engineering Evaluation Report-Title I. Authority to implement a remedial action exists under the Atomic Energy Act of 1954, as amended.

ALBANY METALLURGICAL RESEARCH CENTER
ALBANY, OREGON

OWNER HISTORY

The site has been and is currently owned by the Bureau of Mines, U.S. Department of the Interior.

SITE LOCATION

The site is located in Albany, Oregon, approximately 23 miles south of Salem. Eight buildings and their surroundings were used for former MED/AEC activities.

MED/AEC SITE USE

From 1954 to 1971, the Albany Metallurgical Research Center was engaged in metallurgical operations involving thorium. Operations included reduction, melting, machining, welding, and alloying. Research on alloys of uranium and thorium started in 1955 and continued to 1978.

POST MED/AEC SITE USE

Research involving uranium and thorium was suspended in 1978. Onsite areas that contain contaminated soils have been fenced to restrict access. None of the buildings are currently used for uranium or thorium alloy research.

RADIOLOGICAL HISTORY

At the time that the original AEC contract was terminated (approximately 1960), these buildings were decontaminated according to the general guidelines provided by the AEC to the Bureau of Mines. These guidelines were not as specific as later guidelines, and there is no record that the final decontamination was documented. Contaminated materials, equipment, or wastes generated under the AEC contracts were removed from the site for disposal.

The Argonne National Laboratory (ANL) conducted a radiological survey of these buildings and grounds in 1978 and found contamination that exceeded current guidelines for unrestricted use still existed on surfaces and that some areas of soil were contaminated with uranium and thorium. As an interim measure, the Bureau of Mines has fenced in areas of contaminated soil to restrict access. Some additional survey work, including an aerial radiometric survey, was conducted in 1979, and some subsurface investigations are scheduled for 1980. ANL is preparing a radiological survey report to document all survey activities.

No significant public health impact exists due to restricted use of the contaminated areas; however, potential health impacts could result if usage was changed. Interim access control measures have been employed.

REMEDIAL ACTION OPTIONS AND COSTS

Remedial action may be required and could involve excavation of contaminated soils, decontamination of buildings and removal of structural elements and plumbing. Thirty-seven-hundred cubic yards of contaminated material could be produced. The estimated cost for remedial action is $3,000,000.

PROJECT STATUS

A radiological survey has been completed and a final report is in preparation. Upon completion of this report, the Assistant Secretary for Environment will determine whether remedial action is required. Authority to implement remedial action exists under the Atomic Energy Act of 1954, as amended.

ASHLAND OIL COMPANY
TONAWANDA, NEW YORK

OWNER HISTORY

1943-1944:	E. Haist et al. - leased by MED
1944-1960:	U.S. Government
1960-Present:	Ashland Oil Company

SITE LOCATION

The 10-acre site is located in a large industrial area in Tonawanda, New York. It is adjacent to the Seaway Industrial Park, another formerly utilized MED/AEC site.

MED/AEC SITE USE

From 1943 to 1946, the site was used for disposal of uranium-processing residues from the Linde Air Products Division-Union Carbide Corporation ore refinery operations. Eight-thousand tons of residue containing approximately 0.54 percent uranium were spread over two-thirds of the site to a depth of 1 to 5 feet.

POST MED/AEC SITE USE

In 1974, 6,000 cubic yards of residue were removed by Ashland and transported to the adjacent Seaway Industrial Park. The site was developed as an oil storage site at that time.

RADIOLOGICAL HISTORY

A radiological survey was conducted in 1958. Following this survey, the property was released for unrestricted use without removal of the residues. A detailed survey was conducted under the FUSRAP during July and August 1976. An aerial survey was conducted in September 1979.

Results of the 1976 survey indicated that external gamma radiation exceeded applicable guidelines over fairly large areas of the site. However, the results indicated that the residues on the site "do not pose an immediate health hazard, assuming that residues remain in place and that the site continues to be used in the manner in which it is presently used." The radon daughter concentration in the onsite building is close to background level, and only small quantities of radium or uranium are carried from the site in surface runoff. Because the property is located in an industrial area, the population density surrounding the site is very low, and thus there are few people at risk. If the site use were changed and buildings constructed onsite, there could be an increase in exposure and a potential health hazard could result.

REMEDIAL ACTION OPTION AND COSTS

Remedial action is indicated and could involve removal of approximately 48,000 cubic yards of residues and contaminated soil. The estimated cost for this remedial action is $29,000,000.

PROJECT STATUS

A radiological survey was completed in August 1976; a final report was issued in May 1978. The Assistant Secretary for Environment has determined that the site will require remedial action. Additional authority to implement remedial action will be required.

BAYO CANYON AREA
LOS ALAMOS, NEW MEXICO

OWNER HISTORY

1944-1967: U.S. Government
1967-Present: Los Alamos County

SITE LOCATION

Bayo Canyon is located adjacent to the townsite of Los Alamos in north central New Mexico, about 25 miles northwest of Santa Fe. Bayo Canyon is one of many canyons cut into the Pajarito Plateau.

MED/AEC SITE USE

Experiments with high explosives were conducted in Bayo Canyon during the period 1944 through 1961. The explosive test assemblies included natural and depleted uranium and lanthanum-140, which was used as a tracer. Strontium-90 was also present as a contaminant of the lanthanum-140. The site facilities include radiochemistry laboratories, radioactive liquid-waste disposal facilities, and solid-waste disposal facilities.

POST MED/AEC SITE USE

The site was decommissioned in 1963. Since 1967 the canyon has been used exclusively for recreational purposes, including picnicking, trail riding, hiking, wood cutting, and pinon nut gathering. Proposed uses include residential and light commercial development.

RADIOLOGICAL HISTORY

From 1949 through 1969, 1.355 curies of natural uranium, 1.218 curies of depleted uranium, and between 30 and 40 curies of strontium-90 were dispersed into the surface environment of the Bayo Canyon area. An additional 85 to 120 curies of strontium-90 were deposited in waste-handling facilities and some fraction migrated into the subsurface environment. Most of the activity was associated with debris that was removed in 1963, leaving a comparatively small amount of radioactivity at the surface of the site and in subsurface layers of soil. A radiological survey was conducted under the FUSRAP in 1977.

The results of this survey show that exposure of current nearby residents to airborne strontium-90 and uranium is no different than that of other northern New Mexico residents. However, dose estimates for construction workers if the area were to be developed indicate exposure levels at less than 1.5 percent of DOE guidelines. The estimated exposure of residents in the developed area would be, at most, 3 percent of DOE guidelines. Individuals presently using the area for recreational purposes receive somewhat lower exposures because of the shorter exposure period and minimal interaction with disturbed soil.

REMEDIAL ACTION OPTIONS AND COSTS

Remedial action is indicated and could take the form of stabilization of dispersed radioactivity with restrictive control over change in site use or decontamination by excavation of soil to remove radioactivity. If decontamination is performed, 3,500 cubic yards of contaminated material will be produced. The estimated cost to perform this remedial action is $2,800,000.

PROJECT STATUS

A radiological survey was completed in 1977; the final report was issued in June 1979. The Assistant Secretary for Environment has determined that the site will require remedial action. Preparation of an Engineering Evaluation Report-Title I, has been initiated. Authority to implement remedial action exists under the Atomic Energy Act of 1954, as amended.

GILMAN HALL
UNIVERSITY OF CALIFORNIA
BERKELEY, CALIFORNIA

OWNER HISTORY

University of California

SITE LOCATION

The site is located on the Berkeley Campus of the University of California and consists of the third floor and basement of Gilman Hall.

MED/AEC SITE USE

Laboratory facilities in Gilman Hall were used in support of the Manhattan Project and/or early AEC activities. It is believed that weapons-grade plutonium was involved.

POST MED/AEC SITE USE

A preliminary radiological survey was completed by Lawrence Livermore Laboratory and a letter report issued in 1976. The survey was designed to document alpha contamination. However, evidence of significant cesium-137 was also found.

REMEDIAL ACTION OPTIONS AND COSTS

Remedial action is indicated and could take either one of two forms. The area could be left as is but placed under control, which would require that any future renovation and/or demolition work be performed under contamination removal and control procedures. This may require a license.

Alternatively, the area would be decontaminated by stripping away floor tile, sand blasting concrete surfaces, and removing piping. Thirty cubic yards of contaminated material would be produced. Estimated cost for this remedial action is $483,000.

PROJECT STATUS

A preliminary radiological survey was conducted in 1976. A detailed survey will be initiated soon. The Assistant Secretary for Environment has determined that remedial action is required. Authority to implement remedial action exists under the Atomic Energy Act of 1954, as amended.

UNIVERSITY OF CHICAGO
CHICAGO, ILLINOIS

OWNER HISTORY

The site is owned by the University of Chicago.

SITE LOCATION

The University of Chicago buildings associated with the MED work were the New Chemistry Lab and Annex, West Stands, Ryerson Physical Lab, Eckhart Hall, Kent Chemistry Lab, Jones Lab, Ricketts Lab, and an area known as Animal Quarters. A comprehensive information search could not verify the location or even the existence of the Animal Quarters.

MED/AEC SITE USE

The University was the site of the first successful nuclear pile and it conducted associated research required for the production of plutonium and ultimately the atomic bomb. Research was conducted under the MED and the AEC during the 1940s and 1950s.

POST MED/AEC SITE USE

The New Chemistry Lab and Annex, the West Stands, and Ricketts Lab have been torn down. The remaining buildings are currently in use as offices, laboratories, and classrooms. Some of the laboratories are still being used for nuclear research and are under license by the NRC.

RADIOLOGICAL HISTORY

References indicate that all of the buildings were decontaminated prior to release; however, some documentation is missing and some was inadvertently destroyed. Radiological surveys were performed during the period September 1976 to September 1977 under the FUSRAP.

Results of the 1976-1977 surveys indicate that contamination is widespread throughout the laboratories but at fairly low levels except for isolated small areas. Analysis of potential exposure conditions indicate that persons will not receive exposures exceeding current guidelines under present usage. However, remodeling or demolition activities could free fixed contamination resulting in a potential health hazard. Soil samples indicate contamination is confined to the buildings.

REMEDIAL ACTION OPTIONS AND COSTS

Remedial action may be required and could involve decontamination of the buildings involved. Seventy-five cubic yards of contaminated material would be produced. The estimated cost for this remedial action is $630,000.

PROJECT STATUS

A radiological survey was completed in September 1977; a draft report has been issued for review. Upon issuance of the final report, the Assistant Secretary for Environment will make a determination as to whether remedial action is required. Authority to implement remedial action exists under the Atomic Energy Act of 1954, as amended.

However, as the University campus is under license by the NRC, this site would not be decontaminated under the FUSRAP program since the NRC has sufficient licensing authority to protect public health and safety.

CHUPADERA MESA AREA
WHITE SANDS MISSILE RANGE, NEW MEXICO

OWNER HISTORY

The site was and continues to be private lands with multiple ownership.

SITE LOCATION

The site is located approximately 70 miles southeast of Albuquerque, New Mexico, and immediately north of the White Sands Missile Range.

MED/AEC SITE USE

The site area received fallout from an atomic bomb test at Trinity site in 1945.

POST MED/AEC SITE USE

Chupadera Mesa is extensively used as grazing land. In the northern area, the land is used primarily for growing alfalfa and assorted row crops.

RADIOLOGICAL HISTORY

The University of California, Los Angeles, conducted the first contamination survey in the 1947 to 1950 period. Thousands of soil and biological samples were obtained. Subsequently, in the 1972 to 1976 period, the Los Alamos Scientific Laboratory (LASL) collected similar samples. In 1977, LASL collected additional data around Trinity ground zero and the outlying fallout zones. The existing data are being evaluated and a radiological survey report is currently being prepared.

REMEDIAL ACTION OPTIONS AND COSTS

It is expected that some stabilization of contamination may be required. The estimated cost is $180,000.

PROJECT STATUS

Following the completion of the radiological survey report, the Assistant Secretary for Environment will determine whether the site requires remedial action. Work on an Engineering Evaluation Report-Title I has been initiated. Authority to implement a remedial action exists under the Atomic Energy Act of 1954, as amended.

CLECON METALS, INC.
CLEVELAND, OHIO

OWNER HISTORY

MED/AEC utilization period:	Horizons, Inc.
Present:	Clecon Metals, Inc.

SITE LOCATION

The site, encompassing approximately 3.5 acres, is located within Cleveland, Ohio, in a primarily industrial area which is sparsely populated. Two of three buildings on the site were used for processing radioactive materials.

MED/AEC SITE USE

During the 1940s and 1950s, two buildings at the Horizons metal-handling facility were used for the production of granular thorium metal. The feed material, thorium nitrate tetrahydrate, was processed through a number of steps and ultimately converted to thorium metal by use of an electrolytic process.

POST MED/AEC SITE USE

The plant site is currently used for the production of gaskets and for the lamination of various materials. The buildings were formerly used for processing radioactive materials, for receiving and storing nonradioactive materials, and for office space. Approximately 60 workers use these buildings.

RADIOLOGICAL HISTORY

In December 1954, the Health and Safety Laboratory performed an air hygiene survey that revealed airborne concentrations of thorium in both buildings to be 18 to 377 times greater than the applicable guideline. A subsequent survey indicated that the contamination was either removed or covered due to construction modifications made since the thorium operations. A radiological survey was conducted under the FUSRAP during February and March 1977.

Results of the 1977 survey indicate alpha, beta, and gamma levels in excess of current guidelines in several areas of both buildings. Contamination is located mainly in storage areas, drains and under floors. Exposure is limited to a few persons for short time periods. If use of buildings changes, doses of 0.2 to 0.4 rem/year could occur.

REMEDIAL ACTION OPTIONS AND COSTS

Remedial action is indicated, and could include decontamination of building surfaces, removal of some structural elements, removal of portions of the pumping system, and excavation of soil. An estimated 800 cubic yards of contaminated material would be produced. The estimated cost for remedial action is $2,400,000.

PROJECT STATUS

A radiological survey was conducted in February and March 1977. The final report was issued in February 1979. The Assistant Secretary for Environment has determined that the site will require remedial action. Additional authority for the ASNE to implement remedial action is required.

CONSERV INC.
NICHOLS, FLORIDA

OWNER HISTORY

1952-1960:	Virginia-Carolina Chemical Corporation
1960- :	Unidentified - changed ownership 3 times
Present:	Conserv Inc.

SITE LOCATION

The site is located at Nichols, Florida, approximately 22 miles east of Tampa. The area involved with radioactive materials is approximately 0.5 acres.

MED/AEC SITE USE

Starting in 1952, a pilot plant was operated for the recovery of uranium from wet-process-produced phosphoric acid. This plant was disassembled in 1960. Location of equipment, tanks, piping, and building materials is unknown.

POST MED/AEC SITE USE

1961-1968:	Phosphoric acid and other phosphate product production
1969-1973:	Plant shut down
1974-Present:	Phosphoric acid and other phosphate product production. The site of the former recovery plant is currently used for storage and contains a building that houses a maintenance shop, lunchroom, tool storage cage, and a small office. This building is built on the concrete pad of the former recovery plant.

RADIOLOGICAL HISTORY

A preliminary radiological survey, conducted in April 1977, indicated alpha, beta, and gamma contamination of the concrete pad of the former recovery plant and uranium-238 and radium-226 contamination of nearby soil. Soon after the survey, the plant operator removed approximately 4 cubic yards of contaminated soil. The soil was buried in an inactive gypsum pile located about 2,600 feet from original site and covered with 2 to 3 feet of gypsum and soil. A detailed radiological survey was conducted under the FUSRAP during December 1977.

Results of the December 1977 survey indicate contamination is primarily located in the soil around the concrete pad, on the pad outside the building, and in the area where contaminated soil was dumped. It should be noted that present site activities dealing with phosphate product production contribute significantly to elevated radiation levels at the plant site. In many areas of the plant site, the levels are unrelated to the former MED/AEC activities. No significant health hazard currently exists, principally because of infrequent occupancy. However, if the site use were changed to crop production or if a new building were constructed over the areas of higher contamination, exposures exceeding the guidelines could result.

REMEDIAL ACTION OPTIONS AND COST

Remedial action is indicated and could involve excavation of contaminated soils near the concrete pad and in the area of dumping of previously excavated soil. Cleaning and/or removal of the concrete pad may be required. One-hundred-thirty cubic yards

of contaminated material would be produced. The estimated cost for this remedial action is $660,000.

PROJECT STATUS

A radiological survey was completed during December 1977; the final report was issued in February 1979. The Assistant Secretary for Environment has determined that the site will require remedial action. Additional authority to implement remedial action will be required.

E. I. du PONT de NEMOURS AND COMPANY - CHAMBERS WORKS
DEEPWATER, NEW JERSEY

OWNER HISTORY

The site is owned and operated by the E. I. du Pont de Nemours Company.

SITE LOCATION

The 700-acre Chambers Works site is located adjacent to the residential communities of Deepwater, Pennsville, and Penns Grove, New Jersey. Within this site, operations involving MED/AEC activities were confined to four locations. These were three buildings and a radioactive material burial facility.

MED/AEC SITE USE

The du Pont operations for the MED included development of a process for converting uranium oxide to uranium tetrafluoride, production of uranium peroxide from the MED scraps, production of uranium tetrafluoride, uranium metal, uranium hexafluoride, and various related research activities. Such activities took place during the period 1942 through 1947. Decontamination and radiological survey activities took place during 1948. The last portion of the site used for the MED was released to du Pont in December 1948.

POST MED/AEC SITE USE

Of the three buildings involved in the MED activities, two have been demolished and one is still in use as a warehouse. A parking lot has been constructed on the site of one of the demolished buildings and a new building constructed at the site of the other. The radioactive material burial facility, which is approved by the State of New Jersey, possibly contains a few pieces of equipment from the demolished buildings.

RADIOLOGICAL HISTORY

In 1948, all contaminated equipment was removed from the site. Building decontamination, conducted under the direction of the AEC, included sandblasting, vacuuming, and washing of all building surfaces. A radiation survey was made by the Health Division of the AEC and the buildings were subseqently released to du Pont. A radiological survey was conducted under the FUSRAP during March 1977.

Results of the 1977 survey indicate that elevated concentrations of uranium were found in residues from the operations building and in some surface and subsurface soil samples. Alpha and beta-gamma contamination levels in some areas of the operations buildings were above the limits of current Federal guidelines. Under current conditions of site use, this contamination does not cause employees working at the site to receive radiation exposures appreciably different from those due to background radiation. However, under different conditions of use (i.e., use of contaminated soils for growing crops or actions which involve agitation or abrasion of dry contaminated surfaces), potential radiation exposures to employees and the public could result.

REMEDIAL ACTION OPTIONS AND COSTS

Remedial action is indicated and could involve decontamination of building surfaces and excavation of soil. Twenty-seven-hundred cubic yards of contaminated material would be produced. The estimated cost for this remedial action is $3,000,000.

PROJECT STATUS

A radiological survey was completed in March 1977; the final report was issued in December 1978. The Assistant Secretary for Environment has determined that the site will require remedial action. Authority to implement remedial action exists under the Atomic Energy Act of 1954, as amended.

GARDINIER INCORPORATED
TAMPA, FLORIDA

OWNER HISTORY

1951-1962:	Tennessee Corporation, U.S. Phosphoric Products Division
1963-1973:	Cities Service Company
1974-Present:	Gardinier, Incorporated

SITE LOCATION

The formerly utilized site, consisting of approximately 1.5 acres, is located within the Gardinier phosphoric acid production plant boundaries in Tampa, Florida.

MED/AEC SITE USE

During the period 1951 to 1960, Tennessee Corporation extracted uranium from phosphoric acid. This process consisted of (1) pretreatment of wet-process phosphoric acid, (2) solvent extraction of uranium, (3) precipitation of the uranium product, (4) drying and crushing, and (5) handling, packaging, and shipping. Pilot operations were carried out from 1951 through 1954 and the process plant was operated from 1956 through 1960.

POST MED/AEC SITE USE

A three-story building which housed the process plant is currently used as a workshop, lunchroom, office space, and as a storage area for equipment remaining from the uranium-recovery operations. A former pilot plant building is currently used as office space. Approximately 30 employees use these buildings. A new uranium recovery pilot operation is conducted on the site, which operation is currently licensed by the State of Florida. This license does not cover the MED/AEC material.

RADIOLOGICAL HISTORY

A radiation survey was conducted under the FUSRAP by Oak Ridge National Laboratory during December 1977. Some contaminated equipment was removed following the survey and transported to a licensed site.

Results of the 1977 survey indicate only slight contamination of the former pilot plant building, significant contamination of the former process building, and significant contamination of adjacent outdoor areas. Various measurements of alpha, beta, and gamma activity exceed current guidelines throughout the former process building. Highest levels of contamination were found on the second floor and are associated with stored equipment which was used in the uranium recovery process. External gamma levels measured outdoors also exceed guidelines and appear to be associated with radium-226, which has plated out in buried pipes and vessels.

REMEDIAL ACTION OPTIONS AND COSTS

Remedial action is indicated and could involve removal of stored equipment, excavation of soil and buried pipes and tanks, and decontamination of structures. Two-thousand cubic yards of contaminated material would be produced. The estimated cost for this remedial action is $2,300,000.

PROJECT STATUS

A radiological survey was performed in December 1977; a draft of the final report is currently under review. The Assistant Secretary for Environment has determined that the site will require remedial action. Additional authority is needed for the implementation of remedial action.

W. R. GRACE & COMPANY
CURTIS BAY, MARYLAND

OWNER HISTORY

This was and continues to be private land under the ownership of W. R. Grace & Company.

SITE LOCATION

The site consists of 4 acres of land at the Davison Division of W. R. Grace & Company at Curtis Bay, Maryland.

MED/AEC SITE USE

In late 1956 and early 1957, W. R. Grace assumed the license and contract of Rare Earths, Inc., to process, transfer, and use the radioactive material thorium. The thorium was shipped to Davison as a component of monazite sand. Title to the monazite and the thorium remained with the government during the performance of the work. The monazite sand was processed to remove the thorium which was shipped to GSA. Residue from the process was collected in dumpsters and emptied in a designated area of the onsite dump. The processing plant was never completed and the project was abandoned in 1957.

POST MED/AEC SITE USE

The site is presently unoccupied, untraversed, remote, and within the fenced enclosure surrounding the entire plant but not separately enclosed.

RADIOLOGICAL HISTORY

Radiation Management Corporation conducted a survey in 1978 to measure external radiation levels and investigate the possible migration of radioactive material from the deposit site.

It is estimated that the total volume of waste material possibly contaminated with monazite residue is 504,000 cubic feet in one location and 200,000 cubic feet in a second. There is no apparent indication of migration from the burial area. It is unclear whether or not the waste material exceeds 0.05 percent ThO_2. Surface radiation levels ranged from background levels to 17 mr/hr. Analysis of plant material indicated no detectable thorium daughter products. Core samples indicated thorium concentrations of 6.2 ± 0.9 pCi/gm at a depth of 5 feet and 97 ± 10 pCi/gm at 15 feet. The results assumed thorium in equilibrium with its daughters. Institutional control measures have been instituted to limit access to the disposal site.

REMEDIAL ACTION OPTIONS AND COSTS

Remedial action may be required and could involve excavation of contaminated soils and restoration. An estimated 26,000 cubic yards of contaminated material would be produced. The estimated cost for this remedial action is $17,000,000.

PROJECT STATUS

A detailed radiological survey is scheduled for 1980. Upon completion of this survey, the Assistant Secretary for Environment will determine if remedial action is required. Determination of whether additional authority is required to implement remedial action is currently underway.

GUTERL SPECIAL STEEL CORPORATION
LOCKPORT, NEW YORK

OWNER HISTORY

MED/AEC utilization period:	Simonds Saw & Steel Company
Present:	Guterl Special Steel Corporation, Simonds Steel Division

SITE LOCATION

The plant site is located in an industrial area of Lockport, New York. The formerly utilized site consists of the rolling mill building, the forging shop building, and the area immediately surrounding these buildings. The area involved is approximately 4 acres.

MED/AEC SITE USE

1948-1956 Rolling mill operations of uranium and thorium metal; operations included weighing, heating, rolling, shearing, and quenching.

POST MED/AEC SITE USE

1957-Present: Rolling mill operations of nonradioactive metals; approximately 50 persons currently work in the buildings formerly involved with radioactive materials.

RADIOLOGICAL HISTORY

During all operations from 1948 through 1956, the AEC was responsible for radiological monitoring and safety. Residue from the operation was returned to the AEC or National Lead of Ohio. Protective measures included the use of hoods and dust-collection equipment over the 16-inch rolling mill stands and pans in the mill pits to collect material. A radiological survey performed during November 1958 indicated highest radiation levels in the quench tank area. Decontamination was performed and consisted of removing the quench tank, covering this area with steel plate, and washing and vacuuming other areas. A resurvey was conducted in December 1958 to verify decontamination actions. A radiological survey was conducted under the FUSRAP during October 1976.

Results of the 1976 survey indicate that only small accessible areas of contamination in the rolling mill building exceed present exposure guidelines. Other areas, particularly the former quench tank, have significantly high contamination levels but do not presently contribute greatly to exposure because of inplace shielding in the form of steel plates. Under current conditions of site use, this contamination does not cause employees working at the site to receive radiation exposure appreciably different than those due to background. However, under different conditions of site use (i.e., removal of steel plates, disturbance of soil or soil floors in buildings), potential exposure to employees and the public could result.

REMEDIAL ACTION OPTIONS AND COSTS

Remedial action is indicated and could involve excavation of outdoor soil, indoor soil floors, removal of some equipment, and cleaning of structures. Three-hundred-fifty cubic yards of contaminated material would be produced. The estimated cost for this remedial action is $1,100,000.

PROJECT STATUS

A radiological survey was completed during October 1976; the final report was issued in November 1979. The Assistant Secretary for Environment has determined that the site will require remedial action. Additional authority to implement remedial action will be required.

HARSHAW CHEMICAL COMPANY
CLEVELAND, OHIO

OWNER HISTORY

The site has been and is currently owned by Harshaw Chemical Company.

SITE LOCATION

The site is located within Cleveland, Ohio, and consists of three buildings and surrounding areas.

MED/AEC SITE USE

In September 1942, the MED contracted with Harshaw for the production of green salt (UF_4). This work was a continuation of smaller scale work performed for the Office of Scientific Research and Development. In 1943, Harshaw also began production of uranium hexafluoride, an operation that was substantially expanded in 1947. Another MED/AEC contract involved the production of uranium tetrachloride and uranium oxyfluoride. Building G1 (Plant C) was used for the UF_6 production and the foundry building was used for the UF_4 production. Analytical work was performed in building K1. Equipment and material from the MED/AEC operations was apparently stored in those and other buildings at the site. In 1960, the facility was released to the Harshaw Chemical Company from AEC control.

POST MED/AEC SITE USE

Building G1 is presently being used primarily as a storage warehouse, but it does contain some chemical production operations including the drying of fluorspar. The building is normally occupied by fewer than 10 people and contains a locker room area on the second floor which is used by employees working at another building on the Harshaw site. Additional personnel are present only during use of the locker room and transfer of material in and out of storage. A 60- by 200-foot addition was constructed on the north side of the building after the MED/AEC use of the facility was terminated. This addition is used for storing fluorspar.

RADIOLOGICAL HISTORY

This site was visited by the AEC personnel on October 27 and 28, 1953, to survey the equipment and buildings for contamination and to provide the necessary actions prior to the return of the building to the contractor. A meeting with representatives from the Harshaw Chemical Company was held, and a decontamination program was agreed to. The actions taken as a result of this visit are unknown.

Another survey was conducted on November 21, 1957, by the Research and Development Division, Oak Ridge, Tennessee. The purpose of this survey was to locate any areas where residual contamination was of such magnitude that it might represent a potential radiation or contamination control problem that would require the imposition of restrictions on the use of the building. At the time of this survey, all equipment had been removed except for the Rockwell furnace, two denitration pots, and some process vessels in the recovery area. The report of this survey identified contaminated areas with recommended methods for decontamination. A supplemental agreement assigned the responsibility to the contractor for decontaminating all equipment transferred to it and for decontaminating its own premises used in the performance of the contract. Further, the decontamination effort was to be

accomplished in accordance with the recommendations contained in the report of survey. The building was released from further AEC control in 1960.

A radiation survey of the building at Harshaw was performed in May 1976 by the Chicago Operations Office to identify previously utilized MED/AEC sites. During this survey, three soil samples were taken in the area adjacent to the building. These soil samples showed readings greater than normally expected. A draft of the radiation survey report was furnished to the Harshaw Chemical Company on July 8, 1976. The results of the survey showed residual contamination remained at the building.

Soil corings were taken by the Argonne National Laboratory at selected locations around the Harshaw complex on November 10, 1976. A draft of this soil survey report was transmitted to the DOE Headquarters with a recommendation that the survey be extended. The DOE Headquarters concurred with the recommendations, and additional survey work was accomplished between August and September 1979, including an annual radiometric survey. Preliminary results indicate that there is general deposition of contamination throughout the site and it may extend beyond the Harshaw site boundary.

Based on the completed preliminary surveys, the contamination is at an acceptable level and does not represent a hazard to Harshaw personnel. However, if modifications, remodeling, cleanup, or other structural changes were to be undertaken, radioactive material now fixed in the structure could be released and lead to airborne contamination. Harshaw has indicated that they would contact the DOE prior to any such actions. Likewise, no health hazard is envisioned from the contaminated soil in its present status.

REMEDIAL ACTION OPTIONS AND COSTS

Remedial action may be required and could involve excavation of soil, decontamination of the building, and excavation of a portion of the Cuyahoga River. Ninety-two-hundred cubic yards of contaminated material would be produced. The estimated cost for this remedial action is $9,000,000.

PROJECT STATUS

Upon completion of the currently initiated radiological survey, the Assistant Secretary for Environment will determine whether remedial action will be required. Additional authority to implement remedial action is required.

IOWA STATE UNIVERSITY
AMES, IOWA

OWNER HISTORY

The site has been and is currently owned by Iowa State University. Additional areas that have become contaminated by activities at the University site are owned by the Municipality of Ames, Iowa.

SITE LOCATION

Four buildings on the University campus at Ames were used for the MED/AEC activities. Three additional areas have become involved because of disposal of contaminated sewage sludge. The areas are the Ames Iowa Municipal Airport, the Grand Avenue underpass, and the Ames Municipal Cemetery.

MED/AEC SITE USE

Early MED/AEC activities were concerned with metallurgical research, fundamental chemical and analytical research, and the development of processes to produce pure uranium and other materials. During the 1942 period, the small-scale production in the physical chemistry laboratory furnished about 2 tons of uranium for use as heart metal in the first chain-reacting pile in Chicago. About 2 million pounds of virgin uranium were produced up to January 1, 1945, at which time production at Ames was discontinued. A recovery process developed at Ames resulted in the recovery of over 600,000 pounds of metal from scrap supplied by all of the MED sites. This operation was discontinued in December 1945. In 1947, the project at Ames was declared a major research facility and a program to produce thorium metal was initiated. Prior to 1947, approximately 4,500 pounds of thorium had been produced. Approximately 65 tons were produced in total.

RADIOLOGICAL HISTORY

Between July 1951 and August 1952, filtrates containing thorium and mesothorium were released into the sewage lines. Water-removal operations at the Water Pollution Control Plant produced a dry sludge cake that contained much of the released thorium and mesothorium (less than 1 curie). This sludge cake was collected and held at the west end of the drying beds at the Water Pollution Control Plant. In accordance with AEC recommendations, the sewage sludge cake containing mesothorium was placed on the City of Ames Municipal Airport grass runway, the Municipal Cemetery, and the grass areas of the Grand Avenue underpass.

An initial radiation survey was conducted on May 12, 1976, at the Municipal Airport of Ames, the Municipal Cemetery, the Grand Avenue underpass, and the site of buildings on the Iowa State University campus. Based on preliminary results of this survey and subsequent surveys, minor contamination of some land does exist. The Municipal Cemetery and the Grand Avenue underpass show no significant contamination. There was no discernible radiation different from the background level at the sites of Chemistry Annexes I and II. A single area in a taxi strip at the Municipal Airport shows some thorium contamination. The area west of the sludge beds at the Water Pollution Control Plant shows thorium contamination in a "ditch" area (approximately 6 times background) and a more generalized area (up to 2 times background).

None of the areas surveyed have contamination that will have a significant impact on the health of the public under current site usage. However, change of site usage could result in undesirable exposure.

REMEDIAL ACTION OPTIONS AND COSTS

Remedial action may be required and could involve excavation of contaminated soils and decontamination of building floors and surfaces. Sixty cubic yards of contaminated material would be produced. The estimated cost is $570,000.

PROJECT STATUS

A complete radiological survey was completed in FY 1980 and a report is in preparation. Upon completion of the report, a determination will be made as to whether remedial action is required. Additional authority to implement remedial action is required.

KELLEX RESEARCH FACILITY
JERSEY CITY, NEW JERSEY

OWNER HISTORY

1942-1951:	Kellex Corporation
1951- :	Vitro Corporation of America
Current:	Delco-Levco and Pierpont Associates

SITE LOCATION

The Kellex research facility activities were conducted in one building located on the site of the M. W. Kellogg Company property in Jersey City, New Jersey.

MED/AEC SITE USE

The Kellex Corporation was established by the M. W. Kellogg Company in 1943 in order to design and construct the first gaseous diffusion plant for uranium enrichment. The work continued to July 1952 and included research and development of purex reprocessing for spent fuel and component testing with uranium hexafluoride.

POST MED/AEC SITE USE

The Kellex buildings were demolished around 1953 and only the concrete slab floor remains. The original area of the Kellogg facilities has been subdivided and is currently being developed as commercial properties. A supermarket and other stores have been constructed on part of the property. The location of the former Kellex building is presently unused and is owned by Pierpont Associates.

RADIOLOGICAL HISTORY

In 1953, the Vitro Corporation of America prepared a contamination status report that detailed the findings of a radiation survey of the former Kellex building. This report indicated that most external gamma radiation readings were less than 100 microroentgens per hour, and no transferable alpha or beta-gamma contamination was observed in any of the accessible areas.

Representatives from Oak Ridge Operations and ORNL conducted a site visit and exploratory survey of the Kellex site on October 21, 1976. The survey revealed gamma ray readings in the 5- to 6-microroentgen per hour range (background). However, due to the size of the property and uncertainty as to the exact location and extent of Kellex operations, it was decided that a formal survey should be conducted. A radiological survey was conducted under the FUSRAP by ORNL during March 1977.

Results of the 1977 radiological survey indicate that the radiation and radioactive levels were indistinguishable from background levels with the exception of a few isolated and well defined spots on or near the site of the former Kellex Laboratory.

REMEDIAL ACTION OPTIONS AND COSTS

Remedial action was indicated and work was started on the site in July 1979. During the remedial action, additional contamination was discovered and the decontamination effort extended to cover the additional areas. This additional work has since been suspended in order to evaluate results in the context of the criteria appropriate to the intended use of the site. The estimated cost for remedial action is $1,400,000.

PROJECT STATUS

A radiological survey was completed in March 1977; a draft of the final report, dated September 1977, has been prepared.—The Assistant Secretary for Environment has determined that remedial action is required. Remedial action is underway. Authority for completing the remedial action exists under the Atomic Energy Act of 1954, as amended.

LAKE ONTARIO ORDNANCE WORKS ASSOCIATED PROPERTIES
LEWISTON, NEW YORK

OWNER HISTORY

1944-1955: U.S. Government
1955-Present: Private

In 1948, the AEC acquired approximately 1,511 acres of the former Lake Ontario Ordnance Works (LOOW) from the Army. In 1955, the AEC declared 1,298 acres excess and, as of 1968, this acreage had been acquired by the town of Lewiston (89 acres), Fort Conti Corporation (642 acres), Mr. M. W. Frank (199 acres), Niagara Mohawk Power Company (5 acres), The Somerset Group, Inc. (133 acres), and the Air Force (230 acres). In 1975, the ERDA declared a 22-acre sewage plant excess and transferred this plot to the town of Lewiston, New York, leaving 191 acres under DOE control.

SITE LOCATION

The DOE storage site currently consists of 191 acres and is located about 3 miles southeast of Youngstown, 3 miles northeast of Lewiston, and 7 miles north of the City of Niagara Falls in the County of Niagara Falls, New York. However, that portion of LOOW that was declared excess by the AEC and contains residual radioactive material above background, is considered the FUSRAP site.

MED/AEC SITE USE

This site was a portion of the former LOOW and was first used by the MED in 1944 for the storage of radioactive low-grade pitchblende residues from the nearby Tonawanda refinery. Following World War II, contaminated materials from wartime plants and some post-wartime operations were stored at the site. After April 1, 1949, part of the high-grade pitchblende residues from the St. Louis refinery were stored at the site in drums, and subsequently transferred to the 165-foot high concrete silo. In the early 1950s, the site was used as an interim storage site for incoming and outgoing uranium billets. In addition, radioactive materials from the University of Rochester and Knolls Atomic Power Laboratory (KAPL) were transferred to this storage site. The KAPL wastes were later transferred to the Oak Ridge National Laboratory burial grounds.

In about 1953, the AEC operated a boron isotope separation plant at the site. The plant was placed on standby in 1958 and was restarted in 1964 and again put on standby in July 1974.

POST MED/AEC SITE USE

The DOE site is currently dormant and the National Lead Company of Ohio (NLO) is under contract to act as caretaker. The 191 acres of this site that remain under DOE control constitute a DOE Surplus Facility. However, in 1958, at the termination of ore procurement contracts, 25-year-storage lease agreements were negotiated with African Metals Corporation (Afrimet), the U.S. subsidiary of Union Miniere du Haut Katanga of Brussels, Belgium (owner and supplier of Belgian Congo ore), for the storage of its residues in four concrete structures on the site. Approximately 60 percent (12,000 tons) of the radioactive residues stored at the site belong to Afrimet. These storage lease agreements expire on July 1, 1983.

RADIOLOGICAL HISTORY

In October 1970 and June 1971, radioactive surveys of the 1,298 acres formerly held by the AEC showed that about 6.5 acres exceeded the AEC criteria of 50 microroentgen per hour including background. Decontamination was carried out in 1972 and involved the removal of about 15,000 to 20,000 cubic yards of radioactive soil and debris. This contaminated material was piled on the remaining 191-acre AEC site. A final radiation survey conducted in June 1972 indicated that only a few portions of the central drainage and Sixmile Creek exceeded the 50 microroentgen per hour criteria, and beta-gamma levels measured at contact were less than 0.2 mrad/hr.

For a number of years, NLO has periodically sampled and analyzed the groundwaters and surface waters on and around the site. No significant radioactivity has been found in surface waters, and radium-226 and uranium concentrations in well samples are substantially below levels specified in guidelines for water in uncontrolled areas. In August 1978, the DOE Environmental Measurements Laboratory began offsite radon monitoring, both indoors and outdoors, to supplement the site fence-line monitoring conducted by NLO. To date, the average concentrations in residences neighboring the DOE site are within the range of indoor concentrations found in New York City and its suburbs.

REMEDIAL ACTION OPTIONS AND COSTS

The DOE is evaluating a number of options for long-term disposition of the residue at this site. In the interim, temporary remedial measures to minimize emanation of radon from the residues are being instituted and the monitoring program is being expanded. Further remedial action may be required. Preliminary estimates of cost are approximately $3,000,000.

PROJECT STATUS

A detailed radiological survey under the FUSRAP is underway. Remedial action to remove residual contamination from drainage areas and steps to prevent further offsite transport will be initiated during FY 1980. Authority to implement remedial action exists under the Atomic Energy Act of 1954, as amended.

LINDE AIR PRODUCTS DIVISION
TONAWANDA, NEW YORK

OWNER HISTORY

Union Carbide Corporation - Linde Air Products Division

SITE LOCATION

The site, which contains approximately 55 acres, is located in a partially industrialized area of Tonawanda, New York. Five buildings on this site were involved in the MED activities.

MED/AEC SITE USE

The Linde Division was under contract with the MED to perform uranium separations during the period from 1942 through approximately 1948. Uranium oxide (UO_2) was produced from ores received from Colorado and the Belgian Congo and then converted to uranium tetrafluoride. All buildings involved in the MED activities were transferred back to Linde Division in 1953.

POST MED/AEC SITE USE

Four of the five buildings involved are presently being used for either warehousing, fabrication facilities, research laboratories, or offices. Approximately 50 employees utilize these four buildings. The fifth building is presently not being used.

RADIOLOGICAL HISTORY

A radiation survey was conducted by the AEC Health and Safety Division-NYO in November 1952 to determine disposition of equipment used in the uranium operations. All equipment was removed and decontamination took place in 1953. A radiological survey was conducted under the FUSRAP during October and November 1976. As a result of findings of this survey, Linde applied for and received an amendment to its New York State license to include the contaminated building.

REMEDIAL ACTION OPTIONS AND COST

Remedial action is indicated and could involve extensive decontamination of buildings, excavation of soils under building floors and outdoors, and cleanup of streams and ditches onsite. Fifty-thousand cubic yards of contaminated material would be produced. Estimated cost for this remedial action is $35,000,000.

PROJECT STATUS

A radiological survey was completed during October and November 1976. The final report was issued in May 1978. The Assistant Secretary for Environment has determined that the site will require remedial action. However, additional radiological work is required to develop engineering plans. Authority to implement remedial action exists under the Atomic Energy Act of 1954, as amended.

MALLINCKRODT, INC.
ST. LOUIS, MISSOURI

OWNER HISTORY

The site has been and is currently owned and operated by Mallinckrodt, Inc., formerly named Mallinckrodt Chemical Works.

SITE LOCATION

Mallinckrodt leased portions of two locations in St. Louis at Broadway Street and at Destrehan Street to the MED/AEC for the processing of uranium concentrate. About 20 existing buildings on the Mallinckrodt property at Broadway and Destrehan, plus their surroundings, were subject to radiological contamination.

MED/AEC SITE USE

In April 1942, Mallinckrodt Chemical Works was requested by the Army to set up an industrial-scale process to produce uranium dioxide and uranium trioxide. Mallinckrodt had the processing system operating by early summer 1942 and provided uranium compounds and uranium metal for use in the research, development, and production programs of the AEC. Work also included (1) production of uranium tetrafluoride (UF_4), (2) production of uranium derby metal (vacuum recast of purified ingot metal), (3) machining of uranium metal rods for reactor fuel slugs, (4) reversion of uranium tetrafluoride to UO_2 or U_3O_8, (5) recovery of scrap uranium metal, (6) production of UO_2F_2, (7) extraction and concentration of thorium-230 from pitchblende raffinate, and (8) experimental processing of very low enrichment UF_4. From 1942 through 1945, uranium processing was done exclusively at the Broadway Street location. Some uranium metallurgical research continued through 1956. From 1945 to 1957, uranium ore or concentrate was processed in buildings at the Destrehan Street location. In 1957, all operations at Destrehan were terminated.

POST MED/AEC SITE USE

Since 1962, the site has been used for various commercial chemical production operations. Some of the original buildings have been torn down, some are being used as warehouses, and new buildings have been constructed. Columbian-Tantalum ore and potassium compounds are stored onsite.

RADIOLOGICAL HISTORY

From 1948 to 1950, the main plant property was decontaminated and final contamination surveys were performed. In 1951, the main plant property was returned to Mallinckrodt for unrestricted use. Between 1957 and 1962, the Destrehan and Broadway Street properties were also decontaminated, surveyed, and released for unrestricted use. In the process, some of the buildings were removed to the AEC waste disposal sites. Contaminated earth was also removed and backfilled. Early in the program, decontamination procedures were supervised by the New York Operations Office of AEC and later by the Oak Ridge Operations Office. The AEC decontamination activities did not reduce radioactivity levels to background but reduced them only to the prevailing acceptable levels at that time. A new radiological survey of the former uranium processing areas was conducted under the FUSRAP during the summer of 1977.

Results of the 1977 survey indicate alpha and beta-gamma contamination levels inside and outside some of the buildings were above limits set by current Federal guidelines

concerning the release of property for unrestricted use. Elevated external gamma radiation levels were measured at some outdoor locations and in some of the buildings. Quantities of uranium in an amount that may require licensing were found in soil at some places, and the concentration of uranium in one water sample taken from an old waste pit was in excess of Federal water quality standards stated in 10 CFR 20. Radon and radon daughter concentrations in three buildings were in excess of current Federal guidelines for nonoccupational radiation exposure.

REMEDIAL ACTION OPTIONS AND COSTS

Remedial action is indicated and could involve extensive excavation of contaminated soil and decontamination of buildings including removal of structural elements. Forty-nine-thousand cubic yards of contaminated material would be produced. Estimated cost for this remedial action is $26,000,000.

PROJECT STATUS

A radiological survey was completed in 1977, a draft report has been completed, and the final report is being prepared. The Assistant Secretary for Environment has determined that the site will require remedial action. Additional authority is needed to implement remedial action.

MIDDLESEX MUNICIPAL LANDFILL
MIDDLESEX, NEW JERSEY

OWNER HISTORY

Pre 1961: Borough of Middlesex
Post 1961: Borough of Middlesex and Middlesex Presbyterian Church (5 acres)

SITE LOCATION

The site is located in the Borough of Middlesex, New Jersey, approximately 35 miles northeast of Trenton. The contaminated area covers about 3 acres.

MED/AEC SITE USE

This area is a former landfill for the Borough of Middlesex. The landfill was used by the Middlesex Sampling plant for disposal of nonradioactive wastes. However, during the operation of the sampling plant, some contaminated wastes were shipped to the landfill. There is no documented material to indicate when the contamination of the landfill occurred; however, a review of operating files from 1946 to 1966 indicates that the most probable time frame was between November 1947 and October 1948. Construction of a drainage ditch and paved storage area took place during this period. It is believed that the material deposited at the landfill may have resulted from this construction effort.

POST MED/AEC SITE USE

The contaminated area is currently undeveloped and not used for any activity.

RADIOLOGICAL HISTORY

In May 1960, during a local civil defense (CD) exercise, CD monitors detected elevated radiation levels in the landfill. The matter came to public attention and received newspaper coverage. The AEC noted the issue and upon reviewing its past local activities concluded that AEC operations were the source. Upon analytical confirmation of the presence of pitchblende, a further survey of the area was made. Readings taken at that time confirmed gamma radiation levels 20 to 50 times background over a fairly consolidated area of less than one-half acre.

Following meetings with local officials in November 1960 to discuss the significance of survey findings and to offer remedial assistance, the AEC removed the part of the material nearest the surface (about 650 cubic yards). The area was covered with about 2 feet of clean dirt sufficient to shield surface radiation levels to about 50 microroentgens per hr at 1 meter. The contaminated soil was removed to the AEC New Brunswick Laboratory site. Upon receiving assurance by the AEC that no health hazard existed, Borough officials agreed that the situation was satisfactory. No official record of the residual contamination exists in available Borough records. On January 30, 1974, another meeting was held with Borough officials to request permission to resurvey the involved area to permit re-evaluation of current conditions. Location of the suspect area was confirmed by survey data; it was in the area of the boundary between the church and Borough properties. The Oak Ridge National Laboratory has conducted additional survey and assessment work during 1978. During the period May 20-27, 1978, EG&G (a DOE contractor) performed an aerial survey of Middlesex. The survey produced no new conclusions related to the landfill.

As a result of the survey findings, the following conclusions were made:

- The contaminated area in its present configuration and use presents no significant radiation exposure potential to the public. This should be the case as long as the area is undisturbed by excavation or the construction of habitable enclosures.

- The exposure of individuals at or exceeding guide levels cannot be convincingly dismissed as a credible possibility under circumstances which could exist if the area were developed in the future with residences or other habitable structures.

REMEDIAL ACTION OPTIONS AND COSTS

Remedial action is indicated. In April 1978, an engineering evaluation and environmental analysis was completed of options for various remedial actions at this site. The options range from stabilization of the material onsite to removal of all material to background radiation levels and backfilling to present condition with clean fill. Based upon the engineering evaluation of the site, it is estimated that the original 6,500 cubic yards of contaminated soil from the sampling plant have now been dispersed with other soil and landfill debris. The contaminated portion involves a volume of between 34,000 to 69,000 cubic yards of soil. There has been additional sanitary landfill activity since the radioactivity was dispersed in the landfill. An estimated 16,000 to 21,000 cubic yards of nonradioactive soil and debris currently cover the contaminated soils. The estimated cost for the removal and backfill remedial action is $50,000,000.

PROJECT STATUS

Radiological surveys have been completed. An engineering evaluation report was issued in April 1979 and an environmental analysis was issued in July 1979. The Assistant Secretary for Environment has determined that the site will require remedial action. Authority to implement remedial action exists under the Atomic Energy Act of 1954, as amended.

MIDDLESEX SAMPLING PLANT
MIDDLESEX, NEW JERSEY

OWNER HISTORY

1943-1950: American Marietta Company
1950-Present: U.S. Government

SITE LOCATION

The site is located in Middlesex, New Jersey, and contains six buildings on 9.6 acres. Some portions of the adjacent and nearby properties, especially along the south border, have significantly contaminated soil. Two nonadjacent private properties have also been identified as having contaminated soil from the Middlesex Sampling Plant: the Our Lady of Mount Virgin Catholic Church at 650 Harris Avenue, Middlesex, New Jersey, and the private residence at 432 Williams Street, Piscataway, New Jersey.

MED/AEC SITE USE

This facility, also known as Perry's Warehouse, was used for the sampling, weighing, assaying, and storage of uranium and thorium ores. The uranium sampling operations were conducted between November 1943 and February 1955. The bulk of the Belgian Congo uranium ores and other uranium ores used by the United States were handled at this site. The residue from the processing of these ores was temporarily stored at Middlesex prior to its return to the vendor. There are indications that the site was also used as an interim holding site for disposition of various research-related and decontamination wastes. Following the termination of the uranium-sampling operations, the primary AEC activities at the plant involved the sampling and storage of thorium materials and residue. All AEC activities at the site terminated in September 1967 with the conclusion of the decontamination of the site and certification of the site for unrestricted disposal.

POST MED/AEC SITE USE

The site was used by the U.S. Marine Corps for their 6th Motor Transport Battalion reserve training from 1969 to approximately 1975. The site is presently in the custodial care of the DOE. Access is restricted by a 7-foot-high chain-link fence.

RADIOLOGICAL HISTORY

Prior to 1967, the AEC contracted Isotopes, Inc., to decontaminate the site. The AEC Health and Nuclear Safety Branch performed a follow-up survey and additional decontamination. Upon completion of this decontamination on September 2, 1967, Oak Ridge Operations certified the site for unrestricted disposal. Decontamination required sandblasting, vacuuming, detergent and acid washing, concrete chipping, equipment removal, and in cases of severe contamination, building member removal. Waste was transported by rail to a Nuclear Fuel Services licensed burial site at West Valley, New York. A radiological survey was completed under the FUSRAP in May 1976.

Results of the 1976 survey indicate surface contamination levels on the former plant site exceed the Nuclear Regulatory Commission guidelines, and radon concentration levels exceed the nonoccupational maximum permissible concentration (10 CFR 20) in some structures. These results indicate the possible need for extensive radon and radon daughter measurements in structures both onsite and offsite over periods as recommended in 10 CFR 712 for structures in Grand Junction, Colorado. As a result

of an aerial survey conducted by EG&G for the DOE between May 20 and May 27, 1976, and followup ground surveys by ORNL, two additional properties were identified that were contaminated by material handled at the Sampling Plant.

REMEDIAL ACTION OPTIONS AND COSTS

Remedial action is indicated and could involve excavation of soil at the site and adjacent and nearby properties, and removal of buildings and equipment from the sampling plant site. The DOE has proposed a two-stage remedial action at this site and is in the process of obtaining local government and owner approval. The plan would entail the cleanup of all offsite contaminated property and interim storage of the contaminated material onsite until a disposal site is identified at which time the entire site would be decontaminated. Seventy-seven-hundred cubic yards of contaminated materials would be produced. Estimated cost for this remedial action is $48,000,000.

PROJECT STATUS

A radiological survey was performed in May 1976. The final report was issued in November 1977. Additional offsite survey work is being conducted. The Assistant Secretary for Environment has determined that remedial action is required. An engineering evaluation report (Title I) and an environmental analysis report were issued in July 1979. The DOE has drafted preliminary remedial action plans that schedule the remedial action to begin in FY 1980 and a cooperative agreement between the DOE, the Borough of Middlesex, and the State of New Jersey was signed in December 1979. In addition, the NEPA process has been completed for remedial actions at the Williams Street and Catholic Church properties and proposed remedial actions have been approved (September 1979). Authority exists for implementation under the Atomic Energy Act of 1954, as amended.

NATIONAL GUARD ARMORY
CHICAGO, ILLINOIS

OWNER HISTORY

The property is owned by the State of Illinois.

SITE LOCATION

The armory is located at 52nd Street and Cottage Grove Avenue, Chicago, Illinois.

MED/AEC SITE USE

During the MED/AEC era, uranium was apparently used at the site and it is believed that some type of uranium processing was performed. Personnel recall that the grandstand surrounding the arena was used for storage of radioactive materials. The use of the arena may have involved the chemical processing and metal casting of uranium. Use of the facility was terminated in 1951.

POST MED/AEC SITE USE

Contaminated dirt from the arena was removed and at a later date additional dirt removed and replaced with a concrete pad. It is currently in use as offices, classrooms, and as storage and garage areas.

RADIOLOGICAL HISTORY

A survey was conducted under the FUSRAP during September and October 1978. Surface contamination was found in 10 of over 160 rooms in the armory. Contamination was generally in small localized spots except for Room 1 where it was widespread. The highest alpha contamination was 5×10^4 dis/min/100cm^2 and the highest beta-gamma was 3.5×10^5 dis/min/100cm^2. Contamination was also observed in catch basins in a number of rooms. Air samples indicated radon concentrations below maximum permissable concentration for uncontrolled areas. Analyses of soil samples indicated results within the range of concentrations found in background samples.

Direct instrument and smear surveys indicate some contamination is still present within the building. All of the contamination in Room 1 exceeds guidelines for unrestricted use. Contamination in two catch basins in Room 1 exceeds guidelines. Seven other locations throughout the building exceed guidelines. Radon concentrations in air samples were normal and soil sample analyses showed no elevated readings above background levels in soils. Other radioactive items such as radium dials were also noted.

REMEDIAL ACTION OPTIONS AND COSTS

Remedial action may be indicated and could involve decontamination of building surfaces and excavation of floor areas. Twenty-five cubic yards of contaminated material would be produced. The estimated cost for this remedial action is $710,000.

PROJECT STATUS

A radiological survey was completed in October 1978. Draft survey reports have been completed and final reports are being prepared. The Assistant Secretary for Environment will make a determination of need following the final report. Authority to implement remedial action will be required.

OLIN CORPORATION
JOLIET, ILLINOIS

OWNER HISTORY

The site was originally owned by Blockson Chemical Company, which was sold in 1955 to Olin Mathieson Chemical Corporation, the present owner.

SITE LOCATION

The site consists of a single building used for a pilot plant operation in Joliet, Illinois.

MED/AEC SITE USE

The site was used during the period of 1951 to 1962 to conduct a development program for the extraction of uranium from phosphoric acid.

POST MED/AEC SITE USE

The building (site) is presently being used to process phosphoric acid which contains elevated levels of natural uranium.

RADIOLOGICAL HISTORY

The work at the site included operation of a small pilot plant for the extraction of uranium from phosphoric acid. A radiological survey for the FUSRAP was conducted from March to November 1978. A draft of the final report has been prepared and is undergoing review.

Natural uranium contamination was found on the floors, overhead beams, and in the tanks and equipment where chemicals were processed. Small areas exceed applicable guidelines. Some contamination of the roof was found in which radium-226 was identified. In some places contamination is easily removed. The extent to which the contamination is due to the MED/AEC work because of the present operation is not known. Radon concentrations in air samples were normal. Results of analyses of soil samples taken about the grounds adjacent to the buildings showed no elevated readings above natural background in the soil.

REMEDIAL ACTION OPTIONS AND COSTS

Remedial action may be required and would involve decontamination of building surfaces and equipment. Three-hundred cubic yards of contaminated material might be produced. Estimated cost for this remedial action is $680,000.

PROJECT STATUS

Upon completion of the radiological survey report, the Assistant Secretary for the Environment will determine whether the site requires remedial action. Authority to implement a remedial action will be required.

PALOS PARK FOREST PRESERVE
COOK COUNTY, ILLINOIS

OWNER HISTORY

1942-1956:	Leased by the U.S. Army Corp of Engineers from Cook County Forest Preserve District
1956-Present:	Cook County Forest Preserve District

SITE LOCATION

The park preserve is located in Cook County, approximately 5 miles east of Lemont, Illinois. Within the park preserve, 20 acres were used for the MED/AEC activities.

MED/AEC SITE USE

The site contained two nuclear reactors and associated buildings and laboratories and a radioactive waste burial facility. The first successful nuclear reactor, CP-1 at the University of Chicago, was rebuilt as CP-2 at the site. The first heavy-water cooled and moderated reactor, CP-3 (designated CP-3' when rebuilt) was also at the site. Among the programs carried out at this site during and after World War II were fission product separations, reactor physics, tritium recovery from irradiated lithium, and studies of the metabolic effects of radionuclides on laboratory animals.

POST MED/AEC SITE USE

The site is currently utilized as part of the entire park forest preserve for recreational activities.

RADIOLOGICAL HISTORY

In 1956, the Federal Government returned all of the 20 acres to the Forest Preserve District. Before that time, the research reactors were decommissioned, radioactive materials were removed from the site and remaining radioactive components, including the reactor vessel, were encased in concrete and buried onsite. The empty buildings were surveyed, decontaminated if necessary, and demolished. The waste burial site was decommissioned by digging 8-foot-deep trenches around the perimeter and filling them with concrete. A 1-foot-thick concrete pad was poured over the top. The plot was then covered with soil and seeded. By the summer of 1956, decommissioning was complete, and the area was surveyed with state-of-the-art portable survey equipment. No detectable surface contamination was found. A limited environmental monitoring program was begun at the Palos site in 1954, continuing about every other year until 1975.

An extensive radiological survey was conducted under the FUSRAP during 1977 which showed that tritium was migrating from the former waste burial site.

Results of the 1977 survey indicate that the only significant pathway for exposure to the public is tritiated water moving from the former waste burial site to a dolomite aquifer and being consumed by individuals using the picnic wells on the preserve. The possible dose to people from this pathway is estimated to be 0.7 mrem/year.

REMEDIAL ACTION OPTIONS AND COSTS

Remedial action is indicated and could involve excavation of contaminated material and restoration. Estimated cost for this remedial action is $7,100,000.

PROJECT STATUS

A radiological survey was completed during 1977 and the final report was issued in April 1978. The Assistant Secretary for Environment has determined that the site will require remedial action. Both an environmental analysis report and an engineering evaluation report-Title I have been completed and were issued in September 1979. Additional authority is required to implement remedial action.

ST. LOUIS AIRPORT
ST. LOUIS, MISSOURI

OWNER HISTORY

1946-1973: U.S. Government
1973-Present: City of St. Louis, Airport Authority

SITE LOCATION

The storage site is a 21.7-acre tract located adjacent to the north boundary of the Lambert-St. Louis International Airport. The site is approximately 15 miles northwest of St. Louis.

MED/AEC SITE USE

The site was used for storage of residues and contaminated scrap and equipment generated by the Mallinckrodt Chemical Corporation, Destrehan Street Plant uranium-processing operations during the period 1946 to 1953. Various residues were stored above ground and in the open, above ground in steel drums, and below ground in an open concrete pit. Contaminated scrap and equipment were buried and later covered with clean fill. During 1966 and 1967, all residues were removed from the site.

POST MED/AEC SITE USE

The site has remained unused since 1967 with access controlled by the airport manager. Decontamination activities have taken place during 1969. Proposals have been made by the NRC to relocate contaminated material from the formerly licensed Latty Avenue site in Hazelwood, Missouri; and the St. Louis Airport Authority has recommended development of the site as a driver-training course for the police academy.

RADIOLOGICAL HISTORY

Wastes generated from uranium processing and other activities between 1947 and 1967 were stored onsite. In addition, 60 truck loads of contaminated scrap metal and a contaminated vehicle were buried onsite. During 1966 and 1967, most of the stored residues were sold and removed from the site. All onsite structures were razed and buried onsite. Contaminated soil in the residue storage area was removed and 1 to 3 feet of clean fill spread over the site. A radiological survey for the FUSRAP was conducted in August and November of 1978. Present access to the site is limited and it is used to receive clean rocks and fill.

Contamination of the site is due to buried deposits of naturally occurring radionuclides, namely uranium-238, radium-226, and thorium-230. Average concentrations of radon and radon daughters in air were well below guideline values for the general public. Surface radiation guidelines are exceeded at 10 onsite locations and 2 offsite locations in a ditch on the site side of an adjacent road north of the site. Soil along the northern fence has been disturbed by burrowing animals and eroded by water drainage. This contamination is the cause of the elevated surface beta-gamma and external gamma radiation exposures found in these ditches. The guidelines for external gamma exposure would be exceeded at five locations at the site if the area were frequently occupied. Currently, access to the site is limited.

REMEDIAL ACTION OPTIONS AND COSTS

Two remedial action options have been proposed. The first is stabilization and control for which a cost estimate ranging from 1.5 to 3 million dollars has been developed. The second is removal of 180,000 cubic yards of the contaminated material and restoration of the site at an estimated cost of $98,000,000.

PROJECT STATUS

A radiological survey was conducted in August and November 1978; the final report was issued in September 1979. An environmental impact analysis was issued in July 1979 addressing proposed and alternative actions. No Title I design has been done. Additional authority for the Assistant Secretary for Nuclear Energy to implement remedial action is required.

SEAWAY INDUSTRIAL PARK
TONAWANDA, NEW YORK

OWNER HISTORY

Seaway Industrial Park Development Company, Inc.

SITE LOCATION

The site, covering 100 acres, is located in Tonawanda, New York, adjacent to the Niagara River. It is primarily used as a landfill. Approximately 13 acres of the landfill has been used for storage of radioactive materials. It is adjacent to the Ashland Oil Company property, another formerly utilized MED/AEC site.

SITE USE

In 1974, approximately 6,000 cubic yards of uranium-processing residue, comprised essentially of low-grade uranium ore tailings, were excavated from the adjacent Ashland Oil, Inc., property and dumped onto three areas of the landfill.

RADIOLOGICAL HISTORY

Since their initial transport to the site, the residues have been somewhat scattered and mixed with clean soil by earthmoving and spreading associated with the landfill operation. A radiological survey was conducted under the FUSRAP during August 1976. The survey indicated that radioactive material is being transported off-site by surface runoff. An aerial survey was conducted in September 1979.

Results of the 1976 survey indicate external gamma, radon, and radon daughter levels exceed guideline values over small areas of the landfill. However, these levels do not present a health hazard under the current site use because of low exposure time to landfill workers in the vicinity of the residues.

Potential health hazards could result from either conversion of the site use by construction of buildings or from use of residues for fill at another site or as a construction material. If a building were constructed in certain portions of the site, radon daughter levels of 0.15 or higher could develop in the building.

REMEDIAL ACTION OPTIONS AND COSTS

Remedial action is indicated and could involve excavation of the residues from the site, including a stream and drainage ditch. Thirty-nine-thousand cubic yards of contaminated material would be produced. The estimated cost for this remedial action is $24,000,000.

PROJECT STATUS

A radiological survey was completed in August 1976; the final report was issued in May 1978. The Assistant Secretary for Environment has determined that the site will require remedial action. Additional authority for the Assistant Secretary for Nuclear Energy to implement remedial action is required.

SENECA ARMY DEPOT
ROMULUS, NEW YORK

OWNER HISTORY

The site is owned and operated by the U.S. Army.

SITE LOCATION

The depot consists of approximately 10,000 acres, of which approximately 20 acres were involved in the MED activities. This area consists of 11 munitions bunkers and surrounding areas over which material was transported.

MED/AEC SITE USE

About 2,000 barrels of pitchblende ore were stored in 11 munitions bunkers during a short period in the 1940s.

POST MED/AEC SITE USE

Upon removal of the ore, the bunkers reverted back to storage sites for ammunition and have continued in this function since that time.

RADIOLOGICAL HISTORY

Since the original short-term storage of uranium ore in munitions bunkers, some contamination of the interior surfaces of at least eight bunkers has been present. A radiological survey was conducted under the FUSRAP during September 1976. The survey indicated that the interior surfaces of at least eight of the bunkers have been contaminated with uranium ore and as a consequence, natural uranium and its daughters, including radium-226, may be found on these surfaces and on outdoor surfaces near the entrances to these bunkers.

Results of the 1976 survey indicate that the interior surfaces of at least eight of the bunkers were contaminated with uranium ore. Direct alpha readings exceeded the maximum guideline in some areas of each of the eight bunkers and transferable alpha exceeded the maximum guideline in six. Transferable beta contamination in excess of the guidelines was found in one area of the floor of one bunker. Radon daughter concentrations exceed 0.03WL in six bunkers but all were less than 0.048WL. External gamma radiation levels at one meter were below guideline values. The only contaminated soil was found near the surface in small areas near bunker entrances. No health hazard exists because of the very low occupancy time of the bunkers.

Potential health hazards could result from exposure to radon and radon daughters concentrations in the bunkers if occupancy times were to increase. While no crops are currently grown on site, use of the contaminated soil for such a purpose could produce additional human exposure.

REMEDIAL ACTION OPTIONS AND COSTS

Remedial action is indicated and could involve thoroughly cleaning all floors, walls, ceilings, vents, and drains. Contaminated soil outside the bunkers could be excavated. Four-hundred cubic yards of contaminated material would be produced. The estimated cost for this remedial action is $860,000.

PROJECT STATUS

A radiological status survey was completed during September 1976; the final report was issued in February 1979. The Assistant Secretary for Environment has determined that the site will require remedial action. Authority to implement remedial action exists under the Atomic Energy Act of 1954, as amended.

SHPACK LANDFILL
NORTON, MASSACHUSETTS

OWNER HISTORY

The property is presently owned by Mrs. Isadore Shpack and had been owned by the Shpack family before the suspected date of contamination.

SITE LOCATION

The site is located in Norton, Massachusetts, near the common corporate boundary of Norton and Attleboro. Norton is approximately 15 miles northeast of Providence, Rhode Island. The area of concern comprises approximately 5 acres.

MED/AEC SITE USE

The Shpack Landfill was a private landfill that received "industrial" wastes from local operations. A NRC investigation determined that the former M&C Nuclear, Inc., Attleboro, Massachusetts (merged with Texas Instruments, Inc., in 1959) had used the Shpack Landfill area for the disposal of trash and other material, including burning zirconium ashes, associated with nuclear fuel operations conducted at the facility from 1957 to 1966. The NRC investigation concluded that it is possible that the aforementioned facility was the source of the major portion of the radioactive material.

POST MED/AEC SITE USE

The landfill is now closed and the area is undeveloped. The surface presently contains metal, brick, concrete, blocks, iron drums, plastics, and miscellaneous debris. The area is poorly drained and covered with water part of the year.

RADIOLOGICAL HISTORY

On September 22, 1978, the NRC Region I Office was contacted by a concerned citizen who had identified elevated (above background) radiation levels at the Shpack Landfill site. A special investigation by the NRC from October through December 1978 verified the presence of radioactivity above background levels at the Shpack Landfill. Gross alpha measurements of well water from the Shpack residence were found to be within EPA Drinking Water Standards. An independent study conducted by Brown University students produced results which were orders of magnitude higher than the gross alpha measurements of the NRC study and far in excess of EPA standards. The NRC, in conjunction with the State of Massachusetts, collected a number of additional water samples and had them analyzed at a number of independent laboratories. The results verified that well water in the area was not affected as all well samples were below EPA standards. As a result, the NRC determined contamination at the landfill posed no immediate hazard to human health but potential for exposure did exist. Representatives from the DOE and ORNL visited the site and performed a preliminary ground survey and EG&G, Inc., performed an aerial radiological survey. The ground survey (July 24, 1979) concluded that the site was contaminated with uranium- and radium-bearing materials and that the uranium was primarily depleted uranium. A full radiological survey was recommended. The aerial survey (August 8 and 9, 1979) did not detect any radiation levels significantly above those due to natural background.

Results of studies completed to date indicate that the current use of the landfill does not pose an immediate hazard to human health but potential for exposure does exist.

REMEDIAL ACTION OPTIONS AND COST

Remedial action may be required and could include excavation of contaminated soil. A preliminary estimate indicated that approximately 4,500 cubic yards of contaminated material would be produced. The estimated cost for this remedial action is $2,200,000.

PROJECT STATUS

The DOE has asked ORNL to develop and implement a survey plan for the Shpack landfill site. Upon completion of these efforts, a determination will be made by the Assistant Secretary for Environment as to whether remedial action is required. A determination as to whether additional authority is required to implement remedial action is currently underway.

UNIVERSAL CYCLOPS, INC.
ALIQUIPPA, PENNSYLVANIA

OWNER HISTORY

1942-1955:	Vulcan Crucible Steel Company
1955-1960:	Vulcan Crucible Steel of H. K. Porter
1960-1966:	Vulcan-Kidd Steel of H. K. Porter
1966-Present:	Vulcan Cyclops, Inc.

SITE LOCATION

The site is located in Aliquippa, Pennsylvania, and consists of one building and surrounding areas.

MED/AEC SITE USE

Uranium billets were received, rolled into rods, boxed, and shipped out. This site consisted of a rolling mill, two furnaces for heating, and cutting and extruding equipment. The finished rods were stored in boxcars after being transferred to the receiving and shipping room for weighing. The building is one story over 30 feet high with part concrete, part dirt, and part metal floor.

POST MED/AEC SITE USE

Portions of the building are presently leased to Heritage Box Company and Precision-Kidd for use as storage areas.

RADIOLOGICAL HISTORY

During February 1949, dust samples at the mill were collected by representatives of the New York Operations Office-AEC. From data obtained from these samples, it was apparent that the entire group of employees was exposed to concentrations of alpha-emitting dust that were above the preferred level. Recommended corrective actions were provided to the Vulcan Crucible Steel Company. A follow-up survey was made and required decontamination and equipment disposition defined. Decontamination was completed by March 1950. A radiological survey was conducted under the FUSRAP during May 1978.

Results of the 1978 survey indicate some contamination is still present in the building. Floor areas and overhead beams showed transferable natural uranium contamination. Radon concentrations in air were normal. Only one soil sample contained elevated levels of uranium. Current use of the building does not present a health hazard. However, cleaning or demolition of the building could cause significant exposure.

REMEDIAL ACTION OPTIONS AND COSTS

Remedial action may be required and could involve excavation of a small amount of soil and decontamination of one building. Fifty-five cubic yards of contaminated material would be produced. The estimated cost for this remedial action is $1,000,000.

PROJECT STATUS

A radiological survey was completed in May 1978. A draft report has been issued and is undergoing review. Upon issuance of the final report, a determination will be made by the Assistant Secretary for Environment as to whether remedial action is required. Additional authority to implement remedial action is required.

VENTRON CORPORATION
BEVERLY, MASSACHUSETTS

OWNER HISTORY

1942-1965:	Metal Hydrides Corporation
1965-1976:	Ventron Corporation
1976-Present:	Thiokol Corporation

SITE LOCATION

The site is located in Beverly, Massachusetts, approximately 15 miles northeast of Boston. Three buildings were used for MED/AEC-related work.

MED/AEC SITE USE

From 1942 to 1948, Metal Hydrides Corporation was under contract to the MED and the AEC for conversion of uranium oxide to uranium metal powder, using calcium hydride. The method was proven at Metal Hydrides Corporation earlier in 1941. As better methods for production of uranium metal were developed, Metal Hydrides Corporation shifted their operations toward recovering uranium scrap and turnings from the slug fabrication plant at Hanford. Two wooden buildings that contained the foundry facilities were demolished some time between 1948 and 1950. Two other buildings have been erected at these locations. The remaining original building contained furnace and leaching facilities, a mixing room, a drying room, and analytical laboratories.

RADIOLOGICAL HISTORY

A radiation survey conducted in 1948 listed as contaminated the two foundry buildings and various pieces of equipment. As a result of that survey, it was recommended that painted surfaces be cleaned by sandblasting and contaminated concrete floor and platform materials be removed.

A visit to the site for exploratory measurements was made in January 1977 by Oak Ridge Operations and ORNL personnel. It was determined, based on the results of the exploratory measurements, that a complete radiological survey of the entire site should be performed.

Based on the 1977 exploratory measurements, soil and building contamination above background levels exist at the site. The degree and extent of the contamination will be determined from a complete radiological survey.

REMEDIAL ACTION OPTIONS AND COSTS

Remedial action may be required and could involve excavation of contaminated soil and decontamination of building floors and surfaces. A preliminary estimate indicated that 100 cubic yards of contaminated material would be produced. The estimated cost for this remedial action is $880,000.

PROJECT STATUS

A radiological survey is scheduled. Upon completion of the survey, a determination will be made by the Assistant Secretary for Environment as to whether remedial action is required. Additional authority to implement remedial action is required.

WATERTOWN ARSENAL
WATERTOWN, MASSACHUSETTS

OWNER HISTORY

1946-1967: U.S. Government
1967-Present: Watertown Redevelopment Corporation

SITE LOCATION

The site is located adjacent to the current boundary of the Watertown Arsenal in Watertown, Massachusetts, approximately 5 miles west of Boston. Only one building has been confirmed as being utilized for the the AEC activities; however, several additional buildings may have been.

MED/AEC SITE USE

The Massachusetts Institute of Technology (MIT) operated a laboratory and a uranium ore testing facility for the AEC in a now-demolished building at the Watertown Arsenal. A modified ion exchange technique for production of U_3O_8, which employed a fluidized bed system, was developed at this site. Initial research on African ores was conducted at MIT in Cambridge. The activity was transferred to the Watertown Arsenal (building 421) in 1946. MIT conducted the research activities until 1950 at which time American Cyanamid took responsibility for the functions of the site. In 1953, the AEC activities at Watertown Arsenal, building 421, were transferred to a new facility.

POST MED/AEC SITE USE

The site has been transferred to the Watertown Redevelopment Corporation and is presently unused. Only the concrete pad of building 421 remains. Operations involving uranium are continuing in other areas of the arsenal.

RADIOLOGICAL HISTORY

The AEC Chicago Operations and Argonne National Laboratory (ANL) completed a comprehensive radiological survey of the portion of the arsenal (building 421 and surrounding area) used for the AEC activities. Direct instrument surveys of the pad of building 421 and south wall of building 331 (nearest building to the pad) identified three small spots on the pad that exceed the proposed ANSI standard No. N13.12. Smears indicated that the contamination was fixed and the analysis of one sample identified the contamination to be from natural uranium. Other direct instrument measurements taken showed no readings above natural background. Analyses of soil samples, water samples, and measurements of radon in the air gave no indication of radiation above natural background.

During the ANL radiological assessment of the building 421 site, it was discovered that several additional buildings and facilities were involved in uranium operations during the MED/AEC era. This included buildings 34 and 41, which have been razed. Both building sites are within the confines of the arsenal area, though they have been turned over to the Watertown Redevelopment Corporation. There is no evidence of a radiological survey being performed for these two buildings. In addition, there is an area on the north side of Arsenal Street that had been used for uranium storage and as burn area. A survey was made in this area by Watertown Arsenal Radiation Safety personnel in 1973. Their investigation revealed a significant amount of contamination on the pad and a need for a more comprehensive survey of the area. The DOE plans to

survey the area north of Arsenal Street and the pads of buildings 34 and 41 during 1980. These areas were used by the Army for uranium storage and as a burn area.

Based on the preliminary surveys, the contamination is at an acceptable level and does not represent a hazard to the general population. However, if site use is changed, there is a potential for excessive exposure.

REMEDIAL ACTION OPTIONS AND COSTS

Remedial action may be required and could involve excavation of soil and decontamination of the concrete pad. Two-hundred-sixty cubic yards of contaminated material would be produced. Estimated cost for this remedial action is $630,000.

PROJECT STATUS

Additional radiological survey work is scheduled for FY 1980. Upon completion of this survey, the Assistant Secretary for Environment will determine whether remedial action is required. Additional authority to implement remedial action is required.

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