Appendixes

Appendix A

Summary of Contaminated Sites and Initial Cleanup Work

INTRODUCTION

This appendix reviews the work underway throughout the Department of Energy (DOE) Nuclear Weapons Complex to identify and characterize contaminated sites, to comply with environmental laws and regulations, and to initiate cleanup projects. The Office of Technology Assessment (OTA) first assembled a report using data published in draft form by DOE during its 1987-1988 Environmental Survey and obtained through interviews with Environmental Protection Agency (EPA) officials in field offices who have been in charge of regulatory oversight at various weapons facilities. That report was then reviewed by DOE officials in headquarters and in the field.[1] This appendix, therefore, contains information deemed accurate by these sources as of July 1990.

The appendix is organized in two parts. The first part contains summary data concerning all facilities in the Nuclear Weapons Complex; the second part summarizes work at each facility. Because this is an overview, some specific data and some smaller sites have been omitted. These omissions were OTA's decision and were made to facilitate brief and direct presentation of status and trends throughout the Nuclear Weapons Complex.

ENVIRONMENTAL ASSESSMENT PROCESS

Prior to EPA becoming intimately involved in the assessment of media contamination problems at the Nuclear Weapons Complex (NWC) sites, DOE had initiated a program designed to address environmental problems and concerns. That program was the Comprehensive Environmental Assessment Response Program (CEARPS). Under CEARPS, DOE developed an approach for gathering information on current and past waste management practices. This program was initiated in light of the growing concern about contamination problems at DOE sites and the knowledge that remediation of contaminated areas would be required. The CEARPS program has been revised and is now referred to as the Environmental Restoration program.

In the early 1980's, EPA became involved with determining how DOE sites and waste management activities at those sites should be regulated under the Resource Recovery and Conservation Act (RCRA) or the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The level of coordination and cooperation between EPA and DOE has varied significantly from site to site. In general, the degree of cooperation and coordination between the two agencies was 1imited at first. However, during the late 1980's, DOE and ERA developed a better working relationship. Both agencies must work together to implement EPA's procedures for evaluating contamination problems under the RCRA and CERCLA programs. At present, DOE is, for the most part, assessing environmental problems as they would normally be assessed under either RCRA, CERCLA, or both. As a result, site assessment activities currently underway at DOE sites are at various initial stages of the environmental assessment process. DOE is progressing through EPA's sequential phases of site assessment in accordance with guidance documents for RCRA and CERCLA.

STATUS OF SITE ASSESSMENT ACTIVITIES

At all DOE sites, RCRA-regulated units have been identified and are in various phases of the RCRA process. For these units, work is proceeding in compliance with respective requirements and in accordance with project schedules. Units that operated under interim status either are closed, are in the process of closing, or have sought part B permits. Sites for which DOE submitted part B permit applications to ERA: 1) have had the part B permit application approved and issued (normally at sites requesting storage permits), 2) have had the permit application reviewed and returned to DOE for more information, or 3) are under review. The RCRA permit process that DOE is following is the same process followed by the commercial sector under the guidance developed by EFA.

All 14 of the sites selected for this OTA review are performing assessment work under one or more of the following regulations: RCRA section 3008(h) order, CERCLA section 120 Federal facility agreement, interagency agreement, triparty agreement, or RCRA permit. DOE is entering an "agreement in principle" for the Nevada Test Site. Eight sites are addressed under an interagency agreement in which RCRA and CERCLA activities are being implemented. Seven sites are implementing activities under RCRA. At those sites, CERCLA will be applied only if conditions can no longer be addressed under RCRA.

All sites will be conducting site assessment activities during the next 2 to 5 years or longer. At the larger sites,

[1]Letter and attachments from R.P. Whitfield, Associate Director, Office of Environmental Restoration Department of Energy, June 22, 1990, to Peter A. Johnson, OTA.

solid waste management units (SWMUs) are grouped together into "operable units." Thus, site assessment work for an operable unit will encompass numerous individual units and should result in the most efficient expenditure of resources. For example, under current plans, at Savannah River 313 SWMUs will be addressed as 44 separate units, at Mound Plant 73 SWMUs will be addressed as 9 units, at Rocky Flats 178 SWMUs will be addressed as 10 units, and at Hanford 1,500 SWMUs will be addressed as 78 units.

All sites either have completed or are conducting RCRA facility assessment and visual site inspection (RFA/VSI) or preliminary assessment and site investigation (PA/SI). All but one (the Nevada Test Site) have finished the first phase of this process, having completed either the RFA/VSI or the PA/SI. Identification of SWMUs is an ongoing process at the sites. As the RCRA facility investigation and CERCLA remedial investigation (RFI/RI) progress, additional SWMUs are discovered. This is not unexpected, due to the nature of past waste handling and disposal operation at DOE sites. At sites with both RCRA and CERCLA activities the two programs are working cooperatively. DOE personnel and EPA's RCRA and CERCLA personnel are jointly evaluating the results of work performed under each program to ensure that program requirements are fulfilled.

SITE CHARACTERIZATION

At all of the NWC sites, DOE will be conducting additional hydrogeologic characterization to adequately define subsurface conditions. DOE's first efforts have focused on characterizing site hydrogeology on a macro scale (regional). Additional characterization must be performed to understand the micro scale (site-specific) associated with either operable units or individual units. The major aquifers or water-bearing zones, which supply water that is suitable for drinking or other domestic purposes, are known on a regional scale. The microscale (e.g., local perched zones that provide sufficient quantities of water for domestic use) is not yet understood.

Knowledge of contaminant fate and transport is inadequate at most DOE sites. Therefore, DOE studies to better define contaminant fate and transport either have already begun or are scheduled to begin within the next 5 years.

GROUNDWATER CONTAMINATION

Most sites exhibit some groundwater contamination, but DOE has yet to assess the full extent of this contamination. In most cases the types and concentration of hazardous constituents must still be determined. DOE will be developing that information through the remedial investigation (RI) or RCRA facility investigation (RFI) process. At the majority of DOE sites, groundwater contamination has the potential to impact aquifers supplying water used for domestic purposes. DOE plans to assess the degree of risk posed by groundwater contamination to human health and the environment. Understanding contaminant fate and transport is a major concern and applies to all sites exhibiting groundwater contamination.

Six sites have initiated some sort of remediation process for removing and treating contaminated groundwater from certain areas. These involve pump and treat systems alone, or with French drains or interceptor trenches. Treatment consists of air stripping, ultraviolet light exposure, physical-chemical treatment, and ozonation.

SURFACE WATER CONTAMINATION

All weapons sites in nonarid locations (i.e., those that have a net positive water balance) either have confirmed or suspected surface water contamination. This results from several factors, such as contaminated groundwater discharge to surface water, point source outfalls, and nonpoint source discharge to surface water (due to precipitation on contaminated soil and subsequent erosion of soil particles to surface water). Some arid sites also have surface water contamination.

In several cases of confirmed surface contamination, the contamination has traveled off-site. DOE needs to determine more fully the degree of exposure and the potential risk that exposure poses to human health and the environment. In general, DOE must pay increased attention to surface water contamination. Hazardous constituents present in contaminated surface water have not been characterized fully, but DOE expects to provide that information through the RI and RFI processes.

SEDIMENT

At sites having old surface impoundments that accepted waste, or where surface water contamination is known to exist, sediment contamination is either suspected or confirmed. The extent of contamination is not fully known, but some off-site migration has occurred, and DOE is beginning to examine the extent of both onsite and off-site sediment contamination. This includes site-specific and waste-specific information concerning the environmental fate and transport of constituents in contaminated sediments. DOE is removing or stabilizing in situ contaminated sediments from some units in an attempt to clean and close those units.

SOIL CONTAMINATION

At all NWC sites, soil contamination is suspected or confirmed. In each case the full extent of on-site as well as off-site contamination has yet to be determined. By the

RI or RFI process, DOE will initiate activities defining the nature and extent of soil contamination, including gathering site-specific and waste-specific information on the environmental fate and transport of constituents in contaminated soils and conducting an exposure assessment to determine the impact on human health and the environment. DOE will initiate a program to define treatment and remediation strategies for handling contaminated soil. DOE's proposed methods of handling contaminated soil will be part of the corrective measures study (CMS) under RCRA or the feasibility study (FS) under CERCLA.

INDIVIDUAL SITE SUMMARIES

This section presents summary data concerning the following facilities in the Nuclear Weapons Complex:

- Fernald,
- Hanford Reservation,
- Idaho National Engineering Laboratory,
- Kansas City Plant,
- Lawrence Livermore National Laboratory-Main Site,
- Lawrence Livermore National Laboratory---Site 300,
- Los Alamos National Laboratory,
- Mound Plant,
- Nevada Test Site,
- Oak Ridge Reservation,
- Pantex Plant,
- Pinellas Plant,
- Rocky Flats Plant,
- Sandia National Laboratory, and
- Savannah River Site.

Fernald

The Fernald site is listed on the National Priority List (NPL); therefore, environmental investigation and restoration activities are being addressed under CERCLA by an administrative order. A PA/SI conducted at the site identified several types of waste management units, including drum storage, tank storage, landfill, tank-incinerator, and surface impoundment.

Results of the PNSI led to several remedial investigations to identify contaminated groundwater, surface water, sediment, and soil. Contaminated groundwater poses the greatest hazard to human health and the environment because private, community, and industrial drinking water wells are affected by the contamination.

At present, five RIs are being conducted at the site. These will more comprehensively identify the types of contaminants, extent of contamination, and risks to human health and the environment from on-site units. The RIs are expected to be completed in stages ranging from 7 months to 2 or 3 years. Exposure assessments will be conducted to determine human health and environmental risks.

Table A-1 identifies the types of contaminants that have been released to the environment in the past.

Groundwater

Groundwater contamination has been confirmed both on-site and off-site. DOE has installed a pump and treat system to remediate on-site groundwater contamination. This pumping system sends contaminated groundwater to the on-site wastewater treatment plant, from which the treated water is discharged to surface waters, in compliance with the facility's National Pollutant Discharge Elimination System (NPDES) permit.

Surface Water

Surface water contamination has been confirmed. DOE has implemented some interim corrective measures. Storm water runoff is also being channeled into, and treated by, the wastewater treatment plant to reduce the impact on surface waters.

Sediment

Sediment contamination exists on-site and off-site; however, the full nature and extent of sediment contamination have not been determined.

Soil

Soil contamination has been confirmed at the facility. DOE has initiated interim measures by removing some contaminated soil in the production areas to reduce both surface and groundwater contamination. Future corrective actions will be conducted pursuant to the administrative order entered into by EPA and DOE.

Hanford Reservation

RCRA and CERCLA activities at the Hanford Reservation are being performed under a tri-party agreement (TPA) signed in May 1990 by DOE, the State of Washington Department of Ecology (WDOE), and EPA. Under this agreement, RCRA activities are performed under WDOE, and CERCLA activities under EPA as the lead agency.

The facility is separated into 78 ''operable units'' (OUs), about half of which are active units covered by RCRA and half are inactive units covered by CERCLA. The OUs include a total of 1,400 waste sites and four groundwater contamination plumes. The TPA outlines schedules for the investigation and remediation of all waste units. RCRA Part B permit applications have been submitted to WDOE for some of the RCRA-regulated units, but no operating permit has been issued to date. RFAs have been completed; RFIs and corrective measures are underway at some units.

Table A-I—Summary of Hazardous Substances Released to the Environment at the Feed Materials Production Center, Fernald, Ohio

Contaminant	Air	Soil	Surface vvater	Groundwater	Sediment
Radionuclides	Radon Radon-decay products Thoron[a] Uranium[b]	Radon Uranium		Cesium-137 Gross alpha Gross beta Neptunium-237 Potassium-40 Ruthenium-106 Strontium-90 Thorium-232 Uranium	Technetium-99 Uranium
Metals		Lead	Chromium	Barium Chromium	
Inorganic compounds	Hydrogen fluoride[c]		Cyanide	Chlorides Fluorides Nitrates Sulfates	
Volatile organic compounds (VOCs)	Perchloroethylene[d]	Perchloroethylene[d e] Trichloroethane[e]	Perchloroethylene[d e] Trichloroethane[e]	Perchloroethylene[d e] Trichloroethane[e]	
Miscellaneous	Particulates	Asbestos PCBs[f]	PCBs[f]	PCBs[f]	

[a]Although believed present, inappropriate methods have been used to detect the presence and Contamination Potential.
[b]Approximately 96 metric tons of this radioactive contaminant had been released up to mid-1986.
[c]An unspecified amount of this contaminant was released to the air from the uranium reduction plant (used for reducing UF_6 and UF_4) in January 1986.
[d]This VOC is also known as tetrachloroethylene or tetrachloroethene.
[e]The presence or potential contamination associated with this pollutant has not been fully determined.

SOURCE: U.S. Department of Energy, Office of Environmental Audit, "Environmental Survey Preliminary Report-Feed Materials Production Center, Fernald, Ohio," DOE/EH/OEV-1-P, March 1987.

PA/SIs completed for the CERCLA-regulated units identified 1,500 individual waste units. Of the 14 RI/FSs initiated thus far by DOE, only 2 (the 1100 Area and the 200 Area) have been approved by EPA. Field investigations under the RI/FS process are being conducted at these two operable units. No other RI/FS activities have been completed. The required risk assessments will be conducted at these and the remaining 76 OUs, as part of an overall Hanford risk assessment to address risks to human health and the environment.

Three major obstacles are inhibiting corrective or remedial action at Hanford. The first is the size and technical complexity of the site itself. The second is the difficulty and hazard of performing waste characterization analyses on samples known to contain hazardous and radioactive materials. The third is the high cost of characterization and remedial action. Although these obstacles have been identified at other weapons sites, they play a significant role at Hanford. The types of contaminants that have been released to the environment in the past are shown in table A-2.

Groundwater

The regional hydrogeologic regime is generally understood. However, additional hydrogeologic, waste characterization, and health risk assessments at the OU level are required to design appropriate remedial measures. Contaminants in groundwater have been identified. Tritium and nitrate contamination has been found in plumes totaling 122 square miles. Other pollutants have been detected in more localized groundwater areas at levels that exceed drinking water standards. Examples of these contaminants include carbon tetrachloride, chromium, cyanide, trichloroethylene, uranium, cobalt-60, technetium-99, iodine-129, and strontium-90. Most of this contamination has resulted from past waste disposal activities.

Wastewater containing hazardous and radioactive constituents continues to be discharged into the soil column at 33 Hanford locations. Although the radionuclide content is known, the nature and quantity of the hazardous components are being investigated. DOE plans to discontinue wastewater discharging into soil in June 1995. The underlying aquifer discharges to the Columbia River, which is a source of drinking water downstream of the site. Corrective actions for the contamination sources and groundwater pathways will be based on the results of investigations under the TPA.

Surface Water

Hanford Reservation is located in a desert climate. Preliminary studies indicate that only during the winter does significant rainfall permit surface water to infiltrate the soil and reach groundwater sources. The only two natural surface water features at Hanford are the Colum-

Table A-2—Summary of Hazardous Substances Released to the Environment at the Hanford Reservation

Contaminant	Air	Soil	Surface water	Groundwater	Sediment
Radionuclides	Argon-41[a] Radon-222[a] Strontium-90[a]	Cesium-137 Ruthenium-106		Cesium-137 Gross alpha Gross beta Iodine-129 Plutonium-239 Plutonium-240 Radium Strontium-90 Tritium	
Metals				Barium Cadmium Chromium Mercury	
Inorganic compounds	Ammonia[a,b]			Fluorides Nitrates	
Volatile organic compounds (VOCs)	Carbon tetrachloride[a]			Carbon tetrachloride[a] Chloroform Dichloromethane[a] Hexone[a] Methylcyclohexane[a] Perchloroethylene[c] Phthalates[a] 1,1,1-Trichloroethane	
Miscellaneous		Pesticide rinsate[a] Untreated wastewater[a,d]	Untreated wastewater[a,d]	Coliform Kerosene[a] Oil Pesticide rinsate[a] Temperature[e] Untreated wastewater[a,d]	

[a]The present or potential contamination associated with current and past discharges of this pollutant has not been fully determined.
[b]Ammonia is released into the air by the plutonium Uranium Extraction facility (PUREX) located at the Hanford Site.
[c]This VOC is also known as tetrachloroethylene or tetrachloroethene.
[d]The direct discharge of untreated sanitary wastewaterand of process wastewaters containing radioactive and nonradioactive hazardous materials into the soil may have contaminated the soil and groundwater at the site.
[e]Changes in ambient groundwater temperatures have been caused by effluent cooling waters.

SOURCE: U.S. Department of Energy, Office of Environmental Audit, "Environmental Survey Preliminary Report-Hanford Site, Richland, Washington," DOE/EH/OEV-05-P, August 1987 and "Environmental Restoration and Waste Management Five-Year Plan for the Hanford Site—Predecisional Draft," April 1989.

bia River and Westlake. The presence of radionuclides in sediment from the Columbia River is attributed to DOE's past waste management practices. The total concentration of radionuclides contributed to river sediments by groundwater contamination at Hanford and the amounts that could be consumed by nearby residents are not known.

Sediment

Contaminated sediments are present in manmade ponds and ditches because of past disposal practices. These contaminants reach groundwater and the Columbia River. No treatment or removal is being performed at this time. Corrective actions under RCRA and CERCLA will be required to clean up contaminated sediments.

Soil

The extent of soil contamination with hazardous constituents has not been determined. The extent of radiological soil contamination, including vegetative uptake of radionuclides, is better understood. The environmental fate of the soil contamination has not been determined.

Idaho National Engineering Laboratory

In 1987, the Idaho National Engineering Laboratory (INEL) and EPA signed a section 3008(h) Compliance Order and Consent Agreement (COCA) to bring INEL into compliance with the permit and corrective action requirements of RCRA. In December 1989, INEL was added to the NPL of Superfund sites. As a result, EPA, DOE, and the State of Idaho are negotiating an agreement to integrate RCRA and CERCLA investigations and cleanup requirements. The agreement, which is to be developed under CERCLA'S section 120 is expected: 1) to supersede the COCA, 2) to define the responsibilities

Table A-3-Summary of Hazardous Substances Released to the Environment at the Idaho National Engineering Laboratory

Contaminant	Air	Soil	Surface water	Groundwater	Sediment
Radionuclides		Cesium-137 Cobalt-60 Iodine-131 Plutonium-238 Plutonium-239 Strontium-90		Iodine-129 Plutonium-238 Plutonium-239 Strontium-90 Tritium	Cesium-137 Cobalt-60 Strontium-90
Metals		Antimony[a] Beryllium Boron[a] Cadmium[a] Fluoride[a] Lead[a] Mercury[a] Palladium[a] Selenium[a] Thallium[a] Zirconium[a]		Beryllium Cadmium[a] Chromium Lead[a] Mercury[a] Palladium[a] Thallium[a] Zirconium[a]	Cadmium Chromium Lead Mercury
Inorganic compounds		Nitrates[a]		Hydrofluoric acid[a] Nitrates[a]	
Volatile organic compounds (VOCs)		Acetone[a] Benzene[a]		Acetone[a] Benzene[a] Carbon tetrachloride[a] Tetrachloroethylene[a] Trichloroethane[a]	
Miscellaneous		Asbestos[a] Fuel oil[a] PCBs[b]		Trichloroethylene[a] Asbestos[a] Fuel oil[a] PCBs[b] Sewage	

[a]The present or potential contamination associated with current and past discharges of this pollutant has not been fully determined.
[b]PCBs = polychlorinated biphenyls.

SOURCE: U.S. Department of Energy, Office of Environmental Audit, "Environmental Survey Preliminary Report—Idaho National Engineering Laboratory, Idaho Falls, Idaho and Component Development and Integration Facility, Butte, Montana," DOE/EH/OEV-22-P, September 1988 and "U.S. Department of Energy Technologies for Identification, Characterization, and Remediation of Environmental Contamination at Selected Sites," contractor report prepared for the Office of Technology Assessment, December 1989.

of the three agencies, and 3) to include schedules for conducting remedial actions.

Under the COCA, DOE has evaluated nearly 350 SWMUs. RFI work plans for two locations at INEL have been approved by EPA and are currently being implemented. Removal of contaminated sludge from an inactive injection well is being carried out as an interim measure.

RCRA part B applications have been submitted for most of the 180 active SWMUs. Although most of these SWMUs are generally in compliance, DOE will have to negotiate agreements with the State for certain high-level radioactive waste and transuranic mixed waste storage units to bring them into compliance. A schedule for submission of outstanding RCRA part B permit applications is being worked out with the State.

The Agency for Toxic Substances and Disease Registry has conducted on-site visits as part of a health assessment. CERCLA baseline risk assessments have been initiated at some release sites. Table A-3 identifies the types of contaminants that have been released to the environment in the past.

Groundwater

The Snake River Plain Aquifer underlies the 890 square miles of INEL at depths ranging from 200 to 1,000 feet. Although the hydrology of the regional aquifer is well understood, local flows at SWMUs are not sufficiently characterized to develop remedial actions, specifically where perched water and vadose zone contamination has occurred. DOE has identified three major sources of groundwater contamination: carbon tetrachloride and trichloroethylene from past waste disposal practices and radionuclides from reactor-related operations. An 8 1/2-mile-long (40-square-mile) plume of tritium has been identified at INEL; however, this radionuclide is barely detectable at the facility boundary. There is essentially no use of the Snake River Plain Aquifer many miles downstream of INEL.

Table A-4-Summary of Hazardous Substances Released to the Environment at the Kansas City Plant

Contaminant	Air	Soil	Surface water	Groundwater	Sediment
Radionuclides		Uranium[a]			PCBs[b]
Metals		Cadmium Chromium Copper Lead Nickel Zinc			
Inorganic compounds					
Volatile organic compounds (VOCs)	Trichloroethylene	1,2-Dichloroethene 1,2-Dichloroethane Toluene Trichloroethane Trichlorethylene	1,2-Dichloroethene Trichloroethene	1,2-Dichloroethane 1,1,1-Trichloroethane Trichloroethene Vinyl chloride	
Miscellaneous	Asbestos Methylene chloride Particulate matter[a]	Diesel oil and grease PCBs[b] Spent acids and plating wastes	PCBs[a b]	Diesel oil and grease Trichlorotrifluoroethane	

[a]The present or potential contamination associated with current and past discharges of this pollutant has not been fully determined.
[b]PCBs = polychlorinated biphenyls.

SOURCE: U.S. Department of Energy, Office of Environmental Audit, "Environmental Survey Preliminary Report—Kansas City Plant, Kansas City, Missouri," DOE/EH/OEV-11-P, January 1988 and "Comments on Site Summary" submitted by DOE on June 18, 1990.

Surface Water

Several intermittent surface water streams, including the Big Lost River, flow into INEL during the winter months and do not leave. A number of SWMUs located near the Big Lost River are protected from potential floods by diversion dams and dikes. INEL's surface waters contain no aquatic biota.

Sediment

Manmade impoundments and ditches at INEL contain sediment contaminated with chromium, mercury, oil, and radionuclides. These contaminants have also been detected in the Snake River Plain Aquifer.

Soil

Past operational and waste disposal practices at INEL have resulted in soil contamination at various locations within the facility.

Kansas City Plant

The environmental restoration activities at the Kansas City Plant are implemented under a RCRA section 3008(h). The authority of CERCLA is not being used but may be invoked in the future to address remedial activities not covered under RCRA.

The site has two closed surface impoundments and several storage areas. Although the standard RFA was not conducted at the site, DOE provided EPA with similar documents that included information normally contained in an RFA report. To date, 35 SWMUs have been identified under the consent order. Of these, 23 have been characterized as having no significant contamination and requiring no further action. The remaining 12 are active or are scheduled for investigation.

The facility is currently developing the required RFI work plans. DOE has already provided some plans to EPA, which has reviewed and commented on them. DOE has not developed a formal risk assessment for the entire facility. Table A-4 identifies the types of contaminants that have been released to the environment in the past.

Groundwater

Groundwater contamination has been confirmed. Under the section 3008(h) consent order, DOE is determining the extent of on-site and off-site contamination. Contaminants present in the groundwater are hazardous and nonradioactive. DOE has installed a pump and treat system for halting migration of the plume. The system includes interceptor wells with ultraviolet light, ozonation, and hydrogen peroxide as treatment processes. DOE has also excavated an interceptor trench to aid the withdrawal system. More than 100 groundwater monitoring wells have been installed on the 137-acre site.

No formal EPA order for conducting house-to-house evaluations of nearby private drinking water wells has been issued to DOE. However, comments by local residents on the real or perceived risks of contamination posed by the plant can be submitted to DOE through the community relations plan required by RCRA section 3008(h) and the facility's community outreach program.

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Surface Water

Some surface water contamination is suspected but not confirmed. One groundwater plume discharges to the Blue River. DOE is monitoring the river but has not found hazardous constituents above detectable limits. The entire site is located within the 70-year recurrence interval floodplain.

Sediment

The contamination found in sediments and soils associated with surface impoundments has been removed. Suspected groundwater contamination at the facility, however, is being investigated. High concentrations of polychlorinated biphenyls (PCBs) are known to exist in a former streambed (Indian Creek) adjacent to the site. Cleanup alternatives are being assessed by DOE and EPA.

Soil

Soil contamination has been confirmed in many areas at the site. DOE is in the process of evaluating areas in which soil contamination is likely. Soil gas analysis has been used to assist in detennining sample collection areas. However, the limited utility of the data obtained from this effort is probably due to the high clay content of the sampled soils. Where visual contamination was observed, the soil was excavated and disposed of as hazardous waste.

Lawrence Livermore National Laboratory—Main Site

The environmental activities at the Lawrence Livermore National Laboratory (LLNL) main site are being conducted under a Federal facility agreement (FFA) involving DOE, EPA, and the State of California. The FFA addresses the activities associated with identification and remediation of environmental problems that pose a threat to human health and the environment, in particular, soil and groundwater contamination caused by volatile halogenated hydrocarbons and metals at various spill sites and an inactive landfill. LLNL covers nearly 640 acres.

A RCRA facility assessment has been completed and, to the extent possible, SWMUs have been identified. However, because the laboratory is a Superfund site, the RCRA facility investigation tasks to determine the nature and extent of contamination associated with possible releases from SWMUs were incorporated into the CERCLA remedial investigation phase. The final "Draft Remedial Investigation Report" released by DOE on May 11, 1990 is now under EPA review. A baseline public risk assessment addressing the health risks associated with soil and groundwater contamination at the site was released the same day.

Groundwater

Extensive hydrogeologic characterization has been performed by DOE to define the extent of groundwater contamination. Although considered adequate by regulatory agencies, this characterization effort may be expanded to the study of contamination problems at selected SWMUs.

Contamination by volatile halogenated hydrocarbons has been confirmed in soil and groundwater on-site and beyond facility boundaries. Gasoline, organic lead, and chromium have been detected in soil and groundwater samples at concentrations exceeding background levels.

Approximately 20 local drinking water supply wells have been closed because of actual or suspected contamination by groundwater. As of June 6, 1990, more than 12,300,000 gallons of groundwater had been treated by one of two pilot treatment facilities to remove halogenated hydrocarbons. The removal of hydrocarbons is accomplished at the pilot treatment plant in a two-step process: the use of ultraviolet light and hydrogen peroxide to oxidize most of the hydrocarbons, followed by air stripping of the effluent water to extract the remaining halogenated hydrocarbons.

Surface Water

Surface water at the facility consists of two seasonal streams (which run only after infrequent periods of heavy rainfall) and a seasonal, manmade surface impoundment constructed by DOE for flood control purposes. The LLNL is a net negative water balance site where the minimum depth to groundwater is 30 feet. Thus, there is no likely path for the observed contamination of surface water.

Sediments

Some contaminants have been detected in the arroyo sediments from past operational practices. DOE is investigating the effect of these contaminants on public health and the environment, and initial observations indicate minimal impact.

Soil

Subsurface soil contamination has been confirmed in the vadose zone below some of the waste management units being investigated. DOE is addressing soil contamination under the remedial action process.

A second pilot treatment facility, operating in the south portion of the site, is used to vacuum extract gasoline from the soil and completely oxidize the product. Another portion of this treatment facility separates free product gasoline from the groundwater and collects it for disposal.

Lawrence Livermore National Laboratory—Site 300

Lawrence Livermore National Laboratory Site 300 has been proposed for inclusion on the NPL because halogenated hydrocarbons have been detected in groundwater. Thus far, however, environmental restoration activities have been carried out under the authority of RCRA, as administered by the State of California's Regional Water Quality Control Board. A work plan for the investigation and remediation of site 300 was sent to the Board outlining the schedule and scope of work there. Nine areas are currently being investigated for possible remediation. A draft RCRA section 3008(h) cleanup order was issued in February 1989, and a second draft of that order was issued in June 1990. The terms of this order are currently being negotiated.

The site contains several surface impoundments, landfills, and waste storage areas. All landfills are closed or in the process of closing. The only two surface impoundments that remain open at site 300 have been constructed to meet current regulatory requirements (double liners and groundwater monitoring) and are monitored to ensure that no RCRA hazardous wastes are disposed in them. Operating storage areas are included in the RCRA part A permit application. When the RFA was conducted, 179 SWMUs were identified. Since 1987, DOE has been performing work equivalent to an RFI under the direction of the State of California.

Formal risk assessments have not yet been performed for the site. A formal risk assessment will be required by the RCRA consent order. Currently, risk assessments for each area of contamination are being performed under a feasibility study for each area.

Groundwater

Site 300 is still being hydrogeologically characterized. Groundwater contamination by halogenated hydrocarbons has been confirmed both on-site and off-site, whereas tritium contamination has been identified on-site. The extent of all off-site plumes except one has been determined both vertically and horizontally.

All on-site groundwater wells located in the area of the plumes will be closed. None of these wells is affected by groundwater contamination. All groundwater wells located in the area of off-site contamination are monitored monthly for volatile organic compounds.

DOE has installed a pilot pump and treat system at one of the areas of contamination and plans to install similar units at other contaminated locations. DOE will obtain all required permits for discharge of air and water generated by these treatment facilities.

Surface Water

The on-site surface water consists of several seasonal streams (which run only after infrequent periods of heavy rainfall) and the two manmade surface impoundments permitted under RCRA. The site is located in a net negative water balance area. Tritium contamination of a spring has been detected, but given the negative water balance, all runoff from this spring recharges to the groundwater before leaving the site. In addition, an off-site spring in a seasonal creek basin has shown detectable levels of volatile organic compounds. Their source is believed to be the on-site contamination.

Because the seasonal nature of surface water streams allows only minimal water usage (and, therefore, limited exposure to pollutants), surface water contamination is a minor concern.

Sediments

Some contaminants have been detected in sediments from the closed waste management units. DOE is investigating the impact of these contaminants on human health and the environment. Initial laboratory results indicate no impact.

Soil

Soil contamination has been confirmed in the vadose zone below some of the waste management units being investigated. DOE is addressing this contamination problem as part of the site investigations and remedial actions.

Los Alamos National Laboratory

The Los Alamos National Laboratory (LANL) did not rank on the Hazardous Ranking System (HRS) for inclusion on the NPL. Therefore, environmental restoration activities at this site are being implemented under RCRA. The State of New Mexico issued the operating permit for incinerator and storage units in November 1989, and EPA issued the Hazardous and Solid Waste Amendments (HWSA) portion of the permit in May 1990. Both portions have been appealed.

The HWSA permit requires DOE to address some 603 SWMUs that have been identified at the site to date. DOE believes it will discover additional SWMUs as it proceeds through the RCRA RFI process. The permit contains the schedule under which DOE is to submit the RFI work plans for EPA review. The schedule calls for submission of RFI work plans on approximately 15 percent of the SWMUs per year for 4 years. All RFIs and CMSs must be completed within 10 years.

To date, sitewide risk or exposure assessments for all hazardous and radioactive constituents have not been performed, although substantial risk assessment and exposure information has been compiled by LANL for

individual facilities, activities, or constituents. A sitewide Environmental Impact Statement was issued in 1979, which is expected to be updated in the near future. Annual environmental surveillance reports have been issued to the public since about 1980. Table A-5 identifies the types of contaminants that have been released to the environment in the past.

Groundwater

DOE has performed characterizations of macroscale hydrogeologic conditions. However, at some SWMUs, EPA anticipates that DOE must conduct additional site characterization work.

The primary aquifer is approximately 800 to 1,000 feet below the surface in most portions of the site. Production wells in this zone provide drinking water to LANL and the city of Los Alamos. To date, no contamination of this aquifer has been documented.

Additionally, groundwater exists in several isolated locations as shallow perched water zones and as shallow groundwater within alluvial deposits in some portions of canyon floors. Some shallow wells in these canyons have contained minimal contamination. However, EPA had indicated that no contamination has been documented in several springs that discharge to the surface within the site boundaries.

DOE originally received a RCRA groundwater monitoring waiver from the State for several operating units while under interim status.

Surface Water

Most of the site is located in a negative net water balance area. Thus, surface water exists onsite only as runoff following precipitation, and as discharges from the 120 permitted NPDES outfalls. None of the streams offsite flow normally. Except during high runoff events, surface water in the canyons does not reach the Rio Grande River, which is the nearest permanent flowing surface water in the vicinity of the site.

Surface water contains compounds which are permitted discharges pursuant to the site's NPDES permit. Some sediment contamination exists in the canyon bottoms. DOE monitors surface waters in accordance with the NPDES permit and may perform additional monitoring as part of the RFI process.

Sediment

The site has several areas that may contain contaminated sediment because of old point source discharges. Many discharge points simply released wastewater into the canyons. EPA has targeted 15 canyons for evaluation to determine if contamination has occurred.

Soil

In addition to the problem discussed for sediments, subsurface soil contamination is suspected in the vadose zone beneath old SWMUs, such as old surface impoundments and landfills. DOE will be required to investigate the extent of subsurface contamination by the RFI.

Mound Plant

The environmental restoration activities at the Mound Plant will be implemented under a CERCLA section 120 agreement that DOE and EPA are considering for signature as of this writing. The Mound Plant is listed on the NPL. The plantwide remedial investigation/feasibility study (RI/FS) work plan was submitted to EPA on April 13, 1990. Performing the RI/FS may require 8 to 9 years, whereas remediation efforts have tentative schedules of 20 years. An administrative order, presently under negotiation with the State of Ohio, is expected to be signed shortly.

The RFA/VSI conducted at Mound Plant identified the following SWMUs: storage areas, lagoons, a surface impoundment, glass melter, retort, thermal treatment unit, an energetic materials pretreatment unit, and various underground storage tanks. Nine RI/FSs will be prepared to address environmental restoration at the facility. For any operable units requiring remediation, DOE will prepare a remedial design and subsequently perform remedial action as established under CERCLA.

Exposure risk assessments were addressed in the 1979 Environmental Impact Statement (EIS) and Focused Risk Assessment of the Miami-Erie Canal. Annual environmental monitoring reports are released to document health impacts from plant operations. The EIS is 11 years old and will require updating to ensure that the risk assessment is still valid under today's regulatory climate and newer methods of dose calculation. Action is presently underway to address the best method to replace or update the EIS for this site.

Groundwater

Groundwater contamination has been confirmed both on-site and off-site. The most serious threat to human health and the environment is created by contaminated groundwater in a sole source aquifer. Contamination is below the maximum containment level (MCL) and is being monitored under a groundwater monitoring program. Groundwater contamination is being addressed under the CERCLA section 120 agreement.

Surface Water

Surface water contamination has been confirmed both on-site and off-site. Its exact nature and extent have not been determined but are being addressed under the CERCLA agreement. DOE has initiated some interim

Table A-5-Summary of Hazardous Substances Released to the Environment at the Los Alamos National Laboratory

Contaminant	Air	Soil	Surface water	Groundwater[a]	Sediment
Radionuclides		Americium-241 Beryllium-7[b] Cesium-134[b] Cesium-137 Cobalt-57[b] Manganese-54[b] Mixed fission products Plutonium-238 Plutonium-239 Plutonium-240 Sodium-22[b] Strontium-90 Thorium[b] Tritium Uranium[b]		Cesium Plutonium-238 Plutonium-239 Plutonium-240 Tritium Uranium	Plutonium-239 Plutonium-240
Metals		Barium[b] Beryllium Cadmium[b] Chromium Copper[b] Lanthanum[b] Lead[b] Mercury[b] Nickel[b] Silver[b] Thallium[b] Cyanide[b]	Barium[b] Beryllium[b]		Barium[b] Beryllium
Inorganic compounds		Ferric chloride	Methylene chloride	Hexachlorobutadiene	
Volatile organic compounds (VOCs)		Hydrochloric acid Hydrofluoric acid Phosphoric acid Sodium hydroxide Sodium thiosulfate Sulfuric acid Acetone[b] Benzene[b] Butyl acetates[b] Ethanol[b] Ethyl acetates[b] Methyl ethyl ketone[b] Tetrachloroethylene[b]		Methyl chloride Undefined VOCs	Acetone[b] Butyl acetates[b] Ethyl acetates[b] Methyl ethyl ketone[b]
Miscellaneous		Explosives[c]			Explosives[c]

[a]The groundwater medium at this facility essentially consists of perched groundwater with no beneficial uses.
[b]The presence or potential contamination associated with this pollutant has not been fully determined.
[c]Examples of the explosives used at the site include Baratol, TNT, HMX, RDX, PETN, and Cytocol.

SOURCE: U.S. Department of Energy, Office of Environmental Audit, "Environmental Survey Preliminary Report—Los Alamos National Laboratory, Los Alamos, New Mexico," DOE/EH/OEV-12-P, January 1988; "Summary for the Los Alamos National Laboratory" submitted by U.S. DOE, Los Alamos Area Office, Environment, Safety and Health Branch on Aug. 3, 1990; and Thomas Buhl, Los Alamos Area Office, Environment, Safety and Health Branch, personal communication, Aug. 7, 1990.

corrective actions to alleviate the impact of contamination on surface waters. Storm water runoff has been channeled into a settling pond prior to release through an NPDES monitoring point.

Sediment

Sediment contamination has been confirmed at the site. DOE has initiated some interim corrective measures by removing contaminated soils under the auspices of the Decontamination and Decommissioning (D&D) Program. The exact nature and extent of soil contamination have not been determined; DOE is addressing this issue under the CERCLA section 120 agreement.

Nevada Test Site

An "agreement in principle" is currently under negotiation with the State of Nevada to implement environmental activities at the Nevada Test Site. The State is

Table A-6-Summary of Hazardous Substances Released to the Environment at the Nevada Test Site

Contaminant	Air	Soil	Surface water	Groundwater	Sediment
Radionuclides	Krypton-85 Plutonium-239 Tritium Xenon-133	Americium-241[b] Antimony-125 Beryllium-7 Cadmium-109 Cesium-137 Cobalt-60 Europium-152[a] Europium-154[a] Europium-155[a] Gross alpha Plutonium-238[a] Plutonium-239[a] Plutonium-240[a] Radium-226 Rhodium-106 Strontium-90 Uranium-235 Uranium-238 Yttrium-90[a]	Cobalt-60[a] Gross beta Plutonium Tritium	Antimony-125 Barium-140 Beryllium-7 Cadmium-109 Cerium-141 Cesium-137 Cobalt-60 Europium-155 Iodine-131 Iridium-192 Krypton Lanthanum-140 Plutonium-238 Plutonium-239 Plutonium-240 Rhodium-106 Ruthenium-103 Sodium-22 Strontium-90 Tritium	Cesium-137 Plutonium-239 Plutonium-240
Metals		Cadmium Silver	Chromium[a] Lead[a]	Lead	
Inorganic compounds					
Volatile organic compounds (VOCs)	Acetylene Benzene Hydrochloric acid Hydrofluoric acid Nitric acid Perchloric acid Toluene	Acetone[a] Chlorobenzene[a] Methylene chloride[a] Xylenes		Methylene chloride	
Miscellaneous	Gamma radiation[a]	Acids Caustics Chlorinated solvents Fission activation products Gamma radiation		Gamma radiation	

[a]The present or potential contamination associated with current and past discharges of this pollutant has not been fully determined.

SOURCE: U.S. Department of Energy, Office of Environmental Audit, "Environmental Survey Preliminary Report—Nevada Test Site, Mercury, Nevada," DOE/EH/OEV-15-P, April 1987 and "Comments on Site Summary" submitted by DOE on June 18, 1990.

primarily responsible for assessment of the site, but by entering into an agreement with DOE, the State's current one-half, full-time equivalent (FTE) will be augmented. The one-half FIX has proved to be inadequate to address the site in a timely manner. Through this agreement, DOE will provide financing for the State to staff and operate an office devoted entirely to overseeing the Nevada Test Site.

The Nevada Test Site contains the following RCRA and CERCLA units: pits, trenches, a storage pad, injection wells, surface pond, leach fields, craters, and underground storage tanks. In 1989 DOE developed a Five-Year Plan to address the environmental restoration and waste management at the site. The State will oversee implementation of this Five-Year Plan until a determination is made by EPA as to the status of the Nevada Test Site as an NPL site.

DOE prepared a preliminary assessment for the site and submitted it to EPA Region IX in April 1988. No risk assessments for past release sites have been completed. Table A-6 identifies the types of contaminants that have been released to the environment in the past.

Groundwater

Groundwater contamination has been detected at the facility; however, the nature and extent are not known at present. DOE plans to drill 10 to 12 wells per year over the next 8 to 10 years in a coordinated effort to determine the extent and types of on-site and off-site contamination. A groundwater characterization work plan has been prepared and submitted to regulators for approval.

Surface Water

No information is available regarding the existence of surface water contamination problems at the Nevada site.

Sediment

No information is available regarding the existence of sediment contamination problems at the site.

Soil

Soil contamination is documented and believed to be a threat to human health and the environment. The exact extent of contamination is not known. DOE has taken interim actions to fence and post the contaminated areas in order to limit their accessibility. Future corrective measures will be conducted pursuant to the Five-Year Plan.

The closure plan for the "23 hazardous waste trench" was completed and submitted to State regulators for approval.

Oak Ridge Reservation

The environmental activities at Oak Ridge Reservation (ORR) will be conducted under a Federal facility agreement (FFA) involving EPA, the State of Tennessee, and DOE. The FFA addresses all activities associated with identifying and remediating environmental contamination problems that pose a threat to human health and the environment.

The entire facility was added to the NPL on December 21, 1989. As a result, environmental investigation and restoration activities are now regulated by CERCLA. Prior to that, RCRA was the authority under which DOE had conducted those activities. Those activities initiated under the RCRA corrective action process will proceed as planned, and CERCLA will be used for any new activities that are required. However, DOE has been implementing CERCLA requirements, guidelines, and procedures in the site investigation process initiated under RCRA.

The Oak Ridge Reservation includes the Oak Ridge National Laboratory, the Y-12 Plant, and the Oak Ridge Gaseous Diffusion Plant. Approximately 600 contaminated sites identified on the ORR may require further investigation and remediation. Offsite contamination is also being addressed.

Some operating permits have already been approved; others will be issued in the future. All of the surface impoundments are either closed or in the process of closing. Most of the postclosure permits are currently being processed; the schedule is for the bulk of the permits to be issued within a year. The most common obstacle to the issuance of postclosure permits is determining the scope of the activities DOE must implement to define groundwater contamination plumes. A trial burn permit has been issued for the new incinerator. The final permit will be issued when DOE successfully completes the next trial burn. DOE has completed short-term health assessments related to contamination problems. Tables A-7 and A-8 identify the types of contaminants that have been released to the environment in the past.

Groundwater

Groundwater contamination is known to exist at several locations throughout the complex. DOE is petitioning EPA for alternative concentration limits (ACLs); however, EPA determined that corrective action will be needed for contaminated groundwater. EPA stated that the extent of groundwater contamination is still unknown. Contaminated groundwater discharges to surface waters that are used for human consumption.

Surface Water

Surface water contamination has been confirmed at several locations throughout the complex. Surface water from the ORR empties into other surface water bodies that are used by a large population. Berms have been constructed around some areas of soil contamination to restrict the flow of precipitation across contaminated soil into surface water.

Sediment

Sediment contamination has been detected in the Clinch River and several of its tributaries. The exact nature and extent of that contamination are not known at present, but a remedial investigation is underway. EPA will require DOE to conduct further investigations to determine the nature and extent of the sediment contamination problem at this site.

Soil

Soil contamination exists throughout the ORR complex. The exact nature and extent of that contamination are not known, but RIs are underway. EPA will require DOE to conduct further investigations to determine the nature and extent of soil contamination at this site, and remediation may be required. Corrective measures implemented by DOE to date include the construction of berms around certain areas with known soil contamination. These berms can prevent storm water runoff traveling over the contaminated soil from entering nearby surface waters and sediments.

Pantex Plant

Environmental activities at the Pantex Plant will be implemented by a RCRA section 3008(h) corrective action order. The authority of CERCLA is not being used, but if conditions arise in the future that cannot be addressed under the RCRA program, CERCLA would be used.

Table A-7—Summary of Hazardous Substances Released to the Environment at the Oak Ridge Reservation

Contaminant	Air	Soil	Surface water	Groundwater	Sediment
Radionuclides	Questionable[a]	Americium-241 Cesium-137 Cobalt-60 Curium-244 Plutonium-238 Plutonium-239 Radium-228 Strontium-90 Uranium-232 Uranium-233 Uranium-234 Uranium-235 Uranium-238	Americium-241 Cesium-137 Cobalt-60 Curium-244 Gross beta Strontium Tritium	Antimony-125 Cesium-137[b] Cobalt-60[b] Europium Gross alpha Gross beta Plutonium Ruthenium-106 Strontium[b] Technetium-99 Thorium-232 Tritium[b] Uranium-232 Uranium-233 Uranium-234 Uranium-235 Uranium-238	Americium-241 Cesium-137 Cobalt-60 Curium-244 Europium Plutonium-238 Plutonium-239 Strontium-90 Uranium-232 Uranium-233 Uranium-234 Uranium-235 Uranium-238
Metals	Lead[b]	Mercury	Chlorine	Arsenic	Chromium
Inorganic compounds	Questionable[a]			Barium Cadmium Chromium Lead Mercury	Lead Mercury
Volatile organic compounds (VOCs)	Questionable[a]			Acetone Benzene Carbon tetrachloride Chloroform 1,1-Dichloroethylene Trans-1,2-Dichloroethylene Dimethyl phthalate Ethylbenzene Methylene chloride Naphthalene 1,1,2,2-Tetrachloroethane Toluene 1,1,1-Trichloroethane Trichloroethylene Xylene	Undefined VOCs[b]
Miscellaneous		Stored petroleum products[b]	Fecal coliform Total suspended solids	Endrin Stored petroleum products[b]	PCBs[c]

[a]Although radionuclide and chemical releases to the air are in compliance, the facility's lack of documentation and quality control regarding reported emission estimates, as well as the inappropriate design and calibration of air samplers, are of concern.
[b]The present or potential contamination associated with current and past discharges of this pollutant has not been fully determined.
[c]PCBs = polychlorinated biphenyls.

SOURCE: U.S. Department of Energy, Office of Environmental Audit, "Environmental Survey Preliminary Report—Oak Ridge National Laboratory (X-10), Oak Ridge, Tennessee," DOE/EH/OEV-06-P; "Comments on Site Summary" submitted by DOE on June 18, 1990; and Thomas Wheeler, Oak Ridge Reservation, personal communication, July 9, 1990.

The order was signed by EPA and DOE's Amarillo Area Office on December 10, 1990. The State of Texas has authority to implement the RCRA program, except for the HSWA provisions. The Texas Water Commission is drafting the RCRA operating permit.

The types of units at the site include storage units, surface impoundments, burning pads, nonhazardous landfills, and several enclosed buildings in which treatment of highly explosive wastewater occurs. The RCRA RFA/VSI identified 143 SWMUs. Because of the size of the Pantex Plant (more than 10,000 acres), additional SWMUs are likely to be discovered in the future.

No exposure or risk assessments have been conducted at this site. Table A-9 identifies the types of contaminants that have been released to the environment in the past.

Groundwater

Hydrogeologic characterization of the site is inadequate, and additional work must be done to fully understand subsurface conditions. Many of the SWMUs

Table A-8-Summary of Hazardous Substances Released to the Environment at the Y-12 Plant

Contaminant	Air	Soil	Surface water	Groundwater	sediment
Radionuclides	Gross alpha Gross beta Uranium-235 Uranium-238	Cesium-137[a] Gross alpha Gross beta Thorium Uranium	Gross alpha[a] Gross beta[a]	Gross alpha Gross beta Radium[a] Uranium	
Metals	Beryllium[a] Mercury[a]	Beryllium[a] Cadmium Chromium Copper Lead Mercury	Cadmium[a] Chromium[a] Copper[a] Lead[a] Mercury	Arsenic Barium Cadmium Chromium Copper Lead Manganese Mercury	Arsenic Cadmium Lead Mercury Nickel
Inorganic compounds	Hydrogen fluoride	Nitrate	Chloride[a] Nitrate[a]	Nitrate	
Volatile organic compounds (VOCs)	Perchloroethylene[b] Trichloroethene	1,2-Dichloroethane Perchloroethylene[b] 1,1,1-Trichloroethane Trichloroethene	1,2-Dichloroethane Perchloroethylene[b] 1,1,1-Trichloroethane Trichloroethene	1,2-Dichloroethane Perchloroethylene[b] Tetrachloroethene Trichloroethene	Anthracene Benz[a]anthracene Benzo[a]pyrene Chrysene Fluoranthene Phenanthrene Phenols Phthalates Pyrene
Miscellaneous		Asbestos Coal pile leachate	Coal pile leachate[a] PCBs[c]	Coal pile leachate Mineral oil PCBs[c]	PCBs[c]
	Particulate matter Unleaded gasoline	Oil PCBs[c]			

[a]The present or potential contamination associated with current and past discharges of this pollutant has not been fully determined.
[b]This VOC is also known as tetrachloroethylene or tetrachloroethene.
[c]PCBs = polychlorinated biphenyls.

SOURCE: U.S. Department of Energy, Office of Environmental Audit, "Environmental Survey Preliminary Report—Y-12 Plant, Oak Ridge, Tennessee," DOE/EH/OEV-07-P; "Comments on Site Summary" submitted by DOE on June 18, 1990; and Thomas Wheeler, Oak Ridge Reservation, personal communication, July 9, 1990.

will be grouped together for the purposes of conducting the RFI. Additional site characterization work will be performed to define subsurface conditions in the immediate vicinity of these groupings.

The primary source of groundwater at the site is the Ogalkda Aquifer. The depth of the groundwater is approximately 450 to 500 feet. However, there are localized perched water zones with groundwater at 250 feet. Although groundwater contamination is not suspected in the Ogallala, low levels of contamination have been detected in the shallower, perched zones. DOE is currently assessing the extent of two gasoline leaks that have contaminated the shallow zones.

The facility has several active wells that withdraw groundwater from the Ogallala for drinking water and for production purposes.

Surface Water

The only surface waters in the vicinity of the site are ditches that drain from the production areas to the playa lakes. Water and sediment in the ditches and the playa lakes are believed to be contaminated. To date, DOE has not implemented any measures to determine the contamination of surface water. The corrective action order will require DOE to submit RFI work plans. These plans should contain the steps for assessing any surface water contamination.

Sediment

Like surface water, the sediments in the transfer ditches and playa lakes are suspected of being contaminated. DOE collected samples of the sediments from the ditches and dry lake beds in October 1989; however, the analyses have not been completed

Soil

Soil contamination is suspected, but not yet confirmed The old burning ground is probably contaminated because waste munitions were burned on the surface for many years. DOE will berequired to address this area in the RFI.

Table A-9-Summary of Hazardous Substances Released to the Environment at the Pantex Plant

Contaminant	Air	Soil	Surface water	Groundwater	Sediment
Radionuclides		Gross alpha[a] Gross beta[a] Plutonium[a] Thorium[a] Tritium[a] Uranium[a]			
Metals		Beryllium[a] Chromium[a] Copper[a] Lead[a] Silver[a]	Chromium[a] Copper[a] Lead[a] Silver[a]		
Inorganic compounds		Barium oxide[a] Hydrogen cyanide[a] Hydrogen fluoride[a] Sulfuric acid[a]	Cyanide[a]		
Volatile organic compounds (VOCs)		Acetone[a] Benzene[a] Carbon tetrachloride[a] Chloroform[a] Dimethylformamide[a] Ethyl acetate[a] Methylene chloride[a] Methyl ethyl ketone[a] Methyl isobutyl ketone[a] Tetrachloroethane[a] Tetrahydrofuran[a] Toluene[a] Trichloroethylene[a]		Acetone[a] Benzene[a] Carbon tetrachloride[a] Chloroform[a] Dimethylformamide[a] Ethyl acetate[a] Methylene chloride[a] Methyl ethyl ketone[a] Methyl isobutyl ketone[a] Tetrachloroethane[a] Tetrahydrofuran[a] Toluene[a] Trichloroethylene[a]	Acetone[a] Benzene[a] Carbon tetrachloride[a] Chloroform[a] Dimethylformamide[a] Ethyl acetate[a] Methylene chloride[a] Methyl ethyl ketone[a] Methyl isobutyl ketone[a] Tetrachloroethane[a] Tetrahydrofuran[a] Toluene[a] Trichloroethylene[a]
Miscellaneous		2,4-D[a b] Dioxin[a] Gasoline PCBs[a c] TNT[a]			

[a]The presence or potential contamination associated with this pollutant has not been fully determined.
[b]2,4-D = (2,4-dichlorophenoxy)acetic acid.
[c]PCBs = polychlorinated biphenyls.

SOURCE: U.S. Department of Energy, Office of Environmental Audit, "Environmental Survey Preliminary Report-Pantex Facility, Amarillo, Texas," DOEIE~OEV-08-P, Sept~rnber 1987.

Other areas of suspected soil contamination are associated with transfer ditches and with soil around the playa lakes.

Pinellas Plant

The environmental activities at the Pinellas Plant are currently proceeding under the RCRA permit and corrective action process. A PA/SI was conducted under CERCLA, but the site did not rank high enough for inclusion on the NPL.

The RFA/VSI completed under RCRA resulted in the identification of 14 SWMs. Corrective action requirements at the SWMUs were included in the RCRA operating permit issued to Pinellas on February 9, 1990. DOE plans to submit the RFI work to EPA for review 120 days after issuance of the operating permit. RI plans for two sites have been completed and sent to EPA for review.

No exposure or risk assessments have been performed at this site. Table A-10 identifies the types of contaminants that have been released to the environment in the past.

Groundwater

The site hydrogeologic characterization studies reviewed by a DOE Tiger Team were found to be incomplete, Therefore, as part of the corrective measures stipulated in the RCRA permit, additional site hydrogeologic characterization work will be conducted. This is planned for FY 1990.

Groundwater contamination has been confirmed in the shallow saturated zone. Groundwater is within a few feet of the surface at this site. The deeper aquifer (Floridan) is a major regional source of potable water. DOE has initiated a study to determine if the Floridan Aquifer has

Table A-10—Summary of Hazardous Substances Released to the Environment at the Pinellas Plant

Contaminant	Air	Soil	Surface water	Groundwater	Sediment
Radionuclides	Tritium		Tritium[a]	Tritium[a]	Tritium[a]
Metals	Chromium Lead Manganese Molybdenum	Lead[a]	Silver[a] Undefined heavy metals[a] Zinc[a]	Chromium Lead Undefined heavy metals[a] Anions Calcium chromate[a]	Undefined heavy metals[a]
Inorganic compounds				Fluoride	
Volatile organic compounds (VOCs)	Acetic acid Acetone Amyl acetate Butyl alcohol Chlorofluorocarbons[b] Ethyl alcohol Methylene chloride Methylenedianiline[a] Nitric acid Toluene diisocyanate[a] 1,1,1-Trichloroethane Trichloroethylene Urethanes[a]	Pinellas does not monitor VOCs in soils.	Spent acids[a] Solvents[a]	Sulfates Acetone trans-1,2-Dichloroethylene Methylene chloride Spent acids[a] Spent solvents[c] Trichloroethylene Undefined solvents[a] Vinyl chloride	Phthalate Spent acids[a] Solvents[a]
				Biocides[a d]	
Miscellaneous		Construction debris[c]	Biocides[a d]	Construction debris[c] Diesel fuel[a] Insecticides Stored petroleum products[a]	Biocides[a d] PCBs[c]

[a]The present or potential contamination associated with current and past discharges of this pollutant has not been fully determined.
[b]Fluorocarbons released from the Pinellas Plant include CFC-11, CFC-12, CFC-113, and CFC-114.
[c]The land disposal of construction debris known to contain hazardous materials is a potential source of soil contamination.
[d]Biocides present in cooling water discharges may have potentially contaminated this medium.
[e]PCBs = polychlorinated biphenyls.

SOURCE: U.S. Department of Energy, Office of Environmental Audit, "Environmental Survey Preliminary Report—Pinellas Plant, Largo, Florida," DOE/EH/OEV-13-P; "Comments on Site Summary" submitted by DOE on June 18, 1990; and Thomas Wheeler, Oak Ridge Reservation, personal communication, July 9, 1990.

been affected by contamination from the site. Therefore, the exact nature and extent of groundwater contamination are not known at this time.

Surface Water

Two natural ponds are located within site boundaries. The ponds, which were part of the wastewater treatment process, have been identified as SWMUs. Although sediments from the ponds passed the extraction procedure (EP) toxicity test, a RCRA facility assessment must be conducted to evaluate all potential contaminants. Given the nature of operations at the facility, DOE officials indicate that surface water contamination is unlikely.

Sediment

The two natural ponds located within site boundaries are the only potential sources of sediment contamination. DOE sampled sediments from the ponds, and they passed the EP toxicity test. These sediments will be assessed in the RFI as required under the operating permit. As with surface water, DOE feels that sediment contamination at the ponds is not likely.

Soil

Soil contamination is suspected based on the observation of soil discoloration during the VSI. At present, analytical results indicate that soil contamination exists. The RFI work plan will include a requirement for conducting further soil sampling at selected areas within the site.

Rocky Flats Plant

The environmental restoration activities at the Rocky Flats Site are implemented by an interagency agreement (IAG) involving EPA, the State of Colorado, and DOE. The IAG encompasses all activities associated with identifying environmental problems and all measures to be implemented for remediation of those problems that pose a threat to human health and the environment.

The activities to be performed according to the IAG will be conducted under the regulatory authority and guidance of CERCLA and RCRA. All activities dealing with problems other than radioactive waste will be

addressed under the RCRA program; CERCLA will be used if radioactive waste is present. The Rocky Flats Site was placed on the NPL in October 1989.

In the facility assessment completed by DOE, a total of 178 SWMUs were identified and grouped into 10 OUs. Included in these SWMUs are land application units, evaporation ponds, land disposal units, and land treatment units. As additional information is developed, SWMUs may be added or eliminated from these groups. Several SWMUs at the Rocky Flats Site have progressed through the various phases of the RCRA-CERCLA corrective action process. The 11 SWMUs in OU 1 are currently in the third phase of the RI/FS, and construction has been initiated as an interim remedial act for groundwater. OU 2 is currently in the second phase of investigation and evaluation, and conceptual interim remedial action plans for this OU are currently being prepared. No RFI/RI has been completed at the remaining SWMUs; however, contracting efforts to accomplish this goal are underway.

One exposure assessment has been completed. Table A-11 identifies the types of contaminants that have been released to the environment in the past.

Groundwater

Hydrogeologic characterization of the entire site is limited, and extensive work is required to develop an adequate understanding of the subsurface environment.

The facility has confirmed groundwater contamination in some SWMUs. One past action taken to halt the movement of contaminated groundwater was the installation of a French drain around the Solar Evaporation Pond. The intercepted water is recycled back to the ponds. Future containment of contaminated groundwater around OU 1 will include a French drain collection and a pump and treat system, which is currently under construction. Closure of the Solar Evaporation Pond in accordance with RCRA is underway. Corrective action is also underway for Hill 881.

Surface Water

Surface water contamination has been confirmed as a result of past practices. Contamination has migrated off-site to surface waters used by the western suburbs of Denver for drinking water. All surface water drainages at the plant have retention ponds within their flow paths. DOE will conduct a risk assessment of the contamination carried offsite via surface water.

Sediment

Radioactively contaminated sediments have been found in the water retention facilities. Risk assessment has yet to be completed so the actual risk to human health and the environment is not known. DOE will conduct the necessary risk assessment for those sediments and for the off-site contamination.

Soil

Soil contamination with radionuclides was confirmed at the site in the mid-1970's. DOE has also undertaken an analysis of the nature and extent of hazardous constituents in the soil.

Sandia National Laboratory

The environmental activities at Sandia will be accomplished under the authority of RCRA. At present there are no CERCLA activities at the site; however, the authority of CERCLA would be invoked if necessary. Currently, all RCRA units are entering closure with the exception of the storage units. The storage units will receive RCRA Part B operating permits.

The RFA/VSI has been completed, but no RFI work plan has been submitted to EPA for review. The draft RCRA-HSWA permit is expected to be ready by September 1990. This permit will contain the schedule for submitting RFI work plans; EPA requires DOE to submit these plans within 120 days following issuance of the permit.

There are approximately 135 SWMUs at the site; these will be combined in groups of about 10 so that several may be addressed under one RFI. EPA states it will evaluate information related to each SWMU and determine the areas that require the highest priority.

No risk or exposure assessments have been completed for this site. Table A-12 identifies the types of contaminants that have been released to the environment in the past.

Groundwater

Sandia is within the boundary of Kirkland Air Force Base and is very large. Given its size, characterization of the entire site is not appropriate, particularly when the "technical areas" are some 2 to 3 miles apart. Therefore, the work conducted to depict the subsurface has not been SWMU-specific. EPA will require DOE to conduct additional hydrogeologic site characterization work to define subsurface conditions relative to the groups of SWMUs addressed under the RFI.

Groundwater contamination in a well adjacent to an abandoned land disposal unit was identified in June 1990.

Surface Water

The only surface waters at the site are intermittent streams in the arroyos. These streams flow to the Rio Grande, approximately 5 miles away. However, flow from the arroyo streams infiltrates the ground before it reaches the Rio Grande. Surface water would leave the

Table A-11—Summary of Hazardous Substances Released to the Environment at the Rocky Flats Plant

Contaminant	Air	Soil	Surface water	Groundwater	Sediment
Radionuclides	Beryllium Plutonium[b]	Americium-241 Gross alpha Gross beta Plutonium Tritium[a] Uranium	Plutonium	Cesium-137[a] Gross alpha Gross beta Strontium[a] Tritium[a] Uranium[a]	Cesium-137 Plutonium-239 Plutonium-240
Metals		Lithium[a]		Beryllium[a] Cadmium Chromium[a] Lead[a] Manganese[a] Molybdenum[a] Nickel[a] Selenium[a] Thallium	
Inorganic compounds		Aluminum hydroxide[a] Ammonium persulfate[a] Cyanide[a] Ferric chloride[a] Hydrochloric acid[a] Lithium chloride[a] Nitrates Nitric acid[a] Sodium nitrate[a] Sulfuric acid[a]	Nitrates Sulfates	Aluminium hydroxide[a] Ammonium persulfate[a] Chloride[a] Cyanide[a] Ferric chloride[a] Hydrochloric acid[a] Lithium chloride[a] Nitrates[a] Nitric acid[a]	
Volatile organic compounds (VOCs)	Carbon tetrachloride	Acetone[a] Benzene[a] Carbon tetrachloride[a] Chloroform[a] Dichloromethane[a] Methylene chloride[a] Methyl ethyl ketone[a] Toluene[a]		Carbon tetrachloride Chloroform 1,2-Dichloroethane 1,1-Dichloroethylene Tetrachloroethylene 1,1,1-Trichloroethane Trichloroethylene	
Miscellaneous	Laundry wastewater[c]	Disposed waste[d] Friable asbestos Oil sludge PCBs[a e] Sanitary sewage sludge[d]	Disposed waste[d] Friable asbestos PCBs[a e]	Disposed waste[d] Friable asbestos Oil sludge PCBs[a e] Total dissolved solids	

[a]The present or potential contamination associated with current and past discharges of this pollutant has not been fully determined.
[b]Primarily due to past accidental releases.
[c]Significant releases of radionuclides into air may have occurred from 1969 to 1973 when radioactively contaminated sludges were dried at the facility's drying beds.
[d]There is a potential for soil, surface water, and groundwater contamination because current practices do not prevent low-level radioactive waste improperly disposed of in landfill designed for hazardous waste.
[e]PCBs = polychlorinated biphenyls.

SOURCE: U.S. Department of *Energy*, Office of Environmental Audit, "Environmental Survey Prelimhary Report-Rocky Flats Plant, Golden, Colorado," DOE/EH/OEV-03-P, January 1988; "Federal Facility Agreement and Consent Order-Rocky Flats Plant"; and "Report on Federal Facility Land Disposal Review," October 1987.

site only under severe precipitation. Therefore, surface water contamination is not suspected.

Soil/Sediment

DOE has sampled soil below the old impoundments and found contamination to a depth of 75 feet below the surface. The extent of surface soil contamination is not known. DOE is expected to address the existing subsurface and potential surface soil contamination in the RFI work plan.

Savannah River Site

The entire contiguous Savannah River Site (SRS) was recently finalized on the NPL. Prior to this, DOE had been proceeding under RCRA to address environmental corrective actions. Therefore, the RCRA process will lead to activities for addressing conlamination problems, whereas CERCLA will be used to address problems associated with radioactive waste and restoration activities not

Table A-12-Summary of Hazardous Substances Released to the Environment at the Sandia National Laboratory

Contaminant	Air	Soil	Surface water	Groundwater	sediment
Radionuclides	Argon[a] Tritium[a]	Uranium			
Metals		Chromium Lead			
Inorganic compounds					
Volatile organic compounds (VOCs)	Chlorinated hydrocarbons			Trichloroethylene[b]	
Miscellaneous		Explosives Petroleum products			

[a]Release data for this and other radionuclides either have not been verified or have not been collected.
[b]Trichloroethylene contamination has been detected at the chemical waste landfill area only. Ongoing efforts to characterize the nature and extent of environmental contamination throughout the facility are expected to be completed in 5 to 6 years.

SOURCE: U.S. Department of Energy, Office of Environmental Audit, "Environmental Survey Preliminary Report—Sandia National Laboratories: Inhalation Toxicology Research Institute, Bendix Albuquerque Operations, Central Training Academy, Transportation Safeguards Division, and Tonopah Test Range, Albuquerque, New Mexico," DOE/EH/OEV-06-P, July 1990.

covered under RCRA. An FFA involving DOE, EPA, and the State of South Carolina is being negotiated.

The SRS includes approximately 300 square miles and has container storage areas, tanks, landfills, and surface impoundments. SRS is planning to construct an incinerator that will be permitted under RCRA to incinerate RCRA and radioactive mixed waste. The RCRA facility assessment RFA/VSI identified 313 SWMUs. DOE will submit 44 site-specific RFI work plans that address contamination issues at the SWMUs contaminated with hazardous waste.

The State of South Carolina has RCRA authorization and is responsible for issuing RCRA part B operating permits. EPA is currently responsible for implementing the RCRA's HSWA provisions. The State of South Carolina has petitioned EPA for HSWA authority, and its application is pending.

DOE has submitted an Exposure Information Report but has not completed formal exposure or risk assessments. Table A-13 identifies the types of contaminants that have been released to the environment in the past.

Groundwater

Hydrogeologic characterization of all individual waste sites is not complete. DOE must conduct additional hydrogeologic investigations to adequately define subsurface conditions around the SWMUs. Groundwater contamination has been detected only within the facility boundaries.

SRS uses onsite groundwater for process water as well as for drinking water. One well in the M area was closed due to low levels of chlorinated solvents. A groundwater corrective action to address the chlorinated solvents has been implemented in the M and A areas. Known impacts to this aquifer have been minimal. EPA stated that releases have been detected from 35 individual waste management units. DOE will continue to define the type and extent of groundwater contamination at individual SWMUs.

Surface Water

Surface water bodies of known or suspected contamination have been identified and are reported to the public in annual environmental reports. Additional evaluation of surface water contamination problems at the facility has been suggested by EPA. The State of Georgia independently collects surface water data adjacent to and downstream from the SRS.

Sediment

Several areas are known or suspected to contain sediment contamination from accidental release sites and SWMUs. Sediment contamination has been confirmed as a result of RCRA closures and RFA/VSIs. The extent of on-site and off-site contamination is known to varying degrees at SWMUs and spill sites, depending on the stage of characterization. RFI work plans will contain proposed schedules for completing that work.

Soil

Soil contamination has been identified or is suspected in several areas by RCRA-CERCLA activities. The nature and extent of soil contamination are known to varying degrees at the SWMUs, depending on the stage of characterization.

Table A-13—Summary of Hazardous Substances Released to the Environment at the Savannah River Site

Contaminant	Air	Soil	Surface water	Groundwater	Sediment
Radionuclides	Carbon-14 Iodine-129 Technetium-99 Tritium Unknown nuclides[b]	Cesium-137 Gross alpha Gross beta Iodine-129 Iodine-131 Strontium-90 Tritium	Cesium-137[a] Cobalt-60[a] Gross alpha[a] Gross beta[a] Iodine-129[a] Iodine-131[a] Strontium-90[a] Tritium Uranium	Cesium-137[a] Cobalt-60[a] Gross alpha Gross beta Plutonium-238 Plutonium-239 Radium Ruthenium-106 Strontium-90 Tritium Uranium[a]	Cerium-243 Cerium-244 Cesium-137 Gross alpha[a] Gross beta[a] Iodine-129[a] Iodine-131[a] Strontium-90[a] Thorium-228 Tritium Uranium-235 Uranium-238
Metals	Mercury		Chromium Copper Mercury Silver	Barium[a] Cadmium Iron Lead Magnesium[a] Manganese Mercury Sodium[a] Zinc	Chromium Copper Mercury Nickel Silver
Inorganic compounds	NO_x[a]		Cyanide	Chloride[a] Sulfate	Cyanide
Volatile organic compounds (VOCs)	1,1,1-Trichloroethane Unknown VOCs			Tetrachloroethylene 1,1,1-Trichloroethane Trichloroethylene Trichloromethane	
Miscellaneous		Stored petroleum products[a]	Coal reject effluents Temperature[c]	Endrin Stored petroleum products[a] Phenol[a] Solvents[a]	

[a]The present or potential contamination associated with current and past discharges of this pollutant has not been fully determined.
[b]Releases of other radionuclides may also have occurred but sampling equipment and monitoring procedures were inadequate.
[c]Thermal impacts associated with the discharge of cooling waters to this medium include deforestation, changes in water levels, reduction of oxygen levels, and increased erosion and sedimentation.

SOURCE: U.S. Department of Energy, Office of Environmental Audit, "Environmental Survey Preliminary Report-Savannah River Plant, Aiken, South Carolina," DOE/EH/OEV-10-P; "Comments on Site Summary" submitted by DOE on June 18, 1990; and Thomas Wheeler, Oak Ridge Reservation, personal communication, July 9, 1990.