United States General Accounting Office

GAO

Report to the Ranking Minority Member,
Subcommittee on Energy, Nuclear
Proliferation, and Government Processes
Committee on Governmental Affairs
United States Senate

December 1985

ENVIRONMENT, SAFETY, & HEALTH

Environment and Workers Could Be Better Protected at Ohio Defense Plants

GAO/RCED-86-61

GAO

United States
General Accounting Office
Washington, D.C. 20548

Resources, Community, and
Economic Development Division

B-221188

December 13, 1985

The Honorable John Glenn
Ranking Minority Member
Subcommittee on Energy, Nuclear Proliferation,
and Government Processes
Committee on Governmental Affairs
United States Senate

Dear Senator Glenn:

On April 15, 1985, you asked us to review the Department of Energy's effectiveness in protecting its workers, the community, and the environment at all its defense production facilities. Specifically, you asked us to begin with three facilities in Ohio: the Feed Materials Production Center at Fernald, Portsmouth Uranium Enrichment Complex at Piketon, and Mound at Miamisburg. This report provides information on these three plants. In addition, on November 29, 1985, we provided you a fact sheet consisting of a transmittal letter and three appendixes--one for each Ohio plant.

Unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from the date of its issuance. At that time, we will send copies to the Secretary of Energy and officials of the three Ohio plants. We will also make copies available to others upon request.

Sincerely yours,

J. Dexter Peach
Director

Executive Summary

The Department of Energy (DOE) contracts with private firms to operate nuclear facilities across the nation. DOE has three facilities in Ohio: the Feed Materials Production Center at Fernald, Portsmouth Uranium Enrichment Complex at Piketon, and Mound at Miamisburg. As a result of radioactive air releases between September and December 1984 from Fernald, the Ranking Minority Member, Subcommittee on Energy, Nuclear Proliferation, and Government Processes, Senate Committee on Governmental Affairs, requested that GAO examine DOE's program to protect the environment and worker safety and health at the three Ohio facilities. GAO examined data on radioactive and nonradioactive environmental releases and worker exposures, reviewed numerous studies that reported problems at each plant, and identified factors that may have contributed to the problems found.

Background

DOE's contractors must comply with numerous environmental, safety, and health (ES&H) statutes, regulations, orders, and guides. To better ensure minimal adverse impacts of its plants, DOE also (1) requires contractors to keep environmental releases and worker exposures as low as reasonably achievable (ALARA), (2) periodically appraises contractors to assess performance, and (3) uses contract award fees as incentives to encourage improved ES&H and production performance.

To carry out its ES&H responsibilities, DOE has a three-tiered management approach. Headquarters program offices provide broad programmatic guidance, operations offices supervise contractor ES&H performance, and contractors perform in-plant ES&H operations. Outside this structure, DOE established an Assistant Secretary for Environment, Safety, and Health on September 18, 1985. DOE is now determining what authority the new office will have over the program and operations offices.

Results in Brief

The three plants have several environmental problems; for example, groundwater, soil, or drinking water sources are radioactively contaminated. While contractor data show that the contamination is within DOE's limits, various DOE and consultant studies, as well as both Ohio and U.S. Environmental Protection Agency officials, have questioned the reliability of the contractors' data. These groups found that the (1) small number and poor location of monitoring wells did not allow contractors to fully evaluate the impact of their operations on the environment and (2) air monitoring systems at some locations were deficient. In addition,

no coordinated DOE/ state/contractor system exists to independently verify, through testing, contractor-reported radiological data.

GAO identified several other factors that may have contributed to these problems. For example, two contractors did not fully implement DOE's environmental monitoring guide and ALARA policy, and DOE's appraisal programs did not identify major ES&H problems. In addition, DOE primarily used award fees to reward production performance—not to improve ES&H activities.

Principal Findings

Reporting Releases

Each Ohio contractor collects, evaluates, and reports its own radioactive air and water releases. In two previous reports, GAO recommended that DOE, in conjunction with the states, develop a system to independently verify environmental monitoring data reported by contractors and ensure that they operate their facilities in an environmentally acceptable and safe manner. DOE did not adopt GAO's recommendation because it believed that the contractors' quality assurance programs provided an effective method for ensuring the reliability of data. GAO found that the quality assurance programs help ensure only that water and air samples are accurately analyzed; they do not verify that data collected are adequate and that they result in accurate reports. Independent verification, in GAO's view, would help enhance public confidence in DOE's operations. In addition, the Ohio contractors operate under cost-plus-award-fee contracts. Independent verification would also help allay concerns about the potential conflict of the contractors' receiving award fees on the basis of self-generated environmental monitoring data they report to DOE. (See p. 34.)

Environmental Problems

In addition to radioactive contamination, each plant has other environmental problems. For example, Fernald and Portsmouth are out of compliance with hazardous waste laws, and Fernald is out of compliance with state permits because it has not completed two of four pollution control projects. Portsmouth has widespread polychlorinated biphenyl (PCB) contamination in and around the plant. DOE or the contractors have initiated or plan to initiate corrective actions for the problems found. (See p. 33.)

Contributing Factors

The Ohio contractors did not always follow DOE's 1977 radiological monitoring guide. The guide recommends that contractors monitor on- and off-site wells to assess environmental impacts of plant operations. Both Portsmouth and Mound had been following the guide, but a 1985 consultant study found that Portsmouth had too few on-site wells and that they were poorly located. While Fernald had on-site monitoring wells, it did not begin to monitor off-site wells until 1981 after a resident complained. Fernald then found three off-site uranium-contaminated wells. In addition, the guide recommends that contractors locate a minimum of five off-site air samplers to better detect radioactive emissions from plant operations. Mound has 15 samplers and Portsmouth has 5, but a 1985 consultant study found that Portsmouth's air samplers were poorly located and that the facility needed more because of its size. Fernald did not begin to follow the guide until July 1985 when it located two off-site air monitors. Fernald expects to have two additional off-site monitors operating by December 1985. Previously GAO recommended to DOE that radiological monitoring guides be mandatory for all DOE facilities. DOE did not adopt this recommendation because it believed contractors would lose flexibility in designing their monitoring programs. (See p. 35.)

In 1960 DOE adopted a many-faceted ALARA policy to reduce environmental releases and worker exposures. One objective of this policy is that contractors establish measurable goals so that DOE can determine their progress in meeting the ALARA policy. DOE allows contractors to develop their ALARA programs, and implementation at the Ohio plants varied. Mound has had an ALARA program with measurable goals since the early 1970's. Fernald did not set worker exposure goals until 1982 and has none for environmental releases. Portsmouth has not set measurable goals for either the environment or workers. (See p. 38.)

The three Ohio plants operate under cost-plus-award-fee contracts whereby DOE pays a fee if the contractor meets preset performance criteria. However, the award fees were not used as an incentive to improve ES&H performance at Mound until 1983 and not until 1985 for Portsmouth and Fernald. As a result, contractors received sizeable fees even though ES&H problems existed. (See p. 40.)

DOE performs appraisals to ensure that contractors' ES&H activities comply with statutes, regulations, and policies. DOE headquarters found that appraisal programs for the two operations offices responsible for the Ohio plants were not identifying major ES&H problems. Some of these

problems contributed to Fernald's 1984 radioactive air releases. (See p. 42.)

Recommendations

GAO's findings at the Ohio plants demonstrate the continued validity of its earlier recommendations to DOE that radiological monitoring guides be mandatory for all DOE facilities and that a coordinated DOE/state/contractor system be developed to verify contractor data. GAO recommends that the Secretary of Energy implement these recommendations.

Agency Comments

GAO did not obtain agency comments on this report. GAO did, however, discuss the facts and conclusions presented with the Ohio contractors, DOE headquarters and operations office officials, and U.S. Environmental Protection Agency officials. Clarifications suggested have been incorporated where appropriate.

Contents

Abbreviations

ALARA	as low as reasonably achievable
DOE	Department of Energy
EMD	Energy and Minerals Division
ES&H	environment, safety, and health
GAO	General Accounting Office
NPDES	National Pollutant Discharge Elimination System
Ohio EPA	Ohio Environmental Protection Agency
ORAU	Oak Ridge Associated Universities
OSHA	Occupational Safety and Health Administration
PCB	polychlorinated biphenyl
RCED	Resources, Community, and Economic Development Division
RCRA	Resource Conservation and Recovery Act of 1976
USEPA	U.S. Environmental Protection Agency

Introduction

The Department of Energy (DOE) contracts with private firms and universities to operate 27 nuclear facilities across the nation, ranging from relatively small weapons-component production plants to major multipurpose operations. In Ohio, DOE contractors operate three diverse nuclear material processing plants: the Feed Materials Production Center at Fernald, Portsmouth Uranium Enrichment Complex at Piketon, and Mound at Miamisburg (referred to as Fernald, Portsmouth, and Mound). In these operations the contractors use and produce radioactive and nonradioactive substances that, if not properly controlled, could cause serious injury to plant workers and people in surrounding communities.

Fernald, Portsmouth, and Mound are located in communities having over 2.25 million people within a 20-mile radius. Together the 3 plants employ about 6,000 people. DOE is responsible for ensuring that plant workers and the surrounding communities are protected from radioactive and hazardous substances associated with the plants' activities and that workers are protected from occupational safety hazards associated with the normal workplace.

Between September and December 1984, Fernald released unusually large quantities of radioactive uranium dust to the environment as a result of malfunctions in the plant's air filtration system. Although these releases were reported to be within standards, concerns were raised in the Congress about how effectively DOE and its contractors have been fulfilling their responsibilities to protect the public and their workers from the hazards associated with plant operations. Consequently, the Ranking Minority Member, Subcommittee on Energy, Nuclear Proliferation, and Government Processes, Senate Committee on Governmental Affairs, asked that we evaluate how effectively DOE protects the environment and worker safety and health at the three Ohio plants.

Overview of the Three Ohio Plants

DOE's three Ohio plants vary greatly in the types of operations performed, radioactive material handled, and hazardous substances produced. Mound is a high-technology operation that conducts research and also produces components for nuclear weapons. Fernald, on the other hand, is a chemical processing and foundry-type operation that does not use a closed system to process radioactive material. Consequently, its operations are very dirty and dusty. Portsmouth falls somewhere in between—a highly mechanized, very large industrial complex that

increases (enriches) the concentration of usable uranium for power reactors or weapons production.

In addition to differing plant operations, the three facilities deal with different types and forms of nuclear material. Mound uses two radioactive substances—plutonium and tritium. Plutonium arrives in sealed capsules and remains that way throughout all operations; tritium is processed utilizing double and triple containment. Fernald uses uranium ore that has been treated with chemicals, heated in furnaces, and cast into 300-400 pound blocks that are then shaped into various sized rods and tubes. Portsmouth uses a mixture of uranium 238 and uranium 235 (uranium hexafloride) as feed for the process that enriches the concentration of uranium 235 to a range of 2-5 percent for commercial reactors and to more than 93 percent for weapons. Since the operations performed at the three plants differ, the types of environmental and worker safety and health concerns also differ.

DOE's Organization for Protecting the Environment and Worker Safety and Health

DOE carries out its responsibilities using a three-tiered management approach. On September 18, 1985, the Secretary of Energy announced a reorganization of DOE's ES&H functions and created an office of Assistant Secretary for Environment, Safety, and Health (an action we recommended in 1981[1]). Although some aspects of DOE's ES&H activities could change with the reorganization, the three-tiered management approach, according to DOE officials, will continue. Program offices, usually directed by an assistant secretary, have overall responsibility for implementing programs in areas such as defense programs, radioactive waste management, and energy research. Eight DOE operations offices and their associated area offices provide day-to-day supervision of contractors for one or more program offices. Ultimately, the contractors implement DOE's programs.

DOE Order 5480.1A—Environmental Protection, Safety, and Health Protection Program for DOE Operations—assigns primary responsibility for environmental, safety, and health (ES&H) implementation to the program office's assistant secretary. Fernald and Mound perform work for the Assistant Secretary for Defense Programs; and Portsmouth, for the Assistant Secretary for Nuclear Energy. The program offices prior to September 1985 had small ES&H staffs that served as focal points for ES&H expertise, conducted assessments of contractors' activities, and

[1]Better Oversight Needed for Safety and Health Activities at DOE's Nuclear Facilities (EMD-81-108, Aug. 4, 1981).

evaluated contractor-reported ES&H data (these ES&H staffs have been eliminated as part of the reorganization). The program offices have delegated implementation of ES&H programs to the operations offices. These offices develop ES&H guidelines for contractors and monitor performance through various appraisals, field visits, and the award fee process. DOE's Oak Ridge, Tennessee, operations office oversees contractor operations at Fernald and Portsmouth while its Albuquerque, New Mexico, operations office oversees Mound.

In addition to ES&H responsibilities assigned to the program offices, DOE-wide ES&H responsibilities prior to the reorganization were under the Assistant Secretary for Policy, Safety, and Environment. This office was responsible for (1) developing ES&H policies, standards, guides, and requirements and measuring performance against them; (2) providing ES&H technical advice and assistance; and (3) serving as a focal point for ES&H matters. This office had no authority over program or operations offices and coordinated with these organizations only in an advisory capacity. DOE is in the process of determining what authority the new office will have over the program and operations offices as a result of the reorganization.

Environmental and Worker Safety and Health Regulations and Standards

Key to DOE's program are the regulations and standards, concerning the environment and worker safety and health. Some are DOE's; others are imposed by federal and state agencies under various legislation.

Environmental Regulations and Standards

Separate regulations and standards apply to environmental impacts resulting from radioactive air or water releases, nonradioactive (hazardous) air or water releases, or waste management practices.

Radioactive Airborne Releases

Prior to February 1985 DOE prescribed its own standards for controlling radioactive airborne releases under authority of the Atomic Energy Act of 1954. The standards DOE adopted were recommended by the International Commission on Radiological Protection, the National Council on Radiation Protection and Measurements, and the Federal Radiation Council. In February 1985 the U.S. District Court for the Northern District of California ordered the U.S. Environmental Protection Agency

(USEPA) to promulgate new air emission standards for radionuclides under authority of the 1977 amendments to the Clean Air Act.[2]

DOE's standards had required contractors to control radioactive air releases to keep annual dose commitments to the general public below 0.5 rem[3] per year to the whole body and 1.5 rem per year to a critical organ (the organ most sensitive to the type of radiation being emitted) and as low as reasonably achievable. USEPA's February 1985 standard sets much lower dose limits of 0.025 rem per year to the whole body and 0.075 rem per year to the critical organ.[4] DOE's contractors now must comply with USEPA's dose limits and keep doses as low as reasonably achievable.

To determine whether these standards are met, DOE requires contractors to (1) measure the plants' stack releases for each radioactive substance emitted, (2) measure and calculate the concentration of those substances beyond the plant boundary, and (3) use the resulting release data to calculate an expected dose for an individual beyond the plant boundary. Contractors annually report doses to DOE in site monitoring reports.

Radioactive Releases to Water

Under the Atomic Energy Act of 1954, as amended, DOE regulates itself in the area of radioactive releases to ground and surface water. DOE's ES&H Order 5480.1 provides limits on the maximum allowable concentration of radioactive elements that can be released to sanitary sewage systems, concentration guides for water sources outside DOE facilities, and maximum allowable doses to the public. The concentration guides are designed to assist contractors in ensuring that radiation doses to offsite individuals do not exceed maximum allowable doses of 0.5 rem per year to the whole body or 1.5 rem per year for an organ—the same dose limit DOE applied to airborne releases prior to the new USEPA air emission standard. DOE requires contractors to monitor water leaving their boundaries to ensure that contaminants do not exceed DOE's concentration limits and are as low as reasonably achievable. Contractors report the results of all such releases to DOE annually.

[2]USEPA has appealed to the U.S. Court of Appeals for the Ninth Circuit, claiming that the District Court's decision exceeded its jurisdiction. The appeal is still pending as of December 1985.

[3]Rem (Roentgen Equivalent Man) is a measurement unit used to quantify the effect of radiation on man.

[4]During its standard-setting process, USEPA considered a wide range of release limits including 0.010 rem per year for the whole body and 0.030 rem per year for the critical organ. The Sierra Club and the state of Ohio are suing USEPA to have these more restrictive standards adopted.

In addition to limiting radioactive air emissions and liquid releases to specific criteria, DOE's contractors previously had to limit combined releases of all radioactive substances to 0.5 rem per year to the whole body and 1.5 rem per year to a critical organ. However, in August 1985 DOE adopted new standards for combined radioactive releases—0.1 rem per year dose equivalent to the whole body and 5.0 rem per year committed effective dose equivalent for an individual organ. These changes were based on 1977 recommendations from the International Commission on Radiological Protection and National Council on Radiation Protection and Measurements.

ALARA Philosophy

To better ensure that environmental and worker radiation exposures are reduced to the lowest practical level, the Federal Radiation Council directed DOE and other federal agencies in 1960 to adopt an as-low-as-reasonably-achievable (ALARA) policy. Under this policy DOE's contractors are required to reduce radiation releases and exposures to the lowest levels commensurate with sound economics and operating practices. DOE's ALARA requirements are set out in DOE Order 5480.1, which states that DOE should never stop looking for ways to reduce exposures. The order does not set out specific or detailed criteria for contractors' use in implementing ALARA. Rather it provides contractors general guidance to encourage support for radiation protection activities through plant and equipment design features, regular inspections of equipment, and monitoring procedures to detect radiation in the workplace. DOE's operations offices are required to appraise contractors against ALARA requirements to ensure that releases and doses are kept at the lowest practicable level.

Nonradioactive Airborne Releases

The Clean Air Act of 1970, as amended, (42 U.S.C. §§ 7401 et seq.) empowers USEPA to establish and enforce national ambient air quality standards, requires the states to develop implementation plans, and gives the states primary responsibility for implementing, maintaining, and enforcing the national standards. Pursuant to the Clean Air Act, USEPA established standards for six pollutants—nitrogen dioxide, carbon monoxide, sulfur dioxide, ozone, lead, and particulate matter. To meet the act's requirements, DOE's contractors must monitor emissions to ensure they are kept within levels specified by the states and USEPA. DOE's contractors use various methods to do this—some measure stack emissions or calculate emissions from their knowledge of the processes and materials used, and some place air samplers on the plant boundary

to better define the impact of plant operations on the environment. Monitoring results are reported by contractors to DOE, states, and USEPA.

Nonradioactive Releases to Water

The Federal Water Pollution Control Act Amendments of 1972 and 1977 amendments, known as the Clean Water Act, (33 U.S.C. §§ 1251 et seq.) provide the basis for the nation's clean water program and give USEPA the authority to control nonradioactive pollutant releases to water. The act created the National Pollutant Discharge Elimination System (NPDES) whereby states receive authority from USEPA (Ohio has such authority) to issue NPDES permits governing nonradioactive pollutant releases from various sources. The permit specifies (1) discharge limits for specific pollutants or substances, (2) the types of actions required to control releases and time frames to comply with the discharge limits, (3) requirements for self-monitoring of waste water flows—including the specific plant monitoring locations—and specific pollutants, and (4) requirements for reporting compliance to state and federal offices.

Radioactive Waste Management

DOE's defense contractors generate large quantities of radioactive waste from the numerous processes they perform. DOE regulates itself in all areas of radioactive waste management. Waste management regulations depend on the class—high level, transuranic, or low level—of waste. All classes of waste are subject to numerous regulations for packaging, transporting, and disposal to minimize environmental and worker impacts.

High-level waste is produced by nuclear reactions in both commercial and defense reactor fuel, contains high levels of radioactivity that decays rapidly but remains dangerous for hundreds of years, and must be handled by remote control behind protective shielding. Transuranic waste is man-made and contains medium radioactivity that decays slowly. Most can be handled without protective shielding. However, transuranic waste is toxic and remains that way for thousands of years. Ultimately, DOE plans to isolate both high-level and transuranic waste from the environment in permanent disposal facilities or repositories. Until such facilities are available, the wastes are segregated and stored at six DOE sites. Low-level waste is produced by many commercial, medical, industrial, and defense activities; typically contains small amounts

of radioactivity in large volumes; and does not require shielding. Low-level waste is usually buried on the plant sites or at other DOE facilities.

Nonradioactive (Hazardous) Waste

In 1976 Congress passed the Resource Conservation and Recovery Act (RCRA) (42 U.S.C. §§ 6901 et seq.) giving USEPA authority to regulate nonradioactive (hazardous) waste or to delegate that authority to the states. DOE originally maintained that its facilities were exempt from RCRA. However, in December 1982 it issued DOE Order 5480.2—Hazardous and Radioactive Mixed Waste Management—that directed the operations offices to establish hazardous waste management procedures to comply with the technical requirements of RCRA.

In 1983 an environmental public interest organization and the state of Tennessee sued DOE for noncompliance with RCRA at one facility in Tennessee. In 1984 the United States District Court for the Eastern District of Tennessee ruled that (1) the exemption in the Atomic Energy Act did not apply to waste that was not radioactive and (2) such hazardous waste is subject to RCRA. While the case involved only one facility, DOE extended the ruling to all its defense plants.

Mixed Waste

A third category of waste—referred to as mixed waste— includes both radioactive and hazardous substances. These wastes have hazardous characteristics as defined by USEPA under RCRA but also contain radioactive substances. Regulatory authority for mixed waste is in question because it contains both radioactive and hazardous substances and, therefore, crosses the regulatory responsibilities of both USEPA and DOE. USEPA and DOE are working to develop new regulations to resolve this issue and expect to publish regulations by January 1986. In the interim the waste is stored at DOE's facilities.

Worker Safety and Health Programs and Standards

DOE must protect its work force from radioactive and hazardous substances and occupational safety hazards. Three safety and health programs address these hazards: health physics (radiation), industrial hygiene (hazardous substances), and occupational safety.

Health Physics

DOE's health physics program protects workers from unnecessary radiation hazards. The objective is to ensure that doses from exposures to radioactivity are as low as reasonably achievable and below DOE's yearly standard of 5.0 rem to the whole body and 15.0 rem to a critical

organ.[5] DOE adopted these standards in 1960 on the basis of recommendations of the Federal Radiation Council. DOE also requires contractors to report worker radiation exposures that result in a dose to a critical organ exceeding 50 percent of DOE's standard for that organ.

DOE controls radiation exposure through a variety of techniques. For example, shielding and remote (glove-box) operations are used to minimize worker exposures. Work areas are monitored with radiation detection devices to warn workers and management of unsafe conditions, and workers are monitored with various types of personal radiation devices that allow DOE to calculate doses they receive. Contractors accumulate worker dose information monthly or quarterly and report it to DOE annually.

Industrial Hygiene

In the nonradiation area, the industrial hygiene program identifies, evaluates, and controls those workplace factors that may cause sickness and/or significant discomfort and impair the health of workers. Environmental factors may be chemical (liquid, particulate, vapor, and gas); physical (noise, vibration, and magnetic fields); biological (bacteria and virus); and ergonomic (repetitive motion and mental or physical fatigue).

In the private sector, these workplace hazards are controlled by the Occupational Safety and Health Act of 1970, as amended, (29 U.S.C. §§ 651 et seq.) as administered by the Occupational Safety and Health Administration (OSHA). DOE's government-owned/contractor-operated facilities are not covered by OSHA requirements, but DOE has developed orders that prescribe and enforce OSHA programs at its facilities.

DOE Order 5480.10—Contractor Industrial Hygiene Program—establishes requirements for contractors to identify, evaluate, and control nonradioactive hazards in the workplace. This order establishes exposure standards for chemicals on the basis of applicable federal regulations and requires contractors to have a system to determine that standards are met. One method contractors use to do this is to take air samples throughout their plants. In addition, contractors are required to

[5]Exposure standards for workers are less stringent than those applicable to the general public.

have employee training programs on the hazards to which they are exposed and to document industrial hygiene accidents.

Occupational Safety

Another worker protection area is occupational safety—the detection, mitigation, management, and prevention of workplace hazards to protect against accidental death or injury. The types of hazards include those that might cause falls, electrocution, amputation, and vehicular accidents. While DOE is also exempt from OSHA requirements in this area, DOE has adopted a program, with requirements and procedures, that it believes provides a level of safety as high as that provided by OSHA.

To assess the quality of occupational safety programs, both DOE and the private sector maintain accident and injury data. The National Safety Council—a nongovernment public service organization chartered by Congress to furnish leadership in safety—compiles the private sector data. Both DOE and the National Safety Council use the same three injury indicators to evaluate occupational safety performance.

The first—total recordable injuries—measures the frequency of work-related injury or illness requiring medical attention. The second—total lost workday injuries—measures the frequency of work-related injury or illness resulting in days away from work and/or restricted activity at work. The third—lost workdays per injury—measures the number of lost or restricted workdays divided by the number of hours worked. These three indicators are converted to a rate based on 200,000 hours of work performed. DOE compares the contractors' accidents and the severity of those accidents to DOE-wide and industry data. The industry DOE uses for this comparison is the chemical and allied products industry, which is the group with one of the best safety records.

Objectives, Scope, and Methodology

In a letter dated April 15, 1985, the Ranking Minority Member, Subcommittee on Energy, Nuclear Proliferation and Government Processes, Senate Committee on Governmental Affairs, requested that we examine DOE's program to protect the environment and worker safety and health at all its defense production facilities. For purposes of this review, we limited our scope to the three Ohio plants. We are, however, conducting a review of ES&H activities at DOE defense facilities nationwide and plan to report our results in 1986.

To determine DOE's procedures and effectiveness in protecting the environment from radioactive and hazardous substances, we interviewed

DOE environmental protection officials in the offices of the Assistant Secretary for Policy, Safety, and Environment; Assistant Secretary for Defense Programs; and Assistant Secretary for Nuclear Energy; the Oak Ridge, Tennessee, and Albuquerque, New Mexico, Operations Offices; Dayton, Ohio, Area Office; and the contractor management and environmental protection staffs at each plant. We also met with and interviewed officials in USEPA's Office of Radiation Programs in Washington, D.C., and USEPA's Region V in Chicago—the region responsible for Ohio. In Ohio we interviewed officials in the offices of the Attorney General, Environmental Protection Agency, and Department of Health. We also met with local officials responsible for environmental matters in the communities around the three plants.

Further, we reviewed appropriate legislation such as the Atomic Energy Act of 1954, the Clean Air Act of 1970, the Federal Water Pollution Control Act of 1972, the Resource Conservation and Recovery Act of 1976, and the Toxic Substances Control Act of 1976. We reviewed this legislation to determine the ES&H requirements that apply to DOE and its contractors.

We toured Fernald, Portsmouth, and Mound, paying particular attention to air and water release points, controls over releases, monitoring equipment, and the waste-handling and storage facilities.

We reviewed numerous reports by DOE, Ohio, and USEPA to evaluate contractor environmental performance and to identify problems needing corrective actions. We also reviewed issues raised in prior GAO reports and DOE's compliance with the recommendations made. We discussed contractor environmental compliance with federal and state officials.

To evaluate DOE's performance in protecting worker safety and health, we interviewed officials in (1) DOE's offices of the Assistant Secretaries of Policy, Safety, and Environment, Defense Programs, and Nuclear Energy; its Oak Ridge and Albuquerque Operations Offices; and its Dayton Area Office and (2) the contractors' safety and health offices. We also met with union representatives for each plant and two consultants who provide safety and health advice to the unions at Fernald and Portsmouth to discuss their specific concerns. In addition, we talked to Fernald employees who were identified in hearings held by the Subcommittee on Energy, Nuclear Proliferation, and Government Processes, Senate Committee on Governmental Affairs, in Cincinnati, Ohio, in April 1985.

We reviewed historical data of worker exposures, contractor accident reports, and various DOE safety and health evaluations. We also reviewed safety and health problems noted in past GAO reports and DOE's actions concerning the recommendations made. We compared contractor safety performance data with DOE-wide and industry performance data. We discussed the results of ongoing worker health studies at Fernald and Portsmouth with the National Institute of Occupational Safety and Health and the Oak Ridge Associated Universities' epidemiological research program officials. We did not, however, verify worker exposure or accident data reported by the contractors.

To address whether past actions could cause long-term environmental or health consequences, we interviewed contractor, DOE, USEPA, and state officials. We obtained contractor data on radiation doses to the general public from 1973 (the first year DOE required contractors to develop and report doses) through 1984 and compared the doses to DOE's standards in effect at the time. Although we reviewed data from 1973, we limited information in the report to the last 5 years (1980-1984). We did not, however, evaluate the adequacy of the standards or the appropriateness of the doses reported. We also obtained radiation dose impacts USEPA computed for Fernald on the basis of DOE's data for the years 1953 to 1985. USEPA did not calculate similar data for Mound or Portsmouth.

Concerning how DOE uses ES&H performance in determining the fee it awards each contractor, we (1) identified the process for awarding fees for each contractor, (2) identified how ES&H performance was considered in fee awards, and (3) reviewed any recent changes in the award fee process.

As requested, we did not obtain written comments on this report. We did, however, discuss the facts and conclusions presented with the three contractors; DOE officials at the Oak Ridge and Albuquerque Operations Offices and within the office of the Assistant Secretary for Environment, Safety, and Health; and USEPA. Factual clarifications offered by the contractors, DOE, and USEPA were included where appropriate.

Our review was conducted between May and October 1985 and was performed in accordance with generally accepted government auditing standards.

Because of the multiplicity of issues involved and for ease of presentation, chapter 2 summarizes the key ES&H activities and problems at the three Ohio plants and corrective actions taken or planned. A fact sheet

detailing information on each of the Ohio plants was provided on November 29, 1985 (Environment, Safety, & Health: Information on Three Ohio Defense Facilities(GAO/RCED-86-51FS). Chapter 3 discusses some of the factors that may have contributed to the problems found.

Summary of ES&H Activities, Problems, and Corrective Actions Planned

Each of the three Ohio plants must meet and comply with numerous federal and state regulations, procedures, and standards to minimize environmental degradation and worker and public exposures from plant operations. The contractors report that for the last 5 years (1980-1984) their radioactive air emissions and liquid effluents have been within standards. Further, they report they have generally complied with state water release permits for nonradioactive substances. However, various groups have questioned the reliability of Fernald's and Portsmouth's air monitoring data. In addition, no system exists to verify contractor-reported radiological environmental data (this issue is discussed in chapter 3). Further, each plant has environmental problems unique to its specific site. DOE and the contractors have taken or plan to take actions to minimize the impact of these problems.

Over the 30 years that the three plants have operated, numerous employees have been exposed to radioactive and nonradioactive substances. Most exposures reported have been within DOE standards. For example, Fernald's employee exposure records show that since beginning operations in 1952, only 1 employee exceeded DOE's standards in 1980; Portsmouth reported that 8 employees had exceeded DOE's standards in 1965; and Mound reported that 17 employees exceeded DOE's standards between 1960 and 1979.

Feed Materials Production Center, Fernald

Fernald has been a key element in DOE's weapons production system since it began operating in 1952. Currently Fernald employs about 1,200 people. It produces various uranium metal forms that are used by other plants to produce plutonium and generate electricity. The processes performed at Fernald generate insoluble uranium dust and radioactive and hazardous liquids. Prior to their release to the environment, the dust must be filtered and the liquids treated to reduce the concentration of contaminants. However, some contaminants are released because not all elements can be removed. Further, all the radioactive and hazardous substances generate special worker protection concerns.

To determine whether Fernald meets federal and state environmental requirements, it monitors the air, water, and soil both on- and off-site. Fernald has 7 boundary and 2 off-site air monitors, 21 off-site and 13 on-site monitoring wells, and 8 surface water monitors on and around Fernald. By December 1985 Fernald expects to have two additional on-site and two additional off-site air monitors in operation.

Environmental Issues

DOE reports show that from its inception in 1952 Fernald's radioactive air emissions and estimated exposure doses to its neighbors have been within federal and state standards. For example, the reported radiation dose exposures to the public for the last 5 years have been less than 14 percent of DOE's standard of 0.5 rem to the whole body and 1.5 rem to the lung. However, a DOE appraisal reported, and USEPA and Ohio officials told us, that Fernald's environmental release data was not reliable. Further, although the Ohio Environmental Protection Agency (Ohio EPA) reported that Fernald's nonradioactive air and water releases have generally been within standards for the last 5 years, in 1984 it found Fernald out of compliance with hazardous waste laws.

Radioactive Releases

Air releases are the predominant pathway by which Fernald releases radioactivity. Fernald controls the release of radioactive dust by passing it through dust collectors, determines the amount that escapes up the stacks with monitors, and measures air emission doses to the public on the basis of radiation monitors along the plant boundary. DOE reports showed that between 1980 and 1983 Fernald had the second or third highest doses of any DOE plant and in 1984 Fernald had the highest dose. This was so even though it processed, according to DOE, some of the least radioactive material of any DOE facility.

DOE, USEPA, and Ohio officials question the accuracy of Fernald's air release data. For example, a June 1984 Oak Ridge appraisal noted both that Fernald's sampling equipment had deteriorated and that data collected by the equipment was not reliable. It also suggested that there be an independent assessment of Fernald's stack sampling procedures. Oak Ridge contracted with the Oak Ridge Associated Universities (ORAU)—a consortium of 52 universities—to conduct the assessment recommended. In its August 1985 report, ORAU identified significant problems in Fernald's exhaust stack monitoring systems, including corrosion of the sample probes and inadequate flow measurement systems. For these reasons, the ORAU report pointed out that Fernald's source sampling equipment did not provide accurate emission data and on-site monitors were poorly located. According to USEPA and Ohio officials, a primary consequence of these deficiencies is that Fernald does not really know how much, if any, of the September to December 1984 releases escaped off-site. Further, Fernald's air releases have contaminated soil both on- and off-site, but the degree and effects are uncertain.

In addition, Fernald will have to reduce its radioactive air emissions to meet USEPA's February 1985 air emission standards. These standards

lowered the allowable dose from 0.5 rem to 0.025 rem per year for the whole body and from 1.5 rem to 0.075 rem per year to the critical organ. To determine compliance with these standards, USEPA also requires DOE contractors to use a revised method for calculating critical organ doses (at Fernald the critical organ is the lung). This method was prescribed by the International Commission on Radiological Protection. The Commission concluded that some types of radiation cause larger organ doses than previously thought. DOE and USEPA officials told us that the uranium emitted at Fernald could cause a lung dose 15 to 20 times greater than previously expected using the revised calculation method.

USEPA also found that, using its lower standards and the revised method for calculating critical organ doses, Fernald's 1952-1984 air releases could have exceeded USEPA's dose standard in almost every year. In 1956—Fernald's highest reported release year—it would have exceeded today's standard by 125 times. Fernald estimated that in 1984 it exceeded USEPA's standard by 33 percent.

According to Fernald officials, one of the most significant assumptions made by USEPA was that the airborne particles discharged from the plant were smaller than what the plant is discharging today. If USEPA had used the larger particle size, Fernald officials believe the dose estimates would have been lower by a factor of 10. According to USEPA's Environmental Studies Branch Chief, if the particle size were larger than those USEPA used, then the doses calculated would have been less. However, USEPA did not have historical particle size data but instead made certain assumptions when conducting its analysis.

In December 1984 Fernald instituted various administrative and operating controls, such as installing additional stack monitors and changing dust collectors more frequently, to bring its air releases into compliance with USEPA's standards. As a result, in June 1985 Oak Ridge reported that Fernald had reduced its air emissions by about 90 percent of its 1981-1984 emissions. In addition, DOE has budgeted between $382 million and $482 million to modernize the plant and improve its ES&H performance.

Fernald also controls radioactive liquid effluents by putting them through a process facility that reduces the radioactivity below DOE's guidelines. Between 1980 and 1984 Fernald reported releases within DOE's limits. However, between 1981 and 1984 Fernald found five wells contaminated with both radioactive substances and chemicals. Three are off-site wells contaminated with uranium—one was a source of drinking

water; the other two are on-site wells contaminated with both radioactive and chemical substances. According to Fernald's reports, the radioactivity in the five wells is within DOE's guidelines. A July 1985 consultant report concluded that storm water runoff from the plant and water runoff from an on-site waste disposal pit were the likely sources for the contamination in the off-site wells.

Fernald is taking actions to prevent further contamination of these wells such as building a new storm water retention basin. In addition, Fernald officials told us that they have calculated an estimated dose for individuals drinking water from the contaminated wells and concluded that the doses were within DOE's concentration guide (no standards exist for radioactivity in drinking water wells). However, neither DOE nor Fernald has determined the long-term environmental or health consequences of the contamination but both expect to continue studying the situation to determine if further actions are warranted.

The two on-site wells at Fernald are contaminated with both radioactive substances and chemicals. Fernald reports that the radioactive concentrations were as high as 90 percent of DOE's guidelines, the chemical concentrations in one ranged from 298 to 795 percent above Ohio's standard, and the chemical concentrations in the other, as much as 224 percent above Ohio's standard. DOE and Fernald did not anticipate the high level of contamination in these wells. Fernald plans to determine the cause and extent of the contamination before deciding if corrective actions are warranted.

Nonradioactive Releases

For its nonradioactive hazardous air releases and liquid effluents, Fernald must comply with requirements of the Clean Air Act of 1970, the Clean Water Act of 1972, and the Resource Conservation and Recovery Act of 1976. The Southwestern Ohio Air Pollution Control Agency (a county agency under contract with Ohio EPA to monitor air quality around Fernald) official told us that Fernald is in compliance with air emission standards—its main nonradioactive air emissions are standard boiler plant emissions. However, Fernald is not in compliance with NPDES permits for effluent releases because it has not completed two of four pollution control projects required by its 1980 NPDES permit. These

projects are scheduled to be completed in December 1986—32 months later than specified in Ohio EPA's permit.

Waste Management

Fernald stores both low-level radioactive waste and mixed (combination of radioactive and hazardous) waste on-site. It has about 500,000 metric tons of uranium-contaminated waste in six in-ground pits and three above-ground concrete silos. As previously discussed, Fernald's waste pit operations were identified by a consultant in 1985 as the possible source of the off-site well contamination problems.

In an attempt to reduce the amount of low-level waste disposed, Fernald in fiscal year 1986 will begin construction of a low-level waste processing and shipping facility. This facility will process newly generated low-level radioactive waste into a form suitable for shipment and disposal at DOE's Nevada storage site. Construction is scheduled to be completed in fiscal year 1988. In addition, on July 25, 1985, Fernald issued a request for proposal for a study to identify the contents of the pits and silos, actual or potential environmental impacts, and alternative disposal methods. The study is expected to be completed by March 1988.

Most of the mixed waste stored at Fernald has come from DOE facilities located in Tennessee and Ohio. Fernald generates about 1,100 pounds of mixed waste a year but has received almost 174,000 pounds from the other facilities. Fernald expects to process some of the mixed waste—about 17,000 pounds—thereby converting it to a nonhazardous material. Other mixed waste will eventually be shipped to Oak Ridge for incineration. Oak Ridge expects to begin constructing the incinerator in 1986 and complete it in 1987.

On March 16, 1984, Ohio EPA inspected Fernald to determine compliance with hazardous waste laws. Although Fernald does not generate material classified as hazardous waste only, the state believes that mixed waste is subject to its hazardous waste laws. Ohio EPA found numerous violations with Fernald's mixed waste storage, monitoring, and documentation procedures. Ohio EPA reinspected the plant in April 1984 and found that Fernald was taking actions to correct the deficiencies found. Nevertheless, Ohio EPA officials told us that Fernald has been out of compliance with hazardous waste laws since March 16, 1984.

Worker Safety and Health

Fernald has a program to protect its workers from radioactive and nonradioactive exposures and industrial accidents. To meet DOE's radiation exposure standards and minimize radiation effects on workers, Fernald has plant design features, such as special venting for certain processes. Fernald also uses various personnel monitoring devices to determine exposures such as thermoluminescent dosimeters to measure external radiation, a mobile body counter (radiation monitoring laboratory) to measure lung doses, and urinalysis to calculate the amount of radioactive and nonradioactive substances in the body.

In the worker radiation protection area, reported exposures have been decreasing since Fernald began operations in 1952. In 1980 Fernald reported that one employee received a beta radiation dose to the skin of 8.7 rem, which exceeded DOE's quarterly limit of 5 rem. Except for this one employee, between 1980 and 1984 Fernald reports that no worker has received a whole-body exposure of more than 2 rem.

To assess Fernald's industrial safety program, we relied on two measures of performance. Primarily we compared Fernald's 1980-1984 records on workplace accidents and the severity of those accidents to similar DOE-wide and chemical and allied products industry data. In 1982 and 1983 Fernald's accident rate was slightly higher than that of both the DOE-wide average and the chemical and allied products industry. For 1980-1984 Fernald's rate of lost workdays—a figure indicating the seriousness of accidents—was higher than the industry rate and much higher than the DOE-wide rate (rates ranged from 38 to 209 percent). Fernald attributed these high accident rates to the influx of new employees hired to increase plant production beginning in 1981. Further, during the last 5 years one death occurred at Fernald. This fatality was not included in the above statistics but was reported separately to DOE. DOE's investigation report concluded that the death was not related to safety deficiencies.

Fernald officials, however, took exception to the plant's being compared to the chemical and allied products industry. They pointed out that the National Safety Council compares Fernald to another industry category—nonferrous metals—and Fernald would be well within that industry's occupational injury rates. Nevertheless, DOE continues to use the chemical and allied products industry for comparison.

Current Actions

In fiscal year 1985 DOE started a $382 million to $482 million program for new process technologies and equipment to modernize Fernald's production facilities and meet increasingly stringent radiological and industrial safety requirements and for ES&H improvements including better filter and stack monitors, more off-site air monitors, and improved measures for reducing worker exposures.

Portsmouth Uranium Enrichment Complex, Piketon

The Portsmouth Uranium Enrichment Complex is among the largest industrial facilities in the nation. Currently Portsmouth employs about 2,100 people. In the process of enriching uranium to levels usable for weapons programs and reactors—commercial, test, research, and naval reactors— Portsmouth produces a variety of radioactive and hazardous substances that must be used, monitored, controlled, and released in accordance with DOE, USEPA, and/or state requirements. To meet federal and state environmental requirements, Portsmouth monitors the air, water, and soil both on- and off-site. For example, Portsmouth has 4 on- and 5 off-site air monitors, 21 on-site and 8 off-site monitoring wells, 9 on- and 9 off-site water and 10 stream sediment sampling locations, and 26 soil sample sites up to 14 miles from the plant.

Environmental Issues

Portsmouth reports that its radioactive air emissions and liquid effluents and the impact of these substances on local residents have been within DOE standards for the last 5 years (1980-1984). However, Oak Ridge found that Portsmouth's data may have understated the plant's radioactive air emissions. Oak Ridge found that Portsmouth had been releasing uranium gas in quantities greater than had been reported, and in 1985 Portsmouth found that not all air emission points were continuously sampled particularly in eight buildings—all potential environmental contaminators. Portsmouth is in the process of installing 4 additional air monitors and determining whether 13 other air emission points require monitors. In addition, Portsmouth's reports show that the creek that receives most of the plant's treated liquid effluents has uranium concentrations within DOE's guidelines, but the concentrations are four times higher downstream than creek samples taken upstream of the plant.

According to its own reports and a consultant's study, Portsmouth has not demonstrated to Ohio EPA that all sources of hazardous air emissions are included in its air permits or permit applications. Further, Portsmouth has not received permits for all airborne hazardous substances emitted. A consultant hired by DOE found that Portsmouth is out

of compliance with Ohio regulations because (1) it does not have documentation to support that it has applied for all air emission permits and (2) in cases where Portsmouth has applied for permits, it does not have documentation from the state granting interim operating authority until the permits are issued. DOE pointed out that most of these sources are not of major significance as air emission points, for example, ventilation fans and diesel generator exhaust stacks, and the permits that have not been received primarily apply to the operation of a facility that has been cancelled.

In addition, Portsmouth releases significant quantities of a toxic substance—fluoride—to the air. Although neither DOE, USEPA, nor Ohio has standards for such releases, Kentucky and Tennessee—where other DOE uranium enrichment plants are located—do have standards. For example, Portsmouth's highest monthly fluoride releases would have been 12 times higher than Tennessee's standards. Portsmouth is studying ways to reduce the fluoride in its air emissions in the event the federal or state government adopt regulations limiting the quantities released.

Further, Portsmouth has not fully complied with state water release permits. For example, Portsmouth's reports showed that in 1984 261 of 4,925 water samples (5.3 percent) exceeded state discharge limits.

Portsmouth generates and stores a variety of radioactive and hazardous wastes. It has been burying low-level radioactive waste and hazardous substances on-site and disposing of liquids in a waste treatment pond since 1955. On March 13, 1984, Ohio EPA found Portsmouth out of compliance with hazardous waste laws. The primary deficiency found was that Portsmouth had inadequate groundwater monitoring around its waste disposal sites. Portsmouth is taking actions to correct the problems found, such as drilling additional monitoring wells. Nevertheless, Ohio EPA officials told us that Portsmouth has been out of compliance with hazardous waste laws since March 1984.

In addition, Portsmouth has found radioactive and hazardous substance contamination in wells near the low-level waste burial site and the holding pond. In 1981 Portsmouth found uranium contamination and in 1984 hazardous substances in wells near the burial site. Portsmouth reports that the uranium concentrations were within DOE's guidelines, but the concentrations of hazardous substances were significantly higher than USEPA's guideline of 15 parts per billion—concentrations ranged from 160 to 2,130 parts per billion. In addition, in 1984 Portsmouth found significant quantities of hazardous substances in a well located near the

holding pond and in 1985 found radioactive substances in the well. This well was drilled in late 1984. Portsmouth reports that the radioactive contamination was within DOE's guide, but samples taken from the well show hazardous substance concentrations as high as 291,000 parts per billion compared to the acceptable limit of 15 parts per billion.

Although samples from only two plant areas have shown contamination, Portsmouth does not know if this is the full extent of the problem nor whether off-site environmental degradation has occurred. In 1985 Portsmouth contracted for a study to determine the full extent and source of the problem. In addition, by November 30, 1985, it expects to complete the drilling of 27 new groundwater monitoring wells around the plant.

Another environmental problem both inside and around Portsmouth is polychlorinated biphenyl (PCB) contamination. PCBs have been found in the enrichment cascade (part of the plant that enriches uranium) lubricating oil, cascade building's exhaust ventilation system, sludge from an old sewage treatment plant, and soil in a drainage ditch. USEPA in May 1985 found DOE out of compliance with the Toxic Substances Control Act because of the PCB contamination at Portsmouth.

Portsmouth has plans for or is taking corrective actions for the PCB contamination found—except the contaminated cascade lubricating oil. Oak Ridge does not plan to require Portsmouth to replace the oil because it would cost about $3.5 million to shut down and restart the cascade and PCBs cannot readily be eliminated from the cascade because they impregnate the metal and continue to contaminate fresh oil. Further, Oak Ridge officials do not consider the situation to be unsatisfactory because the lubricating system keeps most material inside. According to a USEPA official, USEPA considers Portsmouth to be in compliance because it is taking corrective actions on the other PCB problems found.

Worker Safety and Health Issues

Portsmouth uses a variety of methods to protect its workers from, and to measure the impact of, radioactive, nonradioactive, and occupational safety hazards. For example, the enrichment cascade is designed to keep all radiation inside and the plant's ventilation filtration systems minimize airborne radioactive releases. To measure the impact of radiation on workers, Portsmouth utilizes such methods as permanent air sampling instruments in specific work areas to determine air contamination, a urinalysis program to determine internal radiation and hazardous substance exposures, thermoluminescent dosimeters to determine external radiation exposure, and an in-vivo (body) counter to determine the

amount of radioactivity in the lungs. Portsmouth also provides employees with protective clothing to prevent the spread of contamination and respirators to reduce harmful inhalations when warranted.

Between 1965 and 1972 Portsmouth reported that eight employees exceeded DOE's annual internal dose standard of 15 rem and nine others received doses more than 7.5 rem—half the standard. Since that time Portsmouth reports show that no employee has exceeded either radioactive or hazardous substances standards. Of the 17 employees, 9 no longer work at Portsmouth, 6 are monitored and reported to DOE, but the other 2 are not because they no longer work in contaminated areas.

Portsmouth's industrial accident rate for the last 5 years has been about 50 percent less than the DOE-wide and comparable industry rates. However, the seriousness of accidents was greater between 1980 and 1983 than DOE-wide performance and greater than industry performance in 1980, 1981, and 1983. The accidents resulted in the employees' being off work for longer periods of time. For example, for the 3-month periods January-March 1980 and January-March 1983, one employee lost 314 work days because of an oil fire that burned over 40 percent of his body, and another employee was out 127 days because of an on-site vehicular accident. Other Portsmouth employees injured during these same periods had an average of 22 lost workdays. Further, over the last 5 years one construction worker died while working at Portsmouth. Since the fatality did not involve a Portsmouth employee, the death is not included in Portsmouth's accident statistics. DOE's investigation report of the accident concluded that the death resulted from safety violations.

Current Actions

Portsmouth is now making ES&H improvements such as

- installing 4 additional permanent air monitors and determining whether 13 more are needed,
- studying ways to reduce fluoride concentrations in its air emissions,
- removing or minimizing PCB contamination, and
- drilling 27 new on-site ground water monitoring wells to better detect contamination, including 14 near the burial site and 13 near the holding pond.

Mound, Miamisburg

Mound is a research, development, and production facility performing work for DOE's weapons, aerospace, and medical programs. Many of Mound's operations are classified. Currently Mound employs about 2,700 people. Prior to 1979 Mound used plutonium oxide in powder form. Although the plutonium it uses now is encapsulated and less dangerous than the powder, Mound must nonetheless protect the environment and workers from its radioactivity and from inadvertent releases or exposures to another substance—tritium—which is hazardous if absorbed. Mound is required to keep radioactive air emissions and liquid effluents within both DOE's standards and guidelines and USEPA's drinking water standards for tritium and comply with federal and state hazardous substances statutes.

To demonstrate compliance with these requirments, Mound has 15 stack samplers, 5 boundary air monitors, 15 off-site air monitors located up to 28 miles from the plant, and 3 on- and 29 off-site water sampling locations—including rivers, ponds, wells, and drinking water sites up to 30 miles from the plant.

Environmental Issues

Mound's reported radioactive air emissions, liquid effluents, and doses to the off-site population have been within DOE's standards. For example, reported air emissions and liquid effluents have been less than 1 percent of DOE's standards over the last 5 years.

However, between 1959 and 1969 Mound released large quantities of tritium to the air and water. These releases were accepted practices at that time. In 1970 Mound implemented an ALARA-type program and took actions to reduce its air emissions and water releases, such as installing a tritium stack reclaimer and building a liquid effluent holding pond. In addition, in 1970 Mound found that a local drinking water aquifer contained tritium. Because the tritium concentrations were below DOE's standards, no remedial actions were taken.

In 1976 USEPA assumed regulatory authority for tritium in drinking water and issued standards that were lower than DOE's. As a result, the tritium concentrations found in the aquifer exceeded the new limits; and Mound hired a consultant in 1976 to identify the source and extent of the contamination. The consultant reached no definitive conclusions on the extent of contamination but identified several possible sources of the contamination: a past disposal practice, the quantities of tritium released in liquid effluents, leaks from a ruptured underground waste transfer line, highly contaminated soil around three tritium handling

buildings, and airborne tritium releases that rain carried back to the soil. In 1976 Mound instituted tritium dilution activities for the aquifer—pumping contaminated water from two wells thereby lowering the water level in the aquifer and allowing it to be recharged with water from the Great Miami River. The water Mound pumps from the wells also goes into the Great Miami River; Ohio EPA approved this method in 1976. By September 1978 the tritium concentrations were below USEPA's 1976 standards. Mound continues to dilute the aquifer to keep the concentrations within standards.

While DOE and Mound officials told us that the amount of tritium in the aquifer has been in compliance with applicable standards, the enduring nature of tritium raises questions about whether all sources of contamination are known or whether appropriate actions have been taken. For example, in 1970 Mound implemented an ALARA-type program and took actions to reduce the plant's radioactive air and water releases. Further, tritium has a half-life of about 12 years and the pumping activities should have substantially reduced the tritium levels since 1976. However, Mound still dilutes the tritium on a regular basis but the frequency fluctuates and has generally decreased. For example, in 1976 Mound pumped a total of 63 days; in 1981, 302 days; and through October 1985, 42 days. Pumping frequency is related to the amount of rainfall during the year and is determined by Mound through its well monitoring program.

At this point Mound does not know how long dilution activities will continue. Further, DOE does not know the full extent of the contamination, the corrective actions needed to fully resolve the issue, or the associated long-term environmental or health effects. According to DOE's Deputy Assistant Secretary for Safety, Health, and Quality Assurance, as long as Mound continues dilution activities and keeps the levels of tritium within acceptable standards, DOE believes corrective actions have been taken. This official also told us that, if dilution activities stopped, the level of tritium would rise above USEPA's standards.

In addition to the contaminated aquifer, Mound has an off-site soil contamination problem. Until 1976 Mound used and transferred plutonium from the operations area to a waste processing facility through an underground pipe. In 1969 the pipe ruptured, contaminating the adjacent area with plutonium. Although Mound cleaned the area immediately, 5 years later— 1974—Mound found that the plutonium had migrated off-site. Mound, the Ohio Department of Health, and Ohio EPA

studied the problem and concluded that the plutonium was not an immediate hazard to workers. According to Mound officials, the plutonium would only be an immediate hazard to the community if it were dug up as part of a local construction project. The city has agreed to notify Mound if it plans to develop the land. Further, Mound continues to monitor the contamination to ensure the public is protected.

Mound's reported nonradioactive air emissions for 1980-1984 were within USEPA's and Ohio's requirements; its reported nonradioactive liquid effluents met state NPDES requirements with one major exception—releases of suspended solids (mud) after a heavy rain. However, Ohio EPA in September 1985 revised the discharge limits and sampling requirements for suspended solids in Mound's NPDES permit; and Mound has instituted procedures to reduce the amount of mud released to a nearby river. Mound officials believe it can, for the most part, comply with the state's September 1985 permit for suspended solids.

Worker Safety and Health

Mound has a program to protect its workers from, and measure the impact of, radiation and other hazards. It has plant design measures to reduce exposures, area monitors to detect releases, and personal devices to measure employee exposures. For example, urinalysis monitors employee exposures to radioactive substances, thermoluminescent dosimeters measure external exposure to radiation, nose wipes indicate possible particulate inhalation, and a whole-body counter detects radioactivity in the lungs. In addition, Mound provides laboratory coats, shoe covers, respirators, plastic clothing, and bubble suits as warranted.

In the last 5 years Mound's reported worker radiation exposures were within DOE's standards and the number of occupational injuries was well below that of all DOE facilities. Prior to 1979, however, 17 employees received plutonium doses in excess of DOE's standard—the highest accumulated dose is estimated to be 5 times DOE's standard. All 17 people continue to have plutonium in their bodies because once in the blood stream plutonium is carried throughout the body, settles in the liver and bone, and remains many years after the initial exposure. Of the 17 people, 10 no longer work at Mound. Mound continues to monitor exposures for six employees and report to DOE, if necessary. The seventh employee does not have an exposure that requires monitoring.

Summary of ES&H Problems and Corrective Actions Planned

All three Ohio plants have environmental problems. One common to each is contaminated groundwater. Fernald has radioactive contamination in off-site wells and both radioactive and nonradioactive contamination in on-site wells; Portsmouth, on-site radioactive and nonradioactive contaminated wells; and Mound, radioactive contamination of an off-site drinking water source. Other problems also exist at each of the three Ohio plants. For example,

- The location and reliability of Fernald's air monitors have been questioned by DOE, USEPA, and Ohio officials, and Fernald needs to reduce its radioactive air emissions to comply with USEPA's February 1985 standards. DOE has budgeted funds to modernize the plant and to locate additional off-site monitors, and Fernald has instituted various administrative and operating controls to meet USEPA's standards. In addition, Fernald has not completed two of four pollution control projects required by its 1980 NPDES permit; it expects to complete them by December 1986. Further, Ohio EPA found Fernald out of compliance with hazardous waste laws, but Ohio EPA officials told us that Fernald is correcting the deficiencies found.
- Oak Ridge found that Portsmouth's data may have understated the plant's radioactive air emissions, but Portsmouth has installed new equipment to reduce and better measure its emissions. In addition, Portsmouth has widespread PCB contamination in and around the plant but is taking action to clean the contamination and minimize worker exposure to it. Further, Portsmouth has not identified all hazardous air emissions to ensure the state that its permits or permit applications cover all such substances emitted. It is in the process of doing this. In addition, Portsmouth releases significant quantities of fluoride gas but is now studying ways to reduce these releases in the event the federal or state government adopts regulations limiting the quantities released. Further, Portsmouth is out of compliance with hazardous waste laws but is acting to correct the deficiencies found.
- Mound has plutonium-contaminated soil off-site as a result of a waste-transfer-pipe rupture in 1969. Mound has removed the transfer line, continues to monitor the off-site contamination to ensure the public is protected, and will be notified by the city if the land is to be developed in the future.

Many Factors May Have Contributed to Problems Found

As stated in chapter 2, the three Ohio plants report that radioactive environmental releases have been within standards for the last 5 years. However, no coordinated DOE/state/ contractor system exists to ensure that the radioactive environmental releases reported by contractors represent the amounts actually released. In addition, each site has environmental problems. Some factors that may have contributed to the problems were that contractors implemented DOE's groundwater and air monitoring guide and ALARA policy differently and operations offices did not effectively use the award fee process to improve ES&H performance or the appraisal process to identify and correct deficiencies found.

Subsequent to Fernald's 1984 air releases, DOE initiated some changes to its ES&H process and structure. For example, DOE began to place greater emphasis on direct contractor inspections, and DOE now requires Fernald and Portsmouth to comply with the environmental monitoring guide. In addition, ES&H appraisals have recommended that the field offices require contractors to establish measurable ALARA goals for both environmental releases and worker exposures, and DOE has started to use the award fee to improve ES&H performance.

However, a June 1985 consultant report, prepared at the direction of the Secretary of Energy, pointed out that the headquarters ES&H group was perceived as having no implementing authority; consequently, its recommended actions were not carried out. On September 18, 1985, the Secretary took several actions designed to correct this problem and strengthen the department's ES&H functions. For example, he created an office of the Assistant Secretary for Environment, Safety, and Health. Further, he required that DOE survey all facilities to identify and prioritize areas of existing environmental risk and that DOE conduct safety appraisals of its major facilities to determine how well they comply with safety and other requirements.

Verification of Contractor Data Is Not Done in Ohio As Is Done Elsewhere

No system exists to verify contractor-reported radiological environmental monitoring data and ensure that contractors operate their facilities in an environmentally acceptable and safe manner. Each of the Ohio contractors collects, evaluates, and reports its own radioactive air and water release data; no entity verifies these data. However, a variety of groups expressed concern about the reliability of air monitoring data reported by Fernald and Portsmouth. Further, both USEPA and Ohio EPA officials believe there should be a system to ensure that the release data reported by contractors represented the amount actually released. These

officials pointed out that Ohio, through a USEPA grant, evaluates each plant's compliance with nonradioactive water effluent standards.

Previously[1] we concluded that verification of contractor-reported data was an important element of a good monitoring program because it provided a system for ensuring accuracy of the data reported. Prior to our 1981 report, coordinated DOE/state/contractor verification was initiated by Albuquerque with Texas and Colorado for two nuclear weapons plants within Albuquerque's jurisdiction. However, DOE did not adopt our recommendations, and during this review we found that neither Oak Ridge nor Albuquerque has a similar practice with the state for the Ohio plants. DOE officials told us they periodically test each contractors' ability to analyze air and water samples.

We continue to support our previous conclusion that independent verification not only provides a greater degree of public confidence in DOE's operations but also provides a system for ensuring accuracy of contractor-reported data so that corrective actions can be taken. In the case of Fernald, a system for independent verification could have been particularly useful to allay community concerns about the 1984 releases. In addition, the three Ohio contractors operate under cost-plus-award-fee contracts that could financially penalize them for reporting radioactive releases to DOE. Independent verification would help allay concerns about the potential conflict of the contractors' receiving award fees based on environmental monitoring data they report to DOE. Further, while DOE checks the contractors' ability to accurately analyze samples, this does not provide assurance that the release data gathered and reported are accurate.

Implementation of Groundwater and Air Monitoring Guide Varied

In 1977 DOE published a radiological surveillance guide to help contractors design effective groundwater and air monitoring programs that would quickly identify the impact of their operations both on- and offsite. The guide, however, is not a mandatory requirement. In the reports mentioned above, we found that contractor ES&H environmental monitoring programs were not consistent from contractor to contractor and from operations office to operations office. Part of the reason for this was a lack of mandatory program requirements from DOE headquarters concerning how to monitor, what to monitor, and how often to monitor.

[1]Better Oversight Needed for Safety and Health Activities at DOE's Nuclear Facilities (EMD-81-108, Aug. 4, 1981) and DOE's Safety and Health Oversight Program at Nuclear Facilities Could Be Strengthened (GAO/RCED-84-50, Nov. 30, 1983).

We found this same inconsistency in the way the Ohio plants followed DOE's radiological surveillance guide for groundwater and air monitoring.

For groundwater monitoring, the guide recommends that contractors drill on-site test wells and monitor off-site wells that could be influenced by liquid effluents—particularly those closest to the plant. Although Fernald monitored on-site wells as early as 1976, it did not follow DOE's guide for monitoring off-site wells. In 1981 a resident near Fernald complained to the Ohio EPA that his well had a peculiar odor. As a result, Fernald began to test off-site wells, and it was only then that three uranium contaminated wells were discovered. However, Fernald had warnings as early as 1973 that the plant's sewer system contained particularly high levels of uranium. Between 1973 and 1978, Oak Ridge annually reported this problem and recommended that Fernald identify the source of the contamination, but it was not until 1984 that Fernald acted on Oak Ridge's recommendation.

Unlike Fernald, Mound had a well-monitoring program even before DOE's 1977 guide that allowed it to identify the tritium contamination in the aquifer as early as 1970. When revised standards in 1976 made the contamination levels unacceptable, Mound took corrective action. While the actions have not fully resolved the problem, early implementation may have prevented it from getting worse.

Like Mound, Portsmouth followed DOE's 1977 groundwater monitoring guide. As a result, in 1981 Portsmouth found radioactive contamination in wells near a low-level waste burial site. Although Portsmouth does not know either the source of the contamination or whether off-site contamination exists, it plans to initiate a study to find the answers. In addition, Portsmouth is drilling 27 new on-site wells around the plant to increase its monitoring to detect other possible contamination. However, in August 1985 a consultant study found that Portsmouth's groundwater monitoring wells were not properly located to allow for early detection of contamination nor did they provide a good basis for developing quality assessments once contamination was detected. Portsmouth officials told us they plan to resolve these problems.

DOE's March 1977 environmental monitoring guide also describes where contractors should locate both on- and off-site air sampling monitors to produce the most accurate readings of the plants' radioactive emissions. The guide states that contractors should use historical meteorological

data to identify likely plant release pathways and use this data in conjunction with other factors such as road proximity (road dust can distort readings) to place both on- and off-site monitors. Further, DOE recommended that contractors have a minimum of five off-site monitors at various distances beyond the plant to get a more complete perspective of releases that may affect the public and surrounding communities.

Fernald did not follow DOE's guide, and several groups have questioned the reliability of its air monitoring system. Fernald did not consider meteorological data to locate on-site monitors, did not have off-site monitors until July 1985, and then placed only two as compared to DOE's recommended five. Further, Oak Ridge, USEPA, and Ohio officials all questioned either the reliability or location of Fernald's on- and off-site monitors.

For example, following the uranium releases in the last quarter of 1984, Oak Ridge concluded that Fernald's air sampling monitors could not be relied on to give accurate readings because they were not properly located. USEPA officials told us that because Fernald did not have off-site monitors, it cannot assure USEPA that the 1984 releases stayed on-site and did not contaminate either the environment or the public. Further, Ohio officials have concerns about the reliability of the two off-site air monitors' readings because they are located close to the ground and may provide distorted readings from nearby traffic and farm operations. To rectify this situation, Fernald is upgrading its meteorological station and has installed two additional on-site and two additional off-site air monitors that are expected to be operational in December 1985.

Although Portsmouth followed DOE's air monitoring guide and located five off-site monitors, a 1985 consultant report criticized both the number and location of these monitors. The report noted that five monitors was the bare minimum for a site the size of Portsmouth and considering the number of air emission points on the plant. The report also found that the five monitors are poorly located in relation to wind direction around Portsmouth. According to the report, Portsmouth plans to install eight additional off-site air monitoring stations in fiscal year 1986.

In previous reports, we noted that operations offices allowed contractors to have different groundwater and air monitoring programs partially because of a lack of mandatory program requirements from DOE headquarters concerning how to monitor, what to monitor, and how

often monitoring should be conducted.[2] We recommended that radiation monitoring guides be mandatory for all DOE facilities to ensure uniform compliance with program standards and requirements. DOE did not adopt this recommendation because it believed that contractors would lose flexibility to design their monitoring programs. We continue to believe our recommendation is valid. DOE needs reliable data not only to ensure that its contractors comply with environmental release standards but also to assure the public that their operations cause minimal impact on the environment and surrounding communities.

Contractors Implemented ALARA Differently

In 1960 DOE adopted a policy of keeping worker exposures and environmental releases as low as reasonably achievable. DOE began a review in 1976 to (1) determine how contractors were implementing ALARA and (2) develop guidance for contractors' use in implementing and evaluating their ALARA programs. In April 1980 DOE's Assistant Secretary for Environment issued ALARA guidance outlining what contractors needed to do to achieve DOE's ALARA goals. However, the report pointed out that it was provided as "guidance" rather than a requirement. The report recommended that contractors give greater emphasis to avoiding unnecessary radiation exposures and that merely examining dose trends does not give the complete picture of a worker's or group of workers' exposures. The report stressed that (1) personnel at all levels must provide strong support for ALARA, (2) radiation design should be an integral part of building design, and (3) ventilation systems should trap airborne contamination within a facility. For new buildings, the report set specific radiation exposures for certain work areas.

The three Ohio plants implemented ALARA differently. For example, Mound not only established worker exposure and environmental release goals 75 percent lower than DOE's standard, but it also set performance goals for managers responsible for exposure control and nuclear operations that were even lower than the plant's ALARA goals. Between 1980 and 1984 Mound met both its ALARA and performance goals.

In contrast, as early as 1980 headquarters ES&H found that contractors within Oak Ridge's jurisdiction did not set measurable ALARA goals that could be audited. In July 1982 headquarters ES&H reiterated its earlier finding that Oak Ridge's contractors did not have ALARA goals that could be evaluated. We found that Portsmouth and Fernald, which are under Oak Ridge's jurisdiction, still do not have measurable ALARA goals. For

[2](EMD-81-108, Aug. 4, 1981) and (GAO/RCED-84-50, Nov. 30, 1983).

example, as of October 1985 Portsmouth did not have measurable ALARA goals for worker exposures. According to Portsmouth officials, they do not believe they need measurable goals because worker exposures are low. Rather Portsmouth identified those operations where worker radiation exposures could be reduced and then sought ways to change its operations. A March 1985 headquarters ES&H appraisal of Oak Ridge noted that Portsmouth's progress toward reducing worker exposures was difficult to measure because its stated ALARA goals could not be evaluated. In addition, headquarters ES&H noted that appraisal documentation did not show that Oak Ridge consistently followed up on Portsmouth's progress toward achieving its ALARA goals.

Further, although Fernald set ALARA goals for worker exposures in 1982, it has not established an ALARA program for environmental releases. A February 1985 Oak Ridge evaluation concluded that Fernald did not have an effective ALARA environmental emission program.

DOE officials pointed out that the assessment and achievement of measurable goals is only one aspect of an effective ALARA program. DOE further stated that in some cases it may not be possible to set measurable goals. In those cases, DOE's April 1980 guide requires contractors to improve their radiation control programs, equipment design, and operating practices to reduce both worker and off-site exposures. DOE verifies these reductions by examining trends in contractor-reported exposure monitoring data. DOE stated that the exposure monitoring programs have verified that its flexible approach to ALARA has been effective in reducing overall employee exposures at the three Ohio plants.

While we recognize that goals may be only one part of an effective ALARA program, a number of DOE reports—including the ALARA guide and a 1980 headquarters appraisal—noted that examining trends is not enough and that contractors should establish goals to measure dose reduction performance. A number of reports have also found problems with other ALARA objectives at the three plants. For example, one ALARA objective is facility design features to minimize radiation exposure. In March 1985 Oak Ridge found that Fernald lacked contamination control features and that the plant was very dirty with uranium dust. As a result, DOE is planning to request fiscal year 1987 funding to build barriers to separate contaminated from noncontaminated areas at Fernald, and Fernald is cleaning the plant to minimize airborne particulates. Further, Oak Ridge concluded that Fernald could reduce its air emissions by 90 percent of its 1981-1984 reported releases by merely applying better operating practices with little cost for new equipment. Another ALARA

objective is that personnel monitoring instruments be tested and calibrated to ensure accurate dose readings. In June 1985 DOE found that Mound was not adequately calibrating, testing, nor maintaining radiation protection instruments.

Award Fee Contracts Were Not Fully Used to Enhance ES&H Activities

Fernald's, Portsmouth's, and Mound's contractors operate under cost-plus-award-fee contracts with DOE. Under such contracts, an award fee is paid when the contractor's performance meets criteria that the contractor and DOE agree to prior to each contract period. Such contracts offer DOE an opportunity to use the fee as an effective management tool to encourage contractors to achieve DOE's ES&H and ALARA goals.

However, in the award fee process DOE gave the operations offices flexibility in how they considered ES&H activities. For example, Albuquerque and Mound agree to ES&H performance criteria prior to each contract period but Oak Ridge does not with Fernald and Portsmouth. Rather Oak Ridge and the contractors at Fernald and Portsmouth agree to broad categorical goals such as management and administration that include ES&H activities. The weight ES&H activities carry in the award fee process is not discussed with the contractors and are set by Oak Ridge at the end of the award fee process. The ES&H award fee components vary by facility but generally ranged from 5 to 10 percent of the weight for all components used to determine the award fee for the Ohio plants.

In 1983 Albuquerque began to use the award fee to improve Mound's ES&H performance. First, Albuquerque included industrial safety as a criterion worth 5 percent. In the second half of fiscal year 1984 and 1985, health protection was substituted (including industrial hygiene). Second, in 1984 Albuquerque reduced Mound's fee by over $50,000 because of industrial hygiene deficiencies. A follow-up appraisal later in 1984 found that Mound's industrial hygiene program had improved. Beginning the second half of 1984 Albuquerque also listed environmental protection at Mound as a criterion worth 5 percent.

In contrast, Oak Ridge did not use the award fee to encourage improved ES&H performance at Portsmouth and Fernald until 1985. Portsmouth officials told us that Oak Ridge never discussed ES&H performance with them either prior to the award fee period when rating criteria were established or in award fee meetings because Oak Ridge would lose flexibility to change the weight applied to ES&H and other factors at the end of the award fee process. Consequently, Portsmouth was unaware of the

weight Oak Ridge gave ES&H performance in its award fee determination. When evaluating Portsmouth's performance for the first half of 1985, DOE reduced the fee by $400,000 because of ES&H and other deficiencies. However, the amount applicable to ES&H deficiencies was not specified to Portsmouth.

In April 1984 a task force of Oak Ridge officials conducted a comprehensive review of Fernald's activities including ES&H and the implementation of the award fee contract. In its June 1984 report the task force concluded that Fernald's and Oak Ridge's managerial attitudes contributed to inadequate environmental controls and monitoring programs because both historically stressed production as the first priority—environmental protection and worker health and safety were secondary concerns. The task force recommended that Oak Ridge promote a more balanced view of all important requirements— including production and ES&H activities—facing Fernald. The report noted that Fernald's management and staff did not perceive that the facility had problems. Even noncompliance with environmental regulations was not viewed as a problem. Since the award fee board had always given Fernald excellent ratings, the task force concluded that Fernald's management did not perceive that deficiencies existed and had little incentive to make ES&H improvements.

The task force also concluded that Oak Ridge had not effectively used the award fee process to focus Fernald's efforts on ES&H objectives and needed improvements. It recommended that Oak Ridge revise Fernald's award fee criteria by giving greater weight to ES&H activities and encouraged Fernald to revise its management practices to improve overall plant operations in the areas of operational efficiency, safety and health of employees, employee job satisfaction, public relations, and environmental protection.

Although the task force made these recommendations in June 1984, it was not until December 18, 1984—after the uranium releases at Fernald—that Oak Ridge took several steps to improve its consideration of ES&H performance in Fernald's award fee determinations. Specifically, Oak Ridge segregated environment as a separate criterion. Further, Oak Ridge's manager—who determines the amount of fee to be awarded—and deputy manager agreed to participate in the award fee performance reviews by meeting with the award fee board and the chairperson of the performance evaluation committees to ensure that ES&H performance is appropriately considered in the award fee process. This had not been done in the past.

Adequacy of Oak Ridge's and Albuquerque's Appraisal Programs Questioned

DOE has a multilayered program for appraising contractors' ES&H performance. Its headquarters ES&H office inspects operations offices, operations offices inspect the contractors, and contractors conduct self-audits. In addition, the program offices conduct ES&H appraisals of operations offices and contractor programs. Recent DOE evaluations identified major problems in both Albuquerque's and Oak Ridge's ES&H appraisal programs. The problems found—coupled with the recent problems at Fernald—are part of the reasons DOE cited for reorganizing its ES&H functions under a new Assistant Secretary for Environment, Safety, and Health.

DOE Order 5482.1A—Environmental Protection, Safety, and Health Protection Appraisal Program—stipulates that ES&H appraisals not only assess compliance with applicable policies, standards, and requirements but also identify ES&H deficiencies and recommend actions to correct the deficiencies found. Responsibility for correcting deficiencies rests with the contractors, operations offices, and program offices.

In recent years neither headquarters ES&H or the program offices' ES&H groups identified important problems at the three Ohio plants. Although DOE officials told us that the headquarters groups conducted a limited number of on-site contractor appraisals, the headquarters groups primarily carried out their oversight responsibilities by reviewing the operations offices' ES&H appraisals. Since the operations offices' appraisals were not identifying some major problems at the three plants, the headquarters oversight process did not allow it to readily identify all site-specific problems. Further, in some cases where appraisals identified problems, neither the contractor, operations offices, nor program offices corrected them.

In February 1985 the Oak Ridge board that investigated Fernald's 1984 releases expressed concern about the adequacy and effectiveness of Oak Ridge's ES&H appraisal program and identified major ES&H weaknesses in both Oak Ridge's appraisals and Fernald's self-audits. The board found that Fernald had inadequate or nonexistent internal audits of ES&H areas and a widespread lack of management control and recommended that Oak Ridge evaluate and correct its ES&H appraisal program to ensure that its appraisals report problems found as well as recommendations to resolve significant ES&H problems. The board pointed out that Oak Ridge's appraisal program did not identify the problems that subsequently resulted in the excessive air releases in 1984 at Fernald.

In June 1985 headquarters ES&H reviewed the adequacy and effectiveness of Albuquerque's ES&H appraisal program. ES&H found that Albuquerque's appraisal program had deteriorated— particularly in the health physics (radiation protection) area. The report pointed out that prior to 1982 Albuquerque's health physics appraisal program had been the best in DOE. However, in June 1985 it was inadequate in scope, depth, quality, frequency, and follow-up. Some of the principal deficiencies noted were that (1) Albuquerque abandoned its practice of appraising all aspects of health physics at least every three years and (2) appraisals were not finding important problems primarily because Albuquerque staff lacked operational experience. Headquarters ES&H pointed out that the effect of this deterioration was also seen in the deteriorating ES&H performance of contractors within Albuquerque's jurisdiction.

In response to the concerns raised, Oak Ridge's manager implemented a new appraisal system in June 1985. A key change is that inspectors would spend more time at each plant site reviewing operations first hand so they can better identify and quickly raise problems to appropriate management levels. In addition, Albuquerque has initiated actions to correct the deficiencies found, such as requesting additional technical staff. Further, the events at Fernald have caused the headquarters ES&H office to revise its appraisal program to emphasize direct inspections of facilities rather than limiting inspections to operation offices' ES&H programs.

While the changes in headquarters' and operations offices' appraisal programs could improve ES&H activities, DOE must ensure that deficiencies found are promptly corrected. In 1982 a headquarters ES&H appraisal of Oak Ridge identified problems at Fernald. ES&H found that Fernald lacked contamination controls and did not properly maintain air sampling monitors. DOE did not act to correct these problems promptly. For example, DOE plans to request fiscal year 1987 funding to build barriers at Fernald to separate contaminated from noncontaminated areas, and in 1985 Fernald plans to replace 15 stack samplers and locate 2 additional on-site and 2 off-site monitors.

Conclusions and Recommendations

Each of DOE's Ohio plants must meet and comply with numerous regulations, procedures, and standards to minimize environmental degradation and worker safety and health impacts from plant operations. Plant records show that environmental releases and radiation doses for the last 5 years have been within standards. However, various groups have questioned the reliability of Fernald's and Portsmouth's air monitoring

data. In addition, no coordinated DOE/state/contractor system exists to independently evaluate contractor-reported data on a test basis and determine that they operate their facilities in an environmentally acceptable manner. Federal and state officials told us that on the basis of contractor reports and on-site inspections the plants are complying with or taking actions to comply with Clean Air and Clean Water Acts. However, Ohio EPA through on-site inspections has found Fernald and Portsmouth out of compliance with hazardous waste laws. In addition, past actions, such as waste disposal practices, and inconsistent implementation of the environmental monitoring guide, such as inadequate and poorly located wells and air samplers, have resulted in environmental degradation.

DOE's decentralized management gives operations offices flexibility and latitude in conducting their ES&H programs. Since the 1984 releases by Fernald, DOE acted to improve its implementation and oversight of ES&H activities. For example, DOE required Fernald and Portsmouth to implement its environmental monitoring guide, used the award fee to encourage improved ES&H performance, reduced award fees because of ES&H deficiencies, and began conducting "hands-on" inspections at the Ohio plants. However, Oak Ridge has not (1) established ES&H evaluation criteria with Fernald and Portsmouth prior to the contract award fee period, (2) specified the amount of fee reduction applicable to ES&H deficiencies, and (3) required Fernald or Portsmouth to establish measurable ALARA goals.

In addition, a June 1985 consultant report, prepared at the direction of the Secretary of Energy, pointed out that the headquarters ES&H group was perceived as having no implementing authority; consequently, its recommended actions are not carried out. On September 18, 1985, the Secretary of Energy took several actions designed to correct these problems and strengthen the ES&H function. For example, he created an office of Assistant Secretary for Environment, Safety, and Health to enforce DOE's ES&H programs. Further, he required that DOE survey all facilities to identify and prioritize areas of existing environmental risk and that DOE conduct safety appraisals of its major facilities to determine how well they comply with safety and other requirements. These initiatives are essentially in the planning phase; therefore, we did not evaluate their potential for improving ES&H at DOE facilities.

Our findings at the three Ohio plants demonstrate the continued validity of our earlier recommendations to DOE concerning radiological monitoring guides and independent verification of contractor data. Therefore, we recommend that the Secretary of Energy:

- require that radiological monitoring guides be mandatory for all DOE facilities and
- develop a coordinated DOE/state/contractor system to verify contractor-reported data.

In adddition, we have a broader review of ES&H activities at DOE's facilities nationwide. We may also make recommendations in that report applicable to the three Ohio plants.

☆U.S. GOVERNMENT PRINTING OFFICE: 1 9 8 6— 4 9 1—2 3 4—4 0 0 1 5