

FEMP--2518-Summ.



1995

SITE ENVIRONMENTAL REPORT SUMMARY



U.S. DEPARTMENT OF ENERGY FERNALD FIELD OFFICE
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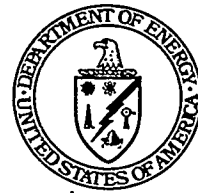
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BY THE SITE RESTORATION SERVICES DEPARTMENT
FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION



Department of Energy

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OCT 31 1996

DOE-0015-97

Dear Fernald Stakeholder:

SUPPLEMENTAL ADDENDUM TO THE 1995 SITE ENVIRONMENTAL REPORT

Enclosed for your information and reference is an addendum to the Fernald Environmental Management Project's 1995 Site Environmental Report. This addendum clarifies errors which were not identified during the final editing stage of the report.

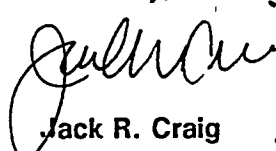
The addendum comprises the following:

- **Shaded text in reference to changes in the Executive Summary and in Chapter 5;**
- **Figure 43 in Chapter 6 has been footnoted to explain the change in units reported;**
- **Changes to Tables 11 and 17, found in Appendix A, have been highlighted for easy reference; and,**
- **Table 31, Fernald - OEPA Sampling Comparison, has been added for reference to surface water sampling for uranium and radium.**

Please insert the enclosed addendum pages into the 1995 Site Environmental Report.

Please accept my sincere apology for any inconvenience or confusion these errors may have caused. If you have any questions regarding the addendum or the 1995 Site Environmental Report, please contact Kathi Nickel at (513) 648-3166.

Sincerely,


Jack R. Craig
Director

FEMP:Nickel

Enclosure: As Stated

1995

SITE ENVIRONMENTAL REPORT SUMMARY

By now, counting calories, applying sunscreen, and exercising may have become a way of life for you. Because you value your health, you try to monitor and control the things that affect it. There are times though, that you rely on others to provide information concerning your health. For example, many of you with seasonal allergies rely on the daily pollen count provided by the weather service to determine your outdoor activities. Likewise, many of you in the area rely on us to provide information about how site activities may affect the community. Since 1959, we have published an annual environmental report to meet the requirements of the Department of Energy (**DOE**), the Ohio Environmental Protection Agency (**OEPA**), and the United States Environmental Protection Agency (**USEPA**). This booklet contains information relevant to your health as well as the safety of the environment. Our environmental monitoring activities measure and estimate the amount of radioactive and nonradioactive materials that may leave the site and enter the surrounding environment.

This booklet summarizes the **1995 Site Environmental Report (SER)**, and describes for you the Fernald site mission, exposure pathways, and environmental standards and guidelines. This presents an overall view of the impact these activities have on the local environment and public health. For many, this summary will contain enough information, but for those who would like to know more about a particular topic, we have included page references to the SER in the margins. The SER is available at:

Public Environmental Information Center
10845 Hamilton-Cleves Road
Harrison, OH 45030
(513) 738-0164

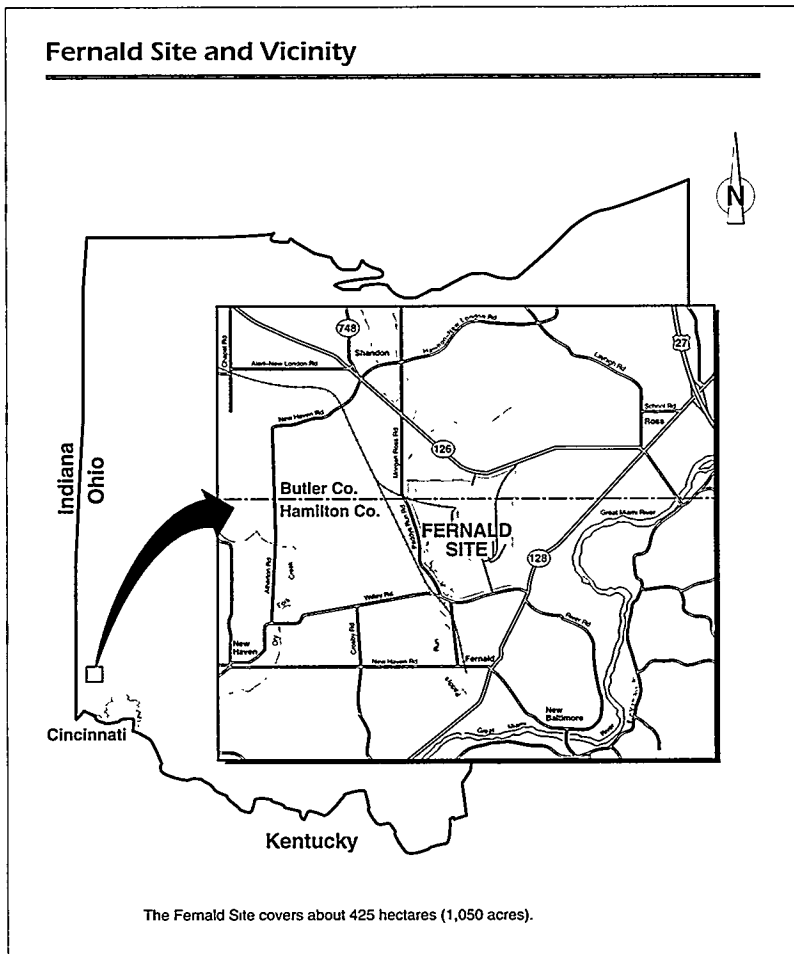
The Fernald Site

For more information on the history of the Fernald Site, see pages 2 through 4 in the Site Environmental Report.

In May 1951, ground was broken on a 1,050 acre area just north of Fernald, Ohio for a new facility to process uranium metal in support of Department of Defense (DOD) activities. This small farming community lies 17 miles northwest of downtown Cincinnati, Ohio. In October 1951, the first uranium derby was produced at the site's Pilot Plant, and by 1954 a major portion of the construction was completed. The government established the Fernald site in the early 1950s primarily to produce uranium metal but has since shifted its mission to waste management and environmental remediation.

During the 1950s and the 1960s the Cold War put uranium-metal production at its peak. Funding for production and related activities, including environmental monitoring, was reduced significantly in the 1970s. In the early 1980s, production

quickly accelerated with DOD spending; by the late 1980s, demand dropped again; and, finally, in July 1989, production was suspended. The Office of Environmental Restoration and Waste Management took over responsibility for the plant from the DOD programs in October 1990. In February 1991, DOE formally announced its intention to end production permanently and submitted a closure plan to Congress which became effective in June 1991. Today, the Fernald Environmental Restoration Management Corporation (FERMCO) operates the site, focusing on environmental restoration and remediation.



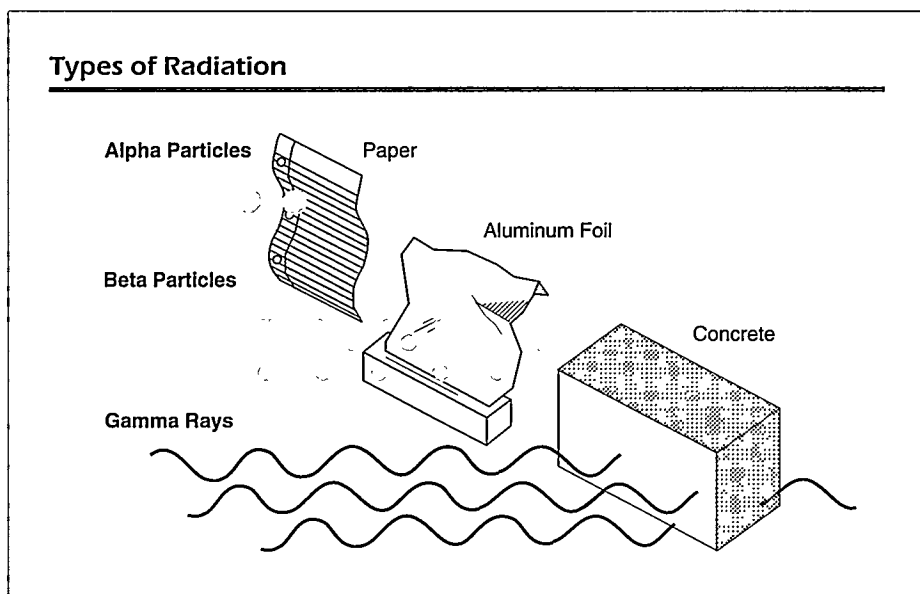
Radiation

Because we store and handle radioactive materials onsite, we think it is important for you to understand the possible health hazards associated with these materials. Radioactivity is the process by which the nucleus of an unstable atom spontaneously disintegrates.

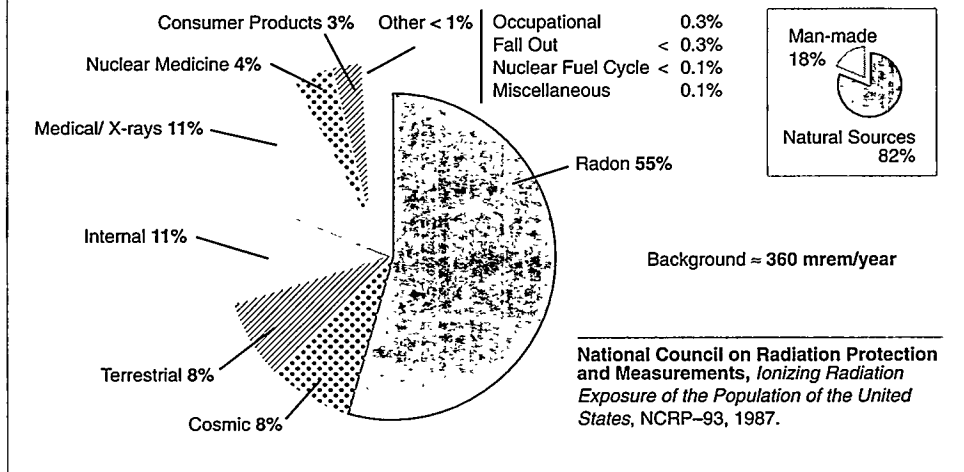
When an atom decays, energy released as particles or waves is called radiation. Radiation exists here at Fernald in alpha particles, beta particles, and gamma rays emitted from substances such as uranium and thorium. Not all radioactive materials emit all three types of radiation, and each kind can be stopped by different materials. The figure below shows the penetration ability of these three types of radiation.

For more information on units of measurement, see pages 35 through 37 in the Site Environmental Report.

Radiation is measured in units of rem; the more rem, the higher the potential damage. We often use a millirem (mrem), equal to 1/1000 of a rem, for measurement because the amount of background radiation and radiation from the Fernald site is so low. (Background radiation averages only 360 mrem, and Fernald site radiation averages well below 100 mrem, which is the DOE standard.)



Exposure to Background Radiation



The term “radiation” can refer to such things as heat, sound, or visible light. Radiation can occur naturally, in the form of cosmic radiation from space, from naturally occurring radioactive materials in soil, and from naturally occurring radioactive elements in food and air. Besides natural sources of radiation, man-made sources, such as medical X-rays,

televisions, building materials, and smoke detectors, are part of our everyday life. The chart above shows the sources and amounts of radiation the average American is exposed to annually.

Environmental Monitoring

For more information on exposure pathways, see page 23 through 26 in the Site Environmental Report.

Environmental monitoring investigates the effects that past and current Fernald site operations have on the environment. Our **Environmental Monitoring Program** is designed to:

- detect unusual release of materials so corrective actions can be taken,
- monitor releases to ensure standards and guidelines are not exceeded,
- evaluate past and present effects on the environment,
- estimate dose from past operations and current clean-up, and
- measure progress of corrective actions.

Environmental monitoring focuses on the **air** and **liquid pathways**, which are routes pollutants travel from Fernald to the surrounding community (see the first diagram on the next page). The air pathway includes pollutants carried from the site through the air and direct radiation. The liquid pathway includes all the pollutants that could travel offsite suspended or dissolved in a liquid. The site’s air pathway monitoring and liquid pathway monitoring are summarized below.

Air Pathway Monitoring

For more information on sampling the air pathway, see Chapter 4 (pages 79 through 96) in the Site Environmental Report.

Monitoring the air pathway for radioactive contaminants consists of two main steps. First, we measure the emission rate of contamination from the Waste Pits Area and the plant stacks. This provides preliminary information on how much contamination is released and how it will act in the environment. Second, we measure the concentration of pollutants in the air onsite and at the fence line.

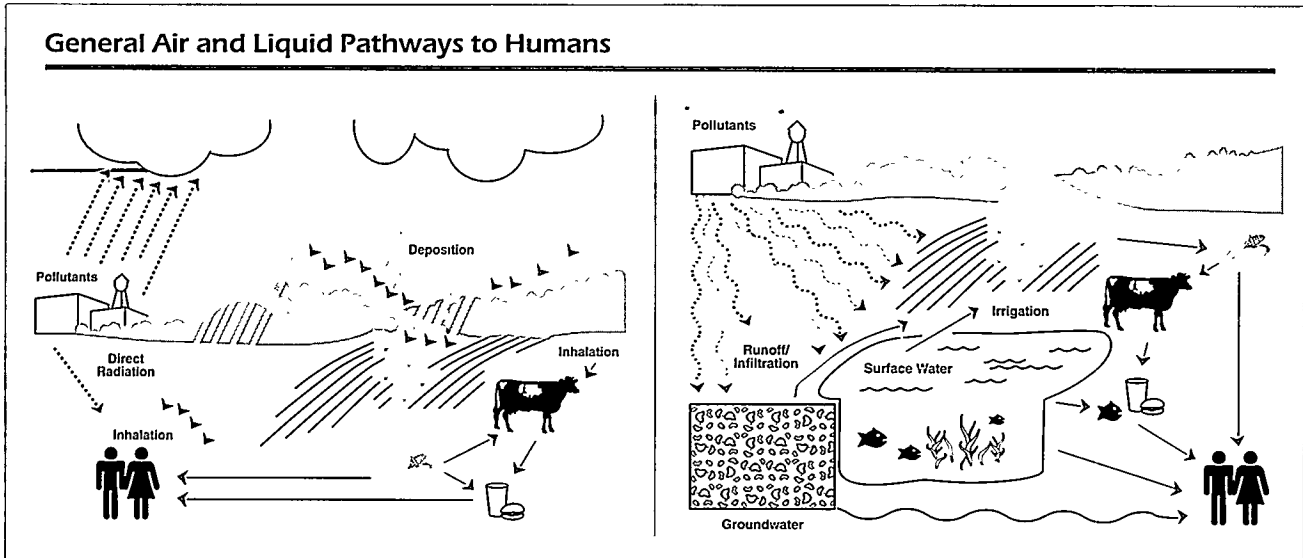
DISCLAIMER

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DISCLAIMER

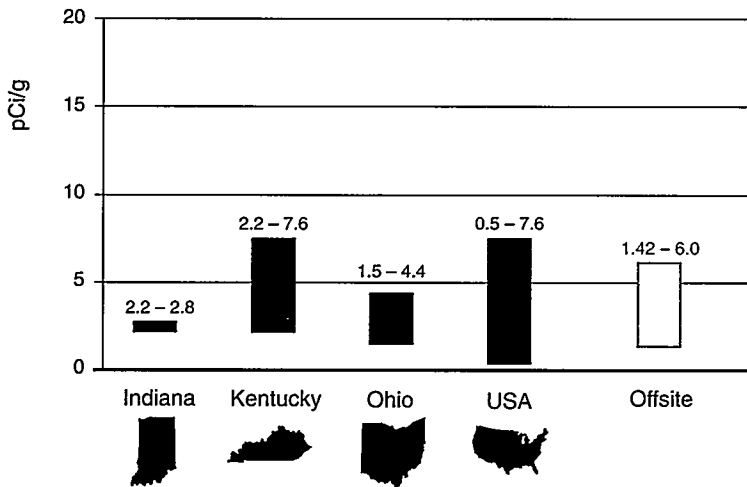
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General Air and Liquid Pathways to Humans



Weather conditions affect how the pollutants are distributed into the environment. We have 20 Air Monitoring Stations (AMSs) located onsite, near the fenceline, and at several locations in nearby communities. The AMSs are used to collect airborne contaminants during the specified sampling period. Each AMS operates 24 hours a day, 7 days a week. We change the filters bi-weekly, create a solution from each filter, and analyze each solution to determine emission levels. Contaminant emissions dropped substantially since production activities were stopped in 1989. In 1995, uranium emissions were estimated to be 3.5 kg (7.7 lbs). Our scientists expect airborne emissions to remain at low levels for several years. However, a future increase in emissions is possible as contaminated buildings and equipment are torn down.

Range of Total Uranium Occurring In Surface Soils



For locations of samples taken, see Figure 27 on page 89 in the Site Environmental Report.

Soil Sampling – By evaluating soil samples taken at the AMSs, we can determine if Fernald site operations have had effects on uranium concentrations in the soil. Uranium found in the soil may be naturally occurring or from Fernald activities. As shown in the graph to the left, the naturally occurring uranium content in soil ranged from 1.5 to 4.4 pCi/g throughout Ohio.

There are no DOE or USEPA standards for uranium levels in soil. The samples taken at different offsite locations ranged from 1.42 to 6.0 pCi/g—within the range of naturally occurring concentrations in Ohio soil.

Grass Sampling – Grass may become contaminated by absorbing uranium in the soil or from deposits on the surface of the plant from the air. Generally, plants do not absorb uranium because it does not have any purpose in their metabolic process. Through a plant's normal growth process, however, small amounts could be absorbed. We collected grass samples at the same locations as the soil samples. The results indicate that uranium concentrations are within the range of historical concentrations and suggest that 1995 emissions have not affected uranium concentrations in grass.

Produce Sampling – The Fernald site is surrounded by farmland, where local residents grow and sell produce. With air emissions reduced since the end of production, the possibility of uranium contamination in produce is very low. However, some uranium may be absorbed through the roots. Uranium detected in produce may be naturally occurring, added by fertilizers, or deposited from airborne emissions. We sample produce yearly to determine if uranium concentrations in produce grown near the site (0–5 km or 0–3 miles) are higher than in those grown distant from the site (11–42 km or 7–26 miles). In general, uranium concentrations varied for each produce type. The average concentrations were consistent with previous years for all types of produce. These comparisons suggest that there are currently no effects from Fernald site emissions on produce.

Milk Sampling – Even though uranium is not normally concentrated in milk, we monitored cows' milk because of public concerns about the dairy farm adjacent to the site. When the dairy farm ended milking operations in March 1995, we ceased collecting milk samples. However, samples were collected in January and February 1995, from both the local dairy as well as from an Indiana dairy 37 km (23 miles) west of Fernald. The results of the sample analyses showed that uranium concentrations at the Indiana dairy were comparable to the concentrations at the local dairy. The results suggest that site emissions do not affect the local dairy's milk.

Beef Cattle Sampling – In late 1994, technicians collected beef tissue samples (bone, kidney, liver, and edible meat) from two cattle taken to a commercial meat processing plant. One was raised at a dairy farm adjacent to the site, and the other at an Indiana farm. The purpose was to compare data on the radionuclide concentrations found in beef cattle raised in varying proximities to the site in order to evaluate the influence site emissions may have on locally raised beef. Tissues were selected based on the deposition and retention of uranium in animal tissue and its significance as a food source.

At the time of sample collection, the dairy farm adjacent to the site was still in operation. In March 1995, the dairy was sold and is no longer in production. Although sampling was limited to a few cattle, the results suggest that there is no substantial impact from past or current emissions on beef raised in the local area.

Direct Radiation Monitoring – Direct radiation originates from sources such as cosmic radiation, naturally occurring radionuclides in soil, worldwide fallout from nuclear weapons testing, and radioactive materials such as those at the Fernald site. Direct radiation levels are measured at 30 locations at the site with thermoluminescent dosimeters (TLDs). When direct radiation comes in contact with the TLD, the energy is stored. We then collect the TLDs containing the stored energy and heat them, causing the energy to be released so we can measure it. There was no statistical difference between direct radiation measurements at the site fenceline and measurements at background locations.

Radon Sampling – In addition to monitoring direct radiation, we also monitor radon. Radon, a naturally occurring, radioactive gas, comprises the majority of the annual background radiation dose that you receive. Onsite (primarily in the K-65 silos), we store materials that decay to form additional radon. The average fenceline radon concentration in 1995 was 0.7 ± 0.4 pCi/L. This is considerably less than DOE's limit of 3.0 pCi/L. Recent research recommends environmental monitoring exposure periods from 3 months to 12 months. Longer monitoring exposure periods would increase the likelihood that data would be produced which could more accurately be measured.

Nonradioactive Pollutants Monitoring – The Clean Air Act requires us to test for sulfur dioxide, nitrogen oxide, and carbon monoxide. We also determine how many particles are present in stack emissions by measuring the shade or density of particle emissions from the coal-fired boilers. To estimate sulfur dioxide emissions, we regularly determine the sulfur content of the coal. For 1995, we calculated sulfur dioxide emissions to be 298,000 kg (657,000 lbs)—well below the allowable limit of 1.1 million kg (2.3 million lbs). Our scientists estimate 1995 nitrogen oxide emissions to be 131,000 kg (288,000 lbs) and 1995 carbon monoxide emissions to be 48,000 kg (105,000 lbs). Nitrogen oxide and carbon monoxide concentration limits have not yet been established for the Boiler Plant.

Liquid Pathway Monitoring

Here at the Fernald site we also investigate the effects of past and current activities on the **liquid pathway**. Because contaminants can leave the site through the regulated liquid effluents and uncontrolled stormwater runoff, we monitor the Great Miami River and Paddys Run.

Effluent Sampling – We control site-generated liquid effluents, monitor them, and treat them as necessary before they combine to form a single liquid effluent that is discharged to the Great Miami River.

In 1995, Manhole-176B carried all controlled effluents to the Great Miami River. Samples were collected continuously and gathered every 24 hours to provide daily contaminant concentrations. A total of 179 kg (394 lbs) of uranium was discharged last year to the river, 49% less than 1994. The uranium contained in all liquid effluents discharged from the site decreased from 461 kg (1,013 lbs) in 1994 to 310 kg (682 lbs) in 1995 as shown in the chart below. This decrease may be attributed to

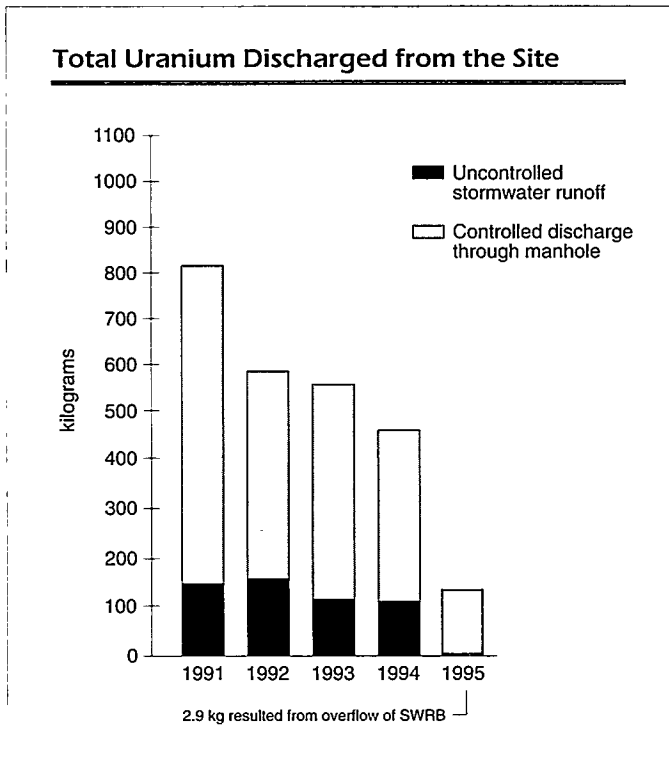
LIQUID EFFLUENT

Liquid waste material usually containing low levels of contamination that is discharged into the environment.

additional treatment capacity provided by the Advanced Waste Water Treatment facility (AWWT). We have estimated that approximately 2.8 kg (6.3 lbs) of uranium are released as uncontrolled stormwater runoff for every inch of rain. In 1995, we estimated that 131 kg (289 lbs) of uranium were released to Paddys Run in the uncontrolled stormwater runoff.

Surface Water Sampling – Untreated contamination can also reach the environment through stormwater runoff. Most of this runoff is collected in the Stormwater Retention Basin or is treated through the Waste Pits Area Runoff Control Removal Action. During 1995, we sampled surface water at 12 locations along the Great Miami River and Paddys Run. Higher uranium concentrations were found in an outfall ditch that flows into Paddys Run. This ditch has had elevated uranium concentrations in the past as well. Downstream uranium concentrations were higher than upstream, but were well

below DOE guidelines for drinking water. These guidelines are used for comparison purposes only.



Sediment Sampling – We monitor sediment in Paddys Run and the Great Miami River because contaminants can settle and accumulate in sediment. In the Fall of 1995, we collected 34 sediment samples and analyzed them for uranium, radium-226, and isotopes of thorium. Sediment samples collected from the Great Miami River and Paddys Run showed no noticeable differences in the concentration of uranium and other radionuclides upstream and downstream of the site.

Fish Sampling – With a research team from the University of Cincinnati, we have been sampling fish from the Great Miami River for the past ten years. In September 1995, we collected over 549 fish from three locations along the Great Miami River. Over the course of our study, the uranium

concentrations in the fish and the fish population of the Great Miami River — both upstream and downstream of the site — have been stable. Nearly all of our testing locations had the same species, and the fish appeared to be in similar health.

For more information on sampling of the liquid pathway, see Chapter 6 (pages 113 through 133) in the Site Environmental Report.

For more information on Final Remediation Levels (FRLs), see page 116 in the Site Environmental Report.

Nonradioactive Pollutants – We monitor and control the discharge of nonradioactive pollutants to ensure they meet our National Pollutant Discharge Elimination System permit. Of the 2,367 NPDES samples we collected in 1995, 37 did not meet drinking water standards. We use these standards for comparison purposes only because no water downstream from the Fernald site is designated as a public source of drinking water.

Private Well Sampling – In 1995, 33 private wells near our site were regularly sampled for uranium and other metals. Twenty-seven wells found maximum uranium concentrations at 3 parts per billion (ppb) or below. For comparison, local background levels range from 0.1 to 3 ppb. Three wells we sampled had average uranium concentrations above the proposed USEPA standard of 20 ppb.

Because the area contains high amounts of natural iron and manganese, several wells showed concentrations above USEPA Secondary Drinking Water Standards. Four wells showed lead concentrations at or above the USEPA action level guideline for lead.

RCRA Groundwater Monitoring – Thirty-three wells located along the downgradient property boundary are sampled regularly to detect and assess potential changes in groundwater conditions before they impact offsite locations. These wells are sampled quarterly for approximately 90 site-specific radiological and nonradiological constituents.

Nine constituents from the RCRA monitoring wells were found to have concentrations that minimally exceed their corresponding FRL. Except for two constituents, there were no trends that indicate increasing concentrations.

South Plume Removal Action – As of December 1, 1995, the pumping system has pumped over 1.6 billion gallons of uranium-contaminated groundwater resulting in the removal of over 102 kg (223 lbs) of uranium from the Great Miami Aquifer.

Monitoring results show that by the second half of 1995, the maximum concentration in the South Plume area has decreased from a high of 300 µg/L (300 ppb, 203 pCi/L) before pumping began to 170 µg/L (170 ppb, 115 pCi/L). Second half results showed that 12 groundwater monitoring wells had uranium concentrations above the 20 µg/L (20 ppb, 13.5 pCi/L) primary drinking water standard for uranium.

KC-2 Warehouse and Coal Pile Runoff Basin – January 1995 sampling results indicate the concentrations for nonradioactive substances were at/or above the primary drinking water standards due to a high sediment content in the water samples. August 1995 sampling results showed the uranium and metal concentrations were below the primary drinking water standards.

In 1995, well 1675 and well 1676 had maximum sulfate concentrations of 369.5 mg/L and 273.3 mg/L, respectively. Both concentrations are below the primary drinking water standard-but above the secondary drinking water standard. Both wells showed total dissolved solids above the secondary drinking water standard.

Estimated Radiation Doses for 1995

For more information on estimated doses, see Chapter 7 (pages 135 through 144) in the Site Environmental Report.

DOE Orders and USEPA regulations require us to keep our radionuclide airborne emissions less than 10 mrem per year. Also, to ensure that we are far below the maximum dose of 100 mrem per year from all exposure pathways (excluding radon), we estimate doses from other components of the air and liquid pathways, as well as direct radiation dose from materials stored onsite. These estimations are done specifically for public safety. Computer or environmental models help us to estimate the upper limit of a dose and identify the most influential pollutant or pathway of exposure.

We use *environmental models*, which are mathematical formulas, to help us estimate doses through environmental sampling. Models are often the only way to estimate a dose, but they do not necessarily predict all environmental processes because they are predictions, not actual measurements.

Airborne Emissions – We estimate airborne emissions with an environmental model called CAP-88. CAP-88 estimated the maximum effective dose from 1995

airborne emissions to be 0.19 mrem to the **maximally-exposed individual (MEI)** located east-southeast of the former production area. This is well below the standard of 10 mrem per person per year.

“MAXIMALLY-EXPOSED” INDIVIDUAL

This is a hypothetical individual who is exposed to all pathways of contamination. This individual only consumes meat, vegetables, and milk produced in the area, local well water, and fish and water from the Great Miami River. For airborne emissions we assume that this person remains outside, along the site fenceline 100% of the time. When estimating direct radiation doses we use the maximum fenceline measurement.

Foodstuffs – We estimated the 1995 doses from foodstuffs eaten by the MEI to be 0.1 mrem. This means that the MEI received only about 0.1% of the DOE dose limit of 100 mrem per year from foodstuffs. This value is based on a yearly diet of 18 kg (40 lbs) of leafy vegetables, 45 kg (100 lbs) of grains, 68 kg (150 lbs) of fruit, 28 kg (62 lbs) of

below-ground vegetables, 45 kg (100 lbs) of other vegetables, and 112 liters (30 gallons) of milk all produced locally.

Direct Radiation Dose – During 1995 no dose was attributed to the Fernald site because there was no statistical difference between the maximum fenceline dose and the average background dose.

Liquid Pathway Doses – We use environmental sample results from groundwater and fish from the river to estimate liquid pathway doses. In our area, background groundwater uranium concentrations range from 0.1 to 3.0 ppb. The maximum concentration of uranium in drinking water from a well near the site was 6.4 ppb. This resulted in a dose of 0.1 mrem. This estimate was based on drinking 2 liters (0.5 gallon) of water from this well each day.

Dose to Maximally-Exposed Individual – We estimated that the total annual dose during 1995 to the MEI was approximately 0.1 mrem from all pathways. This dose is similar to that of 1994. In addition, it is well below the DOE guideline of 100 mrem per year for all pathways.

Estimated Dose from Radon – Because radon is regulated separately from other components of the air pathway, the dose attributable to it is also discussed separately from the dose to the MEI. Based on the average fence-line radon concentration of 0.7 ± 0.4 pCi/L, the dose was estimated to be 504 mrem. This dose includes the annual dose received from average background levels of radon—approximately 200 mrem per year.

Summary

By reading the information provided in this booklet we hope you have a better understanding of our programs at the Fernald site. Monitoring and sampling provide us with data concerning your health as well as the safety of the environment. Together, DOE and FERMCO are committed to the safe, least-cost, earliest, final cleanup of the site. Furthermore, we will honor applicable DOE Orders, regulations, and commitments and address stakeholder concerns while completing the site's final cleanup.

