5.0 Air Pathway

This chapter describes the air pathway monitoring program used to track and evaluate airborne emissions from the Fernald site. It includes a discussion of radiological air particulates, radon, and direct radiation. In addition, this chapter provides a summary of radiological emissions from stacks.

Results in Brief: 2005 Air Pathway

Radiological Air Particulates — Data collected from the site boundary air monitoring stations show that average concentrations for each radionuclide monitored were less than 1 percent of the corresponding DOE-derived concentration guide.

Radon — There were no exceedances of the 10 CFR 834 proposed standard (0.5 pCi/L annual average above background) at the site boundary and off-property locations. The maximum annual average concentration at the Fernald site boundary measured by continuous radon monitors was 0.2 pCi/L above background.

Direct Radiation — 2005 direct radiation measurements at the site boundary were similar to those in 2004. This was attributed to the continuing operation of the Radon Control System.

Air pathway monitoring focuses on airborne pollutants that may be carried from the site as a particle or gas and focuses on how these pollutants are distributed in the environment. The physical form and chemical composition of pollutants influence how they are dispersed in the environment and how they may deliver radiation doses. For example, fine particles and gases remain suspended, while larger, heavier particles tend to settle and deposit on the ground. Chemical properties determine whether the pollutant will dissolve in water, be absorbed by plants and animals, or settle in sediment and soil.

Monitoring the air pathway is critical to ensuring the continued protection of the public and the environment during the remediation process because airborne contaminants can potentially migrate beyond the Fernald site. The site's air monitoring approach (presented in the IEMP) provides an ongoing assessment of the collective emissions originating from remediation activities. The results of this assessment are used to provide feedback to remediation project organizations regarding the site-wide effectiveness of project-specific emission controls relative to DOE, EPA, and OEPA standards. In response to this feedback, project organizations modify or maintain emission controls.

5.1 Remediation Activities Affecting the Air Pathway

When the mission of the Fernald site changed from production to remediation, work activities also changed. This change in work scope altered the characteristics of sources that emit pollutants in the environment via the air pathway. During the production years, the primary emission sources were point sources (i.e., stacks and vents) from process facilities. Today the dominant emission sources are associated with remediation activities in the form of fugitive emissions (i.e., excavation, hauling and processing of waste and contaminated soil, demolition of production facilities, and general construction activities supporting the remediation process), and the storage of radon-generating waste materials.

The following primary emission sources were active during 2005:

- Decontamination and demolition activities (Operable Unit 3)
- Excavation of the waste pit area and the associated waste processing and rail car load-out operations at the Waste Pits Project (Operable Unit 1), which concluded mid-year 2005
- Excavation of contaminated soil and debris (Operable Unit 5)

- Construction activities associated with the on-site disposal facility including excavation, screening, and hauling activities in the on-site disposal facility borrow area (Operable Units 2, 3, and 5)

- Transportation and placement of contaminated material in the on-site disposal facility and interim storage at the on-site material transfer area (Operable Unit 2)

- Radon Control System, Silos 1, 2, and 3 waste retrieval, processing, and shipping operations (Operable Unit 4).

Note that the successful completion of moving the silos waste material to the Transfer Tank Area and demolition of the silos occurred in early 2005. The Transfer Tank Area was designed with safety features for the risk associated with radium-bearing waste and additionally contained process control monitors.

Each project is responsible for designing and implementing engineered and administrative controls for each remediation activity. The fugitive emissions control policy mandates that fugitive emissions be visually monitored and controls be implemented as necessary. The following types of controls are used to keep point source and fugitive emissions to a minimum.

- **Engineered Controls** – Typical engineered controls include physical barriers, wetting agents, filtration, fixatives, sealants, dust suppressants and control, and collection and treatment systems. Engineered designs help reduce point source and fugitive emissions by using the best available technology. The selection of the best available technology for controlling project emissions is conducted during the design process and frequently includes the evaluation of several treatment alternatives.

- **Administrative Controls** – Typical administrative controls include management and control procedures; record keeping; periodic assessments; and establishment of speed limits, control zones, and construction zones.

5.2 Air Monitoring Program Summary for 2005

The site's air monitoring program, as defined in the IEMP, is comprised of three distinct components:

- Radiological air particulate monitoring
- Radon monitoring
- Direct radiation monitoring.

Each component of the air monitoring program is designed to address a unique aspect of air pathway monitoring, and as such, reflects distinct sampling methodologies and analytical procedures. The key elements of the air monitoring program design are:

- **Sampling** – Sample locations, frequency, and the constituents were selected to address DOE and EPA requirements for assessing radiological emissions from the Fernald site. Key considerations in the design of the sampling program included prevailing wind directions, location of potential sources of emissions, and the location of off-property receptors. The IEMP program includes monitoring radiological air particulates, radon measurements, and direct radiation measurements.

- **Data Evaluation** – The data evaluation process focuses on tracking and trending data against historical ranges and DOE, EPA, and OEPA standards. Each section in this chapter presents an evaluation of data and a comparison to applicable standards and guidelines.

- **Reporting** – All data are reported through the annual site environmental reports.

5.3 Radiological Air Particulate Sampling Results

As described in the IEMP, Revision 4, a network of high-volume air particulate monitoring stations is used to measure the collective contributions from fugitive and point source particulate emissions from the site. Figure 5-1 provides the locations of the IEMP air monitoring stations in operation during 2005.

The sampling and analysis program for the site boundary and background locations consists of biweekly total uranium and total particulate analyses, and monthly composites (eight times per year) for isotopic thorium analyses, in addition to a quarterly composite sample. The quarterly composite sample is analyzed for the expected major contributors (i.e., uranium, thorium, and radium) to the radiological air inhalation dose at the site's boundary. The thorium monitor includes biweekly particulate and monthly isotopic thorium analyses. Analytical data from this program are used to assess the effectiveness of the emission control practices throughout the year to ensure particulate emissions remain below health protective standards.

The radiological air particulate monitoring program is designed to demonstrate compliance with the following:

- NESHAP Subpart H requirements which stipulate that radionuclide emissions (not including radon) to the ambient air from DOE facilities shall not exceed those amounts that would cause any member of the public to receive an effective dose equivalent of 10 mrem in a year above background levels. This dose is reported in the annual NESHAP Subpart H compliance report and is included as Appendix D of this report.

- DOE Order 5400.5, Radiation Protection of the Public and the Environment (DOE 1993), guidelines for concentrations of radionuclides in air emissions. These guidelines, referred to as derived concentration guide values, are concentrations of radionuclides that, under conditions of continuous exposure for one year by one exposure mode (e.g., inhalation or ingestion), would result in a dose of 100 mrem to the public. These derived concentration guide values are not limits, but serve as reference values to assist in evaluating the radiological air particulate data.

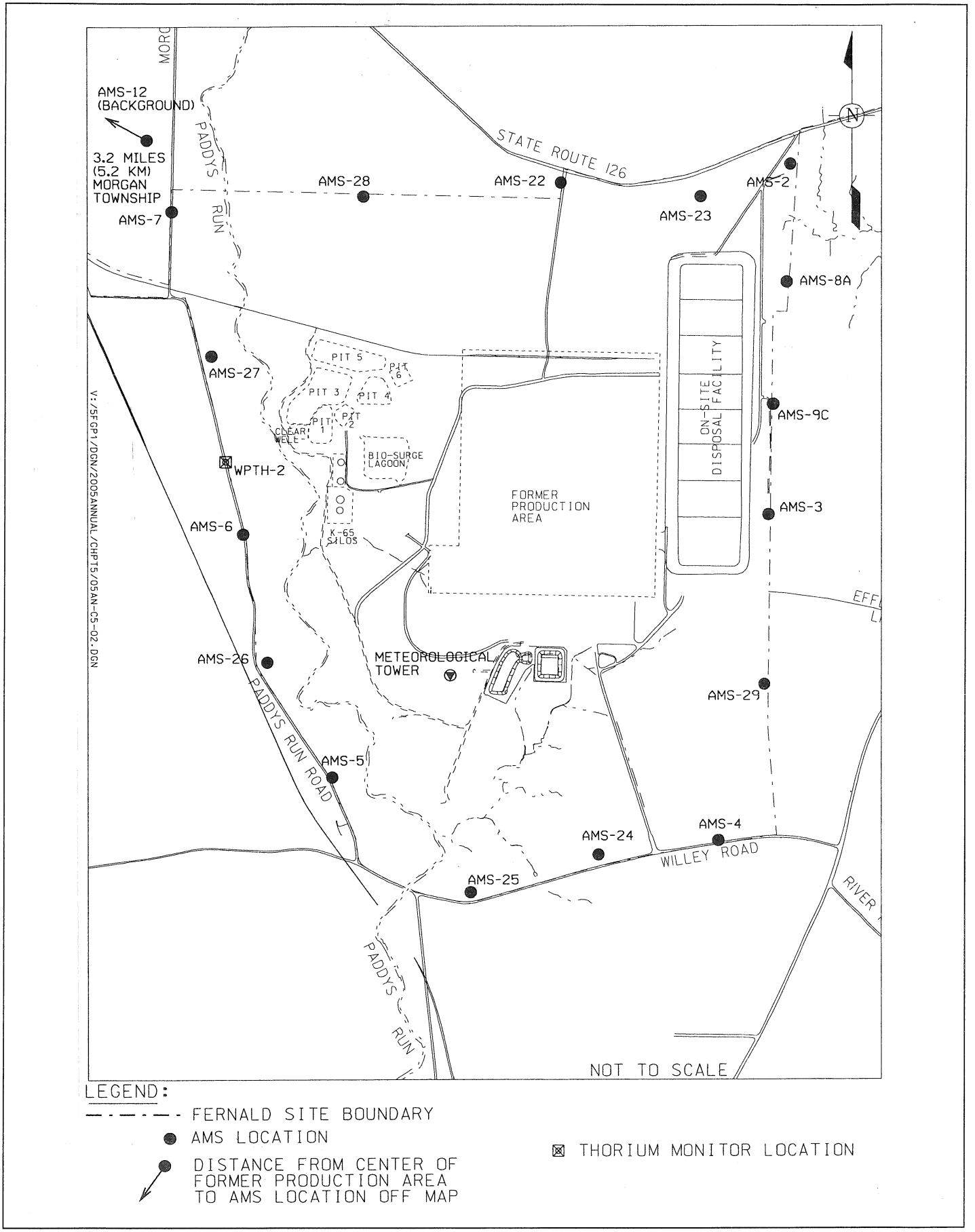


Figure 5.1 Radiological Air Monitoring Locations

Table 5-1 presents a summary of the minimum, maximum, and average concentrations for total uranium, thorium-230, and total particulate in 2004 and 2005 based on the biweekly and monthly sample results used for monitoring air emission trends. For 2005, the annual average concentrations of total uranium at all boundary air monitoring stations were less than 1 percent of the DOE derived concentration guide value (0.1 picoCuries per cubic meter [pCi/m^3]). In 2005, total uranium at all air monitoring locations ranged from non-detectable to 3.5E-04 pCi/m^3. For comparison, the maximum total uranium concentration for 2004 was 1.3E-02pCi/m^3.

TABLE 5-1

SUMMARY OF BIWEEKLY TOTAL URANIUM, TOTAL PARTICULATE, AND MONTHLY THORIUM-230 CONCENTRATIONS IN AIR

Location	2005 Total Uranium (pCi/m^3)	2004 Total Uranium (pCi/m^3)	2005 Total Particulate (µg/m^3)	2004 Total Particulate (µg/m^3)	2005 Thorium-230 (pCi/m^3)	2004 Thorium-230 (pCi/m^3)
Boundary Locations						
Minimum	0.0E+00	1.3E-06	11	8.1	0.0E+00	1.9E-06
Maximum	3.5E-04	1.3E-02	109	102	7.8E-05	4.2E-04
Average	5.1E-05	2.5E-04	35	35	1.8E-05	4.6E-05
Background Location						
Minimum	0.0E+00	0.0E+00	11	6.2	0.0E+00	0.0E+00
Maximum	2.3E-05	1.1E-04	43	42	1.1E-05	2.7E-05
Average	1.2E-05	1.6E-05	26	26	4.8E-06	1.1E-05

Monthly thorium monitoring at the boundary provides timely feedback on project engineered and administrative controls that are implemented to control fugitive emissions, primarily at the Waste Pits Project, which concluded railcar load-out activities mid-year 2005. The boundary concentrations of thorium-230 ranged from less-than-detectable to 7.8E-05 pCi/m^3. For comparison, the maximum thorium-230 concentration at the site boundary for 2004 was 4.2E-04 pCi/m^3.

In addition to the total uranium and isotopic thorium analyses, total particulate measurements are also obtained from each filter every two weeks as summarized in Table 5-1. Total particulate concentrations at the boundary ranged from 11 micrograms per cubic meter (µg/m^3) to a maximum of 109 µg/m^3, at AMS-3. There are no general or site-specific regulatory limits associated with total particulate measurements for use in the data evaluation process.

Total particulate, total uranium, and thorium-230 data were collectively evaluated to identify if any increasing trends may be related to remediation activities. Figures 5-2 and 5-3 show total uranium and thorium-230 concentrations, respectively, at the selected boundary locations (AMS-3, AMS-4, and AMS-27). Appendix C, Attachment C.1, of this report provides graphical displays of the 2005 total uranium, thorium-230, and total particulate data.

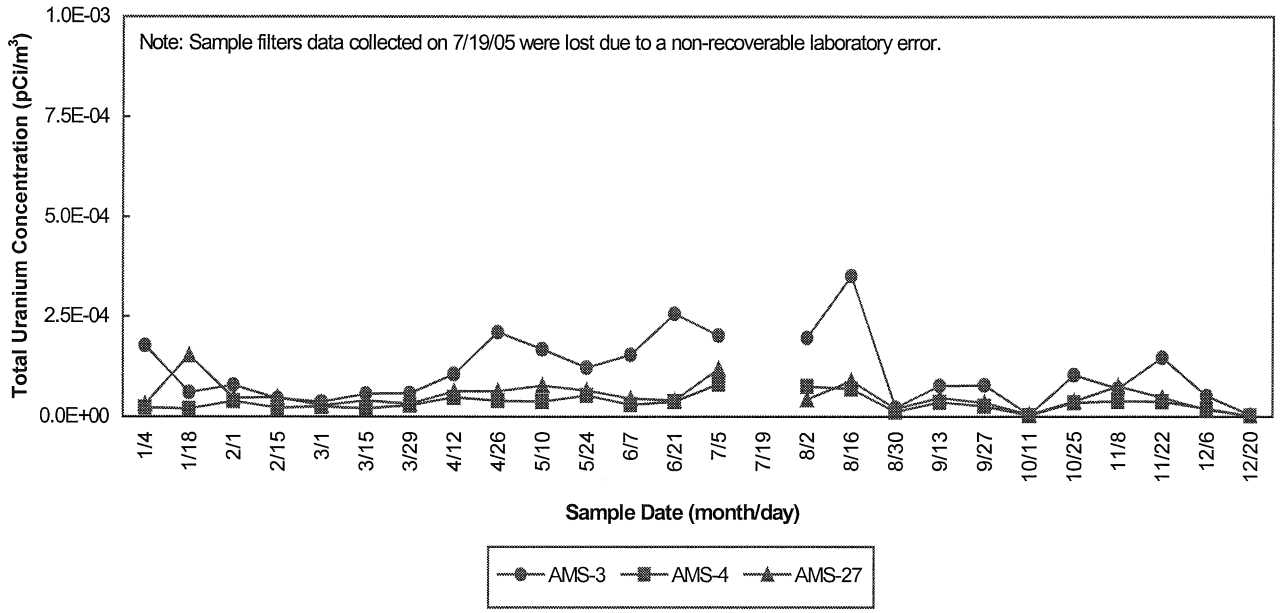


Figure 5-2. 2005 Total Uranium Concentrations in Air at Selected East Boundary Monitors (AMS-3, AMS-4, and AMS-27)

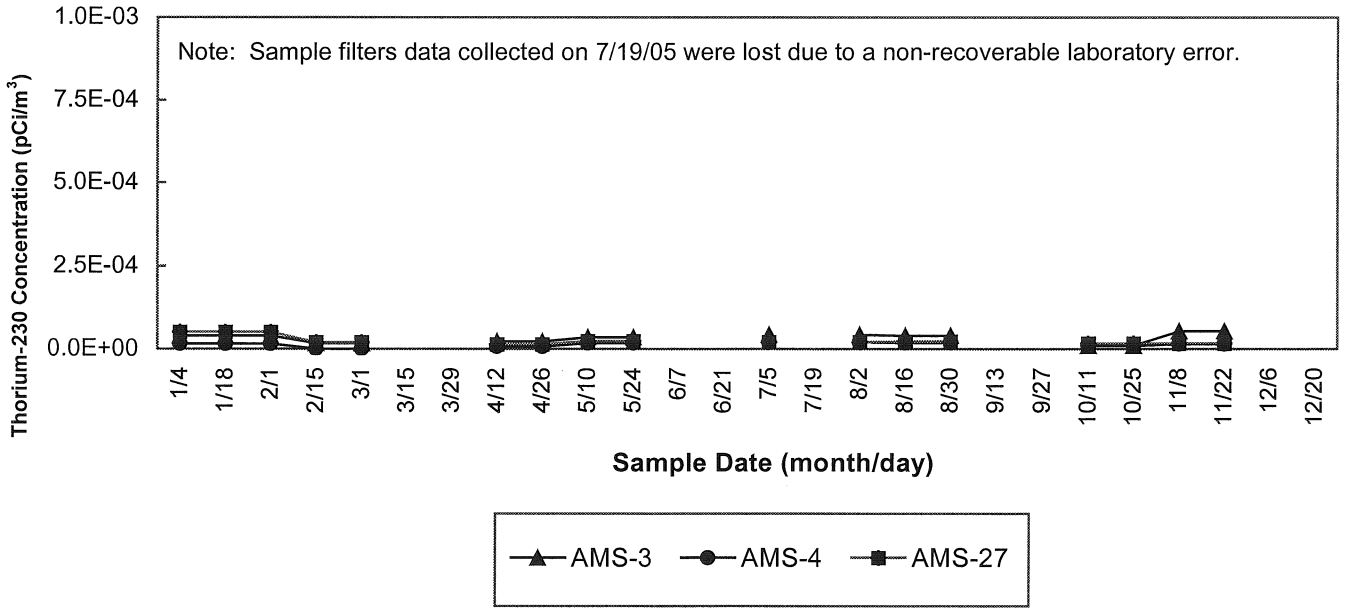


Figure 5-3. 2005 Thorium-230 Concentrations in Air at Selected East Boundary Monitors (AMS-3, AMS-4, and AMS-27)

Quarterly composite air filter samples were formed from the biweekly samples at each IEMP air monitoring station during 2005 to determine the radiological air inhalation dose for each location. The samples were analyzed for isotopes of radium, thorium, and uranium. The quarterly results were used to track compliance with the NESHAP 10-mrem dose limit throughout the year and to demonstrate compliance with the limit at the end of 2005. The maximum dose associated with the quarterly composite results for 2005 was 0.46 mrem (compared to the 10-mrem limit) and occurred at AMS-3. The composite results from the boundary monitors show that, on average, thorium isotopes contribute 48 percent of the dose from 2005 airborne emissions. Isotopes of uranium and radium account for 21 and 31 percent of the dose, respectively. The higher percentage of dose from thorium isotopes is a result of thorium-230 becoming a major dose contributor through emissions from Waste Pits and Silos Project operations. The increase in the percentage of dose from radium isotopes from 4 percent in 2004 to 31 percent in 2005 is associated with the Silos Project activities. Chapter 6 and Appendix D of this report provide more detailed information on the dose associated with the composite results.

The annual average radionuclide concentrations at each air monitoring station, as determined from the quarterly composite results, were compared to the DOE-derived concentration guide values. At each monitoring station, the annual average radionuclide concentrations were below one percent of the corresponding DOE-derived concentration guide values.

The WPTH-2 boundary monitor was installed in late 1998 on the west property boundary to specifically monitor thorium emissions from the Waste Pits Project. Measured airborne concentrations of isotopic thorium were comparable to background concentrations throughout 2005. Appendix C, Attachment C.1, of this report provides graphical displays of the isotopic thorium data from the WPTH-2 monitor.

5.4 Radon Monitoring

Radon-222 (referred to in this section as radon) is a naturally occurring radioactive gas. It is produced by radioactive decay of radium-226, which can be found in varying concentrations in the earth's crust. Radon is also chemically inert and tends to diffuse from the earth's crust to the atmosphere. The concentration of radon in the environment is dynamic and exhibits daily, seasonal, and annual variability.

Many factors influence the concentration of radon in the environment, including the distribution of radium-226 in the ground, porosity of the soil, weather conditions, etc. For instance, radon diffusion from the ground is minimized by the presence of precipitation and snow cover. Alternatively, elevated temperatures and the absence of precipitation can produce cracks in the ground and changes in porosity that increase the rate at which radon escapes. A summary of meteorological data from 2005 is presented in Figures 1-7 through 1-10 in Chapter 1, and Appendix C, Attachment C.4, of this report.

Environmental radon concentrations are also influenced by atmospheric conditions. During periods of calm winds and temperature inversions (when the air near the earth's surface is cooler than the air above it), air is held near the earth's surface, minimizing the mixing of air. Consequently, radon's movement is limited vertically and concentrations tend to increase near the ground.

Waste material that produces radon is stored or processed at the Fernald site. This waste was generated from uranium extraction processes performed decades ago and contains radium-226. This silos material was contained in Silos 1 and 2, Silo 3, and the Transfer Tank Area (Operable Unit 4 remediation) and the waste pit area (Operable Unit 1 remediation).

DOE Order 5400.5 provides guidelines for cleanup of residual radioactive material, the management of resulting wastes and residues, the release of radiological property; and radiological protection requirements. Radon limits at interim storage facilities (such as at the Fernald site) are also defined under DOE Order 5400.5 and/or proposed 10 CFR 834 and must not exceed:

- 100 picoCuries per liter (pCi/L) at any given location and any given time
- Annual average concentration of 30 pCi/L (above background) over the facility
- Annual average concentration of 0.5 pCi/L (above background) at and beyond the Fernald site boundary.

Figure 5-4 illustrates the continuous radon monitoring network used in 2005 for determining compliance with the above limits. The continuous monitoring network provides frequent feedback to remediation projects, regulatory agencies, and stakeholders on trends in ambient radon concentrations, while providing sufficient radon monitoring to ensure compliance with DOE Order 5400.5 and proposed 10 CFR 834 requirements.

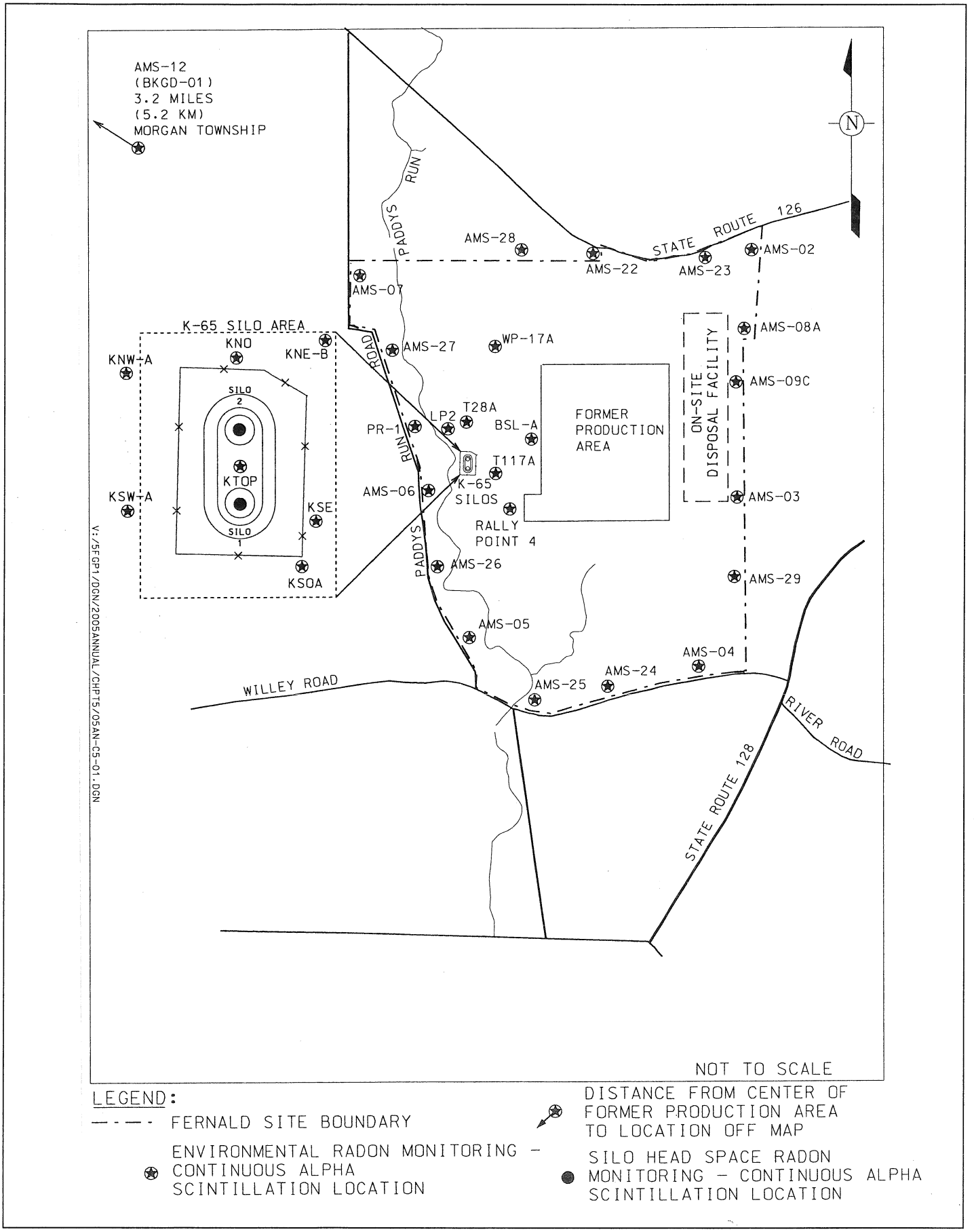


Figure 5.4 Radon Monitoring Locations

In general, monitoring locations were selected near radon-emitting sources, at the property boundary, and a background location. The Federal Facility Agreement identifies additional environmental radon monitoring locations, as well as continuous measurement of radon concentrations in the headspace of the silos. DOE guidance and EPA air monitor citing criteria were considered when selecting monitoring locations.

5.4.1 Continuous Radon Monitors

Continuous radon monitors use scintillation cells to continuously monitor environmental radon concentrations based on an hourly average. Radon gas in ambient air diffuses into the scintillation cell through a foam barrier without the aid of a pump (this technique is called passive sampling). Inside the cell, radon decays into more radioactive material (progeny products), which gives off alpha particles. The alpha particles interact with the scintillation material inside the cell, producing light pulses. The light pulses are amplified and counted. The number of light pulses counted is proportional to the radon concentration inside the cell.

Continuous monitors reveal important information regarding the dynamics of radon concentrations at different times during the day and at various locations on and off site. These monitors allow for the timely review of radon concentrations, to observe any significant variations from day to day and week to week that may occur. However, the location of potential monitoring sites is restricted by certain conditions, such as the availability of electricity.

Table 5-2 provides monthly average radon concentration data from the continuous radon monitors for 2005. The data are used to track radon concentrations throughout the year to ensure the DOE limits are not exceeded. In addition to the summary data presented here, Appendix C, Attachment C.2, of this report provides graphical displays of monthly average radon concentrations from continuous radon monitors during 2004 and 2005.

Results from the boundary monitoring locations indicate radon levels for 2005 were within historical ranges. The maximum annual average site boundary net radon concentration for 2005 was 0.2 pCi/L above background, which is below the proposed 10 CFR 834 site boundary limit of 0.5 pCi/L above background. The annual average radon concentration at the background monitoring location was 0.4 pCi/L (refer to Table 5-2).

In accordance with the Federal Facility Agreement, radon concentrations within the headspace of K-65 Silos 1 and 2 were continuously monitored to assess the effectiveness of control measures in reducing radon emissions. From 1993 to 2002, there was a gradual upward trend in the silos headspace radon concentrations. The increases in the headspace concentration were attributable to degradation of the 1991 application of bentonite clay to the surface of the K-65 Silo residues. In December 2002, the headspace radon concentrations were temporarily lowered through the initial short-term test of the Radon Control System. During 2003 and 2004, the Radon Control System operated continuously with the exception of short-term shut-downs for maintenance activities. Due to the operation of the Radon Control System, radon headspace concentrations indicated a sharp drop, which lasted through 2004. The transfer of the K-65 Silos material was initiated in September 2004 and Silos 1 and 2 were completely dismantled by March 2005. Headspace monitors were also removed by March 2005 (Silo 1: February 1 and Silo 2: March 9). Appendix C, Attachment C.2 of this report provides a graphical display of monthly average radon concentrations from continuous radon monitors for 2004 and early 2005.

TABLE 5-2
CONTINUOUS ENVIRONMENTAL RADON MONITORING MONTHLY AVERAGE CONCENTRATIONS[a]

Location[b]	2005 Summary Results[c] (Instrument Background Corrected) (pCi/L)			2004 Summary Results[c] (Instrument Background Corrected) (pCi/L)		
	Min.	Max.	Avg.	Min.	Max.	Avg.
Boundary						
AMS-02	0.2	0.9	0.5	0.2	1.3	0.5
AMS-03	0.2	0.7	0.4	0.2	1.1	0.5
AMS-04	0.1	0.6	0.4	0.2	0.7	0.3
AMS-05	0.2	1.1	0.6	0.1	1.2	0.5
AMS-06	0.1	1.0	0.5	0.2	0.6	0.3
AMS-07	0.2	1.1	0.6	0.3	1.3	0.6
AMS-08A	0.3	0.6	0.4	0.2	1.0	0.4
AMS-09C	0.2	0.6	0.4	0.2	0.9	0.5
AMS-22	0.2	0.5	0.3	0.1	0.5	0.3
AMS-23	0.3	0.5	0.4	0.2	0.5	0.3
AMS-24	0.2	0.8	0.5	0.3	1.4	0.6
AMS-25	0.3	0.8	0.6	0.2	0.9	0.4
AMS-26	0.1	0.7	0.4	0.2	0.6	0.3
AMS-27	0.2	1.0	0.5	0.3	0.9	0.5
AMS-28	0.1	0.7	0.4	0.2	0.7	0.4
AMS-29	0.3	0.6	0.4	0.2	0.5	0.3
Background						
AMS-12	0.2	0.6	0.4	0.2	0.6	0.3
On-Site						
KNE-B	0.3	1.7	0.9	0.3	0.8	0.5
KNO[d]	0.3	1.2	0.7	0.3	1.1	0.6
KNW-A[d]	0.2	0.8	0.5	0.3	1.2	0.6
KSE	0.2	1.5	0.8	0.2	0.8	0.4
KSOA	0.2	0.7	0.5	0.3	0.8	0.5
KSW-A[d]	0.5	1.0	0.8	0.3	1.2	0.7
KTOP[d]	0.6	0.6	0.6	0.3	1.5	0.7
LP2	0.1	0.6	0.3	0.3	0.7	0.4
PR-1	0.2	1.3	0.6	0.2	1.1	0.5
Rally Point 4	0.3	0.7	0.4	0.2	0.6	0.4
BSL-A	0.1	0.6	0.3	0.3	0.8	0.4
T117A	0.3	0.8	0.5	0.2	0.7	0.4
T28A	0.3	0.9	0.6	0.2	0.7	0.4
WP-17A[d]	0.2	0.7	0.4	0.3	1.1	0.5

[a]Monthly average radon concentrations are calculated from the daily average concentrations.
[b]Refer to Figure 5-4 for radon monitoring locations.
[c]Instrument background changes as monitors are replaced.
[d]Monitors were removed during 2005 based on the completion of activities (removal of Silos) and/or making way for demolition activities: KTOP was removed in February; KNO, KNW-A, and KSW-A were removed in August; and WP-17A was removed in November.

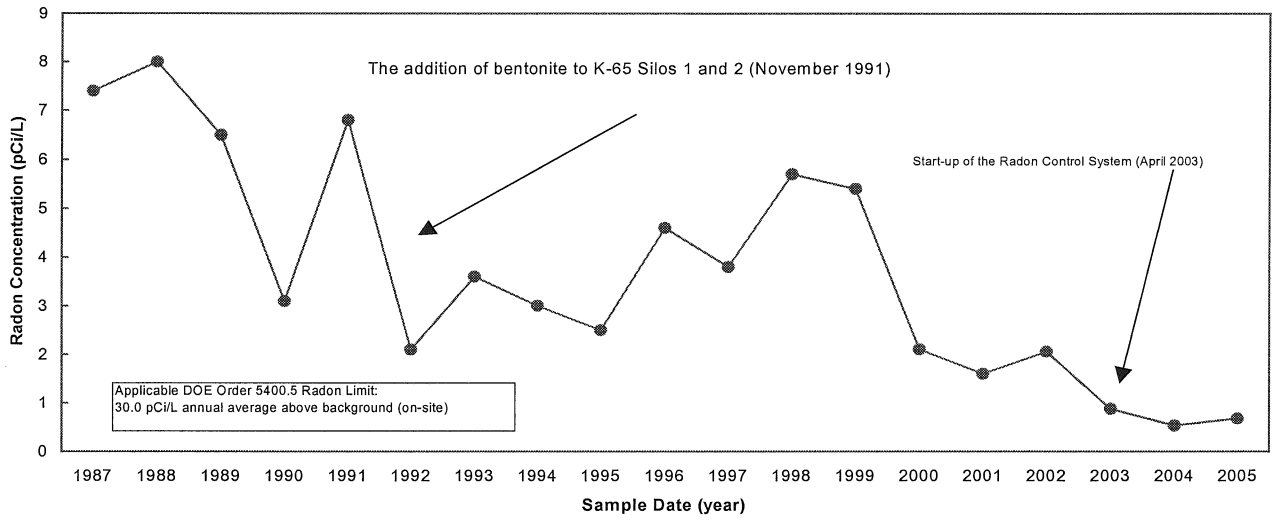
During 2005, as well as in 2003 and 2004, there were no exceedance events measured on-site related to the 100-pCi/L DOE limit, compared with 10 recorded in 2002. The decrease in the exceedance events is attributable to the operation of the Radon Control System. Appendix C, Attachment C.2, of this report provides a graphical display of monthly average radon concentrations from continuous radon monitors for 2004 and 2005.

Long-term comparisons have been performed on average radon concentrations recorded at the former K-65 Silos exclusion fence locations. Historical alpha track-etch and continuous alpha scintillation detector data were used for this comparison (refer to Figure 5-5). The average concentrations adjacent to the K-65 Silos remain below the levels observed prior to the addition of bentonite to the K-65 Silos in 1991.

Long-term comparisons are also performed on average radon concentrations at western property boundary locations and background locations as a basis for comparison to the 0.5 pCi/L annual average limit. In 2005, a marginal difference in radon concentrations was observed between background and western property boundary monitoring locations (refer to Figure 5-6). The on-property monitoring locations also recorded radon levels well below the applicable DOE annual average above background limit (on-site) of 30 pCi/L.

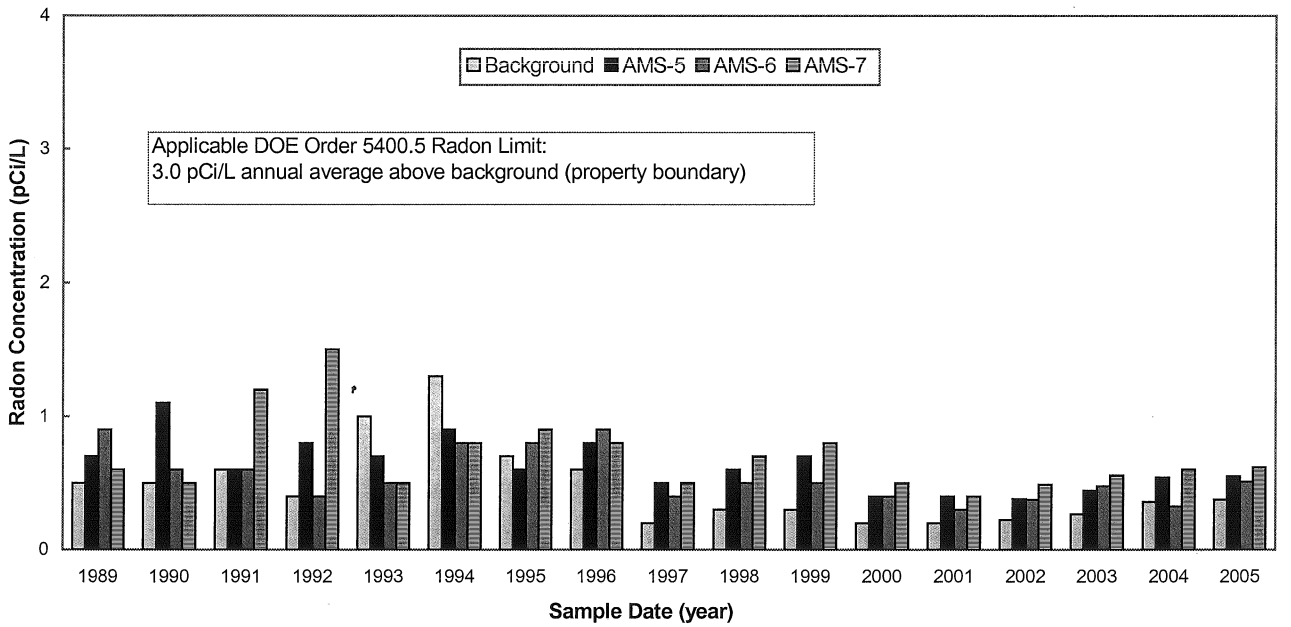
5.5 Monitoring for Direct Radiation

Direct radiation (e.g., X rays, gamma rays, energetic beta particles, and neutrons) originates from sources such as cosmic radiation, naturally occurring radionuclides in soil, as well as radioactive materials at the Fernald site. The largest source of direct radiation is the silos waste materials. Gamma rays and X rays are the dominant types of radiation emitted from the silos waste materials. Energetic beta particles, alpha particles, and neutrons are not a significant component of direct radiation at the Fernald site because uranium, thorium, and their decay products do not emit these types of radiation at levels that create a public exposure concern.



Note: The data from 1987 through 1996 are based on the alpha track-etch detectors and averaging locations corresponding to continuous radon monitors. The data from 1997 through 2005 are based on the average radon concentration from continuous radon monitors at the former K-65 Silos exclusion fence. The 2004 and 2005 averages includes locations KNO and KSO data.

Figure 5-5. Annual Average Radon Concentrations at the former K-65 Silos Exclusion Fence, 1987-2005



Note: The data from 1989 through 1996 are based on the alpha track-etch detectors,and the data from 1997 through 2005 are based on the continuous radon monitors.

Figure 5-6. Annual Average Radon Concentrations at Selected Radon Locations, 1989-2005

Direct radiation levels at and around the Fernald site were continuously measured with thermoluminescent dosimeters (TLDs) during 2005. TLDs absorb and store the energy of direct radiation within the thermoluminescent material. By heating the thermoluminescent material under controlled conditions in a laboratory, the stored energy is released as light, measured, and correlated to the amount of direct radiation. During previous years, this process of reading the TLDs was performed at the on-site dosimetry laboratory. For 2005, this process was outsourced. Figure 5-7 identifies the TLD monitoring locations. These monitoring locations were selected based on the need to monitor the silos waste materials, the Fernald site boundary, and the background locations. Table 5-3 provides summary level information pertaining to direct radiation measurements for 2004 and 2005.

TABLE 5-3
DIRECT RADIATION (THERMOLUMINESCENT DOSIMETER) MEASUREMENT SUMMARY

	Direct Radiation (mrem)	
TLD Location	**Summary of 2005 Results**	**Summary of 2004 Results**
Boundary		
Minimum	91	64
Maximum	110	81
On-Site		
Minimum	85	52
Maximum	781	216
Background		
Minimum	93	63
Maximum	104	75

All monitoring results from TLDs for 2005 were within historical or expected ranges. During 2003, there was a significant decrease in the direct radiation levels, followed by a continuing decrease in 2004. This was attributed to a reduction of the radon concentrations and associated decay products within the K-65 Silos' headspace. This reduction was accomplished through operations of the Radon Control System. A slight upward trend was noted at the end of 2004, which continued into 2005. This increase was most likely due to initiation of pumping operations to transfer K-65 Silo materials to the Transfer Tank Area, which subsided during the last half of 2005 (refer to Figure 5-8).

During 2003, there was a significant decrease in direct radiation levels, particularly at TLD location 6, which is closest to the K-65 Silos, followed by a continuing decrease in 2004 and 2005 (refer to Figure 5-9). These changes at the boundary are also attributable to the reduction of radon concentrations and associated decay products within the former K-65 Silos' headspace by the operation of the Radon Control System and completion of silos materials transfer operations.

Historically, the maximum net radiation levels were measured at the site's western boundary; for 2004 and 2005, the maximum radiation level was monitored in the northeast quadrant of the site. This is reflective of changing conditions at the Fernald site and is a result of decreasing radiation levels near the Silos Project (site's western boundary). Chapter 6 provides more information on the dose associated with the direct radiation results. Detailed results of direct radiation measurements for 2004 and 2005 are provided in Appendix C, Attachment C.3, of this report.

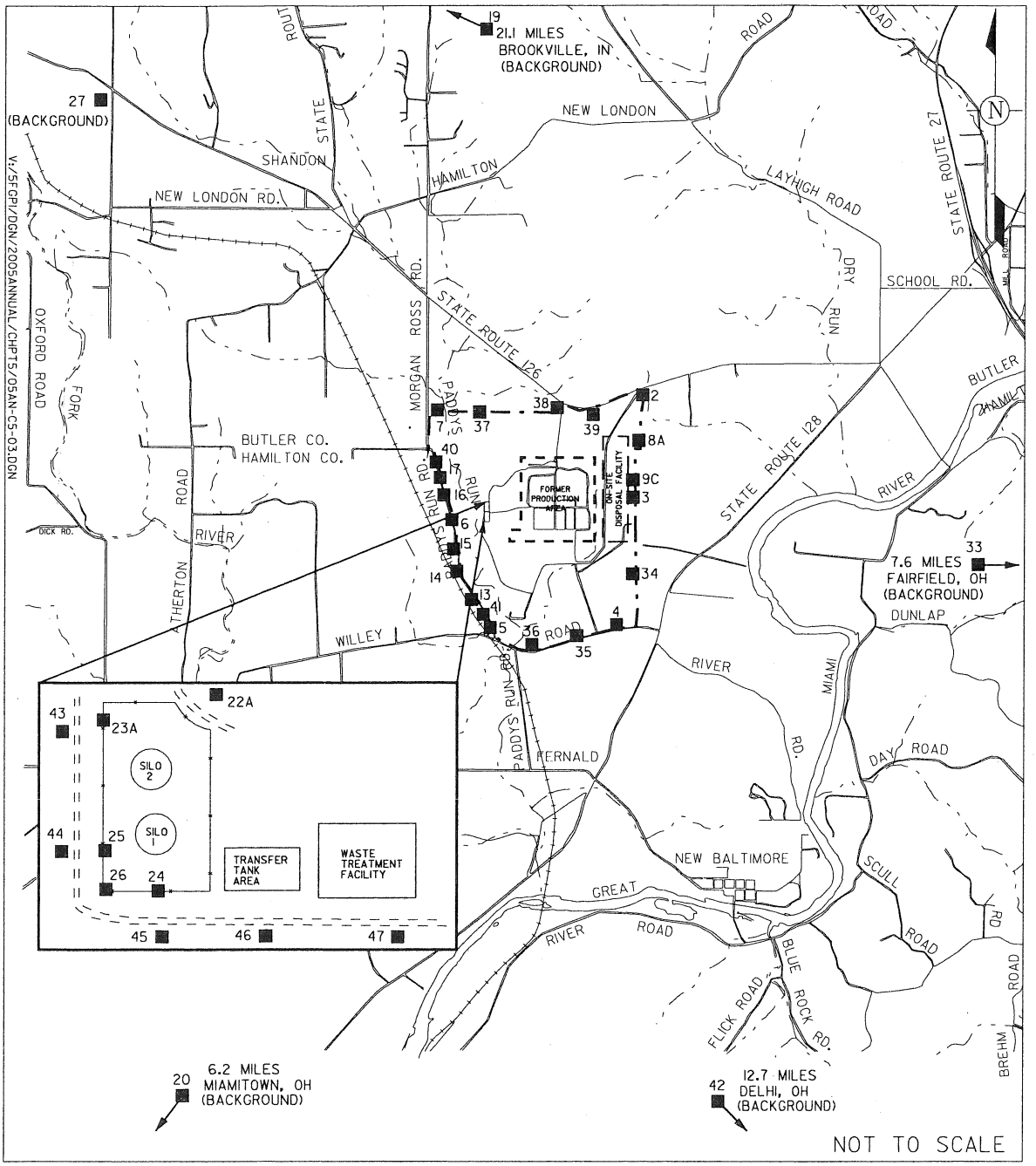


Figure 5.7 Direct Radiation (TLD) Monitoring Locations

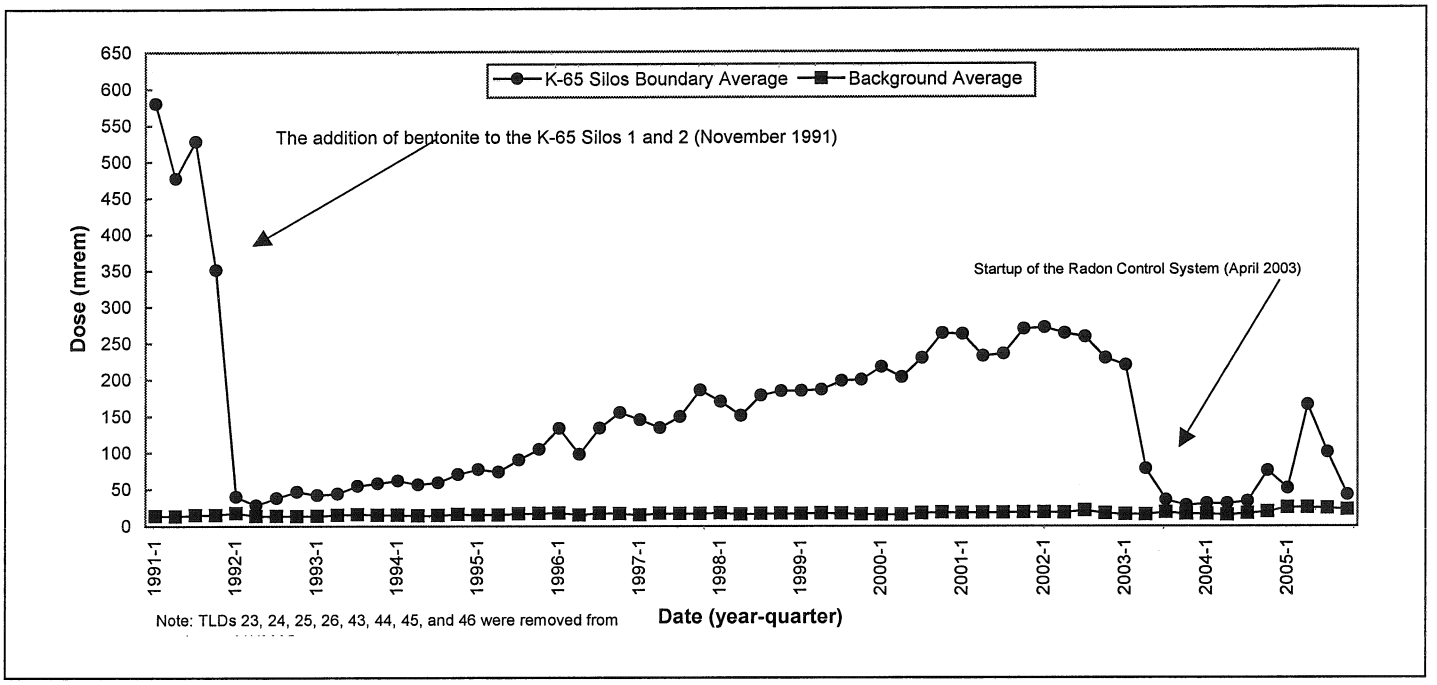


Figure 5-8. Direct Radiation (TLD) Measurements at Silos Boundary, 1991-2005 (Silos Boundary Average vs. Background Average)

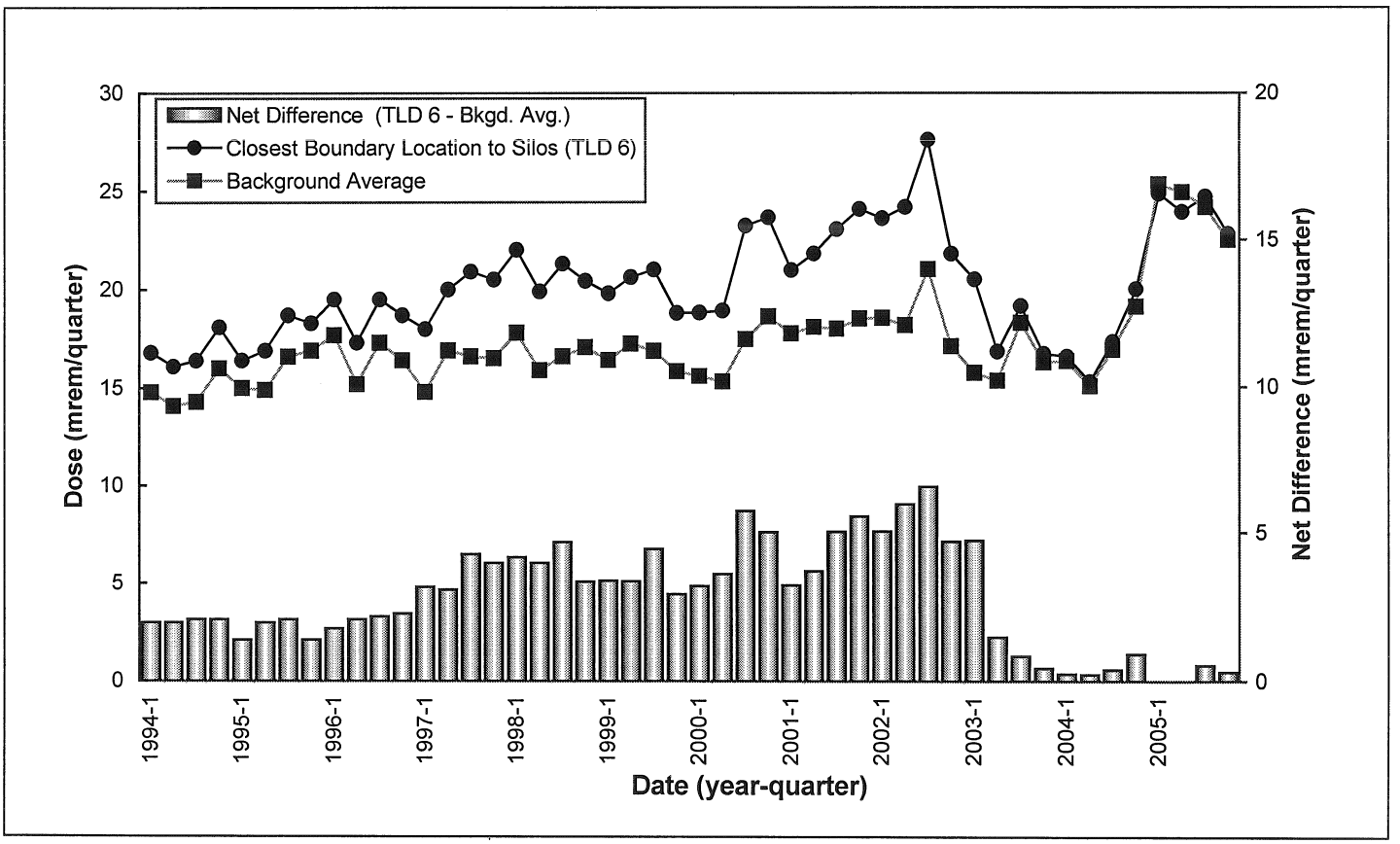


Figure 5-9. Direct Radiation (TLD) Measurements, 1994-2005 (Location 6 vs. Background Average)

5.6 Stack Monitoring for Radionuclide Emissions

During 2005, there were three stacks that were monitored for radionuclide emissions. Two of the stacks (Radon Control System and Silo 3) are identified as requiring monitoring as part of the requirements under the NESHAP Subpart H. The locations of the two stacks are shown in Figure 5-10. The third stack (Silo Remediation Building) was evaluated, prior to operational start-up, and determined to be exempt from monitoring under the provisions of NESHAP Subpart H. Nonetheless, monitoring was performed for project control purposes.

In 2005, the Radon Control System stack particulate filters were analyzed for total particulates, isotopes of uranium, thorium, radium, and polonium, in addition to radon monitoring. The results confirm that the Radon Control System stack particulate and radon emissions were low.

In 2005, the Silo 3 stack particulate filters were also analyzed for total particulates, isotopes of uranium, thorium, radium, and polonium, in addition to radon monitoring. The results confirm that the Silo 3 stack particulate and radon emissions were low.

The data from the Radon Control System and Silo 3 stacks are in Appendix D of this report for compliance purposes. Additionally, the data from the Silo Remediation Building stack is provided in Appendix D as supplemental information and supporting documentation.

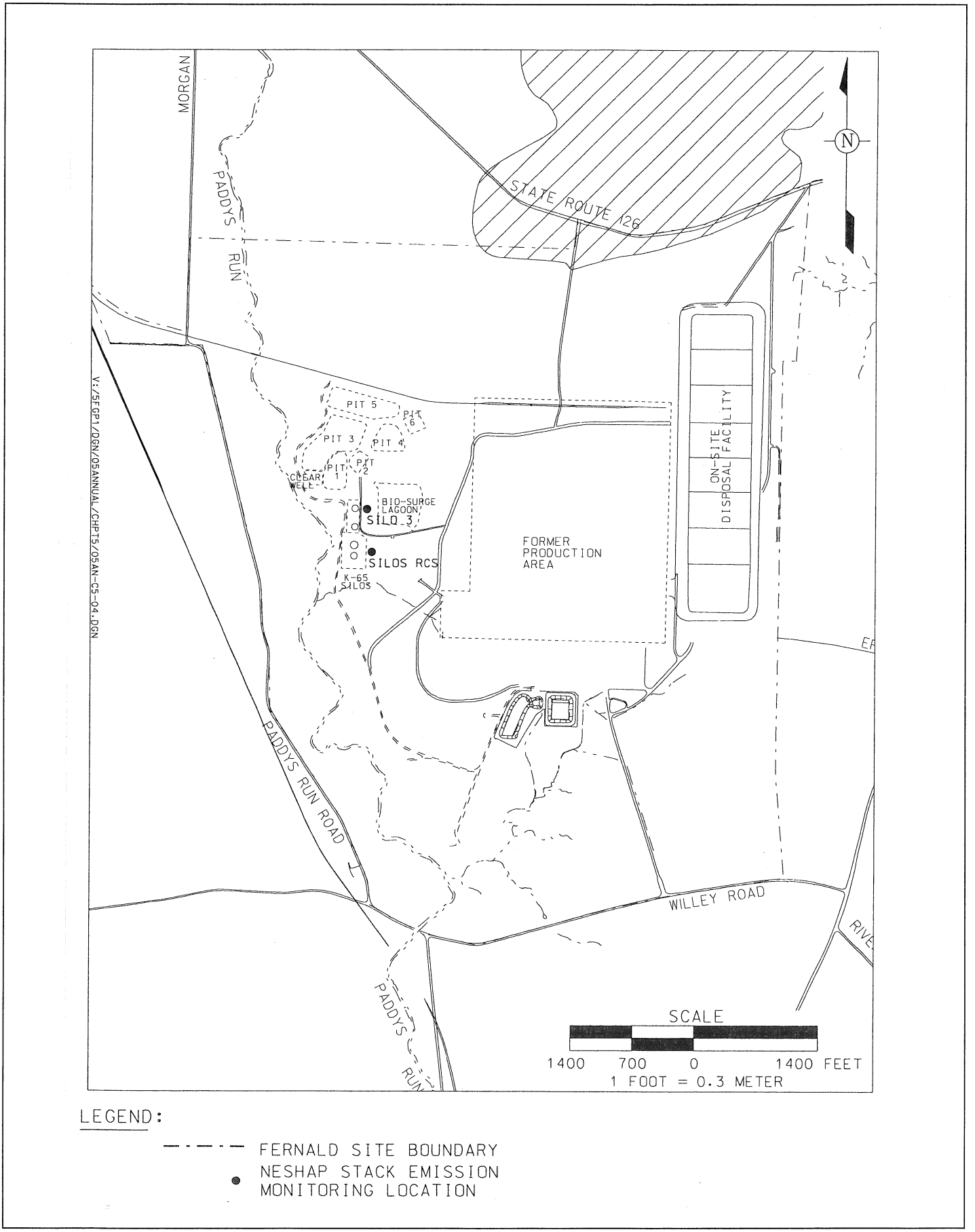


Figure 5.10 NESHAP Stack Emission Monitoring Locations

Table 5-4 presents the 2005 stack results for total particulates, radionuclides, and radon measurements. Typically, post-production era (i.e., 1990 and later) monitoring data have shown stack emissions of radionuclides to be very low or not detectable. The use of high-efficiency particulate air (HEPA) filtration systems in many remediation activities and processes effectively controls stack emissions and limits the release of airborne contaminants. In summary, the 2005 stack emissions are consistent with the low stack emission data for the post-production period.

TABLE 5-4
2005 NESHAP STACK EMISSIONS

Radionuclide (Unit)	Silos Radon Control System Stack[a,b]	Silo 3 Stack[a,b]	Silos 1&2 Remediation Building Stack[a,b,c]
Uranium-238 (lbs/yr)	5.5E-05	2.2E-05	3.9E-05
Uranium-235/236 (lbs/yr)	5.4E-06	2.2E-06	ND
Uranium-234 (lbs/yr)	4.5E-09	1.4E-09	2.6E-09
Thorium-232 (lbs/yr)	1.9E-04	5.8E-05	7.3E-05
Thorium-230 (lbs/yr)	3.1E-09	3.5E-09	3.0E-09
Thorium-228 (lbs/yr)	ND	ND	6.3E-15
Thorium-227 (lbs/yr)	5.0E-17	1.4E-17	ND
Radium-226 (lbs/yr)	1.1E-11	5.7E-11	ND
Polonium-210 (lbs/yr)	3.9E-14	5.1E-14	1.5E-13
Total Particulates (lbs/yr)	3.7E-01	3.9E-01	4.8E-01
Total Radon (mCi/yr)	22,400	24,400	15,200

[a]Includes probe rinse results.
[b]ND = not detectable
[c]Not a NESHAP regulated stack. Data provided for information only

5.7 Monitoring for Non-Radiological Pollutants

The FCP completed operations of the Waste Pits Project gas-fired dryers in June 2004. This concluded the non-radiological pollutant monitoring program at the Fernald site.

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