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2003 NATIONAL EMISSIONS STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAP) ANNUAL REPORT

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

MAY 2004

U.S. DEPARTMENT OF ENERGY

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U.S. Department of Energy
Radionuclide Air Emissions Annual Report
(Under Subpart H of 40 Code of Federal Regulations Part 61)
Calendar Year 2003

Site Name: Fernald Closure Project (FCP), Fernald, Ohio

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LIST OF ACRONYMS

ALARA	as low as reasonably achievable
AMS	air monitoring station
BAT	best available technology
°C	degrees Celsius
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm	centimeter
CY	calendar year
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
°F	degrees Fahrenheit
FCP	Fernald Closure Project
ft^3/min.	cubic feet per minute
HEPA	high-efficiency particulate air
IEMP	Integrated Environmental Monitoring Plan
km	kilometer
m^3/min.	cubic meters per minute
mrem	millirem
mSv	milliSieverts
NESHAP	National Emission Standards for Hazardous Air Pollutants
OEPA	Ohio Environmental Protection Agency
pCi/m^3	picoCuries per cubic meter

PREAMBLE

On May 23, 1997, the U.S. Department of Energy (DOE) Fernald Closure Project (FCP) submitted a written request to the U.S. Environmental Protection Agency (EPA) for approval to use an alternate approach for demonstrating compliance with the National Emission Standards for Hazardous Air Pollutants (NESHAP), Subpart H requirements (DOE 1997). The alternate approach uses environmental measurements of airborne radionuclide concentrations (as provided for under 40 Code of Federal Regulations 61.93[b][5]) rather than air dispersion modeling to demonstrate that radionuclide emissions resulting from FCP operations remain below the annual NESHAP Subpart H standard. The request for approval of the alternative approach was driven by the recognition that the dominant sources of radiological emissions at the Fernald site had changed as the mission of the site changed from uranium metal production (which ended in 1989) to environmental remediation. During production, the primary emission sources from the facility were point sources (stacks and vents). However, under the current mission of full-scale environmental remediation, the dominant emission sources are fugitive emissions from diffuse sources (e.g., large-scale excavations, wind erosion from stockpiled materials, decontamination and dismantling, etc.). Because there is a high degree of uncertainty associated with modeling fugitive emissions, environmental measurements were proposed as an alternative to provide a more accurate assessment of site's emissions.

On August 11, 1997, the EPA granted approval to use environmental measurements as an alternative methodology for demonstrating NESHAP compliance (EPA 1997). The FCP began using environmental measurements for NESHAP compliance purposes in 1998.

SUMMARY

For calendar year (CY) 2003, the maximum effective dose equivalent from emissions of radionuclides to the ambient air, based on radionuclide measurements at the Fernald site fenceline, is estimated to be 0.82 millirem (mrem) (8.2E-03 millisieverts [mSv]), which is in compliance with the Subpart H standard of 10 mrem. This estimation is based on the FCP's radiological air particulate monitoring program which consists of a network of high-volume air monitoring stations (AMS's) operated continuously during the year at the Fernald facility fenceline and a background location.

SECTION I: FACILITY INFORMATION

A. Site Description

The Fernald site is located on a 1,050-acre (425-hectare) area approximately 18 miles (29 kilometers [km]) northwest of downtown Cincinnati, Ohio, just north of the small farming community of Fernald, Ohio. The former production area covers approximately 136 acres (55 hectares) in the center of the site.

The area immediately surrounding the site is primarily rural in nature, characterized by the predominance of agriculture, with some light industry and private residences. The site is located on a relatively level plain, outside of the 500-year flood plain of the Great Miami River, in an ancestral river valley known as the New Haven Trough.

The climate is characterized as continental/subtropical depending on the seasons, with CY 2003 average temperatures ranging from approximately 25 degrees Fahrenheit (°F) (-4 degrees Celsius [°C]) in January to 73°F (23°C) in July. Average annual precipitation is approximately 41 inches (104 centimeters [cm]) per year. Prevailing wind flow is from the south-southwest.

For 37 years, the former Feed Materials Production Center (the Fernald site) produced uranium metals for DOE and its predecessors. On July 10, 1989, uranium metals production was suspended. Management responsibilities of the Fernald site were transferred from the Defense Programs organization to the DOE's Office of Environmental Restoration and Waste Management.

Currently, remedial action activities at the Fernald site are conducted under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). These activities include sample analysis; waste characterization; the management, treatment, storage, and disposal of hazardous, mixed, low-level and solid wastes; and the decontamination and cleanup of radioactively contaminated buildings, equipment, soils, and waters. The site also manages containerized thorium wastes and K-65 Silos waste material (which contains radium and produces radon gas).

B. Source Descriptions

The majority of the radioactive airborne contaminants at the Fernald site consist of thorium and uranium isotopes. Additional radioactive airborne contaminants consist of daughter products from the uranium, actinium, and thorium series decay chains.

For CY 2003, potential radionuclide emissions sources at the FCP included:

- Building 15, fugitive emissions generated from decontamination and dismantling
- Building 51, emissions from the advanced wastewater treatment facility
- Building 68, emissions from sample crusher and laboratory hood operations
- Building 71*, emissions from material sorting and repackaging operations
- Building 79, emissions from decanting/over-packing operations
- Building 80, fugitive emissions from metal fuel-core repackaging operations
- Plant 2/3, fugitive emissions generated from decontamination and dismantling
- Plant 8, fugitive emissions generated from decontamination and dismantling
- On-site disposal facility waste placement and its material transfer area, fugitive emissions from size-reducing material prior to and during placement in the on-site disposal facility
- Silos 1 and 2 Project, Radon Control System* testing and start-up, fugitive emissions from construction activities
- Waste Pits Project dryer stack*, pugmill ventilation system*, clothes dryer, and laboratory operations
- Other sources include fugitive emissions from Waste Pits Project excavations of Waste Pits 1 through 6; various borrow area excavations in clean areas; wind erosion of stockpiles (e.g., Soil Pile 7); and earth-moving equipment, material handling, and storage operations

* Indicates point sources that were continuously monitored during process operations. Table D-1 provides a summary of data from point source monitors; it is included as supporting documentation but is not used to demonstrate 40 Code of Federal Regulations 61.92 compliance.

All monitored stacks are equipped with a high-efficiency particulate air (HEPA) filter used for effluent controls. HEPA filters are 99.97 percent efficient for particles of 0.3 microns or larger. HEPA filtration systems are used throughout the Fernald site to meet Best Available Technology (BAT) for controlling radionuclide emissions and to adhere to the as-low-as-reasonably-achievable (ALARA) philosophy. In accordance with 40 Code of Federal Regulations 61.94(b)(5), some examples of HEPA filters used at the Fernald site include off-gas control systems, vacuum cleaner exhaust controls, negative pressure ventilation controls, venting glove bags and glove boxes, and general decontamination efforts. Table D-2 is provided to comply with 40 Code of Federal Regulations 61.94 (b)(6), which requires reporting the distances from the points of release to the nearest residence, school, business, etc. The information in this table is included as supporting documentation but is not used to demonstrate 40 Code of Federal Regulations 61.92 compliance.

C. Radiological Air Particulate Monitoring Program Description

The FCP's radiological air monitoring program for CY2003 is defined in the Integrated Environmental Monitoring Plan (IEMP), Revision 3 (DOE 2003). With regard to demonstrating NESHAP compliance, revision 3 differs from revision 2 by the reduction from two background air monitors to one background air monitor. The program design, as approved by the EPA, is summarized as follows:

Monitoring Equipment and Locations

- A network of 17 high-volume environmental AMS's comprise the FCP's radiological air particulate monitoring program for NESHAP compliance (refer to Figure D-1 for monitoring locations). The monitors draw air continuously through 8-inch by 10-inch filters at a rate of 40–50 cubic feet per minute (ft^3/min.) (1.13–1.42 cubic meters per minute [m^3/min.]). Each AMS contains a flow-rate chart recorder and an hour-meter that provide a record of the monitor's operational run-time over the sampling period. Additionally, each AMS is equipped with flow controllers that maintain a constant airflow through the monitor automatically adjusting blower/motor speed to correct for variations in line voltage, temperature, pressure, or filter loading.

- The 17 AMS's are divided among on-site and background monitoring locations. Sixteen monitors are located on the Fernald site fenceline generally corresponding to the 16 wind rose sectors. One monitor collects background data and is located in the predominant upwind direction of southwest (6.2 miles [9.98 km]) from the center of the Fernald site. The EPA siting criteria (40 Code of Federal Regulations 58, Appendix E) were considered when selecting these locations.

Analytical Regime and Sampling Frequency

The analytical regime and sampling frequency for this program were designed to account for the major contributors to dose as defined in 40 Code of Federal Regulations 61.93(b)(5)(ii) for the purpose of demonstrating NESHAP Subpart H compliance.

- Filters were exchanged on a biweekly basis and analyzed for total uranium and total particulates. These data are used to track site emissions routinely throughout the year to ensure emission controls at the FCP are operating effectively.

- A portion of each biweekly filter was retained and used to form a monthly composite, and was analyzed for isotopic thorium. This was done to supplement the thorium data from the quarterly composites (i.e., two monthly thorium composites per quarter). These monthly thorium composites combined with the quarterly thorium results are used to track site thorium emissions to ensure process controls at the FCP are operating effectively.

- The remaining portion of each biweekly filter was retained and used to form a quarterly composite sample. The composite sample is analyzed for the radionuclides expected to be the major contributors to dose from site emissions. As mentioned above, the results of the quarterly data are used to track compliance against the NESHAP Subpart H standard during the year and for demonstrating compliance at the end of the year.

Isotopes that comprise the quarterly composite analysis were selected based on the following considerations:

- Radionuclides which are stored in large quantities at the Fernald site and which will be handled or processed during the remediation effort (uranium, thorium-230, thorium-232, and radium-226)
- Radionuclides which have been the major contributors to dose based on environmental and stack filter measurements (uranium)
- Radionuclides that, due to their concentrations in waste and contaminated soil, will be the major contributors to dose (uranium, thorium-228, and thorium-230).

Uranium-238, thorium-232, and uranium-235 are initial radionuclides in the uranium, thorium, and actinide decay chains, respectively. The majority of uranium and thorium received and processed during the production era of the Fernald site had been separated from their decay chain progeny prior to shipment to the site. As a result, decay chain progeny products were not in equilibrium with the parent concentrations, but may have grown into equilibrium with their parents during the history of operations at the site. In addition to the potential in-growth of decay chain progeny, some of the progeny are difficult to quantify using standard radiochemistry analytical techniques. Analysis is particularly difficult given the limited sample volume and low environmental concentrations of all radionuclides in the quarterly composite samples. In order to account for the progeny's contribution to dose (while avoiding analytical difficulties), a number of progeny radionuclides can conservatively be considered to be present in equilibrium with their parents. These radionuclides (thorium-234, radium-228, actinium-228, radium-224, and thorium-231) are assumed to be in equilibrium with their parent concentrations as measured in the quarterly composites. Table D-3 summarizes measured net air concentrations.

Air Emission Data Reporting

In addition to this report, the biweekly, monthly, and quarterly composite data associated with this program were tracked and reported to the EPA and Ohio Environmental Protection Agency (OEPA) through the IEMP mid-year status report during CY 2003. In conjunction with the mid-year report, all monitoring data were provided to the EPA and OEPA electronically on the IEMP Data Information Site.

SECTION II: AIR EMISSIONS DATA

A. Air Monitoring Data Completeness Status

During CY 2003 there were no lost or rejected quarterly composite samples which were used for demonstrating NESHAP, Subpart H compliance.

B. Air Monitoring Station Operational Performance

During CY 2003 operational run-times for the 17 NESHAP AMS's averaged 99.1 percent, with all monitors operating in excess of the 95 percent minimum expectation. In general, interruptions in monitor operations that were encountered during CY 2003 were the result of short-term power failures and/or equipment failures, and down-time for filter exchanges (refer to Table D-4).

SECTION III: DOSE ASSESSMENT

Based on the sum of the quarterly isotopic results and annual air volumes, the net measured concentrations for each radionuclide were calculated at each fenceline air monitor to determine annual average concentrations. The annual average concentrations at each fenceline air monitor are divided by the corresponding values listed in Subpart H of 40 Code of Federal Regulations 61, Appendix E, Table 2 to form a radionuclide-specific compliance ratio. At each fenceline air monitor, the sum of the radionuclide-specific compliance ratios was determined. Refer to Table D-5 for the NESHAP compliance ratios at each air monitor. The maximum value of the sum of the ratios was 0.082 and occurred at AMS-9C. AMS-9C operated 99.97 percent of the time during 2003.

In accordance with 40 Code of Federal Regulations 61.107, compliance with the NESHAP standard is demonstrated when the sum of the ratios is less than 1. Based on this approach for demonstrating compliance, the 40 Code of Federal Regulations 61, Appendix E, Table 2 values can be assumed to represent the annual average radionuclide concentrations that correspond to a 10-mrem annual effective dose equivalent. It follows that a fraction of the 40 Code of Federal Regulations 61, Appendix E, Table 2 values would correspond to an equivalent fraction of a 10-mrem annual effective dose equivalent.

Based on the assumption above, the sum of the radionuclide-specific compliance ratios can be converted to a dose by multiplying the ratio by 10. The maximum value of the sum of the ratios (0.082) converts to a maximum effective dose equivalent of 0.82 mrem (8.2E-03 mSv) at the Fernald site boundary fenceline (AMS-9C). Because the nearest residence is located approximately 2,500 feet (762 meters) downwind (east-southeast) from AMS-9C, the actual dose received by this receptor would be substantially lower than 0.82 mrem (8.2E-03 mSv).

SECTION IV: COMPLIANCE ASSESSMENT

For CY 2003 the maximum effective dose equivalent from emissions of radionuclides to the ambient air, based on radionuclide measurements at the Fernald site boundary fenceline, is estimated to be 0.82 mrem (8.2E-03 mSv), which is in compliance with the Subpart H standard of 10 mrem (0.1 mSv).

SECTION V: ADDITIONAL INFORMATION

A. Meteorological Data

Refer to Figure D-2 for the CY 2003 wind rose data.

B. Construction/Modifications at the FCP

There was one project completed in CY 2003 for which the requirements needed to apply to the EPA for approval to construct or modify were waived due to the provisions of 40 Code of Federal Regulations 61.96. The project was:

- Building 68 Sample Crusher and Laboratory Hood

Attachment D.1 contains CAP88-PC computer model runs as supporting documentation for the waiver.

C. Unplanned Releases of Radionuclides

There were 215 potential release notifications received by the site's release evaluators during CY 2003. The notifications included all spills and/or releases of chemicals, oils, radiological material, or other hazardous materials. Of the 215 notifications, nine releases were identified as having the potential for airborne radiological emissions. A review of these nine releases in combination with the environmental measurement data collected during 2003 found that none of the releases was significant with respect to determining compliance with Subpart H.

TABLE D-1

NESHAP STACK EMISSIONS MONITORING RESULTS

Stack Location/ Analysis Performed	CY 2003 Annual Results: Number of Samples (including rinsate)	CY 2003 Annual Results: Total Pounds[a,b]
Building 71 Stack		
Total Uranium	3	8.8E-06
Uranium-238	3	2.8E-05
Uranium-235/236	3	6.3E-07
Uranium-234	3	1.6E-09
Thorium-232	3	2.2E-05
Thorium-230	3	3.6E-10
Thorium-228	3	9.1E-16
Total Particulate	3	0.0E+00
Silos Project Radon Control System Stack		
Uranium-238	9	3.1E-05
Uranium-235/236	9	5.7E-07
Uranium-234	9	2.1E-09
Thorium-232	9	6.1E-05
Thorium-230	9	3.6E-09
Thorium-228	9	8.2E-15
Thorium-227	9	ND
Radium-226	9	ND
Polonium-210	9	6.3E-15
Total Particulate	8	1.5E-01
Waste Pits Project Dryer Stack		
Uranium-238	14	3.1E-05
Uranium-235/236	14	2.0E-07
Uranium-234	14	1.1E-09
Thorium-232	14	4.1E-06
Thorium-230	14	4.9E-10
Thorium-228	14	1.1E-15
Radium-226	14	4.6E-13
Waste Pits Project Pugmill Stack		
Uranium-238	57	1.2E-03
Uranium-235/236	57	3.4E-06
Uranium-234	57	3.1E-08
Thorium-232	57	2.6E-04
Thorium-230	57	4.4E-08
Thorium-228	57	4.4E-14
Radium-226	57	3.2E-11

[a]ND = not detectable
[b]Total pounds are only determined from detected results.

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TABLE D-2[a]

DISTANCE AND DIRECTION FROM POINTS OF RELEASE TO CRITICAL RECEPTORS

Source	Type of Control	Percent Efficiency[b]	Distance and Direction to Nearest Critical Receptor[c]
Building 51	None	NA	676m WNW
Building 68			
Sample Crusher	HEPA	99.97	770m WSW
Laboratory Hood	HEPA	99.97	770m WSW
Building 71	HEPA	99.97	884m NNW
Building 79			
Enclosure - Part 1	HEPA	99.97	395m E
Enclosure - Part2	HEPA	99.97	395m E
Enclosure - Part 1A	HEPA	99.97	395m E
Building 80	HEPA	99.97	829m W
Silos Project, Radon Control System	HEPA	99.97	429m WSW
WPP			
Clothes Dryer	None	NA	664m WSW
Dryer Stack	HEPA	99.97	635m SW
Laboratory	HEPA	99.97	615m WSW
Pugmill ventilation System	HEPA	99.97	687m SW

[a]Table D-2 is included to comply with 40 Code of Federal Regulations 61.94 (b)(6) and not used to demonstrate compliance with 40 Code of Federal Regulations 61.92.
[b]NA = not applicable
[c]Site boundary air monitoring locations.

TABLE D-3

CY 2003 NET AIR CONCENTRATIONS[a]

	Uranium (pCi/m^3)[b]			Thorium (pCi/m^3)[b,c]			Radium (pCi/m^3)[b]
Location	234	235/236	238	228	230	232	226
Fenceline							
AMS-2	5.2E-05	6.0E-06	8.0E-05	4.0E-07	3.4E-05	3.4E-06	1.7E-05
AMS-3	1.2E-04	1.4E-05	1.4E-04	7.9E-06	7.8E-05	6.6E-06	2.8E-05
AMS-4	1.6E-05	2.5E-06	2.3E-05	2.4E-07	1.8E-05	2.6E-06	2.5E-05
AMS-5	2.3E-05	1.7E-06	3.2E-05	1.9E-06	2.3E-05	0.0E+00	2.0E-05
AMS-6	8.2E-05	8.9E-06	1.2E-04	6.2E-06	6.7E-05	4.9E-06	1.8E-05
AMS-7	2.5E-05	4.0E-06	3.6E-05	0.0E+00	1.9E-05	3.3E-06	1.7E-05
AMS-8A	8.7E-05	1.0E-05	1.1E-04	5.4E-06	4.7E-05	5.2E-06	1.5E-05
AMS-9C	1.2E-04	1.4E-05	1.6E-04	9.2E-06	6.9E-05	8.6E-06	2.2E-05
AMS-22	9.0E-05	8.3E-06	1.8E-04	4.6E-06	5.8E-05	4.9E-06	2.9E-05
AMS-23	5.8E-05	7.2E-06	1.1E-04	2.7E-08	4.0E-05	2.8E-06	1.9E-05
AMS-24	2.2E-05	1.7E-06	3.3E-05	1.8E-06	1.9E-05	4.4E-06	3.6E-05
AMS-25	1.2E-05	1.2E-06	1.7E-05	0.0E+00	9.2E-06	2.3E-06	2.9E-05
AMS-26	6.4E-05	9.5E-06	9.5E-05	4.8E-06	4.0E-05	3.1E-06	1.6E-05
AMS-27	5.4E-05	1.2E-05	1.0E-04	5.4E-06	4.1E-05	5.0E-06	2.8E-05
AMS-28	7.6E-05	1.2E-05	1.5E-04	2.7E-06	5.4E-05	4.6E-06	2.3E-05
AMS-29	6.0E-05	7.0E-06	9.9E-05	6.4E-06	4.7E-05	7.4E-06	1.6E-05
Background							
AMS-12	7.6E-06	1.5E-06	8.2E-06	6.2E-06	8.6E-06	2.9E-06	7.7E-06

[a]Fencline air concentrations adjusted by background concentration and blank filter results.
[b]Thorium-234, radium-228, actinium-228, radium-224, and thorium-231 are considered to be in equilibrium with their parent of the primordial decay chain (i.e., thorium-234 pCi/m^3 = uranium-238 pCi/m^3; radium-228 pCi/m^3 = thorium-232 pCi/m^3; and actinium-228 pCi/m^3, radium-224 pCi/m^3, and thorium-231 pCi/m^3 = uranium 235 pCi/m^3).
[c]0.0E+00 indicates the filter results were less than or equal to the blank results, and/or the indicator concentrations were less than or equal to the background concentration.

TABLE D-4

CY 2003 OPERATIONAL SUMMARY FOR AIR PARTICULATE MONITORING STATIONS

Location	Number of Samples	Sample Start Date	Last Sample Collection Date	Operating Time (hours)[a]	Percent of Operation
Fenceline					
AMS-2	26	12/23/2002	12/23/2003	8745.6	99.8%
AMS-3	26	12/23/2002	12/23/2003	8611.1	98.3%
AMS-4	26	12/23/2002	12/23/2003	8608.9	98.3%
AMS-5	26	12/23/2002	12/23/2003	8670.9	99.0%
AMS-6	26	12/23/2002	12/23/2003	8683.4	99.1%
AMS-7	26	12/23/2002	12/23/2003	8741.5	99.8%
AMS-8A	26	12/23/2002	12/23/2003	8644.1	98.7%
AMS-9C[b]	26	12/23/2002	12/23/2003	8757.6	100%
AMS-22	26	12/23/2002	12/23/2003	8674.2	99.0%
AMS-23	26	12/23/2002	12/23/2003	8667.9	98.9%
AMS-24	26	12/23/2002	12/23/2003	8751.2	99.9%
AMS-25	26	12/23/2002	12/23/2003	8620.0	98.4%
AMS-26	26	12/23/2002	12/23/2003	8755.4	99.9%
AMS-27	26	12/23/2002	12/23/2003	8660.6	98.9%
AMS-28	26	12/23/2002	12/23/2003	8572.1	97.9%
AMS-29	26	12/23/2002	12/23/2003	8629.9	98.5%
Background					
AMS-12	26	12/23/2002	12/23/2003	8751.7	99.9%

[a]There are 8760 available operating hours from December 23, 2002 through December 23, 2003.
[b]AMS-9C percent of operation was rounded to three significant figures from 99.97%.

TABLE D-5

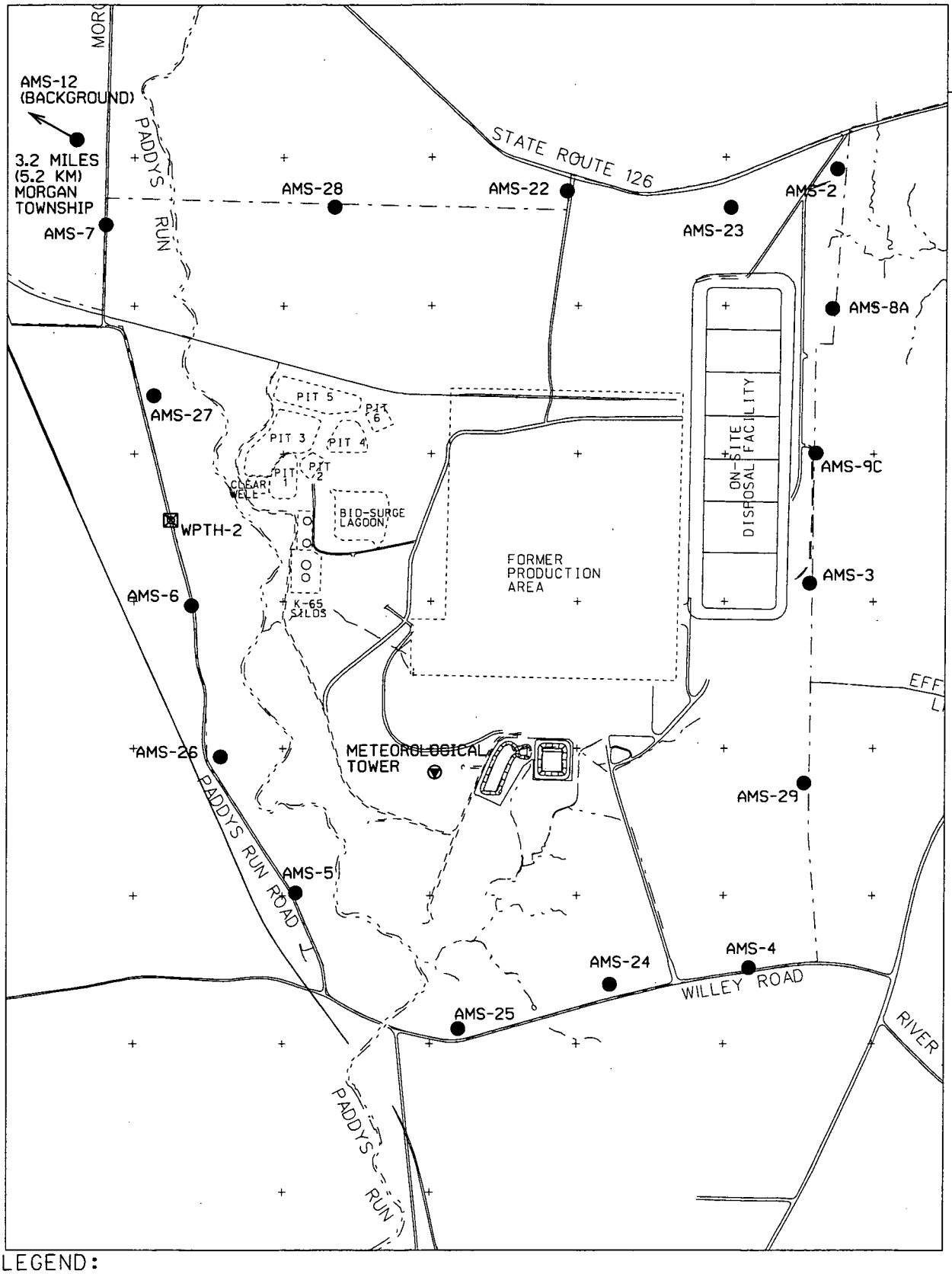
CY 2003 ANNUAL NESHAP COMPLIANCE RATIO REPORT

	40 Code of Federal Regulations 61 (NESHAP) Subpart H Appendix E, Table 2; Net Ratios													
Location	Actinium-228[a]	Radium-224[a]	Radium-226	Radium-228[a]	Thorium-228	Thorium-230	Thorium-231[a]	Thorium-232	Thorium-234[a]	Uranium-234	Uranium-235 Uranium-236	Uranium-238	Ratio Totals	Dose[b] (mrem)
Fenceline														
AMS-2	9.3E-07	2.3E-05	5.0E-03	5.8E-04	1.3E-04	9.9E-03	2.1E-08	5.6E-03	3.6E-05	6.7E-03	8.1E-04	9.6E-03	0.038	0.38
AMS-3	1.8E-06	4.4E-05	8.4E-03	1.1E-03	2.5E-03	2.3E-02	4.7E-08	1.1E-02	6.4E-05	1.6E-02	1.8E-03	1.7E-02	0.080	0.80
AMS-4	7.1E-07	1.7E-05	7.6E-03	4.4E-04	7.7E-05	5.4E-03	8.7E-09	4.2E-03	1.0E-05	2.1E-03	3.4E-04	2.8E-03	0.023	0.23
AMS-5	0.0E+00	0.0E+00	6.0E-03	0.0E+00	6.0E-04	6.8E-03	5.8E-09	0.0E+00	1.5E-05	3.0E-03	2.3E-04	3.9E-03	0.020	0.20
AMS-6	1.3E-06	3.3E-05	5.5E-03	8.4E-04	2.0E-03	2.0E-02	3.1E-08	8.0E-03	5.6E-05	1.1E-02	1.2E-03	1.5E-02	0.063	0.63
AMS-7	8.9E-07	2.2E-05	5.2E-03	5.6E-04	0.0E+00	5.7E-03	1.4E-08	5.3E-03	1.7E-05	3.2E-03	5.4E-04	4.4E-03	0.025	0.25
AMS-8A	1.4E-06	3.4E-05	4.4E-03	8.7E-04	1.7E-03	1.4E-02	3.5E-08	8.3E-03	5.0E-05	1.1E-02	1.4E-03	1.3E-02	0.055	0.55
AMS-9C	2.3E-06	5.8E-05	6.8E-03	1.5E-03	3.0E-03	2.0E-02	4.9E-08	1.4E-02	7.1E-05	1.5E-02	1.9E-03	1.9E-02	0.082	0.82
AMS-22	1.3E-06	3.3E-05	8.9E-03	8.3E-04	1.5E-03	1.7E-02	2.9E-08	7.9E-03	8.0E-05	1.2E-02	1.1E-03	2.1E-02	0.070	0.70
AMS-23	7.5E-07	1.8E-05	5.8E-03	4.7E-04	8.6E-06	1.2E-02	2.5E-08	4.5E-03	4.9E-05	7.5E-03	9.7E-04	1.3E-02	0.044	0.44
AMS-24	1.2E-06	3.0E-05	1.1E-02	7.5E-04	5.9E-04	5.6E-03	6.0E-09	7.1E-03	1.5E-05	2.9E-03	2.4E-04	4.0E-03	0.032	0.32
AMS-25	6.2E-07	1.5E-05	8.7E-03	3.9E-04	0.0E+00	2.7E-03	4.0E-09	3.7E-03	7.9E-06	1.6E-03	1.6E-04	2.1E-03	0.019	0.19
AMS-26	8.3E-07	2.0E-05	4.7E-03	5.2E-04	1.5E-03	1.2E-02	3.3E-08	5.0E-03	4.3E-05	8.4E-03	1.3E-03	1.1E-02	0.045	0.45
AMS-27	1.4E-06	3.4E-05	8.6E-03	8.5E-04	1.7E-03	1.2E-02	4.3E-08	8.1E-03	4.5E-05	7.0E-03	1.7E-03	1.2E-02	0.052	0.52
AMS-28	1.2E-06	3.0E-05	6.9E-03	7.7E-04	8.6E-04	1.6E-02	4.1E-08	7.4E-03	6.8E-05	9.8E-03	1.6E-03	1.8E-02	0.061	0.61
AMS-29	2.0E-06	4.9E-05	4.8E-03	1.3E-03	2.1E-03	1.4E-02	2.4E-08	1.2E-02	4.5E-05	7.8E-03	9.5E-04	1.2E-02	0.055	0.55
Background														
AMS-12	8.0E-07	2.0E-05	2.3E-03	5.0E-04	2.0E-03	2.5E-03	5.2E-09	4.8E-03	3.7E-06	9.9E-04	2.0E-04	9.8E-04	NA[c]	NA[c]

Maximum Year-to-Date Ratio: 0.082
Maximum Year-to-Date Dose (mrem): 0.82

[a]Isotopes are assumed to be in equilibrium with their primordial decay chain parent.
[b]Dose conversions are based on the NESHAP standard of 10 mrem per year.
[c]NA = not applicable.

V:\5fgp1\dgn\2003annual\app-d\03an-dd-01.dgn



LEGEND:

- FERNALD SITE BOUNDARY
- AMS LOCATION
- DISTANCE FROM CENTER OF FORMER PRODUCTION AREA TO AMS LOCATION OFF MAP
- THORIUM MONITOR LOCATION

SCALE

1400 700 0 1400 FEET

FINAL

STATE PLANAR COORDINATE SYSTEM 1983

20-FEB-2004

FIGURE D-1. RADIOLOGICAL AIR MONITORING LOCATIONS

FCP 2003 (10-meter level)
January 1 (2:00 a.m.) through December 31, 2003 (11:00 p.m.)

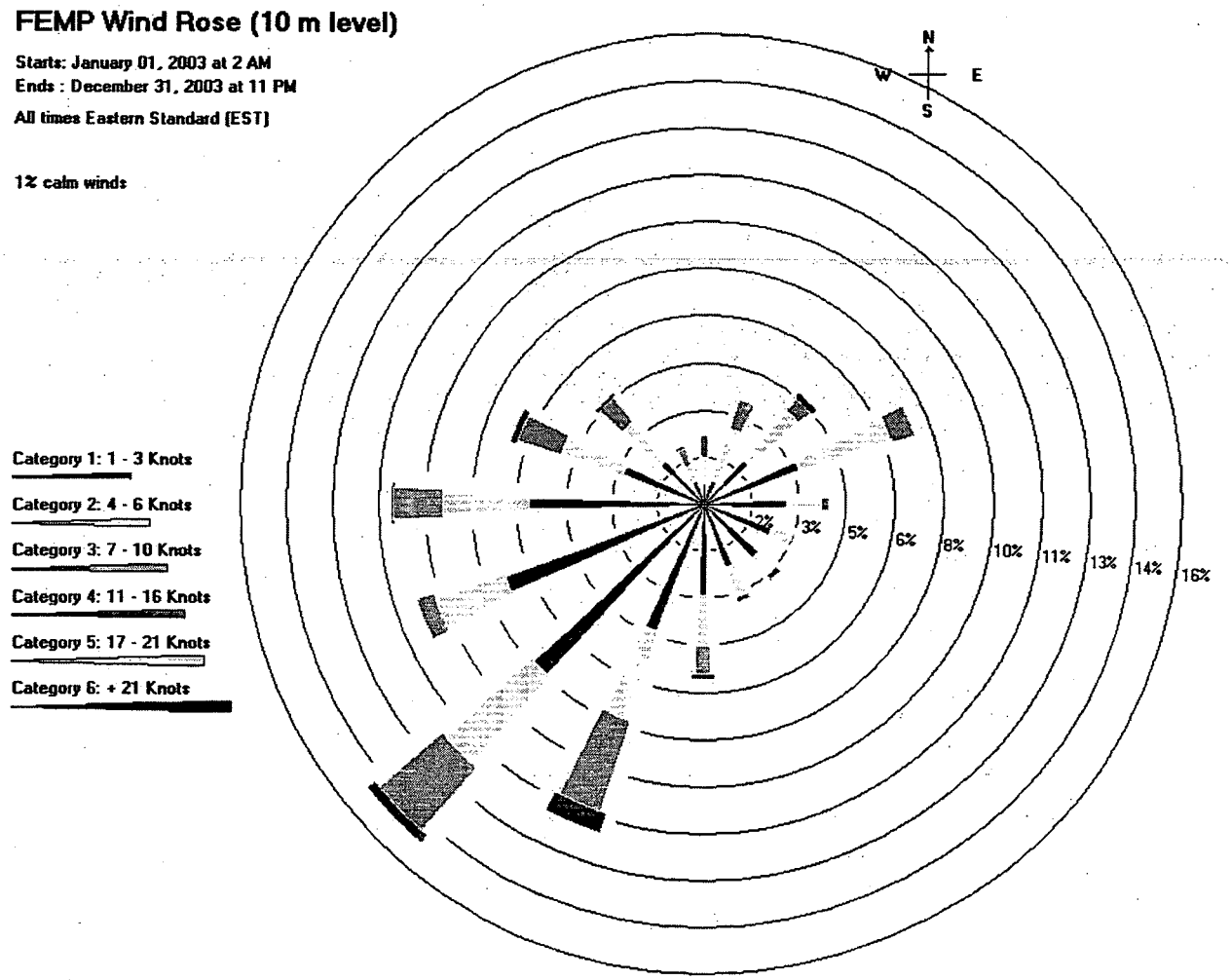


Figure D-2. CY 2003 Wind Rose Data, 10-Meter Height

000018

REFERENCES

U.S. Dept. of Energy, 2003, "Integrated Environmental Monitoring Plan, Revision 3," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Area Office, Cincinnati, OH.

U.S. Dept. of Energy, 1997, DOE-0980-97, Johnny Reising to James Saric and Michael Murphy, "Application for Approval to Use Environmental Measurements to Demonstrate Compliance with the National Emission Standards for Hazardous Air Pollutants Subpart H," dated May 23, 1997.

U.S. Environmental Protection Agency, 1997, Jack Barnett to Johnny Reising, "Application for Approval to Use Environmental Measurements to Demonstrate Compliance with the National Emission Standards for Hazardous Air Pollutants Subpart H," dated August 11, 1997.

SECTION VI: CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment (see 18 U.S.C. 1001).

Name: WILLIAM J TAYLOR

Signature: WJ Taylor

Date: 5/21/04

ATTACHMENT D.1

CAP88-PC COMPUTER MODEL RUNS AS SUPPORTING DOCUMENTATION FOR 40 CODE OF FEDERAL REGULATIONS 61.96

ATTACHMENT D.1-1

BUILDING 68 SAMPLE CRUSHER AND LABORATORY HOOD

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
May 5, 2003 4:38 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P. O. BOX 538704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent (mrem/year)	
5.84E-02	MAXIMUM POTENTIAL IMPACT AT THE SITE BOUNDARY IS 3.4 E-02 MREM/YR AT LOCATION 1058 METERS ENE

At This Location: 770 Meters East Northeast

Source Category: STACK
Source Type: Stack
Emission Year: 2003

Comments: OFFSITE EDE FOR RADIONUCLIDE EMISSIONS
FROM THE BUILDING 68 SAMPLE CRUSHER

Dataset Name: BLDG68-CRUSHER
Dataset Date: May 5, 2003 4:38 pm
Wind File: WNDFILES\5YRCAP88.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 770 Meters East Northeast
Lifetime Fatal Cancer Risk: 7.44E-07

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	2.18E-04
BREAST	2.01E-04
R MAR	8.00E-03
LUNGS	4.41E-01
THYROID	2.29E-04
ENDOST	1.05E-01
RMNDR	4.46E-03
EFFEC	5.84E-02

RADIONUCLIDE EMISSIONS DURING THE YEAR 2003

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
U-234	Y	1.00	6.2E-05	6.2E-05
U-235	Y	1.00	3.3E-06	3.3E-06
U-238	Y	1.00	6.9E-05	6.9E-05
RA-226	W	1.00	4.4E-08	4.4E-08
TH-228	Y	1.00	1.9E-06	1.9E-06
TH-230	Y	1.00	5.5E-06	5.5E-06
TH-232	Y	1.00	2.9E-07	2.9E-07
U-236	Y	1.00	2.4E-06	2.4E-06
SR-90	D	1.00	3.7E-07	3.7E-07
TC-99	W	1.00	7.7E-06	7.7E-06
RU-106	Y	1.00	1.4E-06	1.4E-06
CS-137	D	1.00	1.1E-06	1.1E-06
BA-137M	D	1.00	1.1E-06	1.1E-06
RA-228	W	1.00	1.8E-07	1.8E-07
TH-234	Y	1.00	2.7E-04	2.7E-04
PA-234M	Y	1.00	2.7E-04	2.7E-04
NP-237	W	1.00	2.2E-08	2.2E-08
PU-238	Y	1.00	2.6E-08	2.6E-08
PU-239	Y	1.00	1.7E-07	1.7E-07
PU-240	Y	1.00	4.4E-08	4.4E-08
PU-241	Y	1.00	6.5E-07	6.5E-07
PU-242	Y	1.00	9.6E-12	9.6E-12

SITE INFORMATION

Temperature: 10 degrees C
Precipitation: 100 cm/y
Mixing Height: 1000 m

SOURCE INFORMATION

Source Number:	1
Stack Height (m):	1.00
Diameter (m):	0.15
Plume Rise Momentum (m/s): (Exit Velocity)	2.59E+01

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

1804	1058	1221	805	787	1625	1423	1213	1419	1723
1059	1087	770	1288	1320	1063	1594	(EPA-11)		

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
May 5, 2003 4:38 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P. O. BOX 538704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: STACK
Source Type: Stack
Emission Year: 2003

Comments: OFFSITE EDE FOR RADIONUCLIDE EMISSIONS
FROM THE BUILDING 68 SAMPLE CRUSHER

Dataset Name: BLDG68-CRUSHER
Dataset Date: May 5, 2003 4:38 pm
Wind File: WNDFILES\5YRCAP88.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	2.18E-04
BREAST	2.01E-04
R MAR	8.00E-03
LUNGS	4.41E-01
THYROID	2.29E-04
ENDOST	1.05E-01
RMNDR	4.46E-03
EFFEC	5.84E-02

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	3.10E-03
INHALATION	5.53E-02
AIR IMMERSION	4.82E-09
GROUND SURFACE	3.31E-05
INTERNAL	5.84E-02
EXTERNAL	3.31E-05
TOTAL	5.84E-02

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	2.52E-02
U-235	1.27E-03
U-238	2.49E-02
RA-226	2.35E-06
TH-228	1.41E-03
TH-230	4.07E-03
TH-232	3.08E-04
U-236	9.21E-04
SR-90	3.70E-06
TC-99	1.41E-05
RU-106	2.71E-06
CS-137	3.43E-06
BA-137M	9.74E-11
RA-228	3.81E-06
TH-234	6.23E-05
PA-234M	2.33E-10
NP-237	3.33E-05
PU-238	2.59E-05
PU-239	1.82E-04
PU-240	4.72E-05
PU-241	1.09E-05
PU-242	9.79E-09
TOTAL	5.84E-02

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	7.79E-09
BONE	5.11E-09
THYROID	6.60E-11
BREAST	4.50E-10
LUNG	7.19E-07
STOMACH	6.88E-10
BOWEL	7.91E-10
LIVER	8.63E-10
PANCREAS	1.80E-10
URINARY	8.87E-09
OTHER	2.21E-10
TOTAL	7.44E-07

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	1.70E-08
INHALATION	7.26E-07
AIR IMMERSION	1.08E-13
GROUND SURFACE	7.60E-10
INTERNAL	7.43E-07
EXTERNAL	7.60E-10
TOTAL	7.44E-07

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	3.24E-07
U-235	1.67E-08
U-238	3.23E-07
RA-226	3.17E-11
TH-228	2.83E-08
TH-230	3.34E-08
TH-232	1.73E-09
U-236	1.19E-08
SR-90	6.24E-11
TC-99	5.17E-10
RU-106	1.28E-10
CS-137	8.98E-11
BA-137M	2.33E-15
RA-228	3.94E-11
TH-234	2.02E-09
PA-234M	5.94E-15
NP-237	1.68E-10
PU-238	2.21E-10
PU-239	1.43E-09
PU-240	3.71E-10
PU-241	4.15E-11
PU-242	7.67E-14
TOTAL	7.44E-07

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1804	1058	1221	805	787	1625	1423
N	5.2E-03	1.2E-02	9.6E-03	1.9E-02	2.0E-02	6.1E-03	7.5E-03
NNW	3.8E-03	8.7E-03	7.0E-03	1.4E-02	1.4E-02	4.5E-03	5.5E-03
NW	3.6E-03	8.2E-03	6.6E-03	1.3E-02	1.3E-02	4.2E-03	5.2E-03
WNW	4.5E-03	1.0E-02	8.3E-03	1.6E-02	1.7E-02	5.3E-03	6.6E-03
W	7.0E-03	1.6E-02	1.3E-02	2.6E-02	2.7E-02	8.3E-03	1.0E-02
WSW	7.4E-03	1.8E-02	1.4E-02	2.8E-02	2.9E-02	8.8E-03	1.1E-02
SW	4.1E-03	9.4E-03	7.5E-03	1.5E-02	1.5E-02	4.8E-03	5.9E-03
SSW	3.7E-03	8.4E-03	6.8E-03	1.3E-02	1.4E-02	4.3E-03	5.3E-03
S	3.7E-03	8.4E-03	6.7E-03	1.3E-02	1.4E-02	4.3E-03	5.3E-03
SSE	6.3E-03	1.5E-02	1.2E-02	2.3E-02	2.4E-02	7.4E-03	9.1E-03
SE	1.0E-02	2.4E-02	1.9E-02	3.7E-02	3.8E-02	1.2E-02	1.5E-02
ESE	1.3E-02	3.0E-02	2.4E-02	4.6E-02	4.8E-02	1.5E-02	1.9E-02
E	1.4E-02	3.3E-02	2.6E-02	5.2E-02	5.3E-02	1.7E-02	2.1E-02
ENE	1.4E-02	3.4E-02	2.7E-02	5.4E-02	5.6E-02	1.7E-02	2.1E-02
NE	1.3E-02	3.1E-02	2.5E-02	5.0E-02	5.2E-02	1.6E-02	1.9E-02
NNE	9.0E-03	2.1E-02	1.7E-02	3.4E-02	3.6E-02	1.1E-02	1.3E-02

	Distance (m)						
Direction	1213	1419	1723	1059	1087	770	1288
N	9.7E-03	7.6E-03	5.6E-03	1.2E-02	1.2E-02	2.1E-02	8.8E-03
NNW	7.0E-03	5.5E-03	4.1E-03	8.7E-03	8.3E-03	1.5E-02	6.4E-03
NW	6.7E-03	5.2E-03	3.9E-03	8.2E-03	7.9E-03	1.4E-02	6.1E-03
WNW	8.4E-03	6.6E-03	4.9E-03	1.0E-02	9.9E-03	1.7E-02	7.7E-03
W	1.3E-02	1.0E-02	7.6E-03	1.6E-02	1.6E-02	2.8E-02	1.2E-02
WSW	1.4E-02	1.1E-02	8.0E-03	1.8E-02	1.7E-02	3.1E-02	1.3E-02
SW	7.6E-03	5.9E-03	4.4E-03	9.3E-03	9.0E-03	1.6E-02	6.9E-03
SSW	6.8E-03	5.4E-03	4.0E-03	8.4E-03	8.1E-03	1.4E-02	6.2E-03
S	6.8E-03	5.3E-03	4.0E-03	8.4E-03	8.1E-03	1.4E-02	6.2E-03
SSE	1.2E-02	9.2E-03	6.7E-03	1.5E-02	1.4E-02	2.5E-02	1.1E-02
SE	1.9E-02	1.5E-02	1.1E-02	2.4E-02	2.3E-02	4.0E-02	1.7E-02
ESE	2.4E-02	1.9E-02	1.4E-02	3.0E-02	2.9E-02	4.9E-02	2.2E-02
E	2.7E-02	2.1E-02	1.5E-02	3.3E-02	3.2E-02	5.5E-02	2.4E-02
ENE	2.8E-02	2.1E-02	1.5E-02	3.4E-02	3.3E-02	5.8E-02	2.5E-02
NE	2.5E-02	2.0E-02	1.4E-02	3.1E-02	3.0E-02	5.4E-02	2.3E-02
NNE	1.7E-02	1.3E-02	9.7E-03	2.1E-02	2.0E-02	3.7E-02	1.6E-02

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

Direction	Distance (m) 1320	1063	1594 EPA-11
N	8.5E-03	1.2E-02	6.3E-03
NNW	6.2E-03	8.6E-03	4.6E-03
NW	5.8E-03	8.1E-03	4.4E-03
WNW	7.4E-03	1.0E-02	5.5E-03
W	1.2E-02	1.6E-02	8.6E-03
WSW	1.2E-02	1.7E-02	9.0E-03
SW	6.6E-03	9.3E-03	4.9E-03
SSW	6.0E-03	8.4E-03	4.5E-03
S	6.0E-03	8.3E-03	4.5E-03
SSE	1.0E-02	1.5E-02	7.6E-03
SE	1.7E-02	2.4E-02	1.2E-02
ESE	2.1E-02	3.0E-02	1.6E-02
E	2.3E-02	3.3E-02	1.7E-02
ENE	2.4E-02	3.4E-02	1.8E-02
NE	2.2E-02	3.1E-02	1.6E-02
NNE	1.5E-02	2.1E-02	1.1E-02

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

Direction	Distance (m) 1804	1058	1221	805	787	1625	1423
N	6.3E-08	1.5E-07	1.2E-07	2.4E-07	2.5E-07	7.5E-08	9.3E-08
NNW	4.6E-08	1.1E-07	8.6E-08	1.7E-07	1.8E-07	5.4E-08	6.7E-08
NW	4.3E-08	1.0E-07	8.1E-08	1.6E-07	1.7E-07	5.1E-08	6.4E-08
WNW	5.5E-08	1.3E-07	1.0E-07	2.0E-07	2.1E-07	6.5E-08	8.1E-08
W	8.7E-08	2.1E-07	1.7E-07	3.3E-07	3.4E-07	1.0E-07	1.3E-07
WSW	9.2E-08	2.2E-07	1.8E-07	3.6E-07	3.7E-07	1.1E-07	1.4E-07
SW	4.9E-08	1.2E-07	9.3E-08	1.8E-07	1.9E-07	5.8E-08	7.2E-08
SSW	4.5E-08	1.0E-07	8.3E-08	1.7E-07	1.7E-07	5.3E-08	6.5E-08
S	4.4E-08	1.0E-07	8.3E-08	1.7E-07	1.7E-07	5.3E-08	6.5E-08
SSE	7.7E-08	1.8E-07	1.5E-07	2.9E-07	3.0E-07	9.2E-08	1.1E-07
SE	1.3E-07	3.0E-07	2.4E-07	4.7E-07	4.9E-07	1.5E-07	1.9E-07
ESE	1.6E-07	3.8E-07	3.0E-07	5.9E-07	6.1E-07	1.9E-07	2.4E-07
E	1.8E-07	4.2E-07	3.3E-07	6.6E-07	6.8E-07	2.1E-07	2.6E-07
ENE	1.8E-07	4.3E-07	3.4E-07	6.9E-07	7.2E-07	2.1E-07	2.7E-07
NE	1.7E-07	4.0E-07	3.2E-07	6.4E-07	6.7E-07	2.0E-07	2.5E-07
NNE	1.1E-07	2.7E-07	2.1E-07	4.3E-07	4.5E-07	1.3E-07	1.7E-07

Direction	Distance (m) 1213	1419	1723	1059	1087	770	1288
N	1.2E-07	9.4E-08	6.8E-08	1.5E-07	1.4E-07	2.6E-07	1.1E-07
NNW	8.7E-08	6.8E-08	5.0E-08	1.1E-07	1.0E-07	1.8E-07	7.9E-08
NW	8.2E-08	6.4E-08	4.7E-08	1.0E-07	9.8E-08	1.7E-07	7.5E-08
WNW	1.0E-07	8.1E-08	5.9E-08	1.3E-07	1.2E-07	2.2E-07	9.5E-08
W	1.7E-07	1.3E-07	9.4E-08	2.1E-07	2.0E-07	3.5E-07	1.5E-07
WSW	1.8E-07	1.4E-07	9.9E-08	2.2E-07	2.1E-07	3.9E-07	1.6E-07
SW	9.4E-08	7.3E-08	5.3E-08	1.2E-07	1.1E-07	2.0E-07	8.5E-08
SSW	8.4E-08	6.6E-08	4.8E-08	1.0E-07	1.0E-07	1.8E-07	7.7E-08
S	8.4E-08	6.5E-08	4.8E-08	1.0E-07	1.0E-07	1.8E-07	7.6E-08
SSE	1.5E-07	1.1E-07	8.3E-08	1.8E-07	1.8E-07	3.1E-07	1.3E-07
SE	2.4E-07	1.9E-07	1.4E-07	3.0E-07	2.9E-07	5.1E-07	2.2E-07
ESE	3.0E-07	2.4E-07	1.7E-07	3.8E-07	3.6E-07	6.3E-07	2.8E-07
E	3.4E-07	2.6E-07	1.9E-07	4.2E-07	4.0E-07	7.0E-07	3.1E-07
ENE	3.5E-07	2.7E-07	1.9E-07	4.3E-07	4.2E-07	7.4E-07	3.2E-07
NE	3.2E-07	2.5E-07	1.8E-07	4.0E-07	3.8E-07	6.9E-07	2.9E-07
NNE	2.2E-07	1.7E-07	1.2E-07	2.7E-07	2.6E-07	4.7E-07	2.0E-07

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)		
Direction	1320	1063	1594 EPA-11
N	1.1E-07	1.5E-07	7.7E-08
NNW	7.6E-08	1.1E-07	5.6E-08
NW	7.2E-08	1.0E-07	5.3E-08
WNW	9.1E-08	1.3E-07	6.7E-08
W	1.5E-07	2.1E-07	1.1E-07
WSW	1.5E-07	2.2E-07	1.1E-07
SW	8.2E-08	1.2E-07	6.0E-08
SSW	7.4E-08	1.0E-07	5.4E-08
S	7.4E-08	1.0E-07	5.4E-08
SSE	1.3E-07	1.8E-07	9.4E-08
SE	2.1E-07	3.0E-07	1.6E-07
ESE	2.7E-07	3.7E-07	2.0E-07
E	2.9E-07	4.2E-07	2.2E-07
ENE	3.0E-07	4.3E-07	2.2E-07
NE	2.8E-07	4.0E-07	2.0E-07
NNE	1.9E-07	2.7E-07	1.4E-07

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
May 15, 2003 9:38 am

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P. O. BOX 538704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent (mrem/year)	
4.33E-04	MAXIMUM POTENTIAL IMPACT AT THE SITE BOUNDARY IS 2.5 E-04 MREM/YR AT LOCATION 1058 METERS ENE

At This Location: 770 Meters East Northeast

Source Category: STACK
Source Type: Stack
Emission Year: 2003

Comments: OFFSITE EDE FOR RADIONUCLIDE EMISSIONS FROM THE BUILDING 68 SAMPLE CRUSHER-APPL. FOR APPROVAL

Dataset Name: BLDG68-CRUSH-APP
Dataset Date: May 15, 2003 9:37 am
Wind File: WNDFILES\5YRCAP88.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 770 Meters East Northeast
Lifetime Fatal Cancer Risk: 5.51E-09

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	1.62E-06
BREAST	1.48E-06
R MAR	5.95E-05
LUNGS	3.27E-03
THYROID	1.69E-06
ENDOST	7.80E-04
RMNDR	3.31E-05
EFFEC	4.33E-04

RADIONUCLIDE EMISSIONS DURING THE YEAR 2003

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
U-234	Y	1.00	4.6E-07	4.6E-07
U-235	Y	1.00	2.4E-08	2.4E-08
U-238	Y	1.00	5.1E-07	5.1E-07
RA-226	W	1.00	3.3E-10	3.3E-10
TH-228	Y	1.00	1.4E-08	1.4E-08
TH-230	Y	1.00	4.1E-08	4.1E-08
TH-232	Y	1.00	2.2E-09	2.2E-09
U-236	Y	1.00	1.8E-08	1.8E-08
SR-90	D	1.00	2.7E-09	2.7E-09
TC-99	W	1.00	5.7E-08	5.7E-08
RU-106	Y	1.00	1.1E-08	1.1E-08
CS-137	D	1.00	7.9E-09	7.9E-09
BA-137M	D	1.00	7.9E-09	7.9E-09
RA-228	W	1.00	1.3E-09	1.3E-09
TH-234	Y	1.00	2.0E-06	2.0E-06
PA-234M	Y	1.00	2.0E-06	2.0E-06
NP-237	W	1.00	1.6E-10	1.6E-10
PU-238	Y	1.00	2.0E-10	2.0E-10
PU-239	Y	1.00	1.3E-09	1.3E-09
PU-240	Y	1.00	3.3E-10	3.3E-10
PU-241	Y	1.00	4.8E-09	4.8E-09
PU-242	Y	1.00	7.1E-14	7.1E-14

SITE INFORMATION

Temperature: 10 degrees C
Precipitation: 100 cm/y
Mixing Height: 1000 m

SOURCE INFORMATION

Source Number: 1

Stack Height (m): 1.00
Diameter (m): 0.15

Plume Rise
Momentum (m/s): 2.59E+01
(Exit Velocity)

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

1804	1058	1221	805	787	1625	1423	1213	1419	1723
1059	1087	770	1288	1320	1063	1594 (EPA-11)			

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
May 15, 2003 9:38 am

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P. O. BOX 538704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: STACK
Source Type: Stack
Emission Year: 2003

Comments: OFFSITE EDE FOR RADIONUCLIDE EMISSIONS FROM THE
BUILDING 68 SAMPLE CRUSHER-APPL. FOR APPROVAL

Dataset Name: BLDG68-CRUSH-APP
Dataset Date: May 15, 2003 9:37 am
Wind File: WNDFILES\5YRCAP88.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	1.62E-06
BREAST	1.48E-06
R MAR	5.95E-05
LUNGS	3.27E-03
THYROID	1.69E-06
ENDOST	7.80E-04
RMNDR	3.31E-05
EFFEC	4.33E-04

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	2.29E-05
INHALATION	4.10E-04
AIR IMMERSION	3.56E-11
GROUND SURFACE	2.41E-07
INTERNAL	4.33E-04
EXTERNAL	2.41E-07
TOTAL	4.33E-04

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	1.87E-04
U-235	9.23E-06
U-238	1.84E-04
RA-226	1.76E-08
TH-228	1.04E-05
TH-230	3.03E-05
TH-232	2.33E-06
U-236	6.91E-06
SR-90	2.70E-08
TC-99	1.04E-07
RU-106	2.13E-08
CS-137	2.47E-08
BA-137M	7.00E-13
RA-228	2.75E-08
TH-234	4.62E-07
PA-234M	1.73E-12
NP-237	2.42E-07
PU-238	1.99E-07
PU-239	1.39E-06
PU-240	3.54E-07
PU-241	8.03E-08
PU-242	7.24E-11
TOTAL	4.33E-04

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	5.79E-11
BONE	3.80E-11
THYROID	4.86E-13
BREAST	3.31E-12
LUNG	5.33E-09
STOMACH	5.08E-12
BOWEL	5.86E-12
LIVER	6.46E-12
PANCREAS	1.33E-12
URINARY	6.56E-11
OTHER	1.63E-12
TOTAL	5.51E-09

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	1.26E-10
INHALATION	5.38E-09
AIR IMMERSION	7.95E-16
GROUND SURFACE	5.54E-12
INTERNAL	5.51E-09
EXTERNAL	5.55E-12
TOTAL	5.51E-09

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	2.40E-09
U-235	1.21E-10
U-238	2.39E-09
RA-226	2.38E-13
TH-228	2.08E-10
TH-230	2.49E-10
TH-232	1.31E-11
U-236	8.90E-11
SR-90	4.55E-13
TC-99	3.83E-12
RU-106	1.01E-12
CS-137	6.45E-13
BA-137M	1.68E-17
RA-228	2.85E-13
TH-234	1.50E-11
PA-234M	4.40E-17
NP-237	1.22E-12
PU-238	1.70E-12
PU-239	1.09E-11
PU-240	2.78E-12
PU-241	3.06E-13
PU-242	5.67E-16
TOTAL	5.51E-09

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

Direction	Distance (m) 1804	1058	1221	805	787	1625	1423
N	3.8E-05	8.9E-05	7.1E-05	1.4E-04	1.5E-04	4.5E-05	5.6E-05
NNW	2.8E-05	6.4E-05	5.2E-05	1.0E-04	1.0E-04	3.3E-05	4.1E-05
NW	2.7E-05	6.1E-05	4.9E-05	9.5E-05	9.9E-05	3.1E-05	3.8E-05
WNW	3.4E-05	7.7E-05	6.2E-05	1.2E-04	1.2E-04	4.0E-05	4.9E-05
W	5.2E-05	1.2E-04	9.7E-05	1.9E-04	2.0E-04	6.2E-05	7.6E-05
WSW	5.5E-05	1.3E-04	1.0E-04	2.1E-04	2.2E-04	6.5E-05	8.1E-05
SW	3.0E-05	6.9E-05	5.5E-05	1.1E-04	1.1E-04	3.5E-05	4.4E-05
SSW	2.7E-05	6.2E-05	5.0E-05	9.7E-05	1.0E-04	3.2E-05	3.9E-05
S	2.7E-05	6.2E-05	5.0E-05	9.7E-05	1.0E-04	3.2E-05	3.9E-05
SSE	4.6E-05	1.1E-04	8.6E-05	1.7E-04	1.8E-04	5.5E-05	6.8E-05
SE	7.5E-05	1.8E-04	1.4E-04	2.7E-04	2.8E-04	8.9E-05	1.1E-04
ESE	9.4E-05	2.2E-04	1.8E-04	3.4E-04	3.5E-04	1.1E-04	1.4E-04
E	1.0E-04	2.4E-04	2.0E-04	3.8E-04	4.0E-04	1.2E-04	1.5E-04
ENE	1.1E-04	2.5E-04	2.0E-04	4.0E-04	4.2E-04	1.3E-04	1.6E-04
NE	9.7E-05	2.3E-04	1.9E-04	3.7E-04	3.9E-04	1.2E-04	1.4E-04
NNE	6.6E-05	1.6E-04	1.3E-04	2.5E-04	2.6E-04	7.9E-05	9.8E-05

Direction	Distance (m) 1213	1419	1723	1059	1087	770	1288
N	7.2E-05	5.6E-05	4.1E-05	8.9E-05	8.5E-05	1.5E-04	6.5E-05
NNW	5.2E-05	4.1E-05	3.0E-05	6.4E-05	6.2E-05	1.1E-04	4.8E-05
NW	4.9E-05	3.9E-05	2.9E-05	6.1E-05	5.8E-05	1.0E-04	4.5E-05
WNW	6.2E-05	4.9E-05	3.6E-05	7.6E-05	7.4E-05	1.3E-04	5.7E-05
W	9.8E-05	7.7E-05	5.6E-05	1.2E-04	1.2E-04	2.1E-04	9.0E-05
WSW	1.0E-04	8.1E-05	5.9E-05	1.3E-04	1.2E-04	2.3E-04	9.5E-05
SW	5.6E-05	4.4E-05	3.2E-05	6.9E-05	6.6E-05	1.2E-04	5.1E-05
SSW	5.1E-05	4.0E-05	2.9E-05	6.2E-05	6.0E-05	1.0E-04	4.6E-05
S	5.0E-05	4.0E-05	2.9E-05	6.2E-05	6.0E-05	1.0E-04	4.6E-05
SSE	8.7E-05	6.8E-05	5.0E-05	1.1E-04	1.0E-04	1.8E-04	7.9E-05
SE	1.4E-04	1.1E-04	8.1E-05	1.8E-04	1.7E-04	2.9E-04	1.3E-04
ESE	1.8E-04	1.4E-04	1.0E-04	2.2E-04	2.1E-04	3.7E-04	1.6E-04
E	2.0E-04	1.5E-04	1.1E-04	2.4E-04	2.3E-04	4.1E-04	1.8E-04
ENE	2.0E-04	1.6E-04	1.1E-04	2.5E-04	2.4E-04	4.3E-04	1.8E-04
NE	1.9E-04	1.4E-04	1.1E-04	2.3E-04	2.2E-04	4.0E-04	1.7E-04
NNE	1.3E-04	9.8E-05	7.1E-05	1.6E-04	1.5E-04	2.7E-04	1.1E-04

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)		
Direction	1320	1063	1594 EPA-11
N	6.3E-05	8.8E-05	4.7E-05
NNW	4.6E-05	6.4E-05	3.4E-05
NW	4.3E-05	6.0E-05	3.2E-05
WNW	5.5E-05	7.6E-05	4.1E-05
W	8.6E-05	1.2E-04	6.4E-05
WSW	9.1E-05	1.3E-04	6.7E-05
SW	4.9E-05	6.9E-05	3.7E-05
SSW	4.4E-05	6.2E-05	3.3E-05
S	4.4E-05	6.2E-05	3.3E-05
SSE	7.6E-05	1.1E-04	5.6E-05
SE	1.2E-04	1.7E-04	9.2E-05
ESE	1.6E-04	2.2E-04	1.2E-04
E	1.7E-04	2.4E-04	1.3E-04
ENE	1.8E-04	2.5E-04	1.3E-04
NE	1.6E-04	2.3E-04	1.2E-04
NNE	1.1E-04	1.6E-04	8.1E-05

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

Direction	Distance (m) 1804	1058	1221	805	787	1625	1423
N	4.7E-10	1.1E-09	8.9E-10	1.8E-09	1.9E-09	5.6E-10	6.9E-10
NNW	3.4E-10	8.0E-10	6.4E-10	1.3E-09	1.3E-09	4.0E-10	5.0E-10
NW	3.2E-10	7.6E-10	6.0E-10	1.2E-09	1.2E-09	3.8E-10	4.7E-10
WNW	4.1E-10	9.6E-10	7.7E-10	1.5E-09	1.5E-09	4.8E-10	6.0E-10
W	6.4E-10	1.5E-09	1.2E-09	2.4E-09	2.5E-09	7.7E-10	9.5E-10
WSW	6.8E-10	1.6E-09	1.3E-09	2.7E-09	2.8E-09	8.1E-10	1.0E-09
SW	3.6E-10	8.6E-10	6.9E-10	1.4E-09	1.4E-09	4.3E-10	5.4E-10
SSW	3.3E-10	7.8E-10	6.2E-10	1.2E-09	1.3E-09	3.9E-10	4.8E-10
S	3.3E-10	7.7E-10	6.2E-10	1.2E-09	1.3E-09	3.9E-10	4.8E-10
SSE	5.7E-10	1.4E-09	1.1E-09	2.2E-09	2.2E-09	6.8E-10	8.4E-10
SE	9.4E-10	2.2E-09	1.8E-09	3.5E-09	3.6E-09	1.1E-09	1.4E-09
ESE	1.2E-09	2.8E-09	2.2E-09	4.3E-09	4.5E-09	1.4E-09	1.7E-09
E	1.3E-09	3.1E-09	2.5E-09	4.9E-09	5.0E-09	1.5E-09	1.9E-09
ENE	1.3E-09	3.2E-09	2.6E-09	5.1E-09	5.3E-09	1.6E-09	2.0E-09
NE	1.2E-09	3.0E-09	2.3E-09	4.8E-09	4.9E-09	1.5E-09	1.8E-09
NNE	8.3E-10	2.0E-09	1.6E-09	3.2E-09	3.4E-09	9.8E-10	1.2E-09

Direction	Distance (m) 1213	1419	1723	1059	1087	770	1288
N	9.0E-10	6.9E-10	5.1E-10	1.1E-09	1.1E-09	1.9E-09	8.1E-10
NNW	6.5E-10	5.0E-10	3.7E-10	8.0E-10	7.7E-10	1.4E-09	5.9E-10
NW	6.1E-10	4.7E-10	3.5E-10	7.5E-10	7.2E-10	1.3E-09	5.5E-10
WNW	7.7E-10	6.0E-10	4.4E-10	9.6E-10	9.2E-10	1.6E-09	7.0E-10
W	1.2E-09	9.6E-10	6.9E-10	1.5E-09	1.5E-09	2.6E-09	1.1E-09
WSW	1.3E-09	1.0E-09	7.3E-10	1.6E-09	1.6E-09	2.9E-09	1.2E-09
SW	6.9E-10	5.4E-10	3.9E-10	8.6E-10	8.3E-10	1.5E-09	6.3E-10
SSW	6.2E-10	4.9E-10	3.6E-10	7.7E-10	7.4E-10	1.3E-09	5.7E-10
S	6.2E-10	4.8E-10	3.5E-10	7.7E-10	7.4E-10	1.3E-09	5.7E-10
SSE	1.1E-09	8.5E-10	6.2E-10	1.4E-09	1.3E-09	2.3E-09	9.9E-10
SE	1.8E-09	1.4E-09	1.0E-09	2.2E-09	2.1E-09	3.7E-09	1.6E-09
ESE	2.3E-09	1.8E-09	1.3E-09	2.8E-09	2.7E-09	4.7E-09	2.1E-09
E	2.5E-09	1.9E-09	1.4E-09	3.1E-09	3.0E-09	5.2E-09	2.3E-09
ENE	2.6E-09	2.0E-09	1.4E-09	3.2E-09	3.1E-09	5.5E-09	2.3E-09
NE	2.4E-09	1.8E-09	1.3E-09	3.0E-09	2.8E-09	5.1E-09	2.1E-09
NNE	1.6E-09	1.2E-09	8.9E-10	2.0E-09	1.9E-09	3.5E-09	1.4E-09

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)		
Direction	1320	1063	1594 EPA-11
N	7.8E-10	1.1E-09	5.7E-10
NNW	5.6E-10	8.0E-10	4.2E-10
NW	5.3E-10	7.5E-10	3.9E-10
WNW	6.8E-10	9.5E-10	5.0E-10
W	1.1E-09	1.5E-09	7.9E-10
WSW	1.1E-09	1.6E-09	8.3E-10
SW	6.1E-10	8.6E-10	4.5E-10
SSW	5.5E-10	7.7E-10	4.0E-10
S	5.4E-10	7.7E-10	4.0E-10
SSE	9.5E-10	1.4E-09	7.0E-10
SE	1.6E-09	2.2E-09	1.2E-09
ESE	2.0E-09	2.8E-09	1.4E-09
E	2.2E-09	3.1E-09	1.6E-09
ENE	2.2E-09	3.2E-09	1.6E-09
NE	2.1E-09	2.9E-09	1.5E-09
NNE	1.4E-09	2.0E-09	1.0E-09

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
May 27, 2003 1:20 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P. O. BOX 538704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent (mrem/year)
2.75E-03

MAXIMUM POTENTIAL IMPACT AT THE SITE BOUNDARY IS 1.9 E-03 MREM/YR AT LOCATION 1058 METERS ENE

At This Location: 770 Meters Northeast

Source Category: STACK
Source Type: Stack
Emission Year: 2003

Comments: OFFSITE EDE FOR RADIONUCLIDE EMISSIONS FROM THE BUILDING 68 - LABORATORY HOOD

Dataset Name: BLDG68-LABHOOD
Dataset Date: May 27, 2003 1:20 pm
Wind File: WNDFILES\5YRCAP88.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 770 Meters Northeast
Lifetime Fatal Cancer Risk: 3.50E-08

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	1.09E-05
BREAST	1.01E-05
R MAR	3.91E-04
LUNGS	2.07E-02
THYROID	1.16E-05
ENDOST	5.14E-03
RMNDR	2.27E-04
EFFEC	2.75E-03

RADIONUCLIDE EMISSIONS DURING THE YEAR 2003

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
U-234	Y	1.00	4.6E-06	4.6E-06
U-235	Y	1.00	2.4E-07	2.4E-07
U-238	Y	1.00	5.1E-06	5.1E-06
RA-226	W	1.00	3.3E-09	3.3E-09
TH-228	Y	1.00	1.4E-07	1.4E-07
TH-230	Y	1.00	4.1E-07	4.1E-07
TH-232	Y	1.00	2.2E-08	2.2E-08
U-236	Y	1.00	1.8E-07	1.8E-07
SR-90	D	1.00	2.7E-08	2.7E-08
TC-99	W	1.00	5.7E-07	5.7E-07
RU-106	Y	1.00	1.1E-07	1.1E-07
CS-137	D	1.00	7.9E-08	7.9E-08
BA-137M	D	1.00	7.9E-08	7.9E-08
RA-228	W	1.00	1.3E-08	1.3E-08
TH-234	Y	1.00	2.0E-05	2.0E-05
PA-234M	Y	1.00	2.0E-05	2.0E-05
NP-237	W	1.00	1.6E-09	1.6E-09
PU-238	Y	1.00	2.0E-09	2.0E-09
PU-239	Y	1.00	1.3E-08	1.3E-08
PU-240	Y	1.00	3.3E-09	3.3E-09
PU-241	Y	1.00	4.8E-08	4.8E-08
PU-242	Y	1.00	7.1E-13	7.1E-13

SITE INFORMATION

Temperature: 10 degrees C
Precipitation: 100 cm/y
Mixing Height: 1000 m

SOURCE INFORMATION

Source Number:	1
Stack Height (m):	8.50
Diameter (m):	0.25
Plume Rise Momentum (m/s): (Exit Velocity)	1.86E+01

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

1804	1058	1221	805	787	1625	1423	1213	1419	1723
1059	1087	770	1288	1320	1063	1594 (EPA-11C)			

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
May 27, 2003 1:20 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P. O. BOX 538704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: STACK
Source Type: Stack
Emission Year: 2003

Comments: OFFSITE EDE FOR RADIONUCLIDE EMISSIONS
FROM THE BUILDING 68 - LABORATORY HOOD

Dataset Name: BLDG68-LABHOOD
Dataset Date: May 27, 2003 1:20 pm
Wind File: WNDFILES\5YRCAP88.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	1.09E-05
BREAST	1.01E-05
R MAR	3.91E-04
LUNGS	2.07E-02
THYROID	1.16E-05
ENDOST	5.14E-03
RMNDR	2.27E-04
EFFEC	2.75E-03

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	1.58E-04
INHALATION	2.60E-03
AIR IMMERSION	2.35E-10
GROUND SURFACE	1.63E-06
INTERNAL	2.75E-03
EXTERNAL	1.64E-06
TOTAL	2.76E-03

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	1.19E-03
U-235	5.88E-05
U-238	1.17E-03
RA-226	1.17E-07
TH-228	6.58E-05
TH-230	1.92E-04
TH-232	1.48E-05
U-236	4.40E-05
SR-90	1.86E-07
TC-99	7.31E-07
RU-106	1.39E-07
CS-137	1.72E-07
BA-137M	8.21E-12
RA-228	1.85E-07
TH-234	3.07E-06
PA-234M	2.07E-11
NP-237	1.54E-06
PU-238	1.27E-06
PU-239	8.89E-06
PU-240	2.26E-06
PU-241	5.13E-07
PU-242	4.62E-10
TOTAL	2.76E-03

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	3.83E-10
BONE	2.51E-10
THYROID	3.35E-12
BREAST	2.25E-11
LUNG	3.37E-08
STOMACH	3.52E-11
BOWEL	3.99E-11
LIVER	4.21E-11
PANCREAS	9.06E-12
URINARY	4.52E-10
OTHER	1.11E-11
TOTAL	3.50E-08

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	8.67E-10
INHALATION	3.41E-08
AIR IMMERSION	5.28E-15
GROUND SURFACE	3.76E-11
INTERNAL	3.49E-08
EXTERNAL	3.76E-11
TOTAL	3.50E-08

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	1.52E-08
U-235	7.71E-10
U-238	1.52E-08
RA-226	1.53E-12
TH-228	1.32E-09
TH-230	1.58E-09
TH-232	8.33E-11
U-236	5.65E-10
SR-90	3.14E-12
TC-99	2.68E-11
RU-106	6.44E-12
CS-137	4.50E-12
BA-137M	1.97E-16
RA-228	1.88E-12
TH-234	9.64E-11
PA-234M	5.27E-16
NP-237	7.79E-12
PU-238	1.08E-11
PU-239	6.96E-11
PU-240	1.77E-11
PU-241	1.96E-12
PU-242	3.61E-15
TOTAL	3.50E-08

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

Direction	Distance (m) 1804	1058	1221	805	787	1625	1423
N	3.5E-04	7.1E-04	5.9E-04	1.0E-03	1.0E-03	4.0E-04	4.8E-04
NNW	2.5E-04	5.0E-04	4.2E-04	6.9E-04	7.1E-04	2.9E-04	3.5E-04
NW	2.4E-04	4.6E-04	3.9E-04	6.1E-04	6.3E-04	2.7E-04	3.2E-04
WNW	2.9E-04	5.5E-04	4.7E-04	7.0E-04	7.1E-04	3.3E-04	3.9E-04
W	4.6E-04	9.0E-04	7.6E-04	1.2E-03	1.2E-03	5.3E-04	6.3E-04
WSW	5.1E-04	1.1E-03	8.9E-04	1.6E-03	1.6E-03	6.0E-04	7.2E-04
SW	2.7E-04	5.6E-04	4.7E-04	8.0E-04	8.2E-04	3.2E-04	3.8E-04
SSW	2.5E-04	4.9E-04	4.1E-04	6.8E-04	7.0E-04	2.8E-04	3.4E-04
S	2.5E-04	4.9E-04	4.1E-04	6.9E-04	7.1E-04	2.8E-04	3.4E-04
SSE	4.1E-04	8.2E-04	6.9E-04	1.1E-03	1.1E-03	4.7E-04	5.7E-04
SE	6.5E-04	1.2E-03	1.1E-03	1.6E-03	1.6E-03	7.4E-04	8.8E-04
ESE	8.0E-04	1.5E-03	1.3E-03	1.9E-03	1.9E-03	9.2E-04	1.1E-03
E	9.0E-04	1.7E-03	1.5E-03	2.3E-03	2.3E-03	1.0E-03	1.2E-03
ENE	9.5E-04	1.9E-03	1.6E-03	2.6E-03	2.6E-03	1.1E-03	1.3E-03
NE	8.9E-04	1.9E-03	1.5E-03	2.6E-03	2.7E-03	1.0E-03	1.3E-03
NNE	6.1E-04	1.3E-03	1.1E-03	1.9E-03	1.9E-03	7.2E-04	8.7E-04

Direction	Distance (m) 1213	1419	1723	1059	1087	770	1288
N	6.0E-04	4.9E-04	3.7E-04	7.1E-04	6.9E-04	1.1E-03	5.5E-04
NNW	4.3E-04	3.5E-04	2.7E-04	5.0E-04	4.9E-04	7.3E-04	3.9E-04
NW	3.9E-04	3.2E-04	2.5E-04	4.6E-04	4.5E-04	6.4E-04	3.6E-04
WNW	4.7E-04	3.9E-04	3.1E-04	5.4E-04	5.3E-04	7.2E-04	4.4E-04
W	7.7E-04	6.3E-04	4.9E-04	9.0E-04	8.8E-04	1.2E-03	7.1E-04
WSW	9.0E-04	7.2E-04	5.5E-04	1.1E-03	1.0E-03	1.7E-03	8.3E-04
SW	4.7E-04	3.8E-04	2.9E-04	5.6E-04	5.4E-04	8.4E-04	4.3E-04
SSW	4.1E-04	3.4E-04	2.6E-04	4.9E-04	4.8E-04	7.2E-04	3.8E-04
S	4.2E-04	3.4E-04	2.6E-04	4.9E-04	4.8E-04	7.2E-04	3.8E-04
SSE	6.9E-04	5.7E-04	4.4E-04	8.1E-04	7.9E-04	1.1E-03	6.4E-04
SE	1.1E-03	8.8E-04	6.9E-04	1.2E-03	1.2E-03	1.6E-03	9.9E-04
ESE	1.3E-03	1.1E-03	8.5E-04	1.5E-03	1.5E-03	2.0E-03	1.2E-03
E	1.5E-03	1.2E-03	9.6E-04	1.7E-03	1.7E-03	2.3E-03	1.4E-03
ENE	1.6E-03	1.3E-03	1.0E-03	1.9E-03	1.9E-03	2.7E-03	1.5E-03
NE	1.6E-03	1.3E-03	9.6E-04	1.9E-03	1.8E-03	2.8E-03	1.4E-03
NNE	1.1E-03	8.7E-04	6.6E-04	1.3E-03	1.3E-03	2.0E-03	1.0E-03

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

Direction	Distance (m) 1320	1063	1594 EPA -11
N	5.4E-04	7.1E-04	4.1E-04
NNW	3.8E-04	5.0E-04	3.0E-04
NW	3.5E-04	4.6E-04	2.8E-04
WNW	4.3E-04	5.4E-04	3.4E-04
W	6.9E-04	9.0E-04	5.4E-04
WSW	8.0E-04	1.1E-03	6.1E-04
SW	4.2E-04	5.6E-04	3.2E-04
SSW	3.7E-04	4.9E-04	2.9E-04
S	3.7E-04	4.9E-04	2.9E-04
SSE	6.2E-04	8.1E-04	4.9E-04
SE	9.6E-04	1.2E-03	7.6E-04
ESE	1.2E-03	1.5E-03	9.5E-04
E	1.4E-03	1.7E-03	1.1E-03
ENE	1.5E-03	1.9E-03	1.1E-03
NE	1.4E-03	1.9E-03	1.1E-03
NNE	9.6E-04	1.3E-03	7.4E-04

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

Direction	Distance (m) 1804	1058	1221	805	787	1625	1423
N	4.3E-09	9.0E-09	7.4E-09	1.3E-08	1.3E-08	5.0E-09	6.0E-09
NNW	3.1E-09	6.3E-09	5.2E-09	8.7E-09	8.9E-09	3.6E-09	4.3E-09
NW	2.9E-09	5.7E-09	4.8E-09	7.7E-09	7.8E-09	3.3E-09	3.9E-09
WNW	3.5E-09	6.8E-09	5.8E-09	8.7E-09	8.9E-09	4.1E-09	4.8E-09
W	5.7E-09	1.1E-08	9.6E-09	1.5E-08	1.5E-08	6.6E-09	7.9E-09
WSW	6.3E-09	1.4E-08	1.1E-08	2.0E-08	2.0E-08	7.4E-09	9.0E-09
SW	3.3E-09	7.0E-09	5.8E-09	1.0E-08	1.0E-08	3.9E-09	4.7E-09
SSW	3.0E-09	6.1E-09	5.1E-09	8.5E-09	8.8E-09	3.4E-09	4.1E-09
S	3.0E-09	6.1E-09	5.1E-09	8.6E-09	8.8E-09	3.4E-09	4.1E-09
SSE	5.1E-09	1.0E-08	8.6E-09	1.4E-08	1.4E-08	5.9E-09	7.0E-09
SE	8.1E-09	1.6E-08	1.3E-08	2.0E-08	2.0E-08	9.3E-09	1.1E-08
ESE	1.0E-08	1.9E-08	1.6E-08	2.4E-08	2.5E-08	1.2E-08	1.4E-08
E	1.1E-08	2.2E-08	1.9E-08	2.9E-08	2.9E-08	1.3E-08	1.6E-08
ENE	1.2E-08	2.4E-08	2.0E-08	3.3E-08	3.3E-08	1.4E-08	1.7E-08
NE	1.1E-08	2.4E-08	2.0E-08	3.3E-08	3.4E-08	1.3E-08	1.6E-08
NNE	7.7E-09	1.6E-08	1.4E-08	2.4E-08	2.4E-08	9.0E-09	1.1E-08

Direction	Distance (m) 1213	1419	1723	1059	1087	770	1288
N	7.5E-09	6.0E-09	4.6E-09	8.9E-09	8.6E-09	1.3E-08	6.9E-09
NNW	5.3E-09	4.3E-09	3.3E-09	6.3E-09	6.1E-09	9.1E-09	4.9E-09
NW	4.8E-09	4.0E-09	3.0E-09	5.7E-09	5.5E-09	8.0E-09	4.5E-09
WNW	5.8E-09	4.8E-09	3.8E-09	6.8E-09	6.6E-09	9.1E-09	5.4E-09
W	9.6E-09	7.9E-09	6.1E-09	1.1E-08	1.1E-08	1.6E-08	8.9E-09
WSW	1.1E-08	9.1E-09	6.8E-09	1.4E-08	1.3E-08	2.1E-08	1.0E-08
SW	5.8E-09	4.7E-09	3.6E-09	7.0E-09	6.8E-09	1.1E-08	5.4E-09
SSW	5.1E-09	4.2E-09	3.2E-09	6.1E-09	5.9E-09	9.0E-09	4.7E-09
S	5.1E-09	4.2E-09	3.2E-09	6.1E-09	5.9E-09	9.1E-09	4.7E-09
SSE	8.7E-09	7.1E-09	5.4E-09	1.0E-08	9.9E-09	1.4E-08	8.0E-09
SE	1.3E-08	1.1E-08	8.6E-09	1.6E-08	1.5E-08	2.0E-08	1.2E-08
ESE	1.7E-08	1.4E-08	1.1E-08	1.9E-08	1.9E-08	2.5E-08	1.5E-08
E	1.9E-08	1.6E-08	1.2E-08	2.2E-08	2.1E-08	3.0E-08	1.8E-08
ENE	2.0E-08	1.7E-08	1.3E-08	2.4E-08	2.3E-08	3.4E-08	1.9E-08
NE	2.0E-08	1.6E-08	1.2E-08	2.4E-08	2.3E-08	3.5E-08	1.8E-08
NNE	1.4E-08	1.1E-08	8.2E-09	1.6E-08	1.6E-08	2.5E-08	1.3E-08

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)		
Direction	1320	1063	1594
N	6.7E-09	8.9E-09	5.1E-09
NNW	4.7E-09	6.2E-09	3.7E-09
NW	4.3E-09	5.7E-09	3.4E-09
WNW	5.3E-09	6.8E-09	4.2E-09
W	8.7E-09	1.1E-08	6.8E-09
WSW	1.0E-08	1.4E-08	7.6E-09
SW	5.2E-09	7.0E-09	4.0E-09
SSW	4.6E-09	6.1E-09	3.5E-09
S	4.6E-09	6.1E-09	3.5E-09
SSE	7.8E-09	1.0E-08	6.0E-09
SE	1.2E-08	1.5E-08	9.6E-09
ESE	1.5E-08	1.9E-08	1.2E-08
E	1.7E-08	2.2E-08	1.3E-08
ENE	1.8E-08	2.4E-08	1.4E-08
NE	1.8E-08	2.3E-08	1.3E-08
NNE	1.2E-08	1.6E-08	9.2E-09

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
May 27, 2003 3:38 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P. O. BOX 538704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Effective Dose Equivalent (mrem/year)	
2.75E-04	MAXIMUM POTENTIAL IMPACT AT THE SITE BOUNDARY IS 1.9 E-04 MREM/YR AT LOCATION 1058 METERS ENE

At This Location: 770 Meters Northeast

Source Category: STACK
Source Type: Stack
Emission Year: 2003

Comments: OFFSITE EDE FOR RADIONUCLIDE EMISSIONS
FROM THE BUILDING 68-LAB HOOD- APPL. FOR APPROVAL

Dataset Name: BLDG68-HOOD-APPL
Dataset Date: May 27, 2003 3:33 pm
Wind File: WNDFILES\5YRCAP88.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 770 Meters Northeast
Lifetime Fatal Cancer Risk: 3.50E-09

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	1.09E-06
BREAST	1.01E-06
R MAR	3.91E-05
LUNGS	2.07E-03
THYROID	1.16E-06
ENDOST	5.14E-04
RMNDR	2.27E-05
EFFEC	2.75E-04

RADIONUCLIDE EMISSIONS DURING THE YEAR 2003

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
U-234	Y	1.00	4.6E-07	4.6E-07
U-235	Y	1.00	2.4E-08	2.4E-08
U-238	Y	1.00	5.1E-07	5.1E-07
RA-226	W	1.00	3.3E-10	3.3E-10
TH-228	Y	1.00	1.4E-08	1.4E-08
TH-230	Y	1.00	4.1E-08	4.1E-08
TH-232	Y	1.00	2.2E-09	2.2E-09
U-236	Y	1.00	1.8E-08	1.8E-08
SR-90	D	1.00	2.7E-09	2.7E-09
TC-99	W	1.00	5.7E-08	5.7E-08
RU-106	Y	1.00	1.1E-08	1.1E-08
CS-137	D	1.00	7.9E-09	7.9E-09
BA-137M	D	1.00	7.9E-09	7.9E-09
RA-228	W	1.00	1.3E-09	1.3E-09
TH-234	Y	1.00	2.0E-06	2.0E-06
PA-234M	Y	1.00	2.0E-06	2.0E-06
NP-237	W	1.00	1.6E-10	1.6E-10
PU-238	Y	1.00	2.0E-10	2.0E-10
PU-239	Y	1.00	1.3E-09	1.3E-09
PU-240	Y	1.00	3.3E-10	3.3E-10
PU-241	Y	1.00	4.8E-09	4.8E-09
PU-242	Y	1.00	7.1E-14	7.1E-14

SITE INFORMATION

Temperature: 10 degrees C
Precipitation: 100 cm/y
Mixing Height: 1000 m

SOURCE INFORMATION

Source Number:	1
Stack Height (m):	8.50
Diameter (m):	0.25
Plume Rise Momentum (m/s): (Exit Velocity)	1.86E+01

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

1804	1058	1221	805	787	1625	1423	1213	1419	1723
1059	1087	770	1288	1320	1063	1594(EPA-11)			

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
May 27. 2003 3:38 pm

Facility: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Address: P. O. BOX 538704
7400 WILLEY ROAD
City: CINCINNATI
State: OH Zip: 45253-8704

Source Category: STACK
Source Type: Stack
Emission Year: 2003

Comments: OFFSITE EDE FOR RADIONUCLIDE EMISSIONS
FROM THE BUILDING 68-LAB HOOD- APPL. FOR APPROVAL

Dataset Name: BLDG68-HOOD-APPL
Dataset Date: May 27. 2003 3:33 pm
Wind File: WNDFILES\5YRCAP88.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	1.09E-06
BREAST	1.01E-06
R MAR	3.91E-05
LUNGS	2.07E-03
THYROID	1.16E-06
ENDOST	5.14E-04
RMNDR	2.27E-05
EFFEC	2.75E-04

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	1.58E-05
INHALATION	2.60E-04
AIR IMMERSION	2.35E-11
GROUND SURFACE	1.63E-07
INTERNAL	2.75E-04
EXTERNAL	1.64E-07
TOTAL	2.76E-04

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-234	1.19E-04
U-235	5.88E-06
U-238	1.17E-04
RA-226	1.17E-08
TH-228	6.58E-06
TH-230	1.92E-05
TH-232	1.48E-06
U-236	4.40E-06
SR-90	1.86E-08
TC-99	7.31E-08
RU-106	1.39E-08
CS-137	1.72E-08
BA-137M	8.21E-13
RA-228	1.85E-08
TH-234	3.07E-07
PA-234M	2.07E-12
NP-237	1.54E-07
PU-238	1.27E-07
PU-239	8.89E-07
PU-240	2.26E-07
PU-241	5.13E-08
PU-242	4.62E-11
TOTAL	2.76E-04

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	3.83E-11
BONE	2.51E-11
THYROID	3.35E-13
BREAST	2.25E-12
LUNG	3.37E-09
STOMACH	3.52E-12
BOWEL	3.99E-12
LIVER	4.21E-12
PANCREAS	9.06E-13
URINARY	4.52E-11
OTHER	1.11E-12
TOTAL	3.50E-09

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	8.67E-11
INHALATION	3.41E-09
AIR IMMERSION	5.28E-16
GROUND SURFACE	3.76E-12
INTERNAL	3.49E-09
EXTERNAL	3.76E-12
TOTAL	3.50E-09

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-234	1.52E-09
U-235	7.71E-11
U-238	1.52E-09
RA-226	1.53E-13
TH-228	1.32E-10
TH-230	1.58E-10
TH-232	8.33E-12
U-236	5.65E-11
SR-90	3.14E-13
TC-99	2.68E-12
RU-106	6.44E-13
CS-137	4.50E-13
BA-137M	1.97E-17
RA-228	1.88E-13
TH-234	9.64E-12
PA-234M	5.27E-17
NP-237	7.79E-13
PU-238	1.08E-12
PU-239	6.96E-12
PU-240	1.77E-12
PU-241	1.96E-13
PU-242	3.61E-16
TOTAL	3.50E-09

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

Direction	Distance (m) 1804	1058	1221	805	787	1625	1423
N	3.5E-05	7.1E-05	5.9E-05	1.0E-04	1.0E-04	4.0E-05	4.8E-05
NNW	2.5E-05	5.0E-05	4.2E-05	6.9E-05	7.1E-05	2.9E-05	3.5E-05
NW	2.4E-05	4.6E-05	3.9E-05	6.1E-05	6.3E-05	2.7E-05	3.2E-05
WNW	2.9E-05	5.5E-05	4.7E-05	7.0E-05	7.1E-05	3.3E-05	3.9E-05
W	4.6E-05	9.0E-05	7.6E-05	1.2E-04	1.2E-04	5.3E-05	6.3E-05
WSW	5.1E-05	1.1E-04	8.9E-05	1.6E-04	1.6E-04	6.0E-05	7.2E-05
SW	2.7E-05	5.6E-05	4.7E-05	8.0E-05	8.2E-05	3.2E-05	3.8E-05
SSW	2.5E-05	4.9E-05	4.1E-05	6.8E-05	7.0E-05	2.8E-05	3.4E-05
S	2.5E-05	4.9E-05	4.1E-05	6.9E-05	7.1E-05	2.8E-05	3.4E-05
SSE	4.1E-05	8.2E-05	6.9E-05	1.1E-04	1.1E-04	4.7E-05	5.7E-05
SE	6.5E-05	1.2E-04	1.1E-04	1.6E-04	1.6E-04	7.4E-05	8.8E-05
ESE	8.0E-05	1.5E-04	1.3E-04	1.9E-04	1.9E-04	9.2E-05	1.1E-04
E	9.0E-05	1.7E-04	1.5E-04	2.3E-04	2.3E-04	1.0E-04	1.2E-04
ENE	9.5E-05	1.9E-04	1.6E-04	2.6E-04	2.6E-04	1.1E-04	1.3E-04
NE	8.9E-05	1.9E-04	1.5E-04	2.6E-04	2.7E-04	1.0E-04	1.3E-04
NNE	6.1E-05	1.3E-04	1.1E-04	1.9E-04	1.9E-04	7.2E-05	8.7E-05

Direction	Distance (m) 1213	1419	1723	1059	1087	770	1288
N	6.0E-05	4.9E-05	3.7E-05	7.1E-05	6.9E-05	1.1E-04	5.5E-05
NNW	4.3E-05	3.5E-05	2.7E-05	5.0E-05	4.9E-05	7.3E-05	3.9E-05
NW	3.9E-05	3.2E-05	2.5E-05	4.6E-05	4.5E-05	6.4E-05	3.6E-05
WNW	4.7E-05	3.9E-05	3.1E-05	5.4E-05	5.3E-05	7.2E-05	4.4E-05
W	7.7E-05	6.3E-05	4.9E-05	9.0E-05	8.8E-05	1.2E-04	7.1E-05
WSW	9.0E-05	7.2E-05	5.5E-05	1.1E-04	1.0E-04	1.7E-04	8.3E-05
SW	4.7E-05	3.8E-05	2.9E-05	5.6E-05	5.4E-05	8.4E-05	4.3E-05
SSW	4.1E-05	3.4E-05	2.6E-05	4.9E-05	4.8E-05	7.2E-05	3.8E-05
S	4.2E-05	3.4E-05	2.6E-05	4.9E-05	4.8E-05	7.2E-05	3.8E-05
SSE	6.9E-05	5.7E-05	4.4E-05	8.1E-05	7.9E-05	1.1E-04	6.4E-05
SE	1.1E-04	8.8E-05	6.9E-05	1.2E-04	1.2E-04	1.6E-04	9.9E-05
ESE	1.3E-04	1.1E-04	8.5E-05	1.5E-04	1.5E-04	2.0E-04	1.2E-04
E	1.5E-04	1.2E-04	9.6E-05	1.7E-04	1.7E-04	2.3E-04	1.4E-04
ENE	1.6E-04	1.3E-04	1.0E-04	1.9E-04	1.9E-04	2.7E-04	1.5E-04
NE	1.6E-04	1.3E-04	9.6E-05	1.9E-04	1.8E-04	2.8E-04	1.4E-04
NNE	1.1E-04	8.7E-05	6.6E-05	1.3E-04	1.3E-04	2.0E-04	1.0E-04

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)		
Direction	1320	1063	1594 EPA-11
N	5.4E-05	7.1E-05	4.1E-05
NNW	3.8E-05	5.0E-05	3.0E-05
NW	3.5E-05	4.6E-05	2.8E-05
WNW	4.3E-05	5.4E-05	3.4E-05
W	6.9E-05	9.0E-05	5.4E-05
WSW	8.0E-05	1.1E-04	6.1E-05
SW	4.2E-05	5.6E-05	3.2E-05
SSW	3.7E-05	4.9E-05	2.9E-05
S	3.7E-05	4.9E-05	2.9E-05
SSE	6.2E-05	8.1E-05	4.9E-05
SE	9.6E-05	1.2E-04	7.6E-05
ESE	1.2E-04	1.5E-04	9.5E-05
E	1.4E-04	1.7E-04	1.1E-04
ENE	1.5E-04	1.9E-04	1.1E-04
NE	1.4E-04	1.9E-04	1.1E-04
NNE	9.6E-05	1.3E-04	7.4E-05

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

Direction	Distance (m) 1804	1058	1221	805	787	1625	1423
N	4.3E-10	9.0E-10	7.4E-10	1.3E-09	1.3E-09	5.0E-10	6.0E-10
NNW	3.1E-10	6.3E-10	5.2E-10	8.7E-10	8.9E-10	3.6E-10	4.3E-10
NW	2.9E-10	5.7E-10	4.8E-10	7.7E-10	7.8E-10	3.3E-10	3.9E-10
WNW	3.5E-10	6.8E-10	5.8E-10	8.7E-10	8.9E-10	4.1E-10	4.8E-10
W	5.7E-10	1.1E-09	9.6E-10	1.5E-09	1.5E-09	6.6E-10	7.9E-10
WSW	6.3E-10	1.4E-09	1.1E-09	2.0E-09	2.0E-09	7.4E-10	9.0E-10
SW	3.3E-10	7.0E-10	5.8E-10	1.0E-09	1.0E-09	3.9E-10	4.7E-10
SSW	3.0E-10	6.1E-10	5.1E-10	8.5E-10	8.8E-10	3.4E-10	4.1E-10
S	3.0E-10	6.1E-10	5.1E-10	8.6E-10	8.8E-10	3.4E-10	4.1E-10
SSE	5.1E-10	1.0E-09	8.6E-10	1.4E-09	1.4E-09	5.9E-10	7.0E-10
SE	8.1E-10	1.6E-09	1.3E-09	2.0E-09	2.0E-09	9.3E-10	1.1E-09
ESE	1.0E-09	1.9E-09	1.6E-09	2.4E-09	2.5E-09	1.2E-09	1.4E-09
E	1.1E-09	2.2E-09	1.9E-09	2.9E-09	2.9E-09	1.3E-09	1.6E-09
ENE	1.2E-09	2.4E-09	2.0E-09	3.3E-09	3.3E-09	1.4E-09	1.7E-09
NE	1.1E-09	2.4E-09	2.0E-09	3.3E-09	3.4E-09	1.3E-09	1.6E-09
NNE	7.7E-10	1.6E-09	1.4E-09	2.4E-09	2.4E-09	9.0E-10	1.1E-09

Direction	Distance (m) 1213	1419	1723	1059	1087	770	1288
N	7.5E-10	6.0E-10	4.6E-10	8.9E-10	8.6E-10	1.3E-09	6.9E-10
NNW	5.3E-10	4.3E-10	3.3E-10	6.3E-10	6.1E-10	9.1E-10	4.9E-10
NW	4.8E-10	4.0E-10	3.0E-10	5.7E-10	5.5E-10	8.0E-10	4.5E-10
WNW	5.8E-10	4.8E-10	3.8E-10	6.8E-10	6.6E-10	9.1E-10	5.4E-10
W	9.6E-10	7.9E-10	6.1E-10	1.1E-09	1.1E-09	1.6E-09	8.9E-10
WSW	1.1E-09	9.1E-10	6.8E-10	1.4E-09	1.3E-09	2.1E-09	1.0E-09
SW	5.8E-10	4.7E-10	3.6E-10	7.0E-10	6.8E-10	1.1E-09	5.4E-10
SSW	5.1E-10	4.2E-10	3.2E-10	6.1E-10	5.9E-10	9.0E-10	4.7E-10
S	5.1E-10	4.2E-10	3.2E-10	6.1E-10	5.9E-10	9.1E-10	4.7E-10
SSE	8.7E-10	7.1E-10	5.4E-10	1.0E-09	9.9E-10	1.4E-09	8.0E-10
SE	1.3E-09	1.1E-09	8.6E-10	1.6E-09	1.5E-09	2.0E-09	1.2E-09
ESE	1.7E-09	1.4E-09	1.1E-09	1.9E-09	1.9E-09	2.5E-09	1.5E-09
E	1.9E-09	1.6E-09	1.2E-09	2.2E-09	2.1E-09	3.0E-09	1.8E-09
ENE	2.0E-09	1.7E-09	1.3E-09	2.4E-09	2.3E-09	3.4E-09	1.9E-09
NE	2.0E-09	1.6E-09	1.2E-09	2.4E-09	2.3E-09	3.5E-09	1.8E-09
NNE	1.4E-09	1.1E-09	8.2E-10	1.6E-09	1.6E-09	2.5E-09	1.3E-09

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)		
Direction	1320	1063	1594
N	6.7E-10	8.9E-10	5.1E-10
NNW	4.7E-10	6.2E-10	3.7E-10
NW	4.3E-10	5.7E-10	3.4E-10
WNW	5.3E-10	6.8E-10	4.2E-10
W	8.7E-10	1.1E-09	6.8E-10
WSW	1.0E-09	1.4E-09	7.6E-10
SW	5.2E-10	7.0E-10	4.0E-10
SSW	4.6E-10	6.1E-10	3.5E-10
S	4.6E-10	6.1E-10	3.5E-10
SSE	7.8E-10	1.0E-09	6.0E-10
SE	1.2E-09	1.5E-09	9.6E-10
ESE	1.5E-09	1.9E-09	1.2E-09
E	1.7E-09	2.2E-09	1.3E-09
ENE	1.8E-09	2.4E-09	1.4E-09
NE	1.8E-09	2.3E-09	1.3E-09
NNE	1.2E-09	1.6E-09	9.2E-10