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ANNUAL RADIONUCLIDE AIR EMISSION REPORT FOR CALENDAR YEAR 1991, NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAP) - USED AS A REFERENCE IN OU 5 FS, APPENDIX H - TITLE DIFFERS SLIGHTLY FROM CITATION IN REFERENCES)

00/00/92

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REPORT

Air Emissions Annual Report
(under Subpart H, 40 CFR 61.94)
Calendar Year 1991

Site Name: Fernald Environmental Management Project, Fernald, Ohio

Operations Office Information:

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Site Information

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SECTION I: FACILITY INFORMATION

A. Site Description

The primary activity of the Feed Materials Production Center (FMPC) was the manufacture of purified uranium-metal products. On July 10, 1989, the FMPC suspended production operations, remaining on standby for certain segments of production. On February 4, 1990, DOE formally announced the termination of uranium production at the FMPC. On August 23, 1991, the site was renamed as the Fernald Environmental Management Project (FEMP) to more closely describe its new mission. Currently, the primary activity of the FEMP is identification and implementation of removal actions and remedial actions under CERCLA. Periodic operations of air emitting sources for non-production purposes has continued.

The FEMP is located in southwestern Ohio, approximately 20 miles northwest of the city of Cincinnati and 2 miles south of Ross, Ohio. The FEMP comprises 1050 acres (425 hectares). The Production area covers approximately 136 acres (55 hectares) in the center of the FEMP. The center of the site is located at Latitude 39°-17'-56" north and Longitude 84°-41'-16" west.

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

Data from the Greater Cincinnati Airport has been used to characterize the climate of the region. The climate is defined as continental, with average temperatures ranging from 29.2°F (-1.56°C) in January, to 75.7°F (24.3°C) in July for the period 1960 through 1989. Average annual precipitation for the period 1960 through 1989 was 40.56 inches (103.0 cm), ranging from 27.99 to 52.76 inches (71 to 134 cm). Based on data from the Cincinnati airport, prevailing wind flow is from the south-southwest.

B. Source Description

Production at the FEMP was historically divided into chemical and metallurgical operations. Chemical operations commenced with dissolving uranium ore concentrates and recycled material in nitric acid to produce a uranyl nitrate (UNH) feed solution. The solution was then purified using a solvent extraction process. Purified UNH solution was concentrated by evaporation and thermally denitrated to uranium trioxide (UO_3). UO_3 was converted to uranium tetrafluoride (UF_4). Metallurgical processing began at this step. UF_4 was reacted with magnesium metal to produce uranium metal, in the form of elemental uranium, derby metal. Metallic scraps from subsequent processing of the uranium metal were combined with derby metal and melted in graphite crucibles. When the proper temperature was achieved, the melt was bottom-poured to pre-heated molds to form ingots varying in size, weight and shape determined by their final intended use. Ingots could be further shaped at the FEMP, or other DOE contractors, with final forms being heat treated and

machined at the FEMP. As discussed above, most of these operations ceased in 1989.

Radioactive materials handled and stored at the FEMP include pitchblende ore residues containing radium stored in the K-65 silos, thorium metal and thorium compounds stored in several locations within the FEMP production area, uranium metal, uranium compounds, contaminated magnesium fluoride (MgF_2), and contaminated metals.

In 1991, active emissions sources included operation of monitored dust collection systems (Plant 2/3 and Laboratory), filtering of waste water sludge (Plant 8), fume hoods in analytical laboratories (Laboratory Building), material decontamination (the Decontamination and Decommissioning Building), radionuclides contained in the drift loss from the Cooling Tower, and fugitive emissions from inactive waste storage pit no. 5.

SECTION II: AIR EMISSIONS DATA

A. Accuracy of Reported Emissions

Through CY-1989, the bulk of air emissions from the FEMP were from either monitored process exhaust stacks or processes for which emission factors had been developed through direct emission testing. Emissions from sources such as fugitive emissions, for which no direct measurements were available, were determined through the best engineering estimates. With the cessation of production activities, emissions from monitored sources have become minimal; emissions from sources such as fugitive emissions now comprise the majority of the reported offsite dose. The assumptions and calculations used in deriving these estimates are documented in the remainder of this report.

FEMP recognizes the inherent imprecision in using engineering estimates, rather than direct measurements, of emission data. In estimating fugitive emissions from the waste pits, for example, a USEPA equation developed for coal storage piles, in another climatological regime, is used as the best available method. Although the applicability of the equation to the FEMP has not been specifically verified, it is presented as a conservative estimate.

As has been done in previous years, the dose derived from measured and estimated emissions as required by 40 CFR Part 61, Subpart H, will be evaluated by comparison with ambient monitoring results as soon as the ambient monitoring results have been received and evaluated. This evaluation will be reported in the Annual Site Environmental Report.

The purpose of the data presented in this report is to demonstrate compliance with the 10 mrem/yr standard for the maximally exposed offsite individual [40 CFR 61.92]. Since conservative estimates were used where direct measurements are not available, any imprecision in the data is expected to result in over-estimation of the dose. The data presented in this report, therefore, succeeds in demonstrating compliance with the standard.

B. CY-1991 FEMP Uranium Air Emissions

An inventory of uranium air emissions from the FEMP was developed for CY-1991. The uranium emissions and the sources of those emissions for CY-1991 are listed in Table 1A, with a comparative listing of sources previously reported provided in Table 1B. Uranium was the primary radionuclide emission (in kilograms per year) to the air from the FEMP during the time it was actively operating. This has not changed since operations ceased. The emission inventory includes emissions from monitored stacks, unmonitored stacks, building ventilation ducts, laboratory fume hoods, and fugitive dust from the FEMP's waste pits. The methods utilized for estimating air emissions from the FEMP are generally consistent with the methods used to develop emissions for "Addendum to FMPC-2082, History of FMPC Radionuclide Discharges", March 1989. The methodology developed for the Addendum to FMPC-2082 is the summation of losses from monitored stacks, unmonitored stacks, building vents, fugitive sources, and specific non-routine emissions.

After a review of the logs regarding accidents and other non-routine events occurring at the FEMP during CY-1991, it was determined that no significant uncontrolled releases of materials regulated by Subpart H occurred from such activities in CY-1991.

A total of 0.29 kilograms (kg) of uranium were estimated to be emitted to the air from the FEMP during CY-1991. This may be compared to estimated emissions to the air of 3.2 kg in CY-1990, 30.1 kg in CY-1989, and 107.8 kg for CY-1988. The largest source of uranium emissions in CY-1991 was the estimated fugitive aerosol emissions from the water cooling tower. The water cooling tower also provided the largest contribution to uranium emissions in CY-1990. An additional discussion of uranium emission estimation methods is provided below.

1. Monitored Stack Emissions

Included in the CY-1991 inventory are 2 stacks, similar to the number included for CY-1990. This compares with 33 stacks in the CY-1989 inventory. The decreased number is directly attributable to the cessation of production at the FEMP in 1989. Collectively, these sources accounted for approximately 1.8% (5.3×10^{-3} kg) of the uranium losses for CY-1991. This compares to accounting for 0.08% (0.8 kg) for CY-1990 and 2.6% (0.8 kg) of the uranium losses calculated for CY-89.

Monitored stacks are equipped with either single point continuous isokinetic samplers (SPCIS) or multiple point continuous isokinetic samplers (MPCIS). These samplers consist of a pleated paper filter in a cup-shaped holder. A portion of the discharge process stream is drawn through the filter, leaving particulate on the filter. At scheduled intervals, the filter elements are collected and destructively analyzed for uranium. Emissions of uranium from the monitored emission point are then estimated by a formula that considers the stack volumetric flow rate, the flow rate of the sampler, and the amount of uranium captured on the filter.

On March 30, 1991, a routine maintenance inspection in Plant 2/3 discovered

the induction fan for Dust Collector G1-856 (Stack No. EP2-012) operating; no processing was occurring at that time. The fan was shut off and the filter was removed from the stack sampler to assay for radionuclides. The fan unit's controls were locked out to prevent a recurrence. The monitor on this stack is a MPCIS, which pulls a sample through several orifices on a single probe in the stack to the sample collection filter paper.

On November 27th, 1991, a broken probe alarm sounded. The probe was located downstream of the HEPA control system installed as part of the Analytical Laboratory upgrade, prior to stack no. EP15-001. Investigation found that the probe was broken, the fan operating, and no filter in the sampler. A filter was installed in the collector and the fan was allowed to run for 5 days, until December 2, 1991. At that time, the fan was shut down and the filter analyzed. It was uncertain how long the fan had been operating. Laboratory personnel had taken control of the area around October 21, 1991. It is thought that the fan was started as a test by the installing contractor just prior to turning the area over to FEMP personnel, on or about October 21, 1991. Following the test, the system was operated normally, until the alarm sounded. To develop a more representative estimate of emissions to cover the possible period when the induction fan was operating, the calculated emissions for the 5 days when monitoring occurred was multiplied by the ratio of the number of days that passed from when the fan was tested until it was shut down divided by 5 [the number of days the fan operated with a sample filter in place].

2. Unmonitored Stack Emissions (Ungrouped Stacks)

Unmonitored, ungrouped stacks accounted for approximately 72.7% (0.21 kg) of the uranium losses calculated for CY-1991. This is compared to accounting for 54.9% (1.8 kg) in CY-1990 and 11% (3.3 kg) of the uranium losses calculated for CY-89. This group covers 4 sources which were operated in CY-1991, compared to 4 sources operated in CY-1990 and 15 sources reported for CY-1989. Again, this decrease is directly attributable to the cessation of production. The estimates of emissions were derived by either engineering calculations or engineering calculations utilizing the results of actual stack emission measurements conducted while the FEMP was still in production. Examples of these calculations are provided in the Attachments.

These sources are not monitored for one of two basic reasons. First, the dose estimated due to radionuclides emitted from the stack is estimated to be less than 0.1 mrem, or 1% of the standard. Such stacks are not required to be monitored, per 40 CFR 61.93(b)(4)(i). This is the primary reason for not having a continuous monitor installed. Secondly, the nature of the effluent stream from the stack may be such that no monitoring procedure has been developed for the stack. An example would be a stack equipped with a scrubber unit. The moisture content in the effluent air would generally be such as to wet the sample filter and thus reduce the air flow in the sampling system.

Two sources were operated in Plant 8. They are the East Eimco Filter and the East Oliver Filter. Emissions from these filters are estimated from the number of gallons of water treated, multiplied by the average concentration of uranium in the filtrate and a correction factor for the volume of water

exiting the stack.

Emissions from the Decontamination and Decommissioning Building (Building No. 69), are based on the number of decontamination batches processed in the acid baths multiplied by an emission factor. The factor was established using data from an EPA Method 5 Stack test.

The final source contributor to this group is the Cooling Tower. Various processes at the FEMP used and recycled cooling water to the tower. This led to contamination of the recirculating water and the piping system. On returning to the tower, the water stream cascades down the tower fill. Contact with the air transfers the heat to the air. At the same time, some of the water is removed in the form of mist. Uranium is assumed to only be emitted in this mist, in the same concentration it is found in the water stream. Based on the estimated flow through the tower, the concentration of uranium in the recycle stream, and the drift loss factor for this design of cooling tower, the emission loss may be estimated for any given operating period. For CY-91, the estimated losses from the cooling tower were the largest single contributor to the overall uranium losses to the atmosphere (55.6% or 0.16 kg U).

3. Unmonitored Uranium Emissions from Laboratory Fume Hoods (Grouped Stacks)

Unmonitored emissions from the FEMP Analytical Laboratory Building constituted 0.93% (2.7×10^{-3} kg) of the total estimated emission inventory for uranium for CY-1991. This compares to 0.08% (2.7×10^{-3} kg) for CY-1990 and 6.3% (1.9 kg) of calculated uranium losses in CY-1989. Previously, laboratory emissions were assumed equal to the annual uranium emissions estimate developed for the report "Addendum to FMPC-2082; History of FMPC Radionuclide Discharges", March, 1989, which provided a value of 1.9 kilograms of uranium per year.

Laboratory operations changed significantly with the cessation of production in 1989. With that change, laboratory analyses became less involved with pure metal analysis and more involved with waste products analysis. These materials would be expected to have a lower concentration of uranium and other radionuclides in each sample. Additionally, with the cessation in production, fewer analyses were being conducted in the laboratory.

Laboratory personnel estimated that maximal emissions at each operating laboratory hood was 0.1 gram per year. At the same time, on-going renovations in the Laboratory building meant that fewer hoods were in operation. In CY-1991, lab personnel reported operating 27 hoods which vented through individual, unmonitored stacks. This resulted in the estimated emission rate of 2.7 grams of uranium from the unmonitored laboratory hoods in CY-1991. These emissions were summed together and were modeled as a single stack, having the source parameters of an "average" fume hood stack.

4. Uranium Fugitive Emissions from Waste Pits

Fugitive dust due to wind erosion of the exposed material in Waste Pit no. 5 was calculated to contribute 24.1% (0.07 kg) of the uranium losses for CY-1991 (A removal action conducted under CERCLA in late 1990 placed all the material in Pit No. 6 under water). This compares to accounting for approximately 44.9% (1.46 kg) for CY-1990 and 64.7% (19.47 kg) of the uranium losses in CY-1989, with Waste Pit no. 6 providing 96.6% (18.8 kg) of the calculated uranium losses for that year.

Computations to develop an emission estimate were performed in accordance with the method provided by the USEPA in "Method for Estimating Fugitive Particulate Emissions from Hazardous Waste Sites", U. S. Environmental Protection Agency, Cincinnati, Ohio, August 1987; EPA/600/2-87/066, NTIS no. PB87-232203. Although this method was developed for determining fugitive dust losses in and around storage piles, it was adapted for use in calculating losses from the waste storage pits. Basically, the expected losses are equal to the exposed acreage multiplied by the number of days in storage times the uranium mass concentration times a factor. The factor is based on the silt content of the material, the number of "dry" days during the time period, and the fraction of the time when wind speed exceeds 12 miles per hour.

Fugitive dust emissions from a given area can be considered to result from the following activities:

- Load-in of material into the area;
- Wind erosion of the stored materials;
- Vehicle movement in the area; and
- Load-out of materials from the area.

In calculating the fugitive dust emissions from the FEMP Waste Pits, only the second category listed above was judged to contribute significantly to the overall generation of fugitive dust during CY-1991. Waste pits 1, 2, 3, and 4 were covered prior to CY-1991 and no emissions occurred from these pits. There was no load-in or load-out of material to pits in 1991; and vehicular traffic in the actual area of the pits is minimal; so these terms were considered not applicable.

The basic methodology used in estimating the masses of contaminants (uranium) which potentially left the waste pits in CY-1991 was to first develop a factor for the wind erosion for each pit. Using this factor, the overall mass of particulate matter that could become airborne was estimated. Finally, the average weight fraction of the uranium in the pits was applied to the overall mass of particulate emissions to estimate the mass of uranium potentially leaving the waste pits.

C. CY-1991 FEMP Radionuclide Air Emissions

1. Radionuclide Emissions Estimation Method

Radionuclide release rates were calculated using radionuclide emission factors

per total mass of uranium released. Radionuclide emission factors were determined according to the following hierarchy:

1. Actual measurements during the most recent year available (1989).

2. Weighted average emission factors based on data in FMPC-2082, "History of FMPC Radionuclide Discharges", May, 1987; and/or

3. Assumption based on knowledge of processes, age of materials, and equilibrium, as appropriate.

The best available emission factors were then multiplied by the uranium emission rates to arrive at the radionuclide emission rates (Table 2).

2. Radionuclide Emission Estimates - Monitored Stacks, Unmonitored Stacks, Building Vents, and Laboratory.

Radionuclide emission factors in microcuries per kilogram of uranium (μCi/kg U) were developed from composite samples of filter analysis solutions for uranium from the FEMP monitored stacks. In both 1990 and 1991, there was insufficient operation of processes emitting through monitored stacks to generate a composite sample from the collecting filters; the factors developed for 1989 were therefore used. The μCi/kg U emission factors are shown in Table 2 along with the basis for development of the factors. These factors represented a weighted average emission rate of radionuclides from all the monitored stacks at the FEMP, and are considered the best available for estimating off-site dose due to emissions from all the above-cited sources.

3. Radionuclide Emission Estimates - Waste Pits.

Radionuclide emission factors in microcuries per kilogram of uranium (μCi/kg U) were developed based on analysis of core samples of the Waste Pits taken for a Characterization Investigation Study of the Waste Pit area, on historical records relating to the waste pits, on equilibrium or other appropriate references. The μCi/kg U emission factors are shown in Table 2 along with the basis for development of the factors. These factors are considered the best available emission factors for estimation of radionuclide emissions from the Waste Pits.

SECTION III: DOSE ASSESSMENT

A. Description of Dose Model

The radionuclide dose calculations were performed using the CAP-88 package of computer codes. This package contains EPA's most recent version of the AIRDOS-EPA computer code, which implements a steady-state, Gaussian plume, atmospheric dispersion model to calculate environmental concentrations of released radionuclides and U. S. Nuclear Regulatory Commission Regulatory Guide 1.109 (Revision 1, dated 10/77 is the most current version) foodchain

models to calculate human exposures, both internal and external, to radionuclides deposited in the environment. The human exposure values are then used by the EPA's latest version of the DARTAB computer code to calculate radiation doses to man from radionuclides released during the year. The dose calculations use dose conversion factors in the latest version of the RADRISK data file, which is provided by the EPA with the CAP-88 package.

B. Summary of Input Parameters

Unless otherwise discussed, all important input parameter values used were the default values provided with the CAP-88 computer codes and data bases by the USEPA to the Oak Ridge National Laboratory, which conducted the impact analysis under contract with the FEMP.

1. Meteorological Data

CAP-88 analysis was accomplished using meteorological data developed from the on-site FEMP meteorological station. This station experienced a data recovery rate of 93.9% in CY-1991, which was considered acceptable for the purposes of running the CAP88 code. Wind speed and direction data were provided in a Statistical Array (STAR) format to the Oak Ridge National Laboratory (ORNL); this data is provided in Table 3. Additional inputs developed from site observations were:

Rainfall rate: 96.7 cm for the year.

Average Temperature: 13 °C

Other meteorological data provided were developed from the information developed by the National Weather Service at its station at the Greater Cincinnati International Airport in Covington, KY (CVG). This input was:

Average mixing layer height: 965 m

2. Source Characteristics Data

Information on the emission sources was gathered from plant records (Table 4). The parameters were similar to those used in the 1990 compliance demonstration.

3. Other Input Parameters

The CAP-88 code provides dose estimates from radionuclides ingested. Beef, milk, and food crop production was assumed to be the maximum possible for the available ground area, an assumption that overstates these activities in the area. It was further assumed that 100% of the foodstuffs consumed by the local population were grown within the 80 km/50 mi radius, which also provides a conservative estimate for the impact. The actual values used were:

Fraction of foodstuffs from:	Local Area	50-mile radius	Beyond 50 miles
Vegetables & Produce:	0.700	0.300	0.000
Meat:	0.442	0.558	0.000
Milk:	0.399	0.601	0.000

To provide a collective effective dose equivalent for a fifty mile radius around the FEMP, sector-specific population estimates were needed. 1990 census data for the area around the FEMP was used (Tables 5A and 5B)

C. Compliance Assessment

Meteorological Data Source		Effective Dose Equivalent to Maximally Exposed Individual (mrem)	Collective Effective Dose Equivalent (50 mile Radius) (person - rem)
FEMP 1991	All Sources	0.3	1.2
	Excluding Waste Pits	0.005	0.2

The location of the maximally exposed individual, as determined by the CAP-88 computer code, varied slightly dependent on the sources included in determining the maximally exposed individual. Both maximally exposed individuals were located at residences; they are indicated in Figure 1.

SECTION IV: ADDITIONAL INFORMATION

A) Construction/Modification at the FEMP

Title 40, Code of Federal Regulations, Subpart H [40 CFR 61.94(b)(8)], requires that this report provide information on all construction/modifications completed at the FEMP in calendar year 1991 (CY-90) for which approval was not sought from the United States EPA per the provisions of 40 CFR 61.96. This section addresses that requirement.

In CY-1991, no projects were completed for which the requirements to apply to the USEPA for approval to construct or modify were waived due to the

provisions of 40 CFR 61.96 All projects completed were those with no air emissions associated with their normal operation. These included sprung structure storage units on the Plant 1 pad, installation of new fencing around portions of the plant, installation of steam piping support racks, and similar structures. As there will be no emissions to the air from these structures under normal conditions, there were no emissions to evaluate under the provisions of 40 CFR 61.93(b)(4)(ii) or as described in Appendix D to 40 CFR part 61.

SECTION V: 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).

R. E. Tiller (name)

Mgr. (title)

6/26/92 (date)

TABLES

TABLE 1A: FEMP Uranium Air Emission Sources; Compilation of 1991 Emitters

Table 1B: FEMP Uranium Air Emission Source Compilation

TABLE 2A: 1991 Radionuclide Air Emission Source Compilation

TABLE 2B: Activity of Radionuclides; CY-1988 & CY-1989 Monitored Stacks Composite Sample

TABLE 3: FEMP Site Meteorological Station, STAR data, 1991

TABLE 4: Source Characteristics

TABLE 5: Population Estimates by Sector within a Fifty-Mile Radius of the FEMP

TABLE 1A:
FEMP Uranium Air Emission Sources;
Compilation of 1991 Emitters

FEMP Emission Pt.	1991 Emissions (kg U)	FEMP Source No.	OEPA Source No.	Source Description	Control equipment/No.	Estimate of level of Control (%)	Air Emissions obtained from:	Distance to nearest receptor (m)
EP2-012	7.0E-5	2-021	P215	W. Metal Dissolver (F2E-11)	FFCD/G1-856	99	MPCIS	980
EP15-001	6.23E-4			Laboratory (Monitored Emission)	HEPA/EF3 RMP-1	99.90	SPCIS	930
EP15-001	4.61E-3			Laboratory (extrapolated from Monitored emissions)	"	99.9	EC	930
EP8-013	1.2766E-2	8-009	P239	East Oliver Filter	None	0	EC	970
EP8-015	1.2394E-2	8-011	P248	East EIMCO Filter (Filter No. 1)	None	0	EC	970
Misc.	2.156E-2			Bldg 69 - D & D Facility	None	0	EC	750
Misc.	1.61281E-1			Utility - water cooling tower	None	0	EC	700
Group	2.7E-3			Laboratory Fume Hoods exhausts (27)	None	0	EC	930
Area	4.5E-3			Waste Pit 5 - Fugitive Emissions	Water cover	0	EC	660
TOTAL U	0.29							

NOTE:
EC - Engineering Calculation (Unmonitored Source)
SPCIS - Single Point Continuous Isokinetic Sampler (Monitored Source)
MPCIS - Multiple Point Continuous Isokinetic Sampler (Monitored Source)

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TABLE IB

FEMP
Uranium Air Emission Source
Compilation

FEMP Emission Pt.	1991 Air Emissions (kg U/Emission Pt.)	FEMP Source No.	OEPA Source No.	Source Description	Control Equipment/No.	Air Emissions Obtained From
EP1-001	Out of Service	1-001	P162	Large auger sampler	FFDC/G2-172	SPCIS
EP1-002	0.00000E+00	1-002	P163	Pincutter	HEPA/not assigned	SPCIS
		1-003	P163	Fitzpatrick mill		
	Proposed	1-013	P258	Large Drum Sampling Station	HEPA/G2-6042	
EP1-003	0.00000E+00	1-004	P165	Safe geom feed dumping station	HEPA/G2-76,FFDC/G2-235, FFDC/G2-76	SPCIS
	0.00000E+00	1-008	P177	Titan mill packaging station	FFDC/G2-76,FFDC/G2-235	
EP1-004	Not Monitored*	1-005	P166	D105 digester	None	
EP1-005	0.00000E+00	1-006	P167	Titan mill dumping station	FFDC/G2-2	SPCIS
EP1-006	0.00000E+00	1-007	P168	Titan mill	FFDC/G2-64	SPCIS
EP1-007	0.00000E+00	1-009	P178	East packaging station	FFDC/G2-1	SPCIS
EP1-009	0.00000E+00	1-012	P179	Shot blaster	FFDC/G2-6014	SPCIS
EP1-015	0.00000E+00			236 HYVAC System	FFDC/G2-171	SPCIS
EP2-001	0.00000E+00	2-001	P113	Slg leach digestion (D1-1)	Scrubber with Bubble Cap Tower (NAR)	EC
		2-002	P113	Slg leach digestion (D1-2)		
		2-003	P113	Slg leach digestion (D1-3)		
		2-107	P152	Denitration pot (D1-207)		
		2-113	P153	Denitration pot (D1-213)		
		2-115	P155	Denitration pot (D1-215)		
		2-118	P158	Denitration pot (D1-218)		
		2-119	P159	Denitration pot (D1-219)		
		2-178	P006	Ammonia stripper		
		2-171	P202	North Packaging Station		
		2-004	P116	RTS Process Tank (D1-4)	(Bubble Cap Tower Only)	
		2-007	P119	RTS Process Tank (D1-7)	(Bubble Cap Tower Only)	
		2-020	P214	Charcoal solv tr (F2E-1)	(Bubble Cap Tower Only)	
EP2-002	Not Monitored*	2-010	T021	Uranyl nitrate storage tank (D1-10)	None	
EP2-003	Not Monitored*	2-011	T022	Uranyl nitrate storage tank (D1-11)	None	
EP2-004	Not Monitored*	2-012	T023	Uranyl nitrate storage tank (F1-1)	None	
EP2-005	Not Monitored*	2-013	T024	Uranyl nitrate storage tank (F1-2)	None	
EP2-006	Not Monitored*	2-014	T025	Uranyl nitrate storage tank (F1-25)	None	
EP2-007	Not Monitored*	2-015	T026	Uranyl nitrate storage tank (F1-26)	None	
EP2-008	Not Monitored*	2-016	T027	Uranyl nitrate storage tank (F2E-9)	None	
EP2-009	Not Monitored*	2-017	T028	Uranyl nitrate storage tank(F2E-10)	None	
EP2-010	Not Monitored*	2-018	T005	Nitric acid storage (F1-18)	None	
EP2-011	Not Monitored*	2-019	T006	Nitric acid storage (F1-17)	None	
EP2-012	7.00000E-05	2-021	P215	W. Metal Dissolver(F2E-11)	FFDC/G1-856	MPCIS
EP2-013	Not Monitored*	2-023	T007	Nitric acid storage tank (F1-23)	None	
EP2-014	Not Monitored*	2-024	T008	Dil nitric storage tank (F1-24)	None	
EP2-015	Not Monitored*	2-025	T009	Nitric acid storage tank (F1-8)		
EP2-016	Not Monitored*	2-026	T029	Uranyl nitrate storage tank (F2E-6)	None	
EP2-017	Not Monitored*	2-027	T030	Nitric acid wash storage (F2E-7)	None	
EP2-018	Not Monitored*	2-028	T032	Uranyl nitrate storage (F2E-5)	None	

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TABLE IB
FEMP
Uranium Air Emission Source
Compilation

FEMP Emission Pt.	1991 Air Emissions (kg U/Emission Pt.)	FEMP Source No.	OEPA Source No.	Source Description	Control Equipment/No.	Air Emissions Obtained From
EP2-019	Not Monitored*	2-029	T031	Uranyl nitrate storage (F2E-8)	None	
EP2-020	Not Monitored*	2-030	T033	Slopwater storage tank(F2E-4(25A))	None	
EP2-021	Not Monitored*	2-031	T034	Slopwater storage tank(F2E-4(26A))	None	
EP2-022	Out of Service	2-032	P122	Slg leach dumping station	FFDC/G2-252	SPCIS
EP2-023	0.00000E+00	2-032	P122	Slg leach dumping station	FFDC/G1-94	SPCIS
EP2-024	Not Monitored*	2-033		Pot carbonate storage 3A	None	
EP2-027	Not Monitored*	2-036	T109	Solvent storage tank (G2-4)	None	
EP2-028	Not Monitored*	2-037	T110	Duty solvent storage (D1-117)	None	
EP2-029	Not Monitored*	2-038	T036	Slopwater storage tank (D1-129)	None	
EP2-030	Not Monitored*	2-039	T089	A raffinate storage tank (D1-123)	None	
EP2-031	Not Monitored*	2-040	T035	Slopwater storage tank (D1-130)	None	
EP2-032	Not Monitored*	2-041	T044	Slopwater storage tank (D1-131)	None	
EP2-033	Not Monitored*	2-042	P121	Neut. of solvent (F1-502)	None	
EP2-034	Not Monitored*	2-043	P205	Water mix tank (F1-504)	None	
EP2-035	Not Monitored*	2-044	T051	Solvent storage tank (F1-506)	None	
EP2-043	Not Monitored*	2-052	P129	Extraction settler (Y7)	None	
EP2-059	Not Monitored*	2-068	T050	Caustic storage (D1-174)	None	
EP2-062	Not Monitored*	2-071	T053	Carbonate storage tank (F1-501)	None	
EP2-064	Not Monitored*	2-073	P207	Raff mixer tank (D1-110)	None	
EP2-065	Not Monitored*	2-074	T054	Raff storage tank (D1-111)	None	
EP2-066	Not Monitored*	2-075	P209	Raff mixer tank (D1-125)	None	
EP2-068	Not Monitored*	2-077	P211	TBP & kerosene mixing	None	
EP2-070	Not Monitored*	2-069	P160	Decanter (process)	None	
EP2-071	Not Monitored* Not Monitored*	2-080 2-070	P189 T052	A-3 column (D1-100) Carbonate storage tank (F1-500)	None None	
EP2-072	Not Monitored*	2-081	P190	A-4 column (D1-127)	None	
EP2-076	Not Monitored*	2-085	P194	C-2 column (D1-112)	None	
EP2-079	Not Monitored*	2-088	T067	Sulfuric acid storage	None	
EP2-080	Not Monitored*	2-089	T066	Dirty solv storage tank 5A	None	
EP2-081	Not Monitored*	2-090	T065	Dirty solv storage tank 5B	None	
EP2-082	Not Monitored*	2-091	T064	Dirty solv storage tank 17A	None	
EP2-083	Not Monitored*	2-092	T063	Dirty solv storage tank 17B	None	
EP2-084	Not Monitored*	2-093	T062	Dirty solv storage tank 17C	None	
EP2-085	Not Monitored*	2-094	T068	Solvent storage tank (F1-512)	None	
EP2-086	Not Monitored*	2-095	T010	Nitric acid storage (F2E-501)	None	

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TABLE IB

FEMP
Uranium Air Emission Source
Compilation

FEMP Emission Pt.	1991 Air Emissions (kg U/Emission Pt.)	FEMP Source No.	OEPA Source No.	Source Description	Control Equipment/No.	Air Emissions Obtained From
EP2-087	Not Monitored*	2-096	T011	Nitric acid storage (F2E-502)	None	
EP2-088	Not Monitored*	2-097	T069	OK liq storage tank (F3E-222)	None	
EP2-089	Not Monitored*	2-098	T070	OK liq storage tank (F3E-223)	None	
EP2-090	Not Monitored*	2-099	T071	OK liq storage tank (F3E-224)	None	
EP2-091	Not Monitored*	2-100	T072	OK liq storage tank (F3E-225)	None	
EP2-092	Not in Operation	2-171	P202	North packaging station	Scrubber	EC
EP2-093	Not in Operation	2-172	P203	South packaging station	Scrubber	EC
EP2-097	Not Monitored*	2-120	T078	Condensate storage tank (F1-208)	None	
EP2-098	Not Monitored*	2-121	P197	N. oliver filter (D1-301)	None	
EP2-099	Not Monitored*	2-122	P198	S. oliver filter (D1-302)	None	
EP2-100	Not Monitored*	2-123	T047	S.L. storage tank (F1-301)	None	
EP2-101	Not Monitored*	2-124	T048	S.L. storage tank (F1-302)	None	
EP2-102	Not Monitored*	2-125	T049	S.L. storage tank (F1-303)	None	
EP2-103	Not Monitored*	2-126	T073	Filtrate storage tank (F1-308)	None	
EP2-104	Not Monitored*	2-127	T074	Filtrate storage tank (F1-309)	None	
EP2-105	Not Monitored*	2-128	P199	Neut of filter cake(F1-313)	None	
EP2-106	Not Monitored*	2-129	T075	Lime storage (F1-314)	None	
EP2-107	Not Monitored*	2-130	P200	Neut of filter cake(F1-318)	None	
EP2-108	Not Monitored*	2-131		Lime slur makeup tank (F1-319)	None	
EP2-109	Not Monitored*	2-132		Precoat storage (F1-321)	None	
EP2-110	Not Monitored*	2-133		Precoat storage (F1-324)	None	
EP2-111	Not Monitored*	2-134	T012	Nitric acid storage (D3-2)	None	
EP2-112	Not Monitored*	2-135	T013	Nitric acid storage (D3-27)	None	
EP2-113	Not Monitored*	2-136	T014	Nitric acid storage (F3-12)	None	
EP2-114	Not Monitored*	2-137	T015	Nitric acid storage (F3-19)	None	
EP2-115	Not Monitored*	2-138	T016	Dil nitric storage (F3-22)	None	
EP2-116	Not Monitored*	2-139	T017	Dil nitric storage (F3-23)	None	
EP2-117	Not Monitored*	2-140	T018	Dil nitric storage (F3-24)	None	
EP2-118	Not Monitored*	2-141	T019	Dil nitric storage (F3-25)	None	
EP2-119	Not Monitored*	2-142	T020	Cond hold tank (F3E-7)	None	

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TABLE IB

FEMP
Uranium Air Emission Source
Compilation

FEMP Emission Pt.	1991 Air Emissions (kg U/Emission Pt.)	FEMP Source No.	OEPA Source No.	Source Description	Control Equipment/No.	Air Emissions Obtained From
EP2-120	Not Monitored*	2-143	T077	Filtrate storage (SL) (F1-310)	None	
EP2-121	Not Monitored*	2-144	T079	Filtrate storage (SL) (F1-311)	None	
EP2-122	Not Monitored*	2-145	T080	Filtrate storage (SL) (F1-312)	None	
EP2-123	Not Monitored*	2-146	T081	Filtrate storage (SL) (F1-317)	None	
EP2-124	Not Monitored*	2-147	T059	Raff storage tank (F1-400)	None	
EP2-125	Not Monitored*	2-148	T057	Raff storage tank (F1-401)	None	
EP2-126	Not Monitored*	2-149	T058	Raff storage tank (F1-402)	None	
EP2-127	Not Monitored*	2-150	T056	Raff storage tank (F1-403)	None	
EP2-128	Not Monitored*	2-151	T102	Evap storage tank (F1-405)	None	
EP2-129	Not Monitored*	2-152	T082	Acid cond storage (F1-407)	None	
EP2-130	Not Monitored*	2-153	T103	Evap prod storage (F3E-404)	None	
EP2-131	Not Monitored*	2-154	T104	Evap prod storage (F3E-405)	None	
EP2-132	Not Monitored*	2-155	T043	Uranyl nitrate storage(F3E-406)	None	
EP2-133	Not Monitored*	2-156	T085	Filtrate storage (SL)(F3E-408)	None	
EP2-134	Not Monitored*	2-157	T101	Filtrate storage (SL)(F3E-409)	None	
EP2-135	Not Monitored*	2-158	T046	Slopwater storage tank (F2E-601)	None	
EP2-136	Not Monitored*	2-159	P201	Thickener tank(proc)(F2E-602)	None	
EP2-137	Not Monitored*	2-160	T045	Slopwater storage tank (F1-608)	None	
EP2-138	Not Monitored*	2-161		Slurry mix tank (F1-609)	None	
EP2-139	Not Monitored*	2-162		Slurry mix tank (F1-610)	None	
EP2-140	Not Monitored*	2-163	P206	MgO slurry tank (F1-611)	None	
EP2-141	Not Monitored*	2-164	T061	Raff thickner slur (F1-612)	None	
EP2-142	Not Monitored*	2-165	T083	Nitric acid wash storage(F1-613)	None	
EP2-143	Not Monitored*	2-166		Precoat makeup tank (F1-616)	None	
EP2-144	Not Monitored*	2-167	T042	Uranyl nitrate storage tank(F2-605)	None	
EP2-145	Not Monitored*	2-168	T041	Uranyl nitrate storage tank(F2-606)	None	
EP2-146	Not Monitored*	2-169	T040	Uranyl nitrate storage tank(F2-607)	None	
EP2-147	Not Monitored*	2-170	T039	Uranyl nitrate storage tank(F2-608)	None	
EP2-148	Out of Service	2-171	P202	North packaging station	FFDC/G2-103	SPCIS
EP2-149	Out of Service	2-172	P203	South packaging station	FFDC/G2-104	SPCIS
EP2-151	Not Monitored*	2-174	T087	Nitric acid storage tank (F1-201)	None	
Precip Tk Exh Rec Tk1 Vent Rec Tk2 Vent	Not Monitored* Not Monitored* Not Monitored*	2-181		Refinery sump wastewater treat sys	None None None	
EP4-001	0.00000E+00	4-001 4-002	P083 P081	Bank 7 Bank 8	FFDC/G4-7 & HEPA/Stainless Steel	SPCIS

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TABLE IB

FEMP
Uranium Air Emission Source
Compilation

FEMP Emission Pt.	1991 Air Emissions (kg U/Emission Pt.)	FEMP Source No.	OEPA Source No.	Source Description	Control Equipment/No.	Air Emissions Obtained From
EP4-001 (cont.)		4-003	P082	Bank 9		
EP4-001	0.00000E+00			Talcum Cooling Vent for Banks 7-9	FFDC/G4-7	SPCIS
EP4-002	Not Monitored*	4-004	P083	Talcum reactor bank 7	Cintered Filter, HF Scrubber, & KOH Scrubber	
		4-005	P081	Talcum reactor bank 8		
		4-006	P082	Talcum reactor bank 9		
EP4-003	0.00000E+00	4-007	P087	Portable packaging station	FFDC/G4-13	SPCIS
EP4-004	0.00000E+00	4-008	P088	Packaging station no. 1	FFDC/G4-14	SPCIS
EP4-005	0.00000E+00	4-009	P089	Packaging station no. 2	FFDC/G4-2	SPCIS
EP4-006	0.00000E+00	4-010	P090	Packaging station no. 3	FFDC/G4-12	SPCIS
EP4-007	Out of Service	4-011	P110	Drumming station	FFDC/G4-15	SPCIS
EP4-008	0.00000E+00	4-012	P111	Drum dumper	FFDC/G4-1	SPCIS
EP4-009	0.00000E+00	4-013	P112	Reject green salt	FFDC/G4-5	SPCIS
EP4-025	0.00000E+00			Vacuum Cleaner	FFDC/G4-4	SPCIS
EP5-004	0.00000E+00	5-014	P063	# 4 "F" machine	FFDC/G5-249	SPCIS
EP5-005	0.00000E+00	5-015	P064	# 5 "F" machine	FFDC/G5-250	SPCIS
		5-017	P064	West side capping station		
EP5-006	0.00000E+00	5-012	P061	# 1 "F" machine	FFDC/G5-251	SPCIS
EP5-007	0.00000E+00	5-013	P062	# 3 "F" machine	FFDC/G5-253	SPCIS
EP5-008	0.00000E+00	5-016	P062	East side capping station		
EP5-009	0.00000E+00	5-020	P095	Breakout, west	FFDC/G5-254	SPCIS
EP5-010	0.00000E+00	5-018	P094	Breakout, east	FFDC/G5-256	SPCIS
EP5-013	0.00000E+00	5-022	P040	E - casting no. 1	FFDC/G5-260 & Settling Chamber	SPCIS
		5-023	P040	E - casting no. 2		
		5-024	P040	E - casting no. 3		
		5-025	P040	E - casting no. 4		
		5-026	P040	E - casting no. 5		
		5-027	P040	E - casting no. 6		
		5-028	P040	E - casting no. 7		
		5-029	P040	E - casting no. 8		
		5-030	P040	E - casting no. 9		
		5-031	P040	E - casting no. 10		
		5-032	P040	E - casting no. 11		
		5-033	P040	E - casting no. 12		
		5-034	P040	E - casting no. 13		
		5-035	P040	E - casting no. 14		
EP5-014	0.00000E+00	5-022	P040	E - casting no. 1	FFDC/G5-261 & Settling Chamber	SPCIS
		5-023	P040	E - casting no. 2		
		5-024	P040	E - casting no. 3		
		5-025	P040	E - casting no. 4		
		5-026	P040	E - casting no. 5		
		5-027	P040	E - casting no. 6		
		5-028	P040	E - casting no. 7		
		5-029	P040	E - casting no. 8		
		5-030	P040	E - casting no. 9		
		5-031	P040	E - casting no. 10		
		5-032	P040	E - casting no. 11		
		5-033	P040	E - casting no. 12		
		5-034	P040	E - casting no. 13		
		5-035	P040	E - casting no. 14		
		5-050	P065	E - burnout		
		5-052	P065	E - separation booth		SPCIS

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TABLE IB

FEMP
Uranium Air Emission Source
Compilation

FEMP Emission Pt.	1991 Air Emissions (kg U/Emission Pt.)	FEMP Source No.	OEPA Source No.	Source Description	Control Equipment/No.	Air Emissions Obtained From
EP5-014 (cont.)		5-054	P175	Mold curing oven		
EP5-015	0.00000E+00	5-053	P054	Mold reconditioning	FFDC/G5A-100	SPCIS
		5-055	P054	E. cold saw		
		5-095	P054	W - Separation Booth		
		5-084	P008	Wagner Cold Saw		
		5-057	P008	North Cold Saw		
	Proposed	5-101	P257	Mold Handling Facility (Proposed)		
EP5-016	0.00000E+00	5-019	P038	Slag crushing (east)	FFDC/G5A-101	SPCIS
EP5-017	0.00000E+00	5-059		Gr plug machining-W&S lathe	FFDC/G5-262	MPCIS
		5-060		Horiz boring mill		
		5-061	P218	Lehmann OD turning,block gr		
		5-062	P169	O. D. turning 16A		
		5-063	P170	O. D. turning 16B		
		5-064	P171	Cutting blocks		
		5-065	P172	Horizontal milling		
		5-066	P229	Tool grinding		
		5-085	P230	Crucible grit blaster		
		5-086	P230	Crucible coating - Plasma spray		
EP5-018	0.00000E+00	5-067	P091	Slag storage bin no. 1	FFDC/G55-E100	SPCIS
		5-068	P091	Slag storage bin no. 2		
		5-069	P101	Undersized Slag Milling		
		5-070	P101	Slag storage bin no. 3A		
		5-071	P101	Slag storage bin no. 4		
		5-072	P101	Slag storage bin no. 5		
		5-073	P101	Slag storage bin no. 6		
		5-074	P101	Slag storage bin no. 7		
		5-075	P101	Slag storage bin no. 8		
		5-076	P091	Oversized Slag Milling		
		5-077		Air classifier		
EP5-019	0.00000E+00	5-021	P039	Slag C, west	FFDC/G5-267	SPCIS
EP5-024	0.00000E+00	5-007	P056	West jolters, jolter H	FFDC/G5-247	SPCIS
		5-008	P056	West jolters, jolter I		
		5-009	P056	West jolters, jolter J		
		5-010	P056	West jolters, jolter K		
		5-011	P056	West jolters, jolter L		
		5-079	P108	Slag storage bin no. 251		
	0.00000E+00	5-001	P033	East jolters, jolter A	FFDC/G5-248	SPCIS
		5-002	P033	East jolters, jolter B		
		5-003	P033	East jolters, jolter C		
		5-004	P033	East jolters, jolter D		
		5-005	P033	East jolters, jolter E		
		5-006	P033	East jolters, jolter F		
		5-078	P108	Slag storage bin no. 250		
EP6-001	0.00000E+00	6-015	P023	Blanking bar ends	ESP(North)/G6-6057	SPCIS
		6-016	P023	Extrusion core blanking no.35		
		6-017		Extrusion core blanking no. 36		
EP6-002	Out of Service	6-004	P238	Centerless grinding	ESP(Middle)	SPCIS
EP6-003	0.00000E+00	6-001	P249	Flat ingot cutting A	ESP(South)	SPCIS
		6-002	P250	Flat ingot cutting B		
		6-003	P032	Finish core machining		
		6-060	P251	Flat ingot cutting 425-20		
		6-061	P252	Flat ingot cutting No. 6		
		6-062	P253	Flat ingot machining K&T A		
		6-063	P254	Flat ingot machining K&T B		
		6-064	P255	Flat Ingot Cutting No. 4		
EP6-005	Not Monitored*	6-019	P022	Tool grinding G & L no. 62A	Settling Chamber & Cyclone	EC
		6-020	P022	Tool grinding G & L no. 62B		
		6-021	P022	Tool grinding G & L no. 70		

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TABLE IB

FEMP
Uranium Air Emission Source
Compilation

FEMP Emission Pt.	1991 Air Emissions (kg U/Emission Pt.)	FEMP Source No.	OEPA Source No.	Source Description	Control Equipment/No.	Air Emissions Obtained From
EP6-005 (cont.)	Not Monitored*	6-022	P022	Tool grinding CMM - no. 1		
		6-023	P022	Tool grinding CMM - no. 2		
		6-024	P022	Internal-external grinding		
		6-025	P022	Surface grinding		
		6-026	P022	Tool grinding G & L no. 10		
		6-029	P022	Surface grinding do all		
		6-030	P022	Surface grinding Thompson		
		6-031	P022	Brazing		
		6-032	P022	Cut-off		
		6-033	P022	Tool grinding std. electric		
		6-034	P022	Surface cleaning		
		6-035	P022	Wire brushing		
		6-036	P022	Belt sanding		
		6-037	P022	Tool grinding V & M		
		6-038	P022	Tool grinding Rockwell		
EP6-006	0.00000E+00	6-018	P212	Chip pickling & Briquetting	Cyclone Scrubber	ST
		6-022	P022	Tool grinding CMM - no. 1		
		6-023	P022	Tool grinding CMM - no. 2		
		6-024	P022	Internal-external grinding		
		6-025	P022	Surface grinding		
		6-026	P022	Tool grinding G & L no. 10		
		6-029	P022	Surface grinding do all		
		6-030	P022	Surface grinding Thompson		
		6-031	P022	Brazing		
		6-032	P022	Cut-off		
		6-033	P022	Tool grinding std. electric		
		6-034	P022	Surface cleaning		
		6-035	P022	Wire brushing		
		6-036	P022	Belt sanding		
		6-037	P022	Tool grinding V & M		
		6-038	P022	Tool grinding Rockwell		
EP6-006	0.00000E+00	6-018	P212	Chip pickling & Briquetting	Cyclone Scrubber	ST
EP6-007	0.00000E+00	6-040	P217	Scrap pickling	None	ST
EP6-008	Out of Service	6-041	P210	Slug pickling	None	
EP6-009	Out of Service	6-046	P241	Oil treatment tank, system 1	None	
EP6-010		6-047	P243	Precipitation tank, system 1	None	
EP6-010	Out of Service	6-048	P242	Oil treatment tank, system 2	None	
		6-049	P244	Precipitation tank, system 2		
Tank Vent	Not Monitored*	6-042	T092	Fresh acid receiving tank	None	
Tank Vent	Not Monitored*	6-043	T093	Spent acid tank	None	
Tank Vent	Not Monitored*	6-044	T094	Spent acid tank (6000 gal)	None	
Tank Vent	Not Monitored*	6-045	T095	Decantation tank	None	
Tank Vent	Not Monitored*	6-050	T141	Ingot Pickling Hold Tank	None	
Tank Vent	Not Monitored*	6-051	T142	Acid water hold tank	None	
Tank Vent	Not Monitored*	6-052	T143	Nitric acid storage tank	None	
EP8-001	0.00000E+00	8-001	P180	Rotary kiln	FFDC/G43-27	SPCIS
		8-003	P182	Primary calciner		
EP8-002	0.00000E+00	8-001	P180	Rotary kiln	Cyclone & Scrubber	EC
EP8-005	0.00000E+00	8-003	P182	Primary calciner		
EP8-006	0.00000E+00	8-004	P183	Oxidation furnace #1	FFDC/G8-035	SPCIS

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TABLE IB

FEMP
Uranium Air Emission Source
Compilation

FEMP Emission Pt.	1991 Air Emissions (kg U/Emission Pt.)	FEMP Source No.	OEPA Source No.	Source Description	Control Equipment/No.	Air Emissions Obtained From
EP8-007	0.00000E+00	8-004	P183	Oxidation furnace #1	Scrubber	EC
EP8-010	0.00000E+00	8-006	P185	Box furnace	Scrubber	EC
EP8-011	0.00000E+00	8-007	P186	Rotex screening	FFDC/G43-29	SPCIS
EP8-013	1.27760E-02	8-009	P239	East Oliver filter	None	EC
EP8-014	0.00000E+00	8-010	P240	West EIMCO filter	None	EC
EP8-015	1.23940E-02	8-011	P248	East EIMCO filter (Filter No. 1)	None	EC
EP8-016	Not Monitored* Proposed	8-012 8-035	 P260	Filter precoat mixing Precoat system	None Bel-Tyne DC	
EP8-017	0.00000E+00	8-013	P204	Drum washer	None	
EP8-018	Not Monitored*	8-014	T156	Neut tank (F-203)	None	
EP8-019	Not Monitored*	8-015	T157	Neut tank (F-203A)	None	
EP8-020	Out of Service	8-016	T151	Neut tank (D-101)	FFDC/G8-057	SPCIS
EP8-021	Not Monitored*	8-017	T152	Neut tank (D-102)	None	
EP8-022	Not Monitored*	8-018	T153	Neut tank (D-103)	None	
EP8-023	Not Monitored*	8-019	T154	Neut tank (D-104)	None	
EP8-024	Not Monitored*	8-020	T155	Neut tank (D-105)	None	
EP8-025	Not Monitored*	8-021	T002	Caustic storage tank A	None	
EP8-026	Not Monitored*	8-022	T003	Caustic storage tank B	None	
EP8-027	Not Monitored*	8-023	T004	Caustic storage tank (F43-108)	None	
EP8-028	Not Monitored*	8-024	T096	Filtrate storage tank (21A)	None	
EP8-029	Not Monitored*	8-025	T097	Filtrate storage tank (22A)	None	
EP8-030	Not Monitored*	8-026	T098	Filtrate storage tank (25A)	None	
EP8-031	Not Monitored*	8-027	T099	Filtrate storage tank (28A)	None	
EP8-032	Not Monitored*	8-028	T100	Accountability tank	None	
08-A159ASTK EP8-011 EP8-001,005	Proposed Proposed Proposed	8-036 8-007 8-003	P265 P186 P182	Crusher system Rotex screening Primary calciner	08-A157(A-P)-DC, FFDC/G43-29 CYC SCR	
EP9-001	0.00000E+00	9-005 9-006 9-007 9-008 9-009 9-013 9-014	P013 P012 P013 P013 P013 P013 P013	J & L model 30 lathe North Duomatic lathe East Duomatic lathe North Gisholt lathe South Gisholt lathe W & S turret lathe Gisholt turret lathe	ESP/G9E2-400	SPCIS
EP9-002	0.00000E+00	9-001 9-002 9-003 9-004 9-012	P020 P020 P020 P020 P020	Separation booth Crucible charge/burnout station Remelt furnace # 91 Remelt furnace # 92 Mold cleaning station	Cyclone,FFDC/3DF12 HEPA/E-6	SPCIS
EP9-003	0.00000E+00	9-011	P266	Zirnlo Process HNO3 Declad Tank	None	
EP9-004.	Not Monitored*	9-010	T001	Nitric storage tank	None	

000022

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TABLE IB

FEMP
Uranium Air Emission Source
Compilation

FEMP Emission Pt.	1991 Air Emissions (kg U/Emission Pt.)	FEMP Source No.	OEPA Source No.	Source Description	Control Equipment/No.	Air Emissions Obtained From
EP9-005	Not Monitored*	9-015		Scrap pickling	None	
EP13-001	Not Monitored*	13-001	T121	North spent solvent tank	None	
EP13-003	Not Monitored*	13-002	T120	South spent solvent tank	None	
EP13-003	Not Monitored*	13-003	T107	Spill storage tank westside (F100)	None	
EP13-004	Not Monitored*	13-004	T106	Spill storage tank westside (F101)	None	
EP13-005	Not Monitored*	13-005		Thorium hold tank (T1)	None	
EP13-006	Out of Service	13-006		Thorium hold tank (T2)	None	
EP13-007	Not Monitored*	13-007		Thorium hold tank (T3)	None	
EP13-008	Not Monitored*	13-008	T108	Solvent storage tank (T5)	None	
EP13-009	Not Monitored*	13-009	T105	Solvent storage tank (T6)	None	
EP13-010	Not Monitored*	13-010	T086	Caustic storage tank		
Tank Vent	Not Monitored*	13-011	T088	Nitric acid storage tank	None	
EP13-015	0.00000E+00	13-020		UF6 to UF4 Process No. 1	FFDC/G-1	SPCIS
EP13-016	0.00000E+00	13-020		UF6 to UF4 Process No. 1	FFDC/G-2	SPCIS
Tank Vent	Not Monitored*	46-002	T126	Sulfuric acid tank	None	
R-41	0.00000E+00	13-015 13-012	P173 P233	Pilot plant remelt furnace Plasma spray process	FFDC 735-13-7041	SPCIS
R-50	0.00000E+00	13-014	P174	Crucible grit blaster	FFDC 735-13-7051	SPCIS
EP15-001 "	6.23000E-04 4.61000E-03			Laboratories (Monitored Emissions) Laboratories (extrapolated from monitored emissions)	HEPA/EF3 RMP-1 "	SPCIS EC
EP78-001 EP78-002 EP78-003	Proposed Proposed Proposed	78-001 78-002 78-003	P261 P263 P264	Grit Blast System High Pressure Water Wash System Ultra High Pressure Wter Wash	Impingement Separator with HEPA	
Misc.	0.00000E+00			Plant 1 Building Exhausts	None	EC
Misc.	0.00000E+00			Plant 2/3 Building Exhausts	None	EC
Misc.	0.00000E+00			Plant 4 Building Exhausts	None	EC
Misc.	0.00000E+00			Plant 5 Building Exhausts	None	EC
Misc.	0.00000E+00			Plant 6 Building Exhausts	None	EC
Misc.	0.00000E+00			Plant 8 Building Exhausts	None	EC
Misc.	0.00000E+00			Plant 9 Building Exhausts	None	EC
Misc.	2.70000E-03			Laboratory Fume Hoods (27)	None	EC
Misc.	7.00000E-02			Waste Pit 5 Emissions	None	EC
Misc.	0.00000E+00			Waste Pit 6 Emissions	None	EC
Misc.	1.61281E-01			Utility Cooling Tower	None	EC
Misc.(Plt 5)	0.00000E+00			East Rockwell Air Cooling Well		SPCIS

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TABLE IB

FEMP
Uranium Air Emission Source
Compilation

FEMP Emission Pt.	1991 Air Emissions (kg U/Emission Pt.)	FEMP Source No.	OEPA Source No.	Source Description	Control Equipment/No.	Air Emissions Obtained From
Misc.(Plt 5)	0.00000E+00			West Rockwell Air Cooling Well		SPCIS
Misc.(Plt 5)	0.00000E+00			East Jolter Muffler		EC
Misc.(Plt 5)	0.00000E+00			West Jolter Muffler		EC
Misc.(Plt 5)	0.00000E+00			Breakout Jolter Muffler		EC
Misc.(Plt 5)	0.00000E+00			Remelt Furnace Hilco Oil Rec.		EC
Misc.(Plt 5)	0.00000E+00			East Mold Cooling Booth		SPCIS
Misc.(Plt 5)	0.00000E+00			West Mold Cooling Booth		SPCIS
Misc.(Plt 5)	0.00000E+00			Graphite Breakout Booth		SPCIS
Misc.(Plt. 8)	0.00000E+00			Eimco Filter Hood Fan		EC
Misc.	2.15600E-02			Bldg 69 -- D & D facility		EC
Pilot Plt.	0.00000E+00			Reactor area-Hydrogen safety system		EC
Pilot Plt.	0.00000E+00			Reactor area-scrubber C		EC
Pilot Plt.	0.00000E+00			Building vents - Autoclave area		EC
Pilot Plt.	0.00000E+00			Building vents - Reactor area		EC
Total U	0.29					

LEGEND

Not Monitored* - Contribution Insignificant
SPCIS - Single Point Continuous Isokinetic Sampler
MPCIS - Multiple Point Continuous Isokinetic Sampler

EC - Engineering Calculation
ST - Stack Testing

000024

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TABLE 2A
1991 RADIONUCLIDE AIR EMISSION SOURCE COMPILATION

Plant 2/3	U
Dust Collectors	0.000070
Plt 2/3 Build Vent	0.000000
Total	0.000070

Plant 8	U
Dust Collectors	0.000000
Plt 8 Scrubbers	0.000000
Plt 8 Process	0.025170
Plt 8 Build Vent	0.000000

Plant 2/3 - Dust Collectors
kg U = 0.00007

Isotope	uCi/kg U	Ci/yr
U234	298.6	2.09E-08
U235	15.8	1.11E-09
U236	11.6	8.12E-10
U238	333.6	2.34E-08
SR90	1.76	1.23E-10
TC99	36.94	2.59E-09
RU106	6.86	4.80E-10
CS137	5.13	3.59E-10
BA137M	5.13	3.59E-10
RA226	0.212	1.48E-11
RA228	0.85	5.95E-11
TH228	8.97	6.28E-10
TH230	26.4	1.85E-09
TH232	1.41	9.87E-11
TH234	1319	9.23E-08
PA234M	1319	9.23E-08
NP237	0.107	7.49E-12
PU238	0.127	8.89E-12
PU239	0.816	5.71E-11
PU240	0.204	1.43E-11
PU241	2.93	2.05E-10
PU242	0.000046	3.22E-15

Plant 8 - Total
kg U = 0.025170

Isotope	uCi/kg U	Ci/yr
U234	298.6	7.52E-06
U235	15.8	3.98E-07
U236	11.6	2.92E-07
U238	333.6	8.40E-06
SR90	1.76	4.43E-08
TC99	36.94	9.30E-07
RU106	6.86	1.73E-07
CS137	5.13	1.29E-07
BA137M	5.13	1.29E-07
RA226	0.212	5.34E-09
RA228	0.85	2.14E-08
TH228	8.97	2.26E-07
TH230	26.4	6.64E-07
TH232	1.41	3.55E-08
TH234	1319	3.32E-05
PA234M	1319	3.32E-05
NP237	0.107	2.69E-09
PU238	0.127	3.20E-09
PU239	0.816	2.05E-08
PU240	0.204	5.13E-09
PU241	2.93	7.37E-08
PU242	0.000046	1.16E-12

TABLE 2A
1991 RADIONUCLIDE AIR EMISSION SOURCE COMPILATION

Laboratory	U
EP15-001	0.005233
Fume Hoods (group)	0.002700

Laboratory	U
Lab Dust Coll.	0.005233
Fume Hoods (group)	0.002700

Laboratory - EP15-001
kg U = 0.005233

Isotope	uCi/kg U	Ci/yr
U234	298.6	1.56E-06
U235	15.8	8.27E-08
U236	11.6	6.07E-08
U238	333.6	1.75E-06
SR90	1.76	9.21E-09
TC99	36.94	1.93E-07
RU106	6.86	3.59E-08
CS137	5.13	2.68E-08
BA137M	5.13	2.68E-08
RA226	0.212	1.11E-09
RA228	0.85	4.45E-09
TH228	8.97	4.69E-08
TH230	26.4	1.38E-07
TH232	1.41	7.38E-09
TH234	1319	6.90E-06
PA234M	1319	6.90E-06
NP237	0.107	5.60E-10
PU238	0.127	6.65E-10
PU239	0.816	4.27E-09
PU240	0.204	1.07E-09
PU241	2.93	1.53E-08
PU242	0.000046	2.41E-13

Laboratory Fume Hoods
kg U = 0.002700

Isotope	uCi/kg U	Ci/yr
U234	298.6	8.06E-07
U235	15.8	4.27E-08
U236	11.6	3.13E-08
U238	333.6	9.01E-07
SR90	1.76	4.75E-09
TC99	36.94	9.97E-08
RU106	6.86	1.85E-08
CS137	5.13	1.39E-08
BA137M	5.13	1.39E-08
RA226	0.212	5.72E-10
RA228	0.85	2.30E-09
TH228	8.97	2.42E-08
TH230	26.4	7.13E-08
TH232	1.41	3.81E-09
TH234	1319	3.56E-06
PA234M	1319	3.56E-06
NP237	0.107	2.89E-10
PU238	0.127	3.43E-10
PU239	0.816	2.20E-09
PU240	0.204	5.51E-10
PU241	2.93	7.91E-09
PU242	0.000046	1.24E-13

TABLE 2A
1991 RADIONUCLIDE AIR EMISSION SOURCE COMPILATION

Cooling Tower
kg U = 0.161281

Isotope	uCi/kg U	Ci/yr
U234	298.6	4.82E-05
U235	15.8	2.55E-06
U236	11.6	1.87E-06
U238	333.6	5.38E-05
SR90	1.76	2.84E-07
TC99	36.94	5.96E-06
RU106	6.86	1.11E-06
CS137	5.13	8.27E-07
BA137M	5.13	8.27E-07
RA226	0.212	3.42E-08
RA228	0.85	1.37E-07
TH228	8.97	1.45E-06
TH230	26.4	4.26E-06
TH232	1.41	2.27E-07
TH234	1319	2.13E-04
PA234M	1319	2.13E-04
NP237	0.107	1.73E-08
PU238	0.127	2.05E-08
PU239	0.816	1.32E-07
PU240	0.204	3.29E-08
PU241	2.93	4.73E-07
PU242	0.000046	7.42E-12

Plant 69 D&D
kg U = 0.021560

Isotope	uCi/kg U	Ci/yr
U234	298.6	6.44E-06
U235	15.8	3.41E-07
U236	11.6	2.50E-07
U238	333.6	7.19E-06
SR90	1.76	3.79E-08
TC99	36.94	7.96E-07
RU106	6.86	1.48E-07
CS137	5.13	1.11E-07
BA137M	5.13	1.11E-07
RA226	0.212	4.57E-09
RA228	0.85	1.83E-08
TH228	8.97	1.93E-07
TH230	26.4	5.69E-07
TH232	1.41	3.04E-08
TH234	1319	2.84E-05
PA234M	1319	2.84E-05
NP237	0.107	2.31E-09
PU238	0.127	2.74E-09
PU239	0.816	1.76E-08
PU240	0.204	4.40E-09
PU241	2.93	6.32E-08
PU242	0.000046	9.92E-13

TABLE 2A
1991 RADIONUCLIDE AIR EMISSION SOURCE COMPILATION

Waste Pit 5
kg U = 0.070000

Isotope	uCi/kg U	Ci/yr
U234	441	3.09E-05
U235	18.2	1.27E-06
U236	45.5	3.19E-06
U238	331	2.32E-05
SR90	4.15	2.91E-07
TC99	662.5	4.64E-05
RU106	ND	0.00E+00
CS137	13.5	9.45E-07
BA137M	13.5	9.45E-07
RA226	287.2	2.01E-05
RA228	35.4	2.48E-06
TH228	45.6	3.19E-06
TH230	5135	3.59E-04
TH232	35.4	2.48E-06
TH234	333.3	2.33E-05
PA234M	333.3	2.33E-05
NP237	5.31	3.72E-07
PU238	1.04	7.28E-08
PU239	1.3	9.10E-08
PU240	1.3	9.10E-08
PU241	8.8	6.16E-07
PU242	0.000046	3.22E-12

30.9 mW
12.7

1. U235 values were determined from site records indicating the enrichment of the uranium in the pits. U236 and U234 values were calculated average values for uranium of the specified enrichments at the FEMP. U238 value was the remainder of the uranium on a weight percent basis.
2. SR90, TC99, RU106, CS137, RA226, TH228, TH230, TH232, NP237, PU238, PU239 values are averages of core sample analyses performed on each waste pit. The specific analyses are listed in the following document; Solow, A. J. and Phoenix, D. R.c "Characterization Investigation Study, Vol. 2: Chemical and Radiological Analyses of the Waste Storage Pits", November 1987, FMPC/SUB 008, Vol. 2 UC-70, Appendix D.
3. BA137M is assumed to be in equilibrium with CS137, i.e. BA137M activity equals that of CS137.
4. RA228 is assumed to be in equilibrium with TH232, i.e. RA228 activity equals that of TH232.
5. PU239/240 - half of the analyzed values discussed in 1 above are proportioned to each.
6. TH234 and PA234M are assumed to be in equilibruium with U238, i.e. the TH234 and PA234M activities are equal to that of U238.
7. PU241 is assumed to be in the same ratio to Pu239/240 as is seen for FEMP processes as analyzed for composite dust collector filter samples for 1988.

TABLE 2A
1991 RADIONUCLIDE AIR EMISSION SOURCE COMPILATION

Total
kg U = 0.286014

Isotope	Ci/yr
U234	6.45E-05
U235	3.41E-06
U236	2.51E-06
U238	1.03E-04
SR90	1.65E-06
TC99	1.12E-05
RU106	2.47E-05
CS137	1.40E-06
BA137M	4.75E-05
RA226	4.58E-08
RA228	1.13E-06
TH228	2.88E-06
TH230	2.58E-05
TH232	2.78E-06
TH234	2.88E-04
PA234M	6.44E-04
NP237	2.50E-06
PU238	2.34E-05
PU239	2.35E-05
PU240	4.16E-07
PU241	7.06E-07
PU242	9.10E-08

TABLE 2B
ACTIVITY OF RADIONUCLIDES
CY-1988 & CY-1989 MONITORED STACKS
COMPOSITE SAMPLE

1988 Dust Collector Composite Isotope	uCi/kg U	1989 Dust Collector Composite Isotope		uCi/kg U
U234	293.6	U234	[1]	298.6
U235	14	U235	[1]	15.8
U236	12.9	U236	[1]	11.6
U238	333.9	U238	[1]	333.6
SR90	2.81	SR90	[2]	1.76
TC99	36.94	TC99	[3]	36.94
RU106	6.86	RU106	[3]	6.86
CS137	4.76	CS137	[2]	5.13
BA137M	4.77	BA137M	[4]	5.13
RA226	0.28	RA226	[2]	0.212
RA228	0.31	RA228	[2]	0.85
TH228	6.9	TH228	[2]	8.97
TH230	22.83	TH230	[2]	26.4
TH232	4.94	TH232	[2]	1.41
TH234	4073	TH234	[1]	1319
PA234M	1423	PA234M	[5]	1319
NP237	0.49	NP237	[2]	0.107
PU238	0.26	PU238	[2]	0.127
PU239	0.694	PU239	[2]	0.839
PU240	0.174	PU240	[2]	0.214
PU241	2.93	PU241	[2]	3.125
		PU242	[2]	0.0000466

[1] Mass weighted average of monthly composite samples analyzed at the FEMP.

[2] Annual composite sample analyzed by an offsite contractor.

[3] From Table 5 of "Draft Assessment of Radiation Dose and Cancer Risk for Emissions from 1951 through 1984", prepared by the IT Corporation, March, 1989.

[4] Assumed in equilibrium with Cs-137 with same activity value.

[5] Assumed in equilibrium with Th-234 with the same activity value.

TABLE 3:

FEMP METEOROLOGICAL DATA
FROM SITE STATION
FOR 1991

m/s		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	>10
N	A	0.01158	0.01029	0.00579	0.00000	0.00000	0.00000
NNE	A	0.01415	0.01801	0.00322	0.00064	0.00000	0.00000
NE	A	0.02122	0.03923	0.02186	0.00450	0.00000	0.00000
ENE	A	0.03023	0.06495	0.02379	0.00836	0.00064	0.00000
E	A	0.02315	0.02251	0.00193	0.00129	0.00000	0.00000
ESE	A	0.01479	0.01093	0.00064	0.00000	0.00000	0.00000
SE	A	0.01158	0.00965	0.00000	0.00000	0.00000	0.00000
SSE	A	0.01608	0.00836	0.00064	0.00000	0.00000	0.00000
S	A	0.01865	0.01608	0.01286	0.00707	0.00000	0.00000
SSW	A	0.01222	0.03280	0.04051	0.01543	0.00322	0.00000
SW	A	0.02315	0.04244	0.02508	0.01736	0.00514	0.00193
WSW	A	0.02830	0.02572	0.02894	0.01801	0.00322	0.00064
W	A	0.02251	0.02958	0.02058	0.01222	0.00643	0.00257
WNW	A	0.01994	0.01608	0.01608	0.01158	0.00322	0.00257
NW	A	0.00772	0.01093	0.00707	0.00257	0.00000	0.00000
NNW	A	0.00643	0.01286	0.00836	0.00193	0.00000	0.00000
N	B	0.02077	0.02671	0.01780	0.00297	0.00000	0.00000
NNE	B	0.00890	0.00890	0.00593	0.00593	0.00297	0.00000
NE	B	0.01484	0.02671	0.00297	0.00890	0.00000	0.00000
ENE	B	0.01780	0.03264	0.01780	0.00890	0.00000	0.00000
E	B	0.02671	0.02374	0.00000	0.00000	0.00000	0.00000
ESE	B	0.01187	0.00890	0.00593	0.00000	0.00000	0.00000
SE	B	0.00593	0.00297	0.00000	0.00000	0.00000	0.00000
SSE	B	0.03858	0.01187	0.00000	0.00297	0.00000	0.00000
S	B	0.01484	0.03264	0.02374	0.00297	0.00000	0.00000
SSW	B	0.02671	0.03561	0.03264	0.01187	0.00000	0.00000
SW	B	0.02374	0.01484	0.05045	0.01780	0.00593	0.00000
WSW	B	0.02671	0.00890	0.01187	0.01780	0.02374	0.00890
W	B	0.01484	0.02967	0.01187	0.01187	0.00297	0.00297
WNW	B	0.01187	0.01780	0.00593	0.00890	0.00297	0.00000
NW	B	0.02671	0.00593	0.01484	0.00297	0.00000	0.00000
NNW	B	0.01780	0.01484	0.02671	0.00593	0.00000	0.00000
N	C	0.01140	0.01994	0.02564	0.00285	0.00000	0.00000
NNE	C	0.01140	0.02564	0.00855	0.00570	0.00285	0.00000
NE	C	0.01140	0.02849	0.01709	0.00855	0.00000	0.00000
ENE	C	0.06268	0.03134	0.00570	0.00285	0.00000	0.00000
E	C	0.02279	0.02279	0.00855	0.00000	0.00285	0.00000
ESE	C	0.01425	0.02849	0.00000	0.00000	0.00000	0.00000
SE	C	0.00285	0.00570	0.00000	0.00000	0.00000	0.00000
SSE	C	0.00000	0.01140	0.00000	0.00000	0.00285	0.00000
S	C	0.01425	0.01709	0.01994	0.00855	0.00000	0.00000
SSW	C	0.02279	0.03134	0.04274	0.02849	0.00285	0.00000
SW	C	0.02564	0.00855	0.04274	0.01425	0.00570	0.00000
WSW	C	0.01709	0.01425	0.02279	0.01709	0.00285	0.00285
W	C	0.02279	0.01994	0.01709	0.00285	0.00000	0.00285

TABLE 3:

FEMP METEOROLOGICAL DATA
FROM SITE STATION
FOR 1991

m/s		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	>10
WNW	C	0.01140	0.02279	0.01709	0.00570	0.00285	0.00285
NW	C	0.00855	0.02279	0.01140	0.00285	0.00000	0.00000
NNW	C	0.02279	0.00855	0.01994	0.00855	0.00000	0.00000
N	D	0.01677	0.02493	0.02765	0.00544	0.00091	0.00000
NNE	D	0.02403	0.02539	0.01768	0.00589	0.00045	0.00000
NE	D	0.02584	0.01995	0.02765	0.00453	0.00000	0.00000
ENE	D	0.02811	0.02267	0.01995	0.01360	0.00091	0.00000
E	D	0.00997	0.00997	0.00635	0.00000	0.00000	0.00000
ESE	D	0.00725	0.00771	0.00045	0.00045	0.00000	0.00000
SE	D	0.00952	0.00635	0.00181	0.00000	0.00000	0.00000
SSE	D	0.00589	0.00907	0.00544	0.00363	0.00000	0.00000
S	D	0.00499	0.01949	0.02040	0.00907	0.00181	0.00000
SSW	D	0.00952	0.03717	0.04352	0.02357	0.00453	0.00091
SW	D	0.01405	0.02675	0.02901	0.01269	0.00227	0.00045
WSW	D	0.01995	0.01995	0.01269	0.00861	0.00680	0.00453
W	D	0.03173	0.01224	0.01904	0.01677	0.00680	0.00453
WNW	D	0.00997	0.01405	0.01859	0.01224	0.00816	0.00091
NW	D	0.01315	0.02131	0.01904	0.00091	0.00091	0.00000
NNW	D	0.01541	0.02176	0.01949	0.00408	0.00000	0.00000
N	E	0.01834	0.01133	0.00593	0.00000	0.00000	0.00000
NNE	E	0.02967	0.01510	0.00162	0.00108	0.00000	0.00000
NE	E	0.04531	0.02643	0.01187	0.00000	0.00000	0.00000
ENE	E	0.02481	0.02104	0.01564	0.00000	0.00000	0.00000
E	E	0.01510	0.01456	0.00378	0.00000	0.00000	0.00000
ESE	E	0.01079	0.01025	0.00162	0.00000	0.00000	0.00000
SE	E	0.01348	0.00593	0.00216	0.00054	0.00000	0.00000
SSE	E	0.01456	0.01510	0.00863	0.00485	0.00000	0.00000
S	E	0.01510	0.03236	0.03614	0.01294	0.00270	0.00000
SSW	E	0.02265	0.05502	0.05286	0.02751	0.00755	0.00216
SW	E	0.03128	0.05286	0.03020	0.01618	0.00324	0.00108
WSW	E	0.02050	0.02104	0.02481	0.00647	0.00485	0.00108
W	E	0.01888	0.02481	0.01402	0.00971	0.00054	0.00108
WNW	E	0.00863	0.01510	0.01294	0.00324	0.00054	0.00000
NW	E	0.00647	0.01294	0.00593	0.00162	0.00000	0.00000
NNW	E	0.01187	0.01672	0.00431	0.00054	0.00000	0.00000
N	F	0.03000	0.00500	0.00000	0.00000	0.00000	0.00000
NNE	F	0.07300	0.00700	0.00000	0.00000	0.00000	0.00000
NE	F	0.08300	0.04600	0.00100	0.00000	0.00000	0.00000
ENE	F	0.06000	0.04900	0.01200	0.00000	0.00000	0.00000
E	F	0.03300	0.01400	0.00400	0.00000	0.00000	0.00000
ESE	F	0.02200	0.01100	0.00100	0.00000	0.00000	0.00000
SE	F	0.03200	0.00600	0.00000	0.00000	0.00000	0.00000
SSE	F	0.01900	0.01600	0.00300	0.00000	0.00000	0.00000
S	F	0.02800	0.03600	0.01100	0.00100	0.00000	0.00000
SSW	F	0.04700	0.04000	0.01200	0.00100	0.00000	0.00000
SW	F	0.06300	0.03300	0.01200	0.00000	0.00000	0.00000

TABLE 3:

FEMP METEOROLOGICAL DATA
FROM SITE STATION
FOR 1991

m/s		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	>10
WSW	F	0.03800	0.01800	0.01200	0.00000	0.00000	0.00000
W	F	0.02000	0.00400	0.00200	0.00000	0.00000	0.00000
WNW	F	0.02300	0.00400	0.00000	0.00000	0.00000	0.00000
NW	F	0.02300	0.00600	0.00200	0.00000	0.00000	0.00000
NNW	F	0.02500	0.00900	0.00300	0.00000	0.00000	0.00000
N	G	0.05177	0.01851	0.01194	0.00174	0.00025	0.00000
NNE	G	0.10176	0.02222	0.00647	0.00249	0.00037	0.00000
NE	G	0.13839	0.07173	0.01555	0.00286	0.00000	0.00000
ENE	G	0.07620	0.06361	0.01914	0.00585	0.00037	0.00000
E	G	0.04213	0.01567	0.00386	0.00025	0.00012	0.00000
ESE	G	0.03938	0.00958	0.00100	0.00012	0.00000	0.00000
SE	G	0.04643	0.02241	0.00100	0.00012	0.00000	0.00000
SSE	G	0.04321	0.04023	0.00398	0.00224	0.00012	0.00000
S	G	0.05027	0.06701	0.02855	0.00746	0.00112	0.00000
SSW	G	0.10566	0.09640	0.03966	0.01766	0.00373	0.00075
SW	G	0.11448	0.09365	0.02674	0.01194	0.00286	0.00075
WSW	G	0.07862	0.03040	0.02372	0.00883	0.00473	0.00211
W	G	0.05266	0.02334	0.01542	0.00983	0.00336	0.00224
WNW	G	0.02876	0.01566	0.01219	0.00697	0.00323	0.00087
NW	G	0.03022	0.01739	0.00933	0.00137	0.00025	0.00000
NNW	G	0.03976	0.01443	0.01032	0.00224	0.00000	0.00000

TABLE 4: Source Characteristics

Source	Type	Release Height (m)	Inner diameter (m)	Gas Exit Velocity (m/s)	Gas Exit Temperature (° C)	Distan (m) an Directi to Maximal Expose Individ (MEI) Site M data
EP2-012	Point	18.29	0.4318	0.95	Ambient	1110 N
Plant 8						
EP8-013	Point	13.72	0.381	4.97	Ambient	1200 N
EP8-015	Point	13.72	0.305	13.21	Ambient	1200 N
Laboratory						
EP15-001	Point	14.75	0.9144	17.25	Ambient	1330 N
Lab Hoods	Point	5.26	0.305	7.47	Ambient	1330 N
Building 69	Point	7.62	0.813	18.11	Ambient	820 NN
Cooling Tower	Point	14.9	8.69	7.16	26.7	700 NN
Waste Pit 5	Area	1.0	162.4	0.0	Ambient	800 NN

TABLE 5

POPULATION ESTIMATES BY SECTOR WITHIN A FIFTY-MILE RADIUS OF THE FEMP

TABLE 5A. INCREMENTAL POPULATION DISTRIBUTION AROUND THE FEMP FOR 1990

Distance, (miles)

	0-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
N	2	54	193	20	140	2157	15117	7201	16590	13291
NNE	0	71	51	113	147	12263	8174	9742	30568	86398
NE	2	202	827	97	90	34292	38797	88477	214495	331340
ENE	5	87	1766	219	13	31999	32998	32039	14739	29771
E	3	3	179	301	248	38285	75213	50799	17863	10218
ESE	8	54	78	558	739	42893	160628	68672	22433	13541
SE	10	200	52	394	680	53789	271217	96398	28351	11194
SSE	6	349	165	217	492	21506	226652	58844	12567	8122
S	3	7	17	253	538	9177	32980	38030	8392	9825
SSW	3	27	205	40	188	5638	8999	7630	5390	10277
SW	2	37	26	355	60	4486	14209	9197	3523	4341
WSW	0	15	40	511	313	8540	5255	7725	7556	4681
W	6	13	37	286	596	1664	3547	10295	5357	15708
WNW	5	20	60	123	121	1093	4675	4205	5714	11295
NW	1	18	261	269	254	1196	1423	3757	22376	8795
NNW	2	7	97	312	722	1239	12713	5128	48409	15256
TOTAL	58	1164	4054	4068	5341	270217	912597	498139	464323	584053

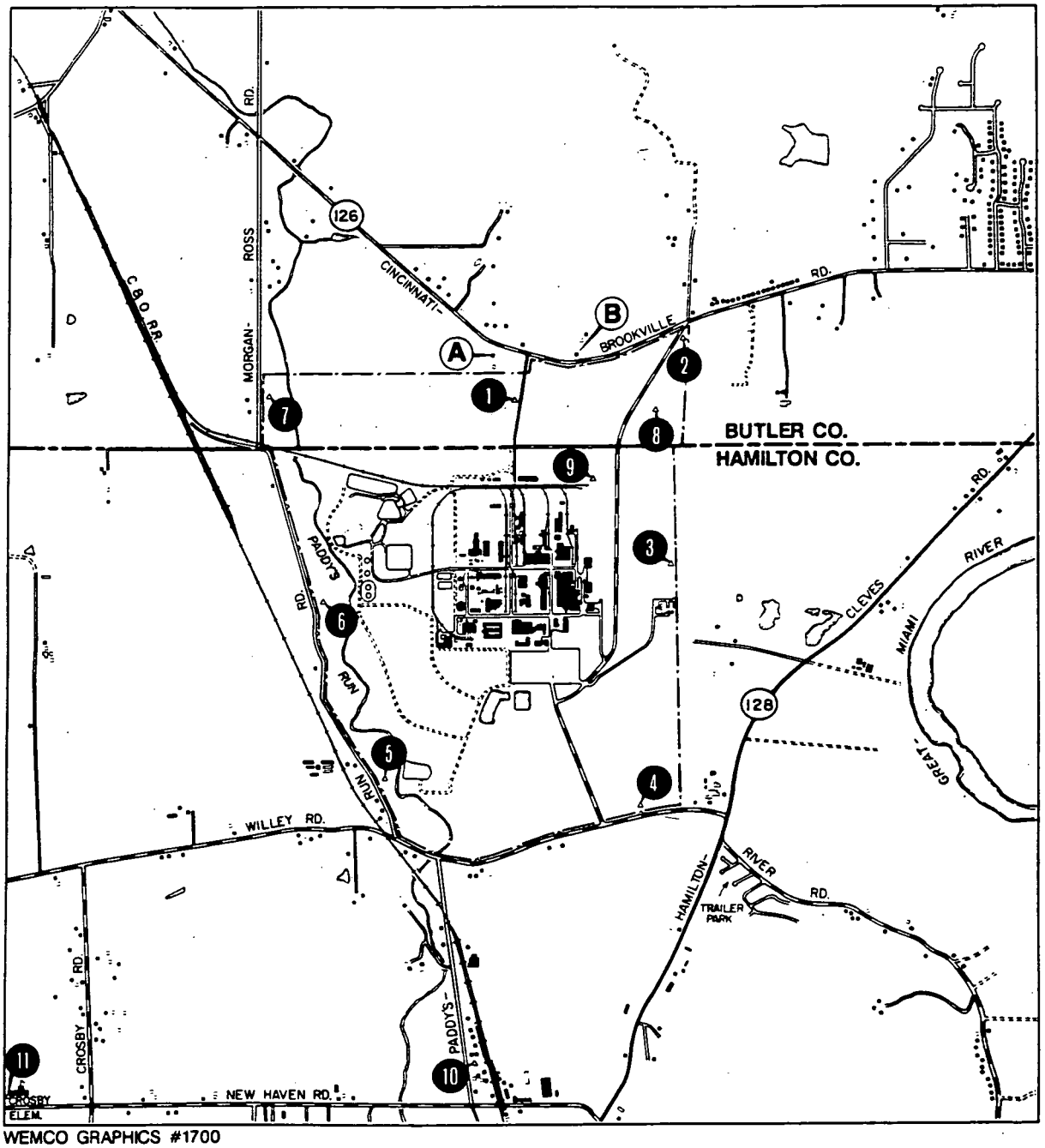
TABLE 5B. CUMULATIVE POPULATION DISTRIBUTION AROUND THE FEMP FOR 1990

Distance, (miles)

	0-1	0-2	0-3	0-4	0-5	0-10	0-20	0-30	0-40	0-50
N	2	56	249	269	409	2566	17683	24884	41474	54765
NNE	0	71	122	235	382	12645	20819	30561	61129	147527
NE	2	204	1031	1128	1218	35510	74307	162784	377279	708619
ENE	5	92	1858	2077	2090	34089	67087	99126	113865	143636
E	3	6	185	486	734	39019	114232	165031	182894	193112
ESE	8	62	140	698	1437	44330	204958	273630	296063	309604
SE	10	210	262	656	1336	55125	326342	422740	451091	462285
SSE	6	355	520	737	1229	22735	249387	308231	320798	328920
S	3	10	27	280	818	9995	42975	81005	89397	99222
SSW	3	30	235	275	463	6101	15100	22730	28120	38397
SW	2	39	65	420	480	4966	19175	28372	31895	36236
WSW	0	15	55	566	879	9419	14674	22399	29955	34636
W	6	19	56	342	938	2602	6149	16444	21801	37509
WNW	5	25	85	208	329	1422	6097	10302	16016	27311
NW	1	19	280	549	803	1999	3422	7179	29555	38350
NNW	2	9	106	418	1140	2379	15092	20220	68629	83885
TOTAL	58	1222	5276	9344	14685	284902	1197499	1695638	2159961	2744014

FIGURES

Figure 1: Locations of Maximally Exposed Individuals
FEMP 1991 Meteorological Data



LEGEND

- (A) Maximally Exposed Individual (Including Waste Pit Emissions)
- (B) Maximally Exposed Individual (Excluding Waste Pit Emissions)
- Heavy Duty Roads
- Medium Duty Roads
- Light Duty Roads
- FEMP Boundary
- (1) Fixed Air Monitoring Stations

Figure 1. Locations of Maximally Exposed Individuals
FEMP 1991 Meteorological Data

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ATTACHMENTS

1) Example of Engineering Calculation for Emissions from Stack Testing (Building 69)

2) Engineering Calculation for Emissions from Cooling Tower

3) Engineering Calculation for Emissions from Waste Pits.

EXAMPLES OF ENGINEERING CALCULATION FOR EMISSIONS:

1) Example of Engineering Calculation for Emissions from Stack Testing (Building 69)

EPA Method V sampling was performed August 24, 1988 at the Decontaminating and Decommissioning Building Facility HCl acid bath stack. Two sample probes were run continuously for an 8-hour period, with all personnel breaks covered. The sampling provided average emissions of 0.11 g U/hour. It was decided that the most useful emission factor would be on a mass/batch run through the acid baths.

(0.11 g U/hr) * (8 hr/day) /(8 batches/day) = 0.11 g U/ batch

2) Engineering Calculation for Emissions from Cooling Tower

As discussed in the body of the report, cooling water came in contact with various processes, creating the possibility for contamination, which persists. Uranium may be emitted from the tower by entrainment in the "drift loss": the small suspended water droplets which form as the water passes through the tower. It is assumed that the uranium concentration in the drift is the same as it is in the rest of the water stream. Manufacturers of cooling towers have developed design dependent drift loss factors: for the mechanical draft towers at the FEMP, the established factor is 0.003 times the flow through the tower.

In 1991, the Utilities Department recorded and maintained records of average water flow through the cooling towers, the number of hours per month of total fan operation (sum of hours of operation of each of 4 fans), and the results of a monthly sample of the water stream for total Uranium concentration. The data was used as follows:

FEMP
CY91 EMISSIONS
COOLING TOWER

MONTH	FLOW (gpm)	Conc. U (lb/gal)	Fan Op. (Hrs)	Drift Loss	U emitted (kg)
Jan	800	0.0000008	2.00	0.3%	0.000105
Feb	800	0.0000007	35.50	0.3%	0.001627
Mar	800	0.0000005	168.25	0.3%	0.005506
Apr	800	0.0000004	360.50	0.3%	0.009439
May	800	0.0000006	1227.50	0.3%	0.048207
Jun	800	0.0000007	858.50	0.3%	0.039335
Jul	800	0.0000004	809.50	0.3%	0.021194
Aug	800	0.0000005	509.00	0.3%	0.016658
Sep	800	0.0000005	447.50	0.3%	0.014645
Oct	800	0.0000005	50.50	0.3%	0.001653
Nov	800	0.0000004	73.00	0.3%	0.001911
Dec	800	0.0000003	51.00	0.3%	0.001001
Total	9600		4592.75		0.161281

NOTE: Hours of fan operation is sum of hours of operation for all four(4) fans.

3) Engineering Calculation for Emissions from Waste Pits.

General Equation:

$$Ew = 1.7(s/1.5)(d/235)(f/15)$$

where

Ew = Total particulate emissions in lb/acre of storage area/day
s = silt content in percent
d = days per year with less than 0.01" of precipitation ("dry days")
f = percent of time wind speed >12 mph at 1 foot above ground.

Source: Method for Estimating Fugitive {Particulate Emissions from Hazardous Waste SIte; EPA/600/2-87/066; pp. 37]

To develop an estimate of the amount of U and other radionuclides lost from wind erosion, the E value is multiplied by the surface area of the pits not covered by water, the weight fraction of the material in the pits that was estimated to be uranium, and a conversion factor from pounds to kilograms. Meteorological data for the site is taken at 10 and 60 meters; it has been assumed that wind speed data at 10 meters is equivalent to wind speed characteristics at 1 foot.

Utilities department evaluates the percentage of the pits surfaces exposed and maintains records of these observations. Due to a removal action in late 1990, only pit 5 had any exposed surface area. Based on historical records and sampling conducted on Pit 5, it has been estimated that the weight fraction of U(total) in the pit is 0.00057. A silt content of 10% has been assumed, based on records of material placed in Pit 5. The total surface area available for pit 5 is 3.56 acres, based on CAD drawings of the FEMP. The conversion factor for pounds to kilograms is 0.4536. The equation thus becomes:

$$E = 1.7(3.56)(e)(0.00057)(10/1.5)(d/235)(f/15)(0.4536)$$

$$= 0.01043(e)(d/235)(f/15) \text{ kg U/ day , where}$$

e = fraction of surface area of pit exposed (averaged for the year)

To obtain an annual emission rate, E is multiplied by 365 days.

For CY1991, the inputs and result are as follows:

	Values
Number of "dry days" in 1991	211
Frequency of winds greater than 12 mph at 10 m.	0.013
Annualized surface area exposed in Waste Pit 5	23%
Calculated Total Particulate Emissions in 1991 [E]	264.36 lb
Calculated Uranium emissions in 1991	0.07 kg

APPENDIX I
ADDITIONAL INFORMATION REQUESTED BY DEPARTMENT OF ENERGY, NOT REQUIRED FOR NESHAP, SUBPART H COMPLIANCE DEMONSTRATION

A) ESTIMATED COLLECTIVE EFFECTIVE DOSE EQUIVALENT (in mrem)

Calendar Year	Site Met. / All Sources	Site Met./ Exclude Pits	CVG Met./ All Sources	CVG Met./ exclude Pits
1989	5.2	1.2	Not Calculated	Not Calculated
1990	0.4	0.03	0.6	0.03
1991	0.3	0.005	Not Calculated	Not Calculated

B) UNPLANNED RELEASES TO THE ATMOSPHERE AND THE ASSOCIATED DOSE

After a review of the Minor Event Reports (MER), Release Evaluation Reports (RER) amd Occurrence Reports (OR) generated in 1991, it was determined that no significant unplanned, uncontrolled releases of materials regulated by Subpart H to the atmosphere occurred during 1991.

General summaries of all MERs, RERs, and ORs was reviewed; if there was any indication that a potential for air emissions could have been associated with the event, the complete MER was then reviewed. This was done for 82 MERs. If the completed MER left any question about the potential for an air release of subpart H regulated radionuclides, persons involved in the event were then contacted to obtain a clearer understanding of the event. Following this review process, the determination was made that no significant amount of Subpart H regulated material was lost to the atmosphere during 1991 due to unplanned, uncontrolled releases.

As discussed in Section II.B.2 of this report, a controlled accidental release did occur from Stack EP2-012 during CY-1991. On March 30, 1991, a routine maintenance inspection in Plant 2/3 discovered the induction fan for Dust Collector G1-856 (Stack No. EP2-012) operating; no processing was occurring at that time. The fan was shut off and the filter was removed from the stack sampler to assay for radionuclides. The fan unit's controls were locked out to prevent a recurrence.

C) RELEASE LEVELS FROM UNMONITORED SOURCES:

Estimates of the release levels from unmonitored sources and descriptions of the methods used in assessing those levels are provided in Section II(B) 2 through 5 and Section II(C) of this report.

Contributions from the unmonitored sources are provided in the following table. As different residences were identified as the Maximally Exposed Individual, dependent on whether the dose contribution from Waste Pit 5 is included, the contribution to each location is provided. As the EDE from the laboratory was calculated in one computer run combining the effect of the monitored and unmonitored stacks, an estimate of the contribution from

the unmonitored stacks has been made by applying a ratio of the release from the unmonitored stack to the total release from the Laboratory building to the calculated dose due to emissions from the Laboratory buliding:

	Plant 8	Building 69	Lab Fume Hoods	Cooling Tower
Activity of Emission (Ci/yr)	8.5E-05	7.3E-05	9.2E-06	5.5E-04
Contribution to EDE (mrem)				
With Waste Pit	5.0E-04	3.6E-04	6.8E-05	1.0E-03
Without Waste Pit	7.7E-04	7.0E-04	1.1E-04	3.2E-03

D) SOURCES OF FUGITIVE EMISSIONS

Waste pit no. 5 was the only source of fugitive emissions at the FEMP evaluated for CY-1991. Following a removal action in late 1990, Waste Pit no. 6 has been maintained with a water cover; this is assumed to have eliminated emissions from that former source. Roadways and material storage piles are potential sources of fugitive dust emissions, but due to decontamination practices implemented in previous years, they are not considered sources for fugitive radionuclide emissions at this time.

Emissions from the waste pits are calculated using a USEPA-derived equation for estimating fugitive particulate emissions from hazardous waste sites [Turner, J. H. et al; A Method for Estimating Fugitive Particulate Emissions from Hazardous Waste Sites; EPA/600/2-87-066]. The equation requires information on the silt content of the material in the waste pit, the number of days experiencing less that 0.01 inches of rainfall, and the frequency that the wind speed at 1 foot above the ground exceeds 12 mph. The equation produces a conservative estimate of pounds of particulate emitted per acre per day. The resultant is then used to generate an estimate of pounds of Uranium released/year from each pit, using the following assumptions:

1) Wind speed at 10 meters (height at which the site's meteorological station monitors wind speed and direction) is equal to the wind speed at 1 foot above ground level. This is a conservative estimate, as wind speed generally will increase with height above ground as the drag created by the ground surface is lessened by distance.

2) Uranium content in the entrained dust [emitted particulate] is the same as the content in the material in the pits, as determined by site records of material placed in the pits.

3) Particulate emissions will only be generated from those portions of the waste pits where waste is directly exposed to air. The FEMP attempts to maintain a water cap over the two pits. A special project was completed at the end of 1990 to place all of the waste in Pit 6 underwater. FEMP personnel perform a scheduled surveillance of the waste pits to estimate the surface area of the two pits which is not covered by water. A log of this surveillance, along with photo documentation of the exposed surface area, is maintained. This log was used to develop an estimate of total exposed surface area for the year.

Radionuclide activity in Ci/lb U were developed from core sampling of the waste pits and from process knowledge of the materials placed in the pits. These factors were used to convert the value developed by the fugitive particulate loss equation from lb U/yr to Ci/yr of each radionuclide. This information was then submitted to the Oak Ridge National Laboratories for performance of the CAP88 dispersion/dose calculation modeling. Values determined were:

Source	Total Activity (Ci/year)	Effective Dose Equivalent (EDE)
Waste Pit 5	0.00054	0.32 mrem
Waste Pit 6	0	0

E) DOSE ESTIMATE BASED ON ENVIRONMENTAL MONITORING AND SURVEILLANCE DATA:

There are 7 ambient monitoring stations located around the perimeter of the FEMP. Two additional stations are located on-site in the predominant down-wind direction of the former production area and 7 additional stations are located in the area surrounding the FEMP. At this time, the samples collected are still being analyzed by off-site contract laboratories to determine the concentrations of radionuclides collected at these stations during CY-1991.

EDEs (50 year) were calculated using data collected at the nine stations located on the FEMP based on environmental monitoring and surveillance data for 1990. Airborne concentrations were provided from (1) calculations from the AIRDOS-EPA portion of the CAP88 code and (2) samples taken at the monitors during the year. Doses were estimated using CAP88 for both sets of concentrations at each monitor. The following table lists the EDEs calculated from the AIRDOS-EPA concentrations with and without the waste-pit emissions and the measured concentrations. The dose calculated from the measured concentrations was noted to be closer to the dose based on the AIRDOS-EPA concentrations with the waste pits than the AIRDOS-EPA concentrations calculated without the waste pits contribution. A similar comparison will be conducted using 1991 monitoring data as it becomes available.

COMPARISON OF EFFECTIVE DOSE EQUIVALENTS (MREM) CALCULATED
AT AIR MONITORING STATIONS FROM CALCULATED & MEASURED CONCENTRATIONS
USING FEMP SITE METEOROLOGICAL DATA -
1990 NESHAP Subpart H COMPLIANCE DEMONSTRATION

AMS No.	Calculated with waste pits	Measured	Calculated, without waste pits
1	0.5	0.2	0.01
2	0.2	0.2	0.03
3	0.2	0.3	0.02
4	0.08	0.1	0.01
5	0.06	0.1	0.01
6	0.1	0.2	0.02
7	0.09	0.2	0.003
8	0.3	0.7	0.03
9	0.4	1.0	0.03

F) **STATUS OF COMPLIANCE WITH 40 CFR 61 SUBPART Q AND T**

Two sources, the K-65 Silos 1 & 2, exist at the FEMP which have been calculated to emit a radon Ci/yr flux estimated to be in excess of 20 $pCi/m^2 \cdot sec$. A preliminary estimate indicates that the flux from Silo 3, the Metal Oxide Silo, is approximately 20 $pCi/m^2 \cdot sec$. Actual measurements of the flux from other potential radon sources (Waste pits 1, 2, and 3) were made during 1991: preliminary results indicate that the radon flux from these three areas is under the 20 $pCi/m^2 \cdot sec$ flux limit. Measurements of other potential radon sources (pits 4, 5) are being planned.

USEPA and DOE have agreed that the 20 $pCi/m^2 \cdot sec$ standard for the two K-65 silos will be attained through implementation of a removal action and a final remedial action consistent with the April 9, 1990 CERCLA Consent Agreement. DOE is currently evaluating the need for a removal action, and is evaluating potential final remedial actions, for Silo 3. CERCLA remedial actions are also being identified for the waste pits.

On November 19, 1991, USEPA and DOE signed a "Federal Facility Compliance Agreement for Control and Abatement of Radon-222 Emissions"(FFA). In additon to requirements concerning measurement and reporting of radon emissions, the FFA requires that actions to minimize radon emissions from the K-65 silos and silo 3 be identified and implemented under the CERCLA consent agreement. The FFA requires that any source which is identified as having emissions potentially exceeding the subpart Q standard be measured and assessed for corrective actions under CERCLA. Any sources of radon must attain the 20 pCi/m^2-sec standard upon completion of remedial actions.

The FEMP is not subject to NESHAP, Subpart T.

G) **PROVIDE INFORMATION ON Rn-220 EMISSIONS FROM SOURCES CONTAINING U-232 AND Th-232:**

FEMP conducts monitoring for radon-220 and radon-222 using "alpha track etch cups". Cups have been placed around the perimeter of the production facility, around the perimeter of the K-65 silos, and inside some of the buildings containing thorium-bearing material. These programs were not designed to provide estimates of emissions of these two radionuclides, and estimating radon-220 emissions from specific sources using the data is speculative.

WEMCO has identified 5 structures storing Thorium-containing materials:

- Warehouse 60
- Warehouse 64
- Warehouse 65
- Warehouse 67
- Warehouse 68

The K-65 silos are known to store radon-generating material. The emissions from these structures is addressed by the provisions of NESHAP, Subpart Q.

AIRDOS-PC runs were conducted in May, 1991, as part of a Removal Site Evaluation (RSE) on the Thorium warehouses at the FEMP. The study used estimated emission rates of radon and Thoron using averaged concentration values for the radionuclides as monitored inside the warehouses (pCi/l). The total activity of the radionuclides in the buildings was estimated by multiplying the concentration by the total volume of the buildings, and assumed that 100% of the radon and thoron is released per day through one air exchange of each building per day. For the catastrophic event (tornado), it was conservatively estimated that 10% of the solids inventory is released. This source term includes:

Thorium-232	Radium -228
Thorium-228	Thorium-230
Uranium-233	

Due to the nature of this release, and the nature of the dose conversion factors used, a separate run for radon and thoron was not required. This AIRDOS modeling was completed on May 24, 1991.

The K-65 silos are known to store radon-generating material. However, the impact of the emissions from these structures is addressed by the provisions of NESHAP, Subpart Q.

Results of the AIRDOS run for radon and thoron assumed 100% release per day from each of the thorium warehouses. The nearest offsite receptor at 1625 meters from the center of the buildings received 2.5×10^{-6} working levels (WL) of radon plus thoron, or 1.3×10^{-4} WLM/yr. This is from the source term:

radon-222	0.15	Ci/yr
radon-220	0.074	Ci/yr

This is roughly one fifteen thousandth (1/15,000) of the USEPA residential limit of 2 WLM/yr (4 pCi/l radon 222).

Using the risk coefficient from the HEAST, the sum of the radon-222 plus daughters and the sum of the radon-220 plus daughters, yields a risk of 1.94×10^{-8}.

Prior to December 15, 1989, NESHAP Subpart H specifically excluded the dose due to Radon, Thoron, and their respective decay products from being included in the EDE calculation. When the regulation was revised on that date, the definition of EDE was changed to read:

> "...For the purposes of this subpart, doses caused by radon-222 and its respective decay products <u>formed after the radon is released from the facility</u> are not to be included. [emphasis added] {40 CFR 61.91(a)}

This change implies that decay products formed <u>prior</u> to the release of the Radon-222, as well as Thoron and its decay products, should be considered.

WEMCO has identified 5 structures storing Thorium-containing materials:

- Warehouse 60
- Warehouse 64
- Warehouse 65
- Warehouse 67
- Warehouse 68

The K-65 silos are known to store radon-generating material. However, the impact of the emissions from these structures is addressed by the provisions of NESHAP, Subpart Q.

Radon and thoron have been detected in some of the process buildings through intermittent monitoring conducted by Radiation Safety. The data available at this time is not sufficient to develop building concentration levels or emission estimates of the radon progeny. However, in all but one building (Building 13A -Pilot Plant, Wet side), the levels detected by the short term monitoring do not indicate that significant levels of radon or thoron exist in those structures. Environmental Monitoring has been advised of the levels in Building 13A and the storage in Warehouse 60; monitoring to evaluate off-site impact will be considered.

Currently, there is no information on the radon/thoron concentration or activity in Warehouse 60. As part of a removal site evaluation (RSE), sampling was conducted in the latter four buildings to determine the total activity in the buildings of the radon and thoron. In developing source terms for air dispersion modeling, WEMCO assumed that the daughters have achieved a 50% equilibrium with the parent isotope, barring empirical evidence of other conditions; this is consistent with reported USEPA practices. WEMCO utilized this assumption, and further assumed that 10% of the daughters were emitted from the building in a year, via normal air exchange processes. There has been no reported operation of any building ventilation fans in these structures, so emissions were assumed to occur at ground level and with no initial velocity. The inputs to the CAP-88 model and their results are provided below.

These results indicate that the contribution to EDE from the Thorium-containing structures is insignificant when the contribution from the waste pit's estimated emissions is considered, in that it will not result in a change in the EDE reported in the FEMP Annual Compliance Demonstration for

1991. However, if the emissions from the waste pit are excluded, the contribution to EDE from the Thorium-containing structures would result in a change in the EDE reported. Due to the above noted ambiguity in the wording of NESHAP Subpart H, it appears appropriate to provide this information with the Annual Demonstration. It may also be appropriate to address this ambiguity in the MOU being developed between DOE and EPA.

THORIUM WAREHOUSE CONTRIBUTION TO EDE IN 1991

INPUTS	Warehouse 64	Warehouse 65	Warehouse 67	Warehouse 68
Radionuclides	μCi/year	μCi/year	μCi/year	μCi/year
Rn-220	4.03	18.5	5.38	9.04
Po-216	2.15	8.25	2.69	4.52
Pb-212	2.15	8.25	2.69	4.52
Bi-212	2.15	8.25	2.69	4.52
Po-212	1.43	5.5	1.79	3.01
Tl-208	0.72	2.75	0.900	1.51
Po-218	0.0438	28.47	0.715	12.63
Pb-214	0.0438	28.47	0.715	12.63
Bi-214	0.0438	28.47	0.715	12.63
Po-214	0.0438	28.47	0.715	12.63
Pb-210	0.0438	28.47	0.715	12.63
Bi-210	0.0438	28.47	0.715	12.63
Po-210	0.0438	28.47	0.715	12.63
Source Inputs				
Stack Height (m)	1.0	1.0	1.0	1.0
Inside Diameter (m)	0.0	0.0	0.0	0.0
Effluent Velocity (m/s)	0.1	0.1	0.1	0.1
Heat Emission Rate(cal/sec)	0.0	0.0	0.0	0.0
Particle Size	1 micron	1 micron	1 micron	1 micron
Location of individual	EDE (mrem)	EDE (mrem)	EDE (mrem)	EDE (mrem)
House A	0.000004	0.002	0.00007	0.0007
House B	0.000007	0.004	0.00009	0.0009

Sum of doses: Building A: 2.7E-3 mrem (0.9% of estimated dose at residence without contribution of warehouses.
Building B: 5.0E-3 mrem (99.9% of estimated dose at residence without contribution of warehouses.

H) **EMISSIONS OF Rn-222 FROM NON-DISPOSAL/NON-STORAGE SOURCES:**

This request was discussed with Mr. Weldon Dillow of the DOE-Oak Ridge office during his visit to the FEMP on March 26, 1991. It appeared that this request was concerned with production-related emissions of radon-222. Based on this understanding, it was determined that the FEMP had no sources which needed to be addressed by this request.

I) **COMPLIANCE WITH MONITORING REQUIREMENTS OF PART 61.93(b):**

Points subject to continuous monitoring requirements:

There are currently no stacks operating out of compliance with the monitoring requirements of Part 61.93(b). This is directly related to the shutdown of production at the FEMP. Prior to the start-up of any new or existing source, an evaluation will be conducted to evaluate the stacks need to comply with this monitoring requirement.

Current WEMCO procedures require that all processes venting to stacks must meet the requirements of DOE Order 6430.1. This requires:

"All exhaust ducts (or Stacks) that may contain radioactive airborne effluent shall be provided with effluent monitoring systems that are designed in accordance with the applicable requirements contained in the directive on Radiation Protection of the Public and the Environment in ...(DOE 5400.5)... and the directive on Radiological Effluent Monitoring and Environmental Surveillance in the DOE 5400 series. Backup capability for monitoring systems shall be considered in the design of each system(e.g., redundant detectors, additional sample line ports, additional sample trains, etc.). Continuous stack sampling and continuous radiation detection shall be considered." **[DOE Order 6430.1, Section 1589-99.0.1]**

Based on this requirement, site procedure FMPC-2171, section 15967 ["Stack and Dust Radionuclide Sampling and Monitoring", Dust Collector Standards] specify that stacks will be equipped with continuously adjusting multipoint isokinetic stack sampling systems. This requirement is currently under review.

Plans for periodic confirmatory measurements:

The FEMP is developing a request to have trained stack sampling personnel perform Method 5 stack testing on 6 stacks in CY 1992. One of these stacks is vented inside a building and one is not a NESHAP regulated stack (Boiler Plant).