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RECORD OF ISSUE/REVISIONS

ISSUE AUTHORIZATION DATE	EFFECTIVE DATE	REV. NO.	DESCRIPTION
Draft	12/29/2003	00-A	New Technical Basis Document for the Mound Site – Occupational Environmental Dose. Initiated by Jeffrey S. Vollmer.
Draft	04/08/2004	00-B	Incorporates internal review comments. Initiated by Jeffrey S. Vollmer.
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ACRONYMS AND ABBREVIATIONS

Bq	Becquerel
Ci	curie
cm	centimeter
cm^2	square centimeter
cpm	counts per minute
cSv	centiseivert
DCF	dose conversion factor
DOE	U.S. Department of Energy
dpm	disintegrations per minute
EEOICPA	Energy Employees Occupational Illness Compensation Program Act of 2000
g	gram
GPHS	General Purpose Heat Source
GSD	Geometric Standard Deviation
HISS	Hydrogen Isotope Separations System
hr	hour
HTO	tritiated water vapor
LLW	low-level radioactive waste
m	meter
m^2	square meter
m^3	cubic meter
mCi	millicurie
MED	Manhattan Engineering District
ml	milliliter
mrem	millirem
NIOSH	National Institute for Occupational Safety and Health
pCi	picocurie
RTG	radioisotope thermoelectric generator
S	seconds
SNM	special nuclear material
SRS	Savannah River Site
Sv	sievert
TBD	technical basis document
TERF	Tritium Emission Recovery Facility
TRU	transuranic
μCi	microcurie

µg microgram
U.S.C. United States Code

WSF Waste Staging Facility

yr year

4.0 OCCUPATIONAL ENVIRONMENTAL DOSE

The occupational environmental dose is the dose received by workers on the job, but outside the operational buildings at the Dayton Facilities and Mound Laboratory. This analysis estimated annual intakes from the inhalation and ingestion of radioactive materials at the Dayton Facilities from the available outdoor radionuclide air-concentration data. Ambient external dose at the Dayton facilities was estimated using available control badge data and a review of available radiation protection practices at the Dayton Facilities.

Annual inhalation intakes of radioactive material at Mound Laboratory have been estimated based on the onsite environmental air monitoring station results from 1971 through 2003. For years in which onsite air monitoring data were unavailable (prior to 1971) and total Mound stack effluent data was available, empirically derived onsite atmospheric dispersion factors (plutonium, polonium particulates, and hydrogen gas/vapor χ/Qs) were used to estimate the intake air concentration. The χ/Q derivation coupled the site-wide median air concentration (^{238}Pu, ^{210}Po, and ^{3}H concentration) with the corresponding total Mound effluent source term for the period from 1973 through 1983. Ingestion intakes and ambient external dose were estimated using radionuclide concentrations measured in 30-cm-thick soil samples at Mound Laboratory.

Sections 4.1 and 4.2 discuss reconstruction of dose for unmonitored environmental exposures at the Dayton Facilities and Mound Laboratory, respectively. Section 4.3 discusses uncertainties for this analysis.

Technical Basis Documents (TBDs) and Site Profile Documents are general working documents that provide guidance concerning the preparation of dose reconstructions at particular sites or categories of sites. They will be revised in the event additional relevant information is obtained about the affected site(s). These documents may be used to assist the National Institute for Occupational Safety and Health (NIOSH) in the completion of the individual work required for each dose reconstruction.

In this document the word “facility” is used as a general term for an area, building, or group of buildings that served a specific purpose at a site. It does not necessarily connote an “atomic weapons employer facility” or a “Department of Energy facility” as defined in the Energy Employees Occupational Illness Compensation Program Act of 2000 [EEOICPA; 42 U.S.C. § 7384l (5) and (12)].

4.1 DAYTON FACILITIES

The principal contaminant at the Dayton Units was ^{210}Po. Dayton Unit I was occupied in September 1943 and was located at 1515 Nicholas Road, Dayton, Ohio. Available reports indicate that ^{210}Po was not produced at Unit I and that operations were transferred from Unit I to Unit III in October 1943. However, various research projects that did involved radionuclides were conducted at Unit I after 1943, some of which were transferred from Mound. These projects involved relatively small quantities of ^{14}C, ^{3}H, and ^{210}Po (DOE 1993b, Mound Site profile).

The ^{210}Po production process was set up initially at Dayton Units III and IV and later at Unit V. Dayton Units III and IV were occupied in October 1943 and February 1944 respectively to extract ^{210}Po from radioactive feedstock supplied by the Hanford Works in the State of Washington (DOE 1993b). From November 1944 to January 1945, a small amount of ^{210}Po was obtained from radioactive lead ores. At the same time, large amounts of ^{210}Po were obtained from irradiated bismuth (Wolf 1945). Unit III was located at Bonebrake Theological Seminary, 1601 First Street, Dayton, Ohio. Unit IV was located at Runnymeade Playhouse at Dixon Avenue and Runnymeade Road in Oakwood, Ohio. Dayton Unit II was a separate district Monsanto facility located in Dayton that was not involved in AEC activities. In 1949, operations involving fabrication of atomic bomb initiators using ^{210}Po transferred from Dayton Units III and IV to Mound Laboratory (Unit V).

4.1.1 Dayton Units Environmental Monitoring

Available Dayton Unit III and IV data consist of Progress Reports for July, August, September, October, and December 1945 (Monsanto1945a through 1945i); Monthly Health Reports for November and December 1947; and Monthly Health Reports for January and March 1948. No data was available for 1943, 1944 and 1946. Available data indicate that gross alpha air sampling was being conducted in both the indoor and outdoor areas of Dayton Units III and IV by 1947. All gross alpha air sample results were assumed to be due to ^{210}Po. A review of the available air sample results for Dayton Units III and IV in 1945, 1947 and 1948 indicates that ^{210}Po airborne concentrations in the operational areas of Units III and IV unit were very similar. Clean area and hallway air sampling results at both units III and IV in 1945 were typically between 0.1 and 0.5 times the acceptable “tolerance” (permissible) level of 2,400 dpm/m^3 or between 1.08E-10 to 5.40E-10 uCi/ml.

In addition, the outdoor site perimeter air monitoring results from Units III and IV in November and December 1947, January 1948 and March 1948 are comparable. Gross alpha levels outside Unit III in March 1948 averaged 1.08E-11 while the levels outside Unit IV averaged 1.62E-10 (Miller and Haring, 1948). Tables 4-1 through 4-6 below present the results of weekly perimeter fence air sampling at units III and IV in November 1947**,** December 1947 and January 1948. Dayton Unit III weekly outdoor perimeter air sample data for the month of December in 1947 are the highest outdoor air monitoring data available for the Dayton Units. Due to the lack of available environmental air monitoring data for the Dayton Units, the environmental intakes for both Dayton Units III and IV has been determined using the December 1947, Dayton Unit III, data. The median ^{210}Po outdoor perimeter airborne concentration for Unit III (4.86E-10 uCi/ml) is shown in Table 4-3 below and is assumed to be applicable to Dayton Units III and IV from November 1944 through 1948 (See Table 4-7). The air sampling data is also assumed to incorporate the resuspension component due to any soil contamination that may have been present.

Table 4-1. November 1947 ^{210}Po environmental air sample results at Dayton Unit III (µCi ml^{-1})

Week Beginning	November 3	November 10	November 17	November 24
South Fence	2.81E-10	1.08E-11	3.03E-10	6.05E-10
North Fence	1.73E-10	1.08E-11	No Sample	4.10E-10
West Fence	4.54E-10	1.08E-11	1.51E-10	5.30E-10
East Fence	3.89E-10	1.08E-11	1.73E-10	2.05E-10
Mean of Monthly Samples	2.48E-10			
Median of Monthly Samples	2.05E-10			

Reference: Monsanto 1947a

Table 4-2. November 1947 ^{210}Po environmental air sample results at Dayton Unit IV (µCi ml^{-1})

Week Beginning	November 4	November 11	November 18	November 25
South Fence	6.49E-11	7.57E-11	4.32E-11	1.08E-10
East Fence	8.65E-11	1.08E-10	7.57E-11	6.49E-11
North Fence	3.24E-11	6.49E-11	5.41E-11	7.57E-11
West Fence	5.41E-11	4.32E-11	1.08E-10	7.57E-11
Mean of Monthly Samples	7.09E-11			
Median of Monthly Samples	7.03E-11			

Reference: Monsanto 1947a

Table 4-3. December 1947 ^{210}Po environmental air sample results at Dayton Unit III (µCi ml^{-1})

Week Beginning	December 1	December 3	December 10	December 17	December 31
South Fence	6.05E-10	7.68E-10	4.86E-10	2.81E-10	8.65E-10
North Fence	4.11E-10	6.27E-10	4.86E-10	3.57E-10	4.00E-10
West Fence	5.30E-10	1.70E-09	3.03E-10	3.03E-10	8.65E-10
East Fence	2.05E-10	7.03E-10	1.41E-10	1.41E-10	7.46E-10
Mean of Monthly Samples	5.27E-10				
Median of Monthly Samples	4.86E-10				

Reference: Monsanto 1947b

Table 4-4. December 1947 ^{210}Po environmental air sample results at Dayton Unit IV (µCi ml^{-1})

Week Beginning	December 5	December 12	December 19	December 29
South Fence	7.57E-11	6.49E-11	3.24E-11	8.65E-11
East Fence	9.73E-11	1.19E-10	8.65E-11	7.57E-11
North Fence	3.24E-11	4.32E-11	6.49E-11	4.32E-11
West Fence	9.73E-11	9.73E-11	8.65E-11	5.41E-11

Week Beginning	December 5	December 12	December 19	December 29
Mean of Monthly Samples	7.23E-11			
Median of Monthly Samples	7.57E-11			

Reference: Monsanto 1947b

Table 4-5. January 1948 ^{210}Po environmental air sample results at Dayton Unit III (µCi ml^{-1})

Week Beginning	January 7	January 15	January 22	January 30
South Fence	7.57E-11	2.38E-10	5.73E-10	1.08E-10
North Fence	7.57E-11	4.32E-11	5.62E-10	9.73E-11
East Fence	8.32E-10	4.32E-11	4.54E-10	4.32E-11
West Fence	2.70E-10	3.14E-10	3.46E-10	2.27E-10
Mean of Monthly Samples	2.69E-10			
Median of Monthly Samples	2.32E-10			

Reference: Svirbely, 1948

Table 4-6. January 1948 ^{210}Po environmental air sample results at Dayton Unit IV (µCi ml^{-1})

Week Beginning	January 2	January 9	January 16	January 23
South Fence	1.19E-10	1.62E-10	9.73E-11	7.57E-11
East Fence	8.65E-11	1.08E-10	2.16E-10	1.08E-10
North Fence	9.73E-11	8.65E-11	1.19E-10	8.65E-11
West Fence	1.30E-10	5.41E-10	8.65E-11	6.49E-11
Mean of Monthly Samples	1.06E-10			
Median of Monthly Samples	9.73E-11			

Reference: Svirbely, 1948

Table 4-7. Annual Median ^{210}Po environmental concentrations at Dayton Units III and IV (µCi ml^{-1})

Year	Unit III Concentration (uCi/ml)	Unit IV Concentration uCi/ml
1944	4.86E-10	4.86E-10
1945	4.86E-10	4.86E-10
1946	4.86E-10	4.86E-10
1947	4.86E-10	4.86E-10
1948	4.86E-10	4.86E-10

4.1.2 Intakes From Inhalation of Airborne ^{210}Po

Environmental intakes are assumed to have occurred beginning in November 1944 when actual ^{210}Po production started at Units III and IV as reported by Wolf (Wolf 1945).

Annual ^{210}Po inhalation intakes are the product of the median ^{210}Po environmental air concentration and 2,400 m^3/yr, which is the product of the breathing rate (1.2 m^3/hr) of reference man doing light work and an exposure duration of 2,000 hr/yr. Table 4-8 below presents the annual environmental intakes at the Dayton Units. Unit I environmental polonium intakes are assumed to be a factor of 1,000 times less than the Unit III and IV intakes, because there was no polonium production at Dayton Unit I, and the work conducted at Unit I involved relatively small quantities of ^{14}C, ^{3}H, and ^{210}Po in dispersible form (DOE 1993b and Mound Site Profile). Polonium is assumed to account for 95% of the internal dose. The most claimant favorable absorption type should be chosen for dose reconstruction because of the various chemical forms of polonium that may have been used at the Dayton facilities.

Table 4-8. Annual ^{210}Po environmental intakes at Dayton Units I, III, and IV

Year	Unit I Intake (Bq)	Unit III Intake (Bq)	Unit IV Intake (Bq)
1944[a]	6.91	6,912	6,912
1945	43.20	43,200	43,200
1946	43.20	43,200	43,200
1947	43.20	43,200	43,200
1948	43.20	43,200	43,200

a. Based on 8 weeks of ^{210}Po production in 1944

An estimate of the uncertainty associated with the median environmental intakes presented in Table 4-8 has been made by assuming that the intakes are lognormally distributed and that the median intakes in Table 4-8 represent the 50th percentile intake rate. The intake from exposure to the "tolerance" level of 2,400 dpm/m^3 (96,000 Bq in each year from 1945 to 1948) for units III and IV and 0.1% of the "tolerance" level for unit I are assumed to represent the upper 95th percentile intake. The resulting geometric standard deviation (GSD) is 1.6.

4.1.3 ^{210}Po Intakes from Soil Ingestion

No soil sampling data are available from the 1940s for the Dayton Facilities to assess soil contamination levels. Due to the short half-life of ^{210}Po, sampling conducted in the late 1990s is of no value. Assuming that soil resuspension accounted for 0.01% of the mean airborne ^{210}Po measured in December 1947 at Dayton Unit III (See Section 4.1.1), the analysis estimated the ^{210}Po soil concentrations using the four-factor formula (equation 3-3) from the Savannah River Site TBD, as follows:

$$CA = SD \times CS \times SF \times RF$$

where:

CA = pCi/m^3 Air
CS = pCi/kg Soil average
SD = 1,600 kg/m^3 soil
SF = 0.08-m surface factor
RF = 1×10^{-9}/m resuspension

$$CS = CA/(SD \times SF \times RF)$$

Unit conversion and soil concentration calculations for Units III and IV:

$$CA = 5.27 \times 10^{-10}\ \mu Ci/ml \times 0.0001 \times ml/cm^3 \times (100cm)^3/m^3 \times 1 \times 10^6\ pCi/\mu Ci = 5.27E\text{-}02\ pCi/m^3$$

$$CS = 5.27E\text{-}02\ pCi/m^3/(1{,}600\ kg/m^3 \times 0.08m \times 1 \times 10^{-9}/m) = 4.12 \times 10^2\ pCi/g\ (15.23\ Bq/g)$$

Assuming 5 grams of ^{210}Po contaminated soil are ingested per year results in an annual ^{210}Po ingestion intake of 76.20 Bq. For the eight weeks of operation in 1944 the resulting intake would be 12.20 Bq. The most claimant favorable absorption type should be chosen for dose reconstruction because of the various chemical forms of polonium that may have been used at the Dayton facilities.

4.1.4 Dayton Facilities External Exposures

4.1.4.1 Annual ^{210}Po Submersion External Exposures

This analysis calculated annual air submersion external exposures at the Dayton Facilities by multiplying the median airborne ^{210}Po intake concentrations (Table 4-7) by 2,000 hours per year (occupancy) yielding an external submersion exposure of 1.30E+08 Bq s m^{-3} at Units III and IV. To assess the magnitude of submersion dose, the submersion exposure was multiplied by the effective dose coefficient of 4.16E-19 Sv per Bq s m^{-3} (Eckerman and Ryman 1993 reproduced in Tables 4A-1 and 4A-2) for ^{210}Po air submersion resulting in an air submersion effective dose of 5.4E-11 Sv. The resulting dose is well below 1 mrem; consequently, dose reconstructors need not consider submersion dose from effluents at the Dayton Facilities.

4.1.4.2 Ground Layer External Exposures Attributed to Soil Contamination

No soil sampling data are available from the 1940s for the Dayton Facilities to estimate environmental contamination levels. Due to the short half-life of ^{210}Po, sampling conducted in the late 1990s is of no value. A radiological survey performed in May 1949 prior to the dismantlement of Unit IV indicated that contamination had been spread over the entire Unit IV area, which in some instances, exceeded 2.0E+05 dpm per 100 cm^2 total alpha contamination (Monsanto, 1950). Even though the contamination levels at the Dayton Facilities likely resulted from the gradual buildup of contamination over time, the reported level has been decay corrected back to the 1946 level of 7.80E+06 dpm per 100 cm^2 (1.30E+07 Bq per m^2). This analysis estimated external exposure attributable to ^{210}Po soil contamination at Units III and IV by assuming that the grounds surrounding Units III and IV were contaminated at a level of 7.80E+06 dpm per 100 cm^2. Based on an exposure duration of 2,000 hr/yr and an effective dose coefficient of 8.29E-21 Sv per Bq s m^{-2}, (Eckerman and Ryman 1993), the resulting external exposure is 9.41E+13 Bq s m^{-2} yielding an effective dose of 7.80E-07 Sv. Based on the magnitude of the resulting dose (<1 mrem), dose reconstructors need not consider the external dose from the soil layer at the Dayton Facilities.

4.1.4.3 Direct External Exposure From Facilities

No documentation of direct gamma radiation outside of the Dayton Facilities is available. The only documentation of a control badge result is for the week of May 17 to May 23, 1944, when a control badge result of 0.13 Roentgen or (0.9 mR/h) was reported (Tybout 1944). Assuming that the control badge data is representative of ambient dose rate outside the Dayton Facilities, the resulting dose for 2,000 hours of occupational exposure is 1,800 mrem.

Direct external ambient dose could have resulted from gamma radiation originating within the operational buildings of Dayton Units III and IV or from the storage of waste material and or irradiated bismuth bricks within facility buildings or onsite structures. It is unlikely that gamma radiation originating from within the operational buildings of the Dayton facilities contributed to the ambient environmental dose. The irradiated bismuth bricks used at the Dayton Facilities were not canned in aluminum like the canned bismuth slugs that were irradiated at the Hanford facility and subsequently shipped to Mound. Consequently, the ^{60}Co content of the slugs used at Dayton were much lower than the canned slugs used at Mound. According to a shielding study report from 1948, the work with polonium entails very limited use of shielding and whenever necessary, "operations are easily performed by valve handles extending through a lead or concrete shield" (Bradley and Haring 1948e).

No detailed description of the administrative radiological control program pertaining to environmental exposure is available for the Dayton Facilities; however, there are several radiological control practices described in 1945 Progress Reports. On October 8, 1945, a shipment of 80 bismuth slugs was received at Unit IV, so a "lead pig barricade" was constructed in the southwest Greenhouse to store the slugs. In addition, a "keep out" sign and a barrier were posted four feet from the barricade in the Greenhouse where exposure rates measured <1 mR/h (Monsanto 1945g).

According to an August 1945 Progress Report, two shipments of waste were shipped from Unit IV in August 1945. One of the shipments contained 15 barrels of waste in a Chevrolet truck with an exposur2e rate of 3.8 mR/h in the truck cab. The other shipment consisted of 18 barrels of waste in a "V-8 truck" truck with an exposure rate of 2.7 mR/h in the truck cab (Monsanto 1945c).

Based on the anecdotal evidence presented in the progress reports and control badge results discussed above, an ambient, external dose rate of 0.90 mR/h or 1.80 cSv based on 2000 hours of occupational exposure per year appears to be a reasonable, claimant favorable estimation (Table 4-9). Unit I ambient external exposures are assumed to be negligible based on fact that there was no polonium production at Dayton Unit I and that projects conducted there involved relatively small quantities of ^{14}C, ^{3}H, and ^{210}Po in dispersible form (DOE 1993b and Mound Site Profile).

Table 4-9. Annual ambient external exposures at Dayton Units III, and IV

Year	Unit III (cSv)	Unit IV (cSv)
1944[a]	0.29	0.29
1945	1.80	1.80

Year	Unit III (cSv)	Unit IV (cSv)
1946	1.80	1.80
1947	1.80	1.80
1948	1.80	1.80

a. Based on 8 weeks of ^{210}Po production in 1944

For 1945 through 1948 an estimate of the uncertainty associated with the ambient dose has been made by assuming that the ambient dose is lognormally distributed and that the median annual dose of 1.80 cSv represents the 50th percentile dose. Exposure to the "tolerance" or permissible level of 15 cSv per year is assumed to represent the upper 95th percentile dose. The resulting geometric standard deviation (GSD) is 3.6. For 1944 an estimate of the uncertainty associated with the ambient dose has been made by assuming that the ambient dose is lognormally distributed and that the median annual dose of 0.29 cSv represents the 50th percentile dose. Exposure to the "tolerance" or permissible level 0.5 cSv (500 mrem) per 40-hour week for 8 weeks (4.0 cSv) is assumed to represent the upper 95th percentile dose. The resulting geometric standard deviation (GSD) is 3.5 for 1944.

4.2 MOUND LABORATORY

Mound Laboratory was an integrated research, development, and production facility performing work in support of U.S. Department of Energy (DOE) weapon and nonweapon programs with emphasis on chemical explosives and nuclear technology. Mound Laboratory originated as a technical organization in 1943 when the Federal Government requested Monsanto Chemical Company to accept responsibility for determining the chemical and metallurgical properties of polonium as a project of the Manhattan Engineering District (MED). Work occurred at Monsanto's Central Research Department and several satellite units in the Dayton, Ohio, area. Late in 1945, the MED determined that the research, development, and production organization at Dayton should become a permanent facility. A search for a suitable location in early 1946 led to the selection of a 728,000-m^2 (182-acre) tract adjacent to Miamisburg, Ohio, about 16 km (10 miles) south-southwest of Dayton. The facility is surrounded by residential and recreational properties as well as agricultural areas and sits atop an elevated area overlooking Miamisburg, the Great Miami River, and the river plain area to the west. In 1981, DOE purchased an additional 123 acres of land south of the original 182 acres for unrealized mission expansion. This parcel was never developed.

Construction of Mound Laboratory began in February 1947 and ended in 1949. In late 1948, work at the Dayton Units moved to the Mound site. The following paragraphs describe key Mound facilities and their historic functions (DOE 1999; Monsanto 1975a, DOE 1993b).

Semi-Works (SW/R) Tritium Complex

This two-story facility was used primarily for handling tritium. Four major operations occurred in the SW/R Tritium Complex: component development, component evaluation operations, tritium recovery, and materials analysis. SW/R, which was built in 1950, underwent 13 major additions. One corridor of rooms in the adjacent building, Research (R), was converted to tritium operations; this corridor, together with the SW building and Building 58, formed the SW/R complex. While the complex was primarily a tritium facility, there were three additional areas. From 1951 through 1953 Mound intermittently conducted a research and development program to recover ^{227}Ac and ^{228}Th from neutron irradiated ^{226}Ra (EG&G 1995a). The three parent radionuclides of ^{227}Ac, ^{226}Ra and ^{228}Th and their radioactive progeny were present in the irradiated material. The recovery operation was conducted in a special shielded process facility referred to as the old cave (room SW-19) on the east side of the building. From 1951 to 1953 work in the cave resulted in the release of 1.6 E+05 uCi of ^{227}Ac, ^{226}Ra, ^{228}Th and their radioactive progeny (Story 1973). From 1964 to 1968, purified ^{227}Ac in oxide and nitrate forms was processed in a hot cell and analytical lab area (Room SW-140) in the SW Building (EG&G 1995a). This work resulted in the release of 5.3 uCi of ^{227}Ac to the atmosphere (Storey 1973). This facility has been demolished.

Technical (T) Building

The T Building was operational in 1949 and was originally used to purify ^{210}Po for use in nuclear weapon initiators. Decontamination work was done from 1971 through 1974 on the ^{210}Po processing areas. Its last mission was to support tritium programs for reconfiguration, safe shutdown, and remaining operations. The facility has also been used to extract radionuclides, to house the plutonium verification facility, and to store transuranic (TRU) materials. Since 1980, KYLE (classified), Tritium Emission Recovery Facility (TERF), Hydrogen Isotope Separations System (HISS), and other tritium facilities large enough to handle multikilogram quantities were added to T Building. Special nuclear material (SNM), primarily ^{239}Pu, was stored in T-Building storage areas A and B prior to transfer to Building 38 for repackaging. The SNM was in the form of metal, metal oxide, residue, and/or combinations thereof; these materials were contained in sealed drums and other metal containers.

Building 38

Building 38 was originally designed to be a radiochemical processing facility for ^{238}Pu, used in the oxide form as fuel for radioisotope thermoelectric generators (RTGs). Building design began in 1965, and construction was complete in December 1967. Assembly and disassembly associated with manufacturing ^{238}Pu heat source modules for RTGs were the primary operations conducted in Building 38. Other programs included assembly of three types of heat sources and two types of RTGs and general-purpose radionuclide handling. RTG and heat source assembly and disassembly, which were supported in the F-line operations, involved the 5-watt, High Power Generator Mod 3 and General Purpose Heat Sources (GPHS) programs.

Building 50

Building 50 was an RTG assembly and test laboratory. Encapsulated ^{238}Pu fuel was loaded into graphite assemblies in Building 38 and welded into stainless-steel containers. The containers were transferred to Building 50 for fuel reduction and subsequent installation in electrical converters.

Building 22, Waste Staging Facility

The Waste Staging Facility (WSF) provides storage and staging for solid low-level radioactive waste (LLW) containers prior to offsite shipment. The facility can store as many as 186 metal boxes, stage lined and unlined 30- or 55-gallon metal drums with or without overpack, and stage closed wooden boxes that contain LLW. Transition to the WSF was complete in June 1995. Building 22, built in 1967, previously housed a property management warehouse, office spaces, and a test facility for glovebox operations.

Building 72

Building 72 is used to store miscellaneous hazardous wastes until they can be shipped off the site for disposal. The wastes are in steel drums, plastic drums, plastic and steel containers of various sizes, and gas cylinders. In addition, waste sampling, packaging, and repackaging of some wastes; drum over packing; and container inspection and marking occur in this facility. Building 72 is a steel-framed building with metal panel siding on three walls.

Table 4-10 lists significant programs and events that occurred at the Mound site that are potentially relevant to dose reconstruction.

Most early programs were concerned with ^{210}Po and its applications, particularly the fabrication of neutron and alpha sources for weapon and nonweapon use. From 1950 to 1963, laboratory investigations of uranium, ^{231}Pa, and ^{239}Pu were part of the national civilian power reactor program. Separation of stable isotopes of noble gases began in 1954. Also in 1954, Mound scientists invented the thermoelectric generator fueled with ^{210}Po. A limited amount of research and development work with ^{239}Pu in gram quantities began in 1955. In 1957, Mound Laboratory began the development, production, and surveillance of detonators for military applications. Beginning in 1959, ^{238}Pu in

Table 4-10. Significant Mound Laboratory programs and events.[a]

1946	Mound Laboratory planning started.
1948	Mound Laboratory occupied.
1949	Polonium operations moved from Dayton Units to Mound Laboratory.
1950	Separation of Po-208 and Po-209 from proton (accelerator) irradiation of bismuth. Separation of Ac-227 from irradiated Ra-226 in the SW 19 (old cave). Uranyl sulfate – heavy water fuel system research. Civilian power reactor research involving uranium, Pa-231, and Pu-239; mission ended in 1963.
1954	Invention of Po-210-fueled thermoelectric generator. Tritium studies began in 1954 with the first of several programs requiring tritium-handling technology starting in 1958. There were facilities for the recovery and purification of tritium from all types of wastes generated at DOE sites that handled tritium. Construction of thorium refinery for breeder reactor program; refinery never operated. In late 1954, Mound Laboratory received 400 tons of thorium (^{232}Th) sludge from Brazilian ore residues, which was subsequently stored outdoors in 55-gallon drums.
1955	Repackaging of 6,000 55-gallon drums containing thorium ore and sludge occurred through 1965 at three different times to help prevent possibility of further contamination. In 1964, the thorium sludge was transferred to a special building for storage. Early in 1975, the thorium ore residues were removed from Mound and sold to a commercial organization.
1956	Completed separation of 1.3 grams of Pa-231 in Building HH. Weighable quantities of Th-230 (ionium) separated. ^{239}PuBe neutron sources manufactured. Nuclear weapon detonator development, production, and surveillance; mission ended in 1989.
1959	Pu-239 reactor fuels laboratory operational. Tritium waste recovery and purification facility operational.
1960	The first reduction of metallic Pu-238 was achieved in the spring of 1960.
1961	Pu-238 production started and Development of Pu-238 heat sources for thermoelectric generators.
1965	Gaseous effluent control system operational in SW Building.
1966	Thorium ore and sludge moved to bulk storage in Building 21.
1968	PP Building 38 operational for processing Pu-238.
1969	Waste line break and subsequent contamination of abandoned Miami-Erie Canal bed with Pu-238. Began tritium recycling from retired weapon parts.
1972	Tritium effluent control project began. Nonweapons polonium work terminated.
1974	Thorium ore and sludge completely removed from site. Po-210 decontamination of T Building completed.
1975	Pu-238 recovery operations terminated.
1977	Californium Multiplier Neutron Radiography Facility installed.
1989	Removal of soil contaminated with uranium near Building 34.
1990	Pu-238 decontamination of inactive laboratories in Research (R) Building.
1991	Removal of Pu-238-contaminated waste line connecting HH Building with WD facility.
1993	DOE decision to transfer defense mission from Mound. Pu-238 decontamination of PP Building 38 and Acid Leach Field (Area D).
1994	Demolition of SM Building structure contaminated with Pu-238.
1995	All weapon components production terminated.

1996	Demolition of SD Building (sanitary waste treatment facility) and Building 21 (thorium ore and sludge bulk storage facility), including excavation of contaminated soil. Miami-Erie Canal removal action (Pu-238- contaminated sediments) fieldwork begins in October.
1997	Removal of soil contaminated with Ac-227 at Area 7.
1998	Miami-Erie Canal removal action fieldwork completed; approximately 30,000 yd^3 removed for offsite disposal.

a. Adapted from DOE 1993b, DOE 1999 and EPA 2003.

quantities up to a kilogram was used in research, development, and production operations; however, the *Summary of Environmental Monitoring Report for 1959 and First Quarter 1960*, states that "during the year 1959, a year of transition, the alpha emitting isotope that would have contributed to environmental background was polonium" (Monsanto,1960).

From 1959 to 1960, the initial plutonium program activities were conducted in R Building. During this early phase, the program consisted of research and development efforts to understand the chemistry and metallurgy of ^{238}Pu. The thermal hazards as well as the chemical reactivity and containment of plutonium during processing and fabrication led to major safety concerns.

In 1960, the SM Building was constructed to provide both the technical and safety related features that were absent in the R Building. The elevated emissions of plutonium (see section 4.2.2) in 1960 were due to R Building operations. The SM Building became operational in 1961 and emissions of plutonium decreased significantly (see section 4.2.2). In 1967, Building 38 (also known as the PP Building) and an annex on the WD Building were constructed to take over the increased plutonium program demands. The SM Building processes and fabrication operations were transferred to the new Building 38 facility.

The total quantity of ^{238}Pu used in operations at Mound Laboratory was sharply reduced in June 1977. Encapsulation of ^{238}Pu for the large heat sources (containing in some cases more than 4 kilograms of this material) was terminated. In late 1979, Mound ended production of plutonium oxide feedstock for heat sources, and began receiving this material already in primary encapsulation.

4.2.1 Environmental Air Monitoring

Mound Laboratory had various environmental air-monitoring programs through most of its history, starting in 1948 and continuing to the present. Gross alpha, tritiated water vapor (HTO), ^{210}Po, ^{238}Pu, $^{239, 240}$Pu, ^{228}Th, ^{230}Th, and ^{232}Th measurements occurred during these years, although not all measurements were collected in any given year. The tables in Attachments 4B, 4C, and 4D list environmental air-monitoring data from 1948 to September 1959, 1959 to 1972, and 1973 to 2001, respectively, along with references for the data.

From 1948 to 1959, air monitoring consisted of offsite, downwind air samples taken at unspecified locations and counted for gross alpha radiation. From 1960 to 1966, Mound conducted roving air sampler measurements of gross alpha activity obtained by truck-mounted equipment driven over a planned route in areas adjacent to the Mound site. From 1967 to 1971, Mound monitored concentrations of HTO, ^{238}Pu, and ^{210}Po off the site. Available data do not contain onsite air-sampling data for these three periods (with the exception of 1971, when "Site Center, Southern and Northern Perimeter" data was acquired). The usefulness of the offsite data prior to 1971 is limited, because the air samples were not collected in one location around the clock. Therefore, it is not certain whether the offsite concentrations reflect a maximum or even average concentration. Consequently, the offsite data cannot be used to infer onsite airborne radionuclide concentrations.

A program to acquire onsite meteorological data began in 1972 (Monsanto 1976a). The average onsite wind speed was approximately 8 mph (13 km/h) and the predominant wind direction was from the southwest. From 1972 to 2002, air-monitoring data was obtained from a network of both onsite (Figure 4-1) and offsite (Figure 4-2) stationary air samplers. This analysis used the site-wide median air concentration from the annual average onsite air monitoring station results to determine intake concentrations from 1971 through 2003 (See Tables 4C-13, 4C-14, and 4D-1 through 4D-29). For years in which onsite air monitoring data were unavailable (prior to 1971) and effluent data was available, empirically derived onsite atmospheric dispersion factors (plutonium, polonium particulates, and hydrogen gas/vapor χ/Qs) were used to estimate the intake air concentration. Table 4-11 summarizes the annual, median effluent air concentrations used to derive intakes for dose reconstruction. Subsequent sections discuss the intakes estimated from these data and effluent release monitoring data.

Some of the environmental air monitoring station results (See Tables 4C-13, 4C-14, and 4D-1 through 4D-30) were reported as “incremental” to reflect that the measured “environmental level” concentration at the control (28 miles upwind) location was subtracted from the concentration at the monitoring stations. Consequently, whenever nonincremental concentration results were reported, the contribution from control location No. 119 was subtracted from the site-wide median results. For all years in which on-site environmental air-monitoring data were available, the median concentration from the onsite annual average monitoring station results was selected to assign radionuclide intakes. For years in which onsite air monitoring data were unavailable (prior to 1971) and effluent data was available, empirically derived onsite atmospheric dispersion factors (plutonium, polonium particulates, and hydrogen gas/vapor χ/Qs) were used to estimate the onsite intake air concentration.

In 1997 Mound Laboratory added ^{232}Th, ^{230}Th and ^{228}Th to the environmental air filter analyses conducted as part of the routine environmental air monitoring program in support of several D&D projects involving thorium contaminated soil and structures. Although these radionuclides are not effluents, the median of the annual average, environmental air-monitoring station results for ^{232}Th, ^{230}Th and ^{228}Th have been included in this section.

Table 4-11. Site-Wide Annual Median effluent intake concentrations by radionuclide (μCi ml^{-1}).

Year	^{238}Pu	^{210}Po	HTO	^{239,240}Pu	^{232}Th	^{230}Th	^{228}Th	^{226}Ra	^{227}Ac
2003	--	--	--	--	--	--	--	--	--
2002	3.76E-18	--	3.50E-12	1.90E-19	0.00E+00	0.00E+00	0.00E+00	--	--
2001	4.01E-18	--	4.83E-12	3.00E-20	2.25E-18	3.04E-18	3.79E-18	--	--
2000	4.08E-18	--	2.28E-12	1.70E-19	2.91E-18	4.12E-18	3.71E-18	--	--
1999	1.43E-18	--	8.45E-12	1.50E-19	4.42E-18	4.41E-18	4.60E-18	--	--
1998	5.11E-18	--	1.01E-11	7.00E-20	1.80E-19	0.00E+00	0.00E+00	--	--
1997	2.06E-17	--	7.19E-12	0.00E+00	2.14E-18	4.47E-18	3.00E-18	--	--
1996	5.94E-18	--	6.94E-12	8.00E-20	--	--	--	--	--
1995	5.99E-18	--	2.11E-12	1.20E-19	--	--	--	--	--
1994	7.29E-18	--	3.69E-12	3.10E-19	--	--	--	--	--
1993	7.10E-18	--	4.16E-12	3.90E-19	--	--	--	--	--
1992	5.83E-18	--	7.43E-12	2.40E-19	--	--	--	--	--
1991	7.70E-18	--	1.17E-11	0.00E+00	--	--	--	--	--
1990	5.64E-18	--	1.86E-11	7.00E-20	--	--	--	--	--
1989	1.50E-17	--	2.50E-11	2.90E-19	--	--	--	--	--
1988	5.80E-17	--	2.41E-11	2.00E-19	--	--	--	--	--
1987	4.35E-17	--	3.33E-11	1.60E-19	--	--	--	--	--
1986	9.34E-17	--	2.13E-11	4.50E-19	--	--	--	--	--
1985	1.26E-16	--	2.73E-11	6.30E-19	--	--	--	--	--
1984	2.32E-17	--	2.21E-11	3.00E-19	--	--	--	--	--

Year	^{238}Pu	^{210}Po	HTO	^{239,240}Pu	^{232}Th	^{230}Th	^{228}Th	^{226}Ra	^{227}Ac
1983	1.32E-17	--	3.43E-11	1.30E-18	--	--	--	--	--
1982	2.39E-17	--	3.93E-11	0.00E+00	--	--	--	--	--
1981	2.07E-17	--	6.76E-11	0.00E+00	--	--	--	--	--
1980	8.80E-18	--	8.88E-11	6.00E-19	--	--	--	--	--
1979	1.60E-17	--	8.60E-12	5.00E-19	--	--	--	--	--
1978	2.50E-17	--	6.20E-12	4.00E-18	--	--	--	--	--
1977	2.80E-17	--	1.60E-11	0.00E+00	--	--	--	--	--
1976	8.40E-17	--	2.00E-11	2.20E-18	--	--	--	--	--
1975	6.40E-17	--	2.90E-11	3.00E-18	--	--	--	--	--
1974	1.88E-16	1.10E-15	1.53E-10	6.06E-18	--	--	--	--	--
1973	1.56E-16	1.10E-15	7.40E-11	5.03E-18	--	--	--	--	--
1972	1.40E-16	1.30E-15	8.20E-11	4.51E-18	--	--	--	--	--
1971	4.00E-16	2.00E-15	4.80E-09	1.29E-17	--	--	--	--	--
1970	1.19E-14	1.94E-13	1.46E-09	3.82E-16	--	--	--	--	--
1969	2.88E-14	2.70E-13	2.56E-09	9.27E-16	--	--	--	--	--
1968	1.56E-14	3.54E-13	2.24E-09	5.03E-16	--	--	--	--	1.53E-03
1967	1.48E-13	1.37E-12	2.96E-09	4.78E-15	--	--	--	--	1.53E-03
1966	8.31E-14	1.27E-12	1.62E-09	2.68E-15	--	--	--	--	1.53E-03
1965	1.58E-14	1.06E-12	1.68E-09	5.10E-16	--	--	--	--	1.53E-03
1964	6.88E-16	8.80E-13	2.13E-09	2.22E-17	--	--	--	--	1.53E-03
1963	2.95E-16	7.33E-13	2.55E-09	9.50E-18	--	--	--	--	--
1962	3.82E-16	6.11E-13	1.98E-09	1.23E-17	--	--	--	--	--
1961	4.37E-16	5.09E-13	1.95E-09	1.41E-17	--	--	--	--	--
1960	6.83E-13	4.24E-13	8.31E-10	2.20E-14	--	--	--	--	--
1959	--	3.54E-13	2.56E-10	--	--	--	--	--	--
1958	--	2.95E-13	2.33E-10	--	--	--	--	--	--
1957	--	2.46E-13	2.11E-10	--	--	--	--	--	--
1956	--	2.05E-13	1.92E-10	--	--	--	--	--	--
1955	--	1.71E-13	1.75E-10	--	--	--	--	--	--
1954	--	1.42E-13	1.59E-10	--	--	--	--	--	--
1953	--	1.18E-13	--	--	--	--	8.16E-19	1.57E-18	4.94E-19
1952	--	1.18E-13	--	--	--	--	8.16E-19	1.57E-18	4.94E-19
1951	--	1.18E-13	--	--	--	--	8.16E-19	1.57E-18	4.94E-19
1950	--	1.18E-13	--	--	--	--	--	--	--
1949	--	1.18E-13	--	--	--	--	--	--	--

To account for trace radionuclides that were not included in the routine environmental air or effluent discharge sampling and analysis programs at Mound, ^{238}Pu scaling factors were developed based on an assay of the feed material, plutonium dioxide, supplied to the Mound facility from SRS, as shown below. As a result, the scaling factor (activity concentration ratio) table (Table 4-12) infers concentrations of trace radionuclides and ^{239,240}Pu for years in which effluent or air monitoring station data only include ^{238}Pu.

The feed material profile discussed above was adjusted to reflect the actual observed air sample ratio of ^{238}Pu to ^{239,240}Pu to infer the ^{239,240}Pu concentration in air for years in which only ^{238}Pu data were available. The actual activity concentration ratio for ^{239,240}Pu was inferred from measurements of air samples taken by Mound for the 1975 through 1980 period of record (See Table 4-13.). The observed ratio of ^{238}Pu to ^{239,240}Pu in air samples from onsite sampling stations recording the highest annual average plutonium concentration from 1975 to 1980 is 31.0 to 1 compared to the theoretical ratio of 824 (i.e., the inverse of the theoretical ^{239,240}Pu activity concentration shown above). The discrepancy between the feed material ratio of ^{238}Pu to ^{239,240}Pu and the observed air sample ratio of ^{238}Pu to ^{239,240}Pu is likely the result of ^{239,240}Pu effluent emissions associated with ^{239,240}Pu research rather than the SRS feed material profile.

The relative internal dose contribution from radionuclides present in SRS plutonium dioxide feed material has been assessed using ICRP Publication 68 dose conversion factors (DCFs), as discussed below (ICRP 1995). Most of the internal dose (99.8%) is attributable to ^{238}Pu (96.5 %) and ^{239,240}Pu (3.3%). As a result, dose reconstructors can neglect the internal dose contribution from trace radionuclides other than ^{239,240}Pu in effluent associated with the feed material. See Table 4-14.

Table 4-12. SRS plutonium dioxide feed material and Mound scaling factors.

Radionuclide	Half-life (y)	Specific activity (Ci/g)	Reported weight fraction	Activity concentration (Ci/g)	Theoretical activity fraction	^{238}Pu activity concentration ratios Theoretical	Corrected[a]
Pu-236[b]	2.86E+00	5.30E+01	1.00E-06	5.30E-05	3.69E-06	3.86E-06	--
Pu-238[b]	8.77E+01	1.71E+01	8.02E-01	1.37E+01	9.56E-01	1.00E+00	--
Pu-239[b]	2.41E+04	6.20E-02	1.59E-01	9.86E-03	6.86E-04	7.18E-04	--
Pu-240[b]	6.56E+03	2.27E-01	3.00E-02	6.81E-03	4.74E-04	4.96E-04	--
Pu-239,240	--	--	--	--	1.16E-03	1.21E-03	3.22E-02
Pu-242[b]	3.73E+05	3.96E-03	1.00E-03	3.96E-06	2.76E-07	2.88E-07	--
Pu-241[b]	1.44E+01	1.03E+02	6.00E-03	6.20E-01	4.31E-02	4.52E-02	--
U-234[c]	2.46E+05	6.22E-03	1.90E-03	1.18E-05	8.22E-07	8.61E-07	--
Np-237[c]	2.14E+06	7.05E-04	3.00E-04	2.12E-07	1.47E-08	1.54E-08	--
Am-241[c]	4.32E+02	3.43E+00	5.00E-04	1.72E-03	1.19E-04	1.25E-04	--
Pa-231[c]	3.28E+04	4.72E-02	1.00E-05	4.72E-07	3.28E-08	3.44E-08	--
Th-232[c]	1.41E+10	1.10E-07	1.00E-05	1.10E-12	7.63E-14	7.99E-14	--
U-232[c]	6.89E+01	2.24E+01	1.00E-05	2.24E-04	1.56E-05	1.63E-05	--
U-235[c]	7.04E+08	2.16E-06	1.00E-05	2.16E-11	1.50E-12	1.57E-12	--
U-236[c]	2.34E+07	6.47E-05	1.00E-05	6.47E-10	4.50E-11	4.71E-11	--
Ac-227[c]	2.18E+01	7.23E+01	1.00E-05	7.23E-04	5.03E-05	5.27E-05	--
Total			1.00E+00	1.44E+01	1.00E+00		

a. The actual ratio of ^{238}Pu to ^{239,240}Pu based on air sample analytical results for 5 years (1975 to 1980) is 31.0:1. This ratio was calculated using the annual mean concentration of ^{238}Pu and ^{239}Pu at maximum sampler location and corrected for offsite contribution of ^{238}Pu and ^{239,240}Pu indicated at the location of the minimum ^{238}Pu and ^{239,240}Pu offsite concentration. [This data is presented in Table 4-13 below.]
b. EG&G (1995a)
c. DOE (1993)

Table 4-13. Pu-238:^{239,240}Pu activity concentration ratios inferred from measurements of environmental air samples taken at Mound.

Year	Annual mean activity concentrations (10^{-18} μCi/ml)[a] Highest onsite ^{238}Pu	Lowest offsite ^{238}Pu	Highest onsite ^{239,240}Pu	Lowest offsite ^{239,240}Pu	^{238}Pu:^{239,240}Pu net activity concentration ratio
1975	1,033	1.2	41.0	16.0	41.3
1976	267	0.5	13.0	3.8	29.0
1977	81	0.9	31.0	16.0	5.3
1978	110	0.8	27.0	22.0	21.8
1979	190	0.5	11.0	7.4	52.6
1980	58	0.2	4.9	3.3	36.1
Min	58	0.2	4.9	3.3	5.3
Max	1,033	1.2	41.0	22.0	52.6
Median	150	0.7	20.0	11.7	32.5
Mean	290	0.7	21.3	11.4	31.0
StdDev	372	0.4	13.8	7.7	16.4

a. Data from Attachment 4D, Tables 4D-3 through 4D-8.

For years in which onsite air monitoring data were unavailable (prior to 1971) and total, annual, stack effluent data was available, empirically derived onsite atmospheric dispersion factors (plutonium, polonium particulates, and hydrogen gas/vapor χ/Qs) were used to estimate the intake air concentration.

The χ/Q derivation coupled the site-wide median air concentration (^{238}Pu, ^{210}Po, and ^{3}H concentration) with the corresponding total, annual, effluent discharges (Table 4-15). This derivation was repeated for an 11-year period of record (1973 to 1983) for plutonium and HTO, and 1 year (1973) for polonium. For assigning an intake concentration, the 11- and 1-year average χ/Q was selected: 8.61E-05 sec/m^3 for plutonium, 5.12E-04 sec/m^3 for polonium, and 2.56E-07sec/m^3 for tritium (Table 4-16). The calculated dispersion factor data for the 11- and 1-year period are presented in Table 4-16 below.

Polonium production and research at Mound were discontinued in the early 1970s (DOE 1993b). Polonium effluent discharge data are available only for 1953, 1973 and 1974; as a result, the ratio of ^{210}Po to ^{238}Pu observed in environmental air samples has been used to infer the ^{210}Po effluent release rate from 1967 through 1970. In addition, the 1973 and 1974 onsite polonium air monitoring results were influenced by the decontamination and decommissioning of the Mound polonium processing facilities (DOE 1993b). Consequently, the 1974 polonium effluent and air monitoring results shown in Table 4-16 were not used in the χ/Q derivation for polonium.

Table 4-14. SRS plutonium dioxide feed material relative dose contribution.

Radionuclide	ICRP 68 DCF (Sv/Bq)	Activity concentration (Ci/g)	Activity fraction	Weighted DCF	Percent Dose Contribution
Pu-236	1.30E-05	5.30E-05	3.58E-06	4.66E-11	1.61E-04
Pu-238*	3.00E-05	1.37E+01	9.28E-01	2.78E-05	9.65E+01
Pu-239,240*	3.20E-05	4.42E-01	2.99E-02	9.56E-07	3.31E-00
Pu-242	3.10E-05	3.96E-06	2.68E-07	8.30E-12	2.88E-05
Pu-241	5.80E-07	6.20E-01	4.19E-02	2.43E-08	8.42E-02
U-234	6.80E-06	1.18E-05	7.99E-07	5.43E-12	1.88E-05
U-235	6.10E-06	2.16E-11	1.46E-12	8.91E-18	3.09E-11
U-236	6.30E-06	6.47E-10	4.37E-11	2.76E-16	9.55E-10
U-232	2.60E-05	2.24E-04	1.51E-05	3.93E-10	1.36E-03
Am-241	2.70E-05	1.72E-03	1.16E-04	3.13E-09	1.08E-02
Pa-231	8.90E-05	4.72E-07	3.19E-08	2.84E-12	9.84E-06
Th-232	2.90E-05	1.10E-12	7.41E-14	2.15E-18	7.45E-12
Np-237	1.50E-05	2.12E-07	1.43E-08	2.14E-13	7.43E-07
Ac-227	6.30E-04	7.23E-04	4.89E-05	3.08E-08	1.07E-01

*Dosimetrically Significant

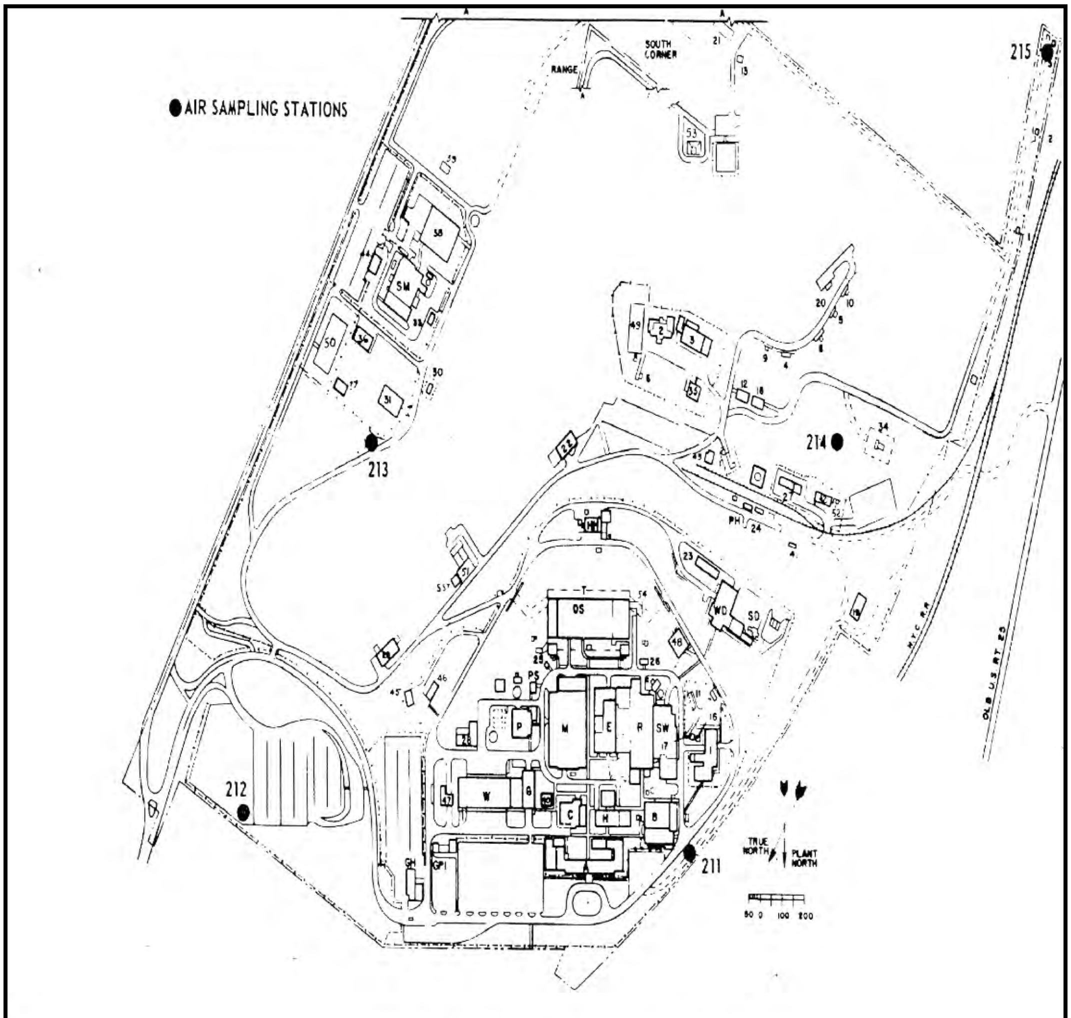

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FIGURE 2 - On-site air sampling locations.

Figure 4-1. Mound onsite airborne radioactivity monitoring locations.

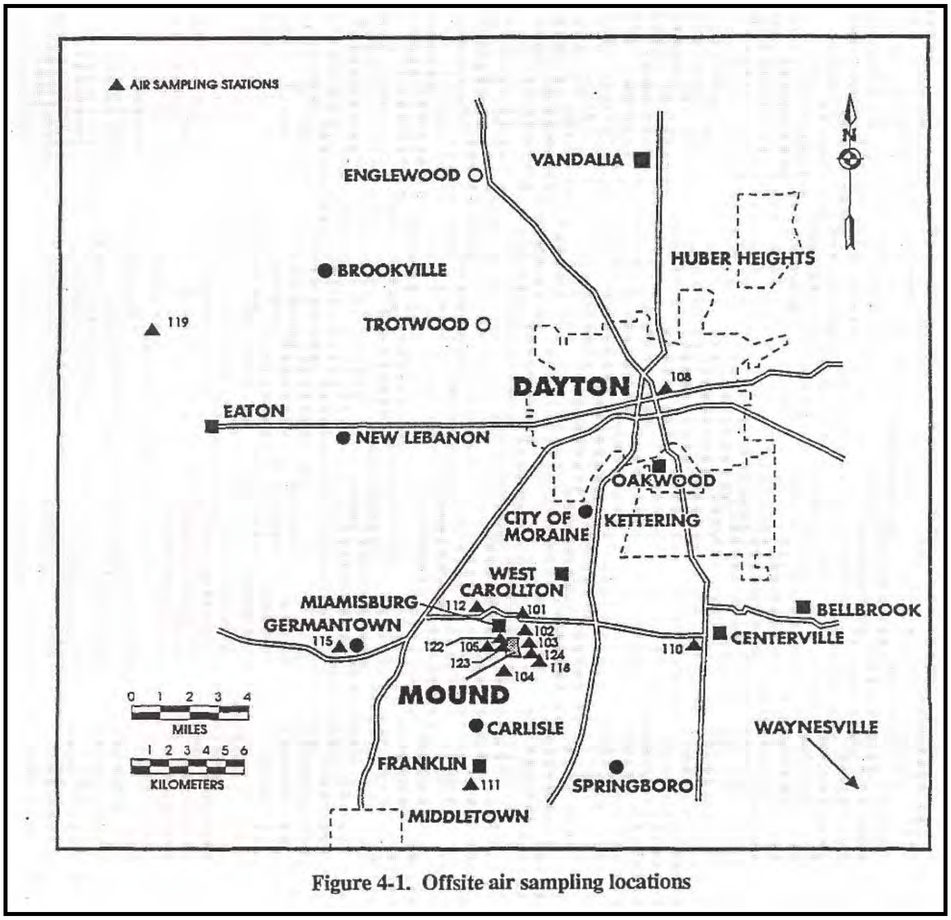

Figure 4-2. Mound offsite airborne radioactivity monitoring locations.

4.2.2 Effluent Intake Concentrations

The following discussion describes the technical approach used to establish airborne radionuclide concentrations to determine radionuclide intakes (Section 4.2.3) and submersion exposures (Section 4.2.4). Section 4.2.5 describes the technical approach and results for the contaminated soil exposure pathways. These exposure pathways are (1) resuspension intakes, (2) external submersion, and (3) direct external from the contaminated soil layer.

For ^{238}Pu, the effluent concentration data from 2001 through 1971 are based on the median, onsite annual environmental air monitoring results. From 1960 through 1970, the effluent concentration data are based on the reported ^{238}Pu annual effluent source term from Table 4-15 combined with the derived atmospheric dispersion factor for ^{238}Pu from Table 4-16 to infer the median onsite environmental concentration.

For ^{210}Po, the effluent concentration data from 1971 through 1974 are based on the median, onsite annual environmental air monitoring results. From 1967 through 1970, the data are based on reported ^{238}Pu annual effluent source terms (scaled to infer ^{210}Po based on the ratio of ^{210}Po to ^{238}Pu on air samples) combined with the derived atmospheric dispersion factor for polonium from Table 4-15 to infer median onsite environmental concentrations. As previously discussed, polonium effluent discharge data are available for only 1953, 1973 and 1974; consequently, from 1949 through 1953, it is assumed that the ^{210}Po effluent source term remained constant at the 20-μCi per day level (Bradley

1953a). From 1954 through 1966, it is assumed that the ^{210}Po release rate increased 20% each year from the constant 1949 through 1953 daily values (Table 4-15). This annual increase was considered necessary and reasonable to extrapolate between 1953 and 1967 effluent release rates. The 1949 through 1966 ^{210}Po annual effluent source terms were combined with the atmospheric dispersion factor derived for polonium (Table 4-16) to infer onsite environmental concentrations.

Table 4-15. Total Mound site radioactive effluent discharges, 1949 – 1983.[a]

Year	^{238}Pu (µCi)	^{210}Po:^{238}Pu ratio[b]	^{210}Po (µCi)	^{3}H (Ci)	^{226}Ra (µCi)	^{227}Ac (µCi)	^{228}Th (µCi)
1983	4	--	--	4,293			
1982	21	--	--	4,283			
1981	8	--	--	4,285			
1980	15	--	--	3,795			
1979	12	--	--	3,831			
1978	14	--	--	7,346			
1977	12	--	--	4,896			
1976	15	--	--	6,206			
1975	23	--	--	8,859			
1974	28	0.025	0.7[c]	10,031			
1973	84	0.81	68[c]	15,331			
1972	74	5.75	426	30,483			
1971	401	3.38	1,355	73,503			
1970	4,342	2.76	11,984	179,468			
1969	10,544	1.58	16,660	315,252			
1968	5,720	3.82	21,850	275,856		1.06	
1967	54,347	1.55	84,238	364,685		1.06	
1966	30,442	2.57	78,263	199,561		1.06	
1965	5,803	11.20	65,009	206,750		1.06	
1964	252	215.40	54,279	262,638		1.06	
1963	108	417.84	45,127	313,932			
1962	140	268.24	37,554	244,455			
1961	160	196.25	31,400	240,644			
1960	250,125[d]	0.10	26,161	102,427			
1959			21,806	31,527			
1958			18,177	28,374			
1957			15,148	25,537			
1956			12,623	22,983			
1955			10,509	20,685			
1954			8,773[e]	18,616[f]			
1953			7,305		0.097	0.03	0.05
1952			7,305		0.097	0.03	0.05
1951			7,305		0.097	0.03	0.05
1950			7,305				
1949			7,305				

a. Adapted from DOE (1993b). "--" means no data.
b. From 1967 through 1972 the ratio of ^{210}Po to ^{238}Pu is based on radionuclide-specific (^{238}Pu and ^{210}Po) analyses of offsite (onsite for 1972) air samples obtained at the 0-3 mile roving locations from 1967 to 1972 (see Attachment 4C, Tables 4C-9 through 4C-14).
c. 1973 and 1974 ^{210}Po effluent data (Carfagno and Westendorf 1974; Carfagno and Robinson 1975).
d. Eleveated ^{238}Pu levels due to R Building operations prior to the SM Building becoming operational in 1961. In 1962 a second bank of HEPA filters was installed in the SM Building plenum (DOE 1993b).
e. From 1954 through 1966, it is assumed that the ^{210}Po release rate increased 20% each year from the constant 1949 through 1953 value.

f. From 1954 through 1958, it is assumed that the HTO release rate decreased 10% each year from that reported for 1959.

For HTO, the data from 1971 through 2001 are based on the median, onsite annual environmental air monitoring results. Beginning in 1959 through 1970, the data are based on reported tritium effluent source terms (Table 4-15) combined with derived atmospheric dispersion factor derived for tritium in Table 4-16 to infer onsite environmental concentrations. From 1954 through 1958, it is assumed that the HTO release rate decreased 10% each year from that for 1959 (31,527 Ci/yr). From 1954 through 1958, the HTO annual effluent source terms were combined with derived atmospheric dispersion factor for tritium to infer onsite median environmental concentrations.

Table 4-11 lists the annual, average, effluent median intake concentrations used to calculate annual claimant intakes described in Section 4.2.3.

Table 4-16. Inferred onsite dispersion factors by radionuclide, 1973–1983.

Year	χ/Q (sec/m^3)		
	H-3	**Pu-238**	**Po-210**
1983	2.52E-07	1.04E-04	--
1982	2.90E-07	3.59E-05	--
1981[a]	4.98E-07	8.17E-05	--
1980[b]	7.38E-07	1.85E-05	--
1979	7.08E-08	4.21E-05	--
1978	2.66E-08	5.64E-05	--
1977	1.03E-07	7.36E-05	--
1976	1.02E-07	1.77E-04	--
1975	1.03E-07	8.78E-05	--
1974[c]	4.81E-07	2.12E-04	4.96E-02
1973[d]	1.52E-07	5.86E-05	5.12E-04
N	11	11	2
Min	2.66E-08	1.85E-05	5.12E-04
Max	7.38E-07	2.12E-04	4.96E-02
Mean	2.56E-07	8.61E-05	2.51E-02

a. Year of maximum ^{238}Pu χ/Q
b. Year of maximum ^{3}H χ/Q
c. Year of maximum ^{210}Po χ/Q due to Mound D&D Program activity
d. ^{210}Po χ/Q used in this analysis based on 1973 data

From 1951 through 1953 Mound intermittently conducted a research and development program to recover ^{227}Ac, ^{226}Ra and ^{228}Th from neutron irradiated ^{226}Ra. The three parent radionuclides of ^{227}Ac, ^{226}Ra and ^{228}Th and their radioactive progeny were present in the irradiated material. The recovery operation was conducted in a special shielded process facility referred to as the old cave (room SW-19) on the east side of the building (EG&G 1995a). From 1951 to 1953 work in the cave resulted in the release of 1.6E+05 uCi of ^{227}Ac, ^{226}Ra, ^{228}Th and their radioactive progeny (Story 1973). At the completion of the program 47.5 Ci of ^{226}Ra, 14.9 Ci of ^{227}Ac, and 24.6 Ci of ^{228}Th were purified.

Health Physics Monthly Information Reports prior to September 1952 do not contain useful air sample or effluent data from the Ra-Ac Program work areas. Beginning in September 1952, most of the Monthly and Quarterly Health Physics Reports contain a summary of the monthly average of initial air filter counts and a summary of the monthly average of final air filter counts performed between 20 to 30 days after the initial count. Initial and final air sample counting data from high risk Ra-Ac work areas is presented in Table 4-17 below. This data has been used to calculate the release rate of long lived radionuclides (^{227}Ac, ^{226}Ra, and ^{228}Th) from the release reported by Storey (1.6 E+05 uCi) assuming that equal quantities were released each year from 1951 through 1953 and assuming that the long lived radionuclides consisted of ^{227}Ac, ^{226}Ra, and ^{228}Th in the same proportion as the amounts purified at the completion the program (55% ^{226}Ra, 17% ^{227}Ac, and 28% ^{228}Th).

Table 4-17. Ratio of initial to final air sample counts from Ra-Ac program areas

High Risk Ra, Ac, and Th Area Air Samples	Month/Year	Ratio of Initial to Final Count	Reference
GP1A	September 1952	2E+04	Bradley 1952b
GP Cave	November 1952	5E+04	Bradley 1952d
GP Lab	December 1952	3E+04	Bradley 1952e
GP Exhaust	February 1953	1E+05	Bradley 1953c
GP High Risk Area Air Samples (5)	April 1953	2E+06	Bradley 1953e
GP High Risk Area Air Samples (5)	May 1953	1E+06	Bradley 1953f
GP High Risk Area Air Samples (5)	June 1953	8E+04	Bradley 1953g
GP High Risk Area Air Samples (5)	July 1953	6E+04	Bradley 1953h
GP High Risk Area Air Samples (5)	August 1953	3E+03	Bradley 1953I
High Risk Air Lock	September 1953	3E+04	Bradley 1953j
High Risk Air Lock	October 1953	1E+05	Bradley 1953k
High Risk Air Lock	November 1953	2E+05	Bradley 1953l
High Risk Air Lock	December 1953	5E+04	Bradley 1953m
Average		3E+05	
Minimum		3E+03	
Maximum		2E+06	

The median site-wide intake concentrations of ^{227}Ac, ^{226}Ra, and ^{228}Th presented in Table 4-11 have been calculated assuming that the T west polonium stack was the source of the emissions with a dispersion factor (χ/Q) of 5.12E-04 sec/m^3.

From 1964 through 1968, purified ^{227}Ac in oxide and nitrate forms was processed in a hot cell and analytical lab area (Room SW-140) in the SW Building (EG&G 1995a). This work resulted in the release of 5.3 uCi of ^{227}Ac to the atmosphere (Storey 1973).

The median site-wide concentration of ^{227}Ac presented in Table 4-11 has been calculated assuming that equal quantities were released each year from 1964 through 1968 from the T west polonium stack with a dispersion factor (χ/Q) of 5.12E-04sec/m^3.

4.2.3 Mound Effluent Inhalation Intakes

4.2.3.1 Site-Wide Annual Median Effluent Radionuclide Inhalation Intakes

The site-wide annual median radionuclide intakes presented in Table 4-18 are derived by multiplying the annual median effluent air concentrations (Table 4-11) by 2,400 m^3/yr, which is the product of reference man's default breathing rate (1.2 m^3/hr) and 2,000 work hr/yr. The tritium intake has been increased by a factor of 1.5 to account for skin absorption. As discussed above, most of the internal dose (99.8%) from SRS feed material is attributable to ^{238}Pu and ^{239,240}Pu. As a result, only intakes of ^{238}Pu, ^{239,240}Pu, HTO, ^{210}Po, ^{232}Th, ^{230}Th, ^{228}Th, ^{226}Ra and ^{227}Ac from Mound effluents are significant for dose reconstruction. The most claimant favorable absorption type should be chosen for dose reconstruction because of the various chemical forms of polonium, thorium and plutonium used at Mound Laboratory.

Table 4-18. Site Wide Annual Median Effluent Inhalation Intakes at Mound (Bq).

Year	^{238}Pu	^{210}Po	HTO	^{239,240}Pu	^{232}Th	^{230}Th	^{228}Th	^{227}Ac	^{226}Ra
2003	--	--	--	--	--	--	--	--	--
2002	3.34E-04	--	4.66E+02	1.69E-05	0.00E+00	0.00E+00	0.00E+00	--	--
2001	3.56E-04	--	6.43E+02	2.66E-06	2.00E-04	2.70E-04	3.37E-04	--	--
2000	3.62E-04	--	3.04E+02	1.51E-05	2.58E-04	3.66E-04	3.29E-04	--	--
1999	1.27E-04	--	1.13E+03	1.33E-05	3.92E-04	3.92E-04	4.08E-04	--	--
1998	4.54E-04	--	1.34E+03	6.22E-06	1.60E-05	0.00E+00	0.00E+00	--	--
1997	1.83E-03	--	9.58E+02	0.00E+00	1.90E-04	3.97E-04	2.66E-04	--	--
1996	5.27E-04	--	9.24E+02	7.10E-06	--	--	--	--	--
1995	5.32E-04	--	2.81E+02	1.07E-05	--	--	--	--	--
1994	6.47E-04	--	4.92E+02	2.75E-05	--	--	--	--	--
1993	6.30E-04	--	5.54E+02	3.46E-05	--	--	--	--	--
1992	5.18E-04	--	9.90E+02	2.13E-05	--	--	--	--	--
1991	6.84E-04	--	1.55E+03	0.00E+00	--	--	--	--	--
1990	5.01E-04	--	2.47E+03	6.22E-06	--	--	--	--	--
1989	1.33E-03	--	3.33E+03	2.66E-05	--	--	--	--	--
1988	5.15E-03	--	3.21E+03	1.78E-05	--	--	--	--	--
1987	3.86E-03	--	4.44E+03	1.42E-05	--	--	--	--	--
1986	8.29E-03	--	2.84E+03	4.00E-05	--	--	--	--	--
1985	1.12E-02	--	3.64E+03	5.59E-05	--	--	--	--	--
1984	2.06E-03	--	2.94E+03	2.66E-05	--	--	--	--	--
1983	1.17E-03	--	4.57E+03	1.15E-04	--	--	--	--	--
1982	2.12E-03	--	5.23E+03	0.00E+00	--	--	--	--	--
1981	1.84E-03	--	9.00E+03	0.00E+00	--	--	--	--	--
1980	7.81E-04	--	1.18E+04	5.33E-05	--	--	--	--	--
1979	1.42E-03	--	1.15E+03	4.44E-05	--	--	--	--	--
1978	2.22E-03	--	8.26E+02	3.55E-04	--	--	--	--	--
1977	2.49E-03	--	2.13E+03	0.00E+00	--	--	--	--	--
1976	7.46E-03	--	2.66E+03	1.95E-04	--	--	--	--	--
1975	5.68E-03	--	3.86E+03	2.66E-04	--	--	--	--	--
1974	1.67E-02	9.77E-02	2.04E+04	5.38E-04	--	--	--	--	--
1973	1.39E-02	9.77E-02	9.86E+03	4.47E-04	--	--	--	--	--
1972	1.24E-02	1.15E-01	1.09E+04	4.01E-04	--	--	--	--	--
1971	3.55E-02	1.78E-01	6.39E+05	1.14E-03	--	--	--	--	--
1970	1.05E+00	1.73E+01	1.94E+05	3.39E-02	--	--	--	--	--
1969	2.56E+00	2.40E+01	3.41E+05	8.24E-02	--	--	--	--	--
1968	1.39E+00	3.15E+01	2.98E+05	4.47E-02	--	--	--	1.53E-03	--
1967	1.32E+01	1.21E+02	3.94E+05	4.24E-01	--	--	--	1.53E-03	--
1966	7.38E+00	1.13E+02	2.16E+05	2.38E-01	--	--	--	1.53E-03	--
1965	1.41E+00	9.38E+01	2.24E+05	4.53E-02	--	--	--	1.53E-03	--
1964	6.11E-02	7.81E+01	2.84E+05	1.97E-03	--	--	--	1.53E-03	--
1963	2.62E-02	6.51E+01	3.39E+05	8.44E-04	--	--	--	--	--
1962	3.39E-02	5.43E+01	2.64E+05	1.09E-03	--	--	--	--	--
1961	3.88E-02	4.52E+01	2.60E+05	1.25E-03	--	--	--	--	--
1960	6.06E+01	3.77E+01	1.11E+05	1.95E+00	--	--	--	--	--
1959	--	3.14E+01	3.41E+04	--	--	--	--	--	--
1958	--	2.62E+01	3.10E+04	--	--	--	--	--	--
1957	--	2.18E+01	2.82E+04	--	--	--	--	--	--
1956	--	1.82E+01	2.56E+04	--	--	--	--	--	--
1955	--	1.51E+01	2.33E+04	--	--	--	--	--	--
1954	--	1.26E+01	2.12E+04	--	--	--	--	--	--
1953	--	1.05E+01	--	--	--	--	7.24E-05	4.39E-05	1.40E-04
1952	--	1.05E+01	--	--	--	--	7.24E-05	4.39E-05	1.40E-04
1951	--	1.05E+01	--	--	--	--	7.24E-05	4.39E-05	1.40E-04
1950	--	1.05E+01	--	--	--	--	--	--	--

Year	^{238}Pu	^{210}Po	HTO	^{239,240}Pu	^{232}Th	^{230}Th	^{228}Th	^{227}Ac	^{226}Ra
1949	--	1.05E+01	--	--	--	--	--	--	--

4.2.3.2 Site-Wide Maximum Annual Average Effluent Inhalation Intakes

Site-wide maximum, annual radionucluide intakes have been calculated to estimate the upper 95th percentile effluent intake. These intakes have been calculated in a similar manner as the median intakes presented in Table 4-18 above. From 1971 to 2001, the maximum, annual average on-site air monitoring station results (Tables 4C-13, 4C-14, and 4D-1 through 4D-30) were used to determine intake concentrations.

For years in which onsite air monitoring data were unavailable (prior to 1971) and annual effluent data was available, empirically derived onsite atmospheric dispersion factors (plutonium, polonium particulates, and hydrogen gas/vapor χ/Qs) were used to estimate the intake air concentration. The χ/Q derivation coupled the onsite air monitoring location indicating the highest annual, average air concentration (^{238}Pu, ^{210}Po, and ^{3}H concentration) with the corresponding effluent source term (shown in Table 4-16). This derivation was repeated for an 11-year period of record (1973 to 1983) for plutonium and HTO, and 1 year (1973) for polonium. For assigning an intake concentration, the 11- and 1-year average χ/Q was selected: 6.03E-04 sec/m^3 for plutonium, 7.43E-04 sec/m^3 for polonium, actinium and thorium and 5.90E-07 sec/m^3 for gases/vapors (e.g. HT/HTO). The dispersion factor data used to infer maximum, annual average radionuclide intakes are presented in Table 4-19 below. The maximum intakes shown in Table 4-20 have been derived by multiplying the maximum, site-wide, annual average effluent air concentrations by 2,400 m^3/yr, which is the product of reference man's default breathing rate (1.2 m^3/hr) and 2,000 work hr/yr. The tritium intake has been increased by a factor of 1.5 to account for skin absorption.

Table 4-19. Inferred maximum onsite dispersion factors by radionuclide, 1983–1973.

	χ/Q (sec/m^3)		
Year	H-3	Pu-238	Po-210, Ac-227, Th-228 and Ra-226
1983	3.12E-07	5.85E-04	--
1982	4.16E-07	1.32E-04	--
1981	5.78E-07	1.44E-03	--
1980	3.43E-06	1.22E-04	--
1979	1.11E-07	5.00E-04	--
1978	3.87E-08	2.48E-04	--
1977	1.80E-07	2.05E-04	--
1976	1.32E-07	5.55E-04	--
1975	1.14E-07	1.41E-03	--
1974	9.85E-07	9.11E-04	
1973	1.89E-07	5.21E-04	7.43E-04
N	11	11	1
Min	3.87E-08	1.22E-04	7.43E-04
Max	3.43E-06	1.44E-03	7.43E-04
Mean	5.90E-07	6.03E-04	7.43E-04

Table 4-20. Site Wide Maximum Annual Intakes at Mound (Bq).

Year	^{238}Pu	^{210}Po	HTO	^{239,240}Pu	^{232}Th	^{230}Th	^{228}Th	^{227}Ac	^{226}Ra
2003	--	--	--	--	--	--	--	--	--
2002	8.32E-04	--	1.51E+03	2.93E-05	0.00E+00	0.00E+00	0.00E+00	--	--
2001	1.41E-03	--	1.01E+03	1.78E-05	2.50E-04	3.47E-04	3.82E-04	--	--

Year	^{238}Pu	^{210}Po	HTO	^{239,240}Pu	^{232}Th	^{230}Th	^{228}Th	^{227}Ac	^{226}Ra
2000	9.85E-04	--	5.89E+02	1.51E-05	5.86E-04	8.01E-04	6.60E-04	--	--
1999	1.39E-04	--	2.65E+03	2.13E-05	4.40E-04	5.14E-04	4.93E-04	--	--
1998	6.75E-04	--	1.79E+03	6.22E-06	3.55E-05	0.00E+00	0.00E+00	--	--
1997	5.12E-03	--	1.57E+03	1.65E-04	3.61E-04	5.48E-04	3.89E-04	--	--
1996	7.91E-03	--	1.26E+03	1.32E-04	--	--	--	--	--
1995	2.90E-02	--	4.46E+02	1.40E-04	--	--	--	--	--
1994	3.15E-02	--	1.00E+03	3.11E-04	--	--	--	--	--
1993	3.68E-03	--	9.00E+02	1.18E-04	--	--	--	--	--
1992	1.98E-03	--	2.20E+03	3.29E-05	--	--	--	--	--
1991	3.04E-03	--	5.18E+03	0.00E+00	--	--	--	--	--
1990	3.11E-03	--	5.11E+03	2.49E-05	--	--	--	--	--
1989	4.08E-03	--	4.13E+03	4.44E-05	--	--	--	--	--
1988	7.10E-03	--	5.41E+03	5.33E-05	--	--	--	--	--
1987	1.68E-02	--	5.17E+03	6.22E-05	--	--	--	--	--
1986	1.58E-02	--	5.45E+03	9.06E-05	--	--	--	--	--
1985	1.62E-02	--	4.36E+03	9.59E-05	--	--	--	--	--
1984	1.12E-02	--	3.77E+03	6.22E-05	--	--	--	--	--
1983	6.59E-03	--	5.66E+03	1.78E-04	--	--	--	--	--
1982	7.81E-03	--	7.53E+03	2.66E-05	--	--	--	--	--
1981	3.23E-02	--	1.05E+04	2.66E-05	--	--	--	--	--
1980	5.15E-03	--	5.50E+04	1.33E-04	--	--	--	--	--
1979	1.69E-02	--	1.80E+03	2.84E-04	--	--	--	--	--
1978	9.77E-03	--	1.20E+03	4.44E-04	--	--	--	--	--
1977	6.93E-03	--	3.73E+03	8.88E-04	--	--	--	--	--
1976	2.34E-02	--	3.46E+03	8.17E-04	--	--	--	--	--
1975	9.15E-02	--	4.53E+03	1.95E-03	--	--	--	--	--
1974	7.18E-02	1.07E-01	4.26E+04	2.31E-03	--	--	--	--	--
1973	1.23E-01	1.33E-01	1.29E+04	3.97E-03	--	--	--	--	--
1972	3.55E-02	2.04E-01	2.66E+04	1.14E-03	--	--	--	--	--
1971	3.55E-02	3.55E-01	7.19E+05	1.14E-03	--	--	--	--	--
1970	7.36E+00	2.51E+01	4.47E+05	2.37E-01	--	--	--	--	--
1969	1.79E+01	3.48E+01	7.85E+05	5.76E-01	--	--	--	--	--
1968	9.70E+00	4.57E+01	6.87E+05	3.13E-01	--	--	--	2.22E-03	--
1967	9.22E+01	1.76E+02	9.08E+05	2.97E+00	--	--	--	2.22E-03	--
1966	5.16E+01	1.63E+02	4.97E+05	1.66E+00	--	--	--	2.22E-03	--
1965	9.84E+00	1.36E+02	5.15E+05	3.17E-01	--	--	--	2.22E-03	--
1964	4.27E-01	1.13E+02	6.54E+05	1.38E-02	--	--	--	2.22E-03	--
1963	1.83E-01	9.46E+01	7.82E+05	5.90E-03	--	--	--	--	--
1962	2.37E-01	7.88E+01	6.09E+05	7.65E-03	--	--	--	--	--
1961	2.71E-01	6.57E+01	5.99E+05	8.74E-03	--	--	--	--	--
1960	4.24E+02	5.47E+01	2.55E+05	1.37E+01	--	--	--	--	--
1959	--	4.56E+01	7.85E+04	--	--	--	--	--	--
1958	--	3.80E+01	7.14E+04	--	--	--	--	--	--
1957	--	3.17E+01	6.49E+04	--	--	--	--	--	--
1956	--	2.64E+01	5.90E+04	--	--	--	--	--	--
1955	--	2.20E+01	5.36E+04	--	--	--	--	--	--
1954	--	1.83E+01	4.88E+04	--	--	--	--	--	--
1953	--	1.53E+01	--	--	--	--	1.05E-04	6.37E-05	1.40E-04
1952	--	1.53E+01	--	--	--	--	1.05E-04	6.37E-05	1.40E-04
1951	--	1.53E+01	--	--	--	--	1.05E-04	6.37E-05	1.40E-04
1950	--	1.53E+01	--	--	--	--	--	--	--
1949	--	1.53E+01	--	--	--	--	--	--	--

An estimate of the uncertainty associated with the median environmental intakes at Mound presented in Table 4-18 has been made by assuming that the intakes are lognormally distributed and that the median intakes represent the 50th percentile intake rate. The site-wide, maximum, annual average intakes presented in Table 4-20 are assumed to represent the upper 95th percentile intake. The resulting geometric standard deviations (GSDs) are presented in Table 4-21 below.

Table 4-21. Geometric Standard Deviation for Effluent Intakes at Mound

Year	^{238}Pu	^{210}Po	^{3}H	^{239,240}Pu	^{232}Th	^{230}Th	^{228}Th	^{227}Ac	^{226}Ra
2003	--	--	--	--	--	--	--	--	--
2002	1.7	--	2.0	1.7	<EL	<EL	<EL	--	--
2001	2.3	--	1.3	3.1	1.1	1.2	1.1	--	--
2000	1.8	--	1.5	1.0	1.6	1.6	1.5	--	--
1999	1.1	--	1.7	1.3	1.1	1.2	1.1	--	--
1998	1.3	--	1.2	1.0	1.6	<EL	<EL	--	--
1997	1.9	--	1.3	<EL	1.5	1.2	1.3	--	--
1996	5.1	--	1.2	5.8	1.3	1.3	1.2	--	--
1995	11.2	--	1.3	4.7	--	--	--	--	--
1994	10.4	--	1.5	4.3	--	--	--	--	--
1993	2.9	--	1.3	2.1	--	--	--	--	--
1992	2.3	--	1.6	1.3	--	--	--	--	--
1991	2.5	--	2.1	<EL	--	--	--	--	--
1990	3.0	--	1.6	2.3	--	--	--	--	--
1989	2.0	--	1.1	1.7	--	--	--	--	--
1988	1.2	--	1.4	1.9	--	--	--	--	--
1987	2.4	--	1.1	2.4	--	--	--	--	--
1986	1.5	--	1.5	1.6	--	--	--	--	--
1985	1.2	--	1.1	1.4	--	--	--	--	--
1984	2.8	--	1.2	1.7	--	--	--	--	--
1983	2.8	--	1.1	1.3	--	--	--	--	--
1982	2.2	--	1.2	<EL	--	--	--	--	--
1981	5.6	--	1.1	<EL	--	--	--	--	--

Year	^{238}Pu	^{210}Po	^{3}H	^{239,240}Pu	^{232}Th	^{230}Th	^{228}Th	^{227}Ac	^{226}Ra
1980	3.1	--	2.5	1.7	--	--	--	--	--
1979	4.5	--	1.3	3.1	--	--	--	--	--
1978	2.4	--	1.3	1.1	--	--	--	--	--
1977	1.9	--	1.4	<EL	--	--	--	--	--
1976	2.0	--	1.2	2.4	--	--	--	--	--
1975	5.4	--	1.1	3.3	--	--	--	--	--
1974	2.4	1.1	1.6	2.4	--	--	--	--	--
1973	3.7	1.2	1.2	3.7	--	--	--	--	--
1972	1.9	1.4	1.7	1.9	--	--	--	--	--
1971	1.0	1.5	1.1	1.0	--	--	--	--	--
1970	3.2	1.3	1.7	3.2	--	--	--	--	--
1969	3.2	1.3	1.7	3.2	--	--	--	--	--
1968	3.2	1.3	1.7	3.2	--	--	--	1.3	--
1967	3.2	1.3	1.7	3.2	--	--	--	1.3	--
1966	3.2	1.3	1.7	3.2	--	--	--	1.3	--
1965	3.2	1.3	1.7	3.2	--	--	--	1.3	--
1964	3.2	1.3	1.7	3.2	--	--	--	1.3	--
1963	3.2	1.3	1.7	3.2	--	--	--	--	--
1962	3.2	1.3	1.7	3.2	--	--	--	--	--
1961	3.2	1.3	1.7	3.2	--	--	--	--	--
1960	3.2	1.3	1.7	3.2	--	--	--	--	--
1959	--	1.3	1.7	--	--	--	--	--	--
1958	--	1.3	1.7	--	--	--	--	--	--
1957	--	1.3	1.7	--	--	--	--	--	--
1956	--	1.3	1.7	--	--	--	--	--	--
1955	--	1.3	1.7	--	--	--	--	--	--
1954	--	1.3	1.7	--	--	--	--	--	--

Year	^{238}Pu	^{210}Po	^{3}H	^{239,240}Pu	^{232}Th	^{230}Th	^{228}Th	^{227}Ac	^{226}Ra
1953	--	1.3	1.7	--	--	--	1.3	1.3	1.3
1952	--	1.3	1.7	--	--	--	1.3	1.3	1.3
1951	--	1.3	1.7	--	--	--	1.3	1.3	1.3
1950	--	1.3	1.7	--	--	--	--	--	--
1949	--	1.3	1.7	--	--	--	--	--	--
Mean GSD	3.1	1.3	1.5	2.6	1.3	1.3	1.2	1.3	1.3

<EL – 50th percentile intake concentration is less than the environmental level measured 28 miles offsite.

4.2.4 Annual Effluent Submersion External Exposures

Annual average air submersion external exposures were calculated by multiplying the effluent air intake concentrations in Table 4-11 by 2,000 work hr/yr as shown in Table 4-22. To assess the magnitude of submersion dose, the values in Table 4-22 were multiplied by the effective dose coefficient for air submersion (Eckerman and Ryman 1993). The results of the assessment indicate that the annual effective submersion dose from all radionuclides in Mound effluents is less than 5.0×10^{-10} Sv (<1 mrem) in any year during Mound operations. Consequently, dose reconstructors need not consider submersion dose from effluents.

4.2.5 Resuspension Intakes, Submersion External Exposures, and Ground Layer External Exposures Attributed to Soil Contamination

This analysis estimated the intake of radionuclides resuspended from soil at the Mound facility using a site-wide average profile of radionuclide soil concentrations measured in 30-cm-thick soil samples (Lyons 2003). The analysis assumes that all the soil samples were obtained in 1990. In addition, the claiment favorable assumption that the soil contamination is the due to a combination of spills, pipeline breaks and effluent deposition in 1949 has been made. As a result, 1990 radionuclide concentrations were decay-corrected to obtain radionuclide activities present in 1949, 1950, 1955, 1960, 1965, 1970, 1975, 1980 and 1985 to provide an estimate of radiological conditions for each time period (see Tables 4-23 through 4-28). No decay correction has been applied to radionuclides with a relatively long half-life or radionuclide progeny in secular equilibrium with a long-lived parent radionuclide present in the soil. Plutonium and Americium soil contamination from SRS feed material is assumed to be present beginning in 1960.

Because there is no ^{210}Po soil data available, the ^{210}Po soil concentrations in Tables 4-23 through 4-28 were inferred based on the relationship between the sum of ^{238}Pu effluent from 1960 to 1983 (362,670 uCi) and the decay corrected soil concentration of ^{238}Pu in 1960 (2160.8 Bq/Kg). The resulting ratio of 5.96E-03 Bq/Kg per uCi emitted was applied to the 1949 through 1974 annual ^{210}Po emissions. To account for the build up and decay of ^{210}Po in soil, 16% of the previous years ^{210}Po soil concentration was added to the next consecutive years ^{210}Po soil concentration starting in 1950, because after one year, only 16% of the original ^{210}Po activity remains. The highest ^{210}Po soil concentration within the time periods shown in Tables 4-23 through 4-28 has been used in the calculations. Because effluent emissions of ^{210}Po at Mound ceased in 1974, ^{210}Po soil contamination is assumed to have decayed by 1975.

The mean soil concentrations (pCi g^{-1}) were converted to resuspension concentrations using the four-factor formula in ORAU (2003, equation 3-3). Resuspension air concentrations were used to calculate (1) external exposures by submersion and (2) submersion (resuspension) intakes (Bq) by multiplying the air concentrations by 2,000 h/yr and using a breathing rate of 2,400 m^3/y for inhalation intake. Resuspension intakes for ^{3}H, ^{238}Pu, ^{239,240}Pu and ^{210}Po intakes were not calculated because the derivation of the inhalation intakes presented in Table 4-18 already accounts for soil resuspension intakes at the Mound site. The results are listed in Tables Tables 4-23 through 4-28 and are applicable (persist) for the periods indicated.

The external submersion and submersion (resuspension) intakes are presented in Tables 4-23 through 4-28. The annual external submersion dose and submersion (resuspension) intake doses due to contaminated soil are less than a 1 mrem annually and can be neglected for dose reconstruction.

Estimates of external exposure from radionuclides present in soil at the Mound facility were made using the same site-wide average decay corrected profile of radionuclides included in the resuspension intake estimates. Soil mass activity concentrations were converted to equivalent volume activity concentrations using a soil density of 1,600 kg/m^3 and exposure duration of 2,000 h/yr to derive soil layer external exposures. These results, (listed in Tables 4-23 through 4-28), are applicable to the radionuclides and periods applied to the resuspension intake assessment. Table 4-29 summarizes the annual, mean, site-wide external exposure results for the Mound site.

No general area environmental measurements of direct gamma radiation were documented for the Mound facility other than a single aerial survey in July 1976 (DOE 1993). The maximum exposure rates documented in the survey report ranged from 20.5 to 23.5 μR h^{-1} around the SM Building and Building 38 on the SM/PP Hill. Data from this report were difficult to interpret in a manner useful to dose reconstruction because they (1) applied to a single moment in time and (2) were probably heavily influenced by isolated radiation sources. Nevertheless, this exposure rate has been used to estimate the maximum exposure rate on site by assuming that the maximum exposure rate of 23.5 μR h^{-1} measured in 1976 was due to a spill in 1949. The spill is assumed to contain a mix of radionuclides identical to the site wide, average soil profile of radionuclides measured in 30-cm thick soil samples (Lyons 2003). Consequently, the maximum exposure rate is assumed to decay over time exactly like the site wide, average soil concentrations (See Table 4-29).

An estimate of the uncertainty associated with the ambient dose from soil contamination has been made by assuming that the ambient dose is lognormally distributed and that the median annual dose from the soil contamination presented in Tables 4-23 through 4-28 represents the 50th percentile dose. The maximum annual exposure rates around the SM Building and Building 38 on the SM/PP Hill are assumed to represent the upper 95th percentile ambient dose. The resulting geometric standard deviation (GSD) is 3.12 for each year from 1949 through 2002.

4.2.6 Direct External Exposure From Facilities

No environmental measurements of direct gamma radiation were documented for the Mound facilities. Direct external ambient dose could have resulted from gamma radiation originating within the operational buildings at Mound or from the storage of waste material and or storage of irradiated bismuth slugs within facility buildings or onsite structures. The following discussion supports the conclusion that it is unlikely that gamma radiation originating from within the operational buildings of Mound contributed to the ambient environmental dose.

Waste transport vehicles were used at Mound beginning in the 1950s for transporting casks of polonium from their unloading area along the railroad siding to the T Building. The irradiated canned bismuth slugs received from the Hanford site were removed from casks and stored in a pool of water located on the second floor of T Building where the separation of ^{210}Po from bismuth took place (DOE 1993b).

Drummed radioactive wastes generated at Mound were typically staged in operating areas and moved by health physics personnel to storage warehouses before shipment. In the 1940s and 1950s the "old explosives bunkers" were used to store waste with high gamma radiation levels to avoid worker exposures. The isolated location of the bunkers allowed these wastes to be stored away from the occupied areas of the site. Modern facilities replaced the old warehouses onsite in the 1960s and 1970s (DOE 1993b).

The most likely source of environmental exposure from gamma sources originating within Mound facilities would be associated with the ^{226}Ra - ^{227}Ac program which separated ^{227}Ac from neutron irradiated ^{226}Ra target material. The radium-actinium technology developed at Argonne National Lab (ANL) was transferred to Mound in early 1950. The General Purpose building (GP) Building later known as the SW Building was constructed with a shielded process facility on the east side of the building referred to as the old cave. The cave design was duplicated from the one used at ANL.

By March 1952, three radium – actinium separation runs had been completed in the cave. The first run contained 0.6 g of radium yielding 135 mCi of ^{227}Ac. The second and third run contained 5 grams each and yielded 2.59 and 2.36 Ci of ^{227}Ac respectively. Gamma surveys conducted during the runs indicated exposure rate levels varying from less than 1 mR/h in the operational area adjacent to the cave to 7 R/h inside the cave (Bradley and Burbage 1952b). Based on the survey results, it is unlikely that gamma radiation originating from within the SW Building cave contributed to the ambient environmental dose.

No detailed description of the administrative practices involving environmental exposure is available for the early operating years at the Mound. Nevertheless, several 1951 Monthly Health Physics Reports state that whenever routine beta and gamma surveys in operational areas detect radiation levels greater than 7.5 mR/h, the area is either shielded or roped off (Bradley and Burbage 1951e, 1951f, 1951g, 1951h, 1951i). Consequently, it is unlikely that gamma radiation originating from within the operational buildings of Mound contributed to the ambient environmental dose.

Table 4-22. Annual average effluent submersion external exposures at Mound by year and radionuclide (Bq s m^{-3}).

Year	^{238}Pu	^{210}Po	HTO	^{236}Pu	^{239,240}Pu	^{242}Pu	^{241}Pu	^{234}U	^{237}Np	^{241}Am	^{231}Pa	^{232}Th	^{232}U	^{235}U	^{236}U	^{227}Ac
2003	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2002	1.14E+00	--	9.32E+05	4.40E-06	6.13E-02	3.29E-07	5.15E-02	9.81E-07	1.76E-08	1.42E-04	3.92E-08	2.00E-02	1.86E-05	1.79E-12	5.37E-11	6.01E-05
2001	1.07E+00	--	1.29E+06	4.12E-06	7.99E-03	3.08E-07	4.82E-02	9.19E-07	1.65E-08	1.33E-04	3.67E-08	5.99E-01	1.74E-05	1.68E-12	5.03E-11	5.63E-05
2000	1.09E+00	--	6.07E+05	4.19E-06	4.53E-02	3.13E-07	4.91E-02	9.36E-07	1.67E-08	1.36E-04	3.74E-08	7.75E-01	1.77E-05	1.71E-12	5.12E-11	5.72E-05
1999	3.81E-01	--	2.25E+06	1.47E-06	4.00E-02	1.10E-07	1.72E-02	3.28E-07	5.87E-09	4.76E-05	1.31E-08	1.18E+00	6.20E-06	5.99E-13	1.80E-11	2.01E-05
1998	1.36E+00	--	2.68E+06	5.25E-06	1.86E-02	3.93E-07	6.15E-02	1.17E-06	2.10E-08	1.70E-04	4.68E-08	4.80E-02	2.22E-05	2.14E-12	6.41E-11	7.17E-05
1997	5.49E+00	--	1.92E+06	2.12E-05	1.77E-01	1.58E-06	2.48E-01	4.72E-06	8.45E-08	6.85E-04	1.89E-07	5.70E-01	8.94E-05	8.63E-12	2.59E-10	2.89E-04
1996	1.58E+00	--	1.85E+06	6.11E-06	2.13E-02	4.56E-07	7.15E-02	1.36E-06	2.44E-08	1.98E-04	5.44E-08	1.26E-13	2.58E-05	2.49E-12	7.46E-11	8.33E-05
1995	1.60E+00	--	5.62E+05	6.16E-06	3.20E-02	4.60E-07	7.21E-02	1.37E-06	2.46E-08	1.99E-04	5.49E-08	1.27E-13	2.60E-05	2.51E-12	7.52E-11	8.41E-05
1994	1.94E+02	--	9.83E+05	7.50E-04	8.26E-02	5.60E-05	8.77E+00	1.67E-04	2.99E-06	2.43E-02	6.68E-06	1.55E-11	3.16E-03	3.06E-10	9.15E-09	1.02E-02
1993	1.89E+00	--	1.11E+06	7.30E-06	1.04E-01	5.46E-07	8.54E-02	1.63E-06	2.91E-08	2.36E-04	6.50E-08	1.51E-13	3.08E-05	2.98E-12	8.91E-11	9.96E-05
1992	1.55E+00	--	1.98E+06	5.99E-06	6.39E-02	4.48E-07	7.01E-02	1.34E-06	2.39E-08	1.94E-04	5.34E-08	1.24E-13	2.53E-05	2.44E-12	7.32E-11	8.18E-05
1991	2.05E+00	--	3.10E+06	7.92E-06	0.00E+00	5.92E-07	9.26E-02	1.77E-06	3.16E-08	2.56E-04	7.05E-08	1.64E-13	3.34E-05	3.23E-12	9.67E-11	1.08E-04
1990	1.50E+00	--	4.95E+06	5.80E-06	1.86E-02	4.33E-07	6.79E-02	1.29E-06	2.31E-08	1.88E-04	5.17E-08	1.20E-13	2.45E-05	2.36E-12	7.08E-11	7.91E-05
1989	4.00E+00	--	6.66E+06	1.54E-05	7.99E-02	1.15E-06	1.80E-01	3.44E-06	6.16E-08	4.99E-04	1.37E-07	3.19E-13	6.51E-05	6.29E-12	1.88E-10	2.10E-04
1988	1.55E+01	--	6.42E+06	5.96E-05	5.33E-02	4.46E-06	6.98E-01	1.33E-05	2.38E-07	1.93E-03	5.31E-07	1.23E-12	2.52E-04	2.43E-11	7.28E-10	8.14E-04
1987	1.16E+01	--	8.87E+06	4.47E-05	4.26E-02	3.34E-06	5.23E-01	9.97E-06	1.79E-07	1.45E-03	3.98E-07	9.26E-13	1.89E-04	1.82E-11	5.46E-10	6.10E-04
1986	2.49E+01	--	5.67E+06	9.60E-05	1.20E-01	7.18E-06	1.12E+00	2.14E-05	3.83E-07	3.11E-03	8.55E-07	1.99E-12	4.05E-04	3.91E-11	1.17E-09	1.31E-03
1985	3.36E+01	--	7.27E+06	1.30E-04	1.68E-01	9.68E-06	1.52E+00	2.89E-05	5.17E-07	4.19E-03	1.15E-06	2.68E-12	5.47E-04	5.28E-11	1.58E-09	1.77E-03
1984	6.18E+00	--	5.89E+06	2.39E-05	7.99E-02	1.78E-06	2.79E-01	5.32E-06	9.52E-08	7.72E-04	2.12E-07	4.94E-13	1.01E-04	9.72E-12	2.91E-10	3.26E-04
1983	3.52E+00	--	9.14E+06	1.36E-05	3.46E-01	1.01E-06	1.59E-01	3.03E-06	5.42E-08	4.39E-04	1.21E-07	2.81E-13	5.73E-05	5.53E-12	1.66E-10	1.85E-04
1982	6.37E+00	--	1.05E+07	2.46E-05	0.00E+00	1.84E-06	2.88E-01	5.48E-06	9.81E-08	7.95E-04	2.19E-07	5.09E-13	1.04E-04	1.00E-11	3.00E-10	3.35E-04
1981	5.51E+00	--	1.80E+07	2.13E-05	0.00E+00	1.59E-06	2.49E-01	4.75E-06	8.49E-08	6.89E-04	1.90E-07	4.41E-13	8.98E-05	8.68E-12	2.60E-10	2.90E-04
1980	2.34E+00	--	2.37E+07	9.05E-06	1.60E-01	6.76E-07	1.06E-01	2.02E-06	3.61E-08	2.93E-04	8.06E-08	1.87E-13	3.82E-05	3.69E-12	1.10E-10	1.23E-04
1979	4.26E+00	--	2.29E+06	1.65E-05	1.33E-01	1.23E-06	1.92E-01	3.67E-06	6.57E-08	5.32E-04	1.47E-07	3.41E-13	6.94E-05	6.71E-12	2.01E-10	2.25E-04
1978	6.66E+00	--	1.65E+06	2.57E-05	1.07E+00	1.92E-06	3.01E-01	5.73E-06	1.03E-07	8.32E-04	2.29E-07	5.32E-13	1.08E-04	1.05E-11	3.14E-10	3.51E-04
1977	7.46E+00	--	4.26E+06	2.88E-05	0.00E+00	2.15E-06	3.37E-01	6.42E-06	1.15E-07	9.32E-04	2.56E-07	5.96E-13	1.21E-04	1.17E-11	3.51E-10	3.93E-04
1976	2.24E+01	--	5.33E+06	8.64E-05	5.86E-01	6.45E-06	1.01E+00	1.93E-05	3.45E-07	2.80E-03	7.69E-07	1.79E-12	3.64E-04	3.52E-11	1.05E-09	1.18E-03
1975	1.70E+01	--	7.73E+06	6.58E-05	7.99E-01	4.92E-06	7.70E-01	1.47E-05	2.63E-07	2.13E-03	5.86E-07	1.36E-12	2.78E-04	2.68E-11	8.03E-10	8.98E-04
1974	5.01E+01	2.93E+02	4.08E+07	1.93E-04	1.61E+00	1.45E-05	2.26E+00	4.31E-05	7.72E-07	6.26E-03	1.72E-06	4.00E-12	8.16E-04	7.88E-11	2.36E-09	2.64E-03
1973	4.16E+01	3.04E+02	1.97E+07	1.60E-04	1.34E+00	1.20E-05	1.88E+00	3.58E-05	6.41E-07	5.19E-03	1.43E-06	3.32E-12	6.77E-04	6.54E-11	1.96E-09	2.19E-03
1972	3.73E+01	3.46E+02	2.18E+07	1.44E-04	1.20E+00	1.08E-05	1.68E+00	3.21E-05	5.75E-07	4.66E-03	1.28E-06	2.98E-12	6.07E-04	5.87E-11	1.76E-09	1.96E-03
1971	1.07E+02	1.07E+03	1.44E+09	4.11E-04	3.43E+00	3.07E-05	4.81E+00	9.17E-05	1.64E-06	1.33E-02	3.66E-06	8.51E-12	1.74E-03	1.68E-10	5.02E-09	5.61E-03
1970	3.16E+03	5.18E+04	3.88E+08	1.22E-02	1.02E+02	9.11E-04	1.43E+02	2.72E-03	4.86E-05	3.94E-01	1.09E-04	2.52E-10	5.14E-02	4.97E-09	1.49E-07	1.66E-01
1969	7.67E+03	7.20E+04	6.82E+08	2.96E-02	2.47E+02	2.21E-03	3.46E+02	6.60E-03	1.18E-04	9.58E-01	2.64E-04	6.13E-10	1.25E-01	1.21E-08	3.61E-07	4.04E-01
1968	4.16E+03	9.44E+04	5.96E+08	1.61E-02	1.34E+02	1.20E-03	1.88E+02	3.58E-03	6.41E-05	5.19E-01	1.43E-04	3.32E-10	6.77E-02	6.54E-09	1.96E-07	2.19E-01
1967	3.95E+04	3.64E+05	7.88E+08	1.53E-01	1.27E+03	1.14E-02	1.78E+03	3.40E-02	6.09E-04	4.94E+00	1.36E-03	3.16E-09	6.44E-01	6.22E-08	1.86E-06	2.08E+00
1968	2.21E+04	3.38E+05	4.31E+08	8.54E-02	7.13E+02	6.38E-03	1.00E+03	1.91E-02	3.41E-04	2.76E+00	7.61E-04	1.77E-09	3.60E-01	3.48E-08	1.04E-06	1.17E+00
1965	4.22E+03	2.81E+05	4.47E+08	1.63E-02	1.36E+02	1.22E-03	1.91E+02	3.63E-03	6.50E-05	5.27E-01	1.45E-04	3.37E-10	6.87E-02	6.64E-09	1.99E-07	2.22E-01
1964	1.83E+02	2.34E+05	5.68E+08	7.07E-04	5.90E+00	5.28E-05	8.27E+00	1.58E-04	2.82E-06	2.29E-02	6.30E-06	1.46E-11	2.98E-03	2.88E-10	8.63E-09	9.65E-03
1963	7.85E+01	1.95E+05	6.79E+08	3.03E-04	2.53E+00	2.26E-05	3.55E+00	6.76E-05	1.21E-06	9.81E-03	2.70E-06	6.27E-12	1.28E-03	1.24E-10	3.70E-09	4.14E-03
1962	1.02E+02	1.63E+05	5.29E+08	3.93E-04	3.28E+00	2.94E-05	4.60E+00	8.76E-05	1.57E-06	1.27E-02	3.50E-06	8.13E-12	1.66E-03	1.60E-10	4.80E-09	5.36E-03
1961	1.16E+02	1.36E+05	5.20E+08	4.49E-04	3.75E+00	3.36E-05	5.25E+00	1.00E-04	1.79E-06	1.45E-02	4.00E-06	9.30E-12	1.89E-03	1.83E-10	5.48E-09	6.13E-03
1960	1.82E+05	1.13E+05	2.21E+08	7.02E-01	5.86E+03	5.25E-02	8.21E+03	1.57E-01	2.80E-03	2.27E+01	6.25E-03	1.45E-08	2.96E+00	2.86E-07	8.57E-06	9.58E+00
1959	--	9.42E+04	6.82E+07	--	--	--	--	--	--	--	--	--	--	--	--	--
1958	--	7.85E+04	6.20E+07	--	--	--	--	--	--	--	--	--	--	--	--	--
1957	--	6.54E+04	5.63E+07	--	--	--	--	--	--	--	--	--	--	--	--	--
1956	--	5.45E+04	5.12E+07	--	--	--	--	--	--	--	--	--	--	--	--	--
1955	--	4.54E+04	4.66E+07	--	--	--	--	--	--	--	--	--	--	--	--	--
1954	--	3.79E+04	4.23E+07	--	--	--	--	--	--	--	--	--	--	--	--	--
1953	--	3.16E+04	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1952	--	3.16E+04	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1951	--	3.16E+04	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Year	^{238}Pu	^{210}Po	HTO	^{236}Pu	^{239,240}Pu	^{242}Pu	^{241}Pu	^{234}U	^{237}Np	^{241}Am	^{231}Pa	^{232}Th	^{232}U	^{235}U	^{236}U	^{227}Ac
1950	--	3.16E+04	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1949	--	3.16E+04	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 4-23. Annual average ground layer external exposure, resuspension submersion external exposure, and resuspension submersion intake at Mound by radionuclide, 1990 to present.

Nuclide	Half-life (yr)	Mean soil (Bq/kg)	Airborne (Bq/m^3)	Submersion intake (Bq)[a]	ICRP (1995) DCF (Sv/Bq)	Submersion intake dose (Sv)	External submersion ($Bq\ s/m^3$)[a]	Sv/($Bq\ s/m^3$) effective DCF	Submersion effective dose (Sv)	Soil layer[b] ($Bq\ s/m^3$)[a]	Infinite thickness DCF Sv/($Bq\ s/m^3$)	Soil exposure dose (Sv/yr)
Ac-227	2.18E+01	12.58	1.61E-06	3.86E-03	6.30E-04	2.43E-06	1.16E+01	5.82E-18	6.75E-17	1.45E+11	2.65E-21	3.84E-10
Th-227	5.12E-02	12.58	1.61E-06	3.86E-03	7.60E-06	2.94E-08	1.16E+01	4.88E-15	5.66E-14	1.45E+11	2.79E-18	4.04E-07
Am-241	4.32E+02	4.81	6.16E-07	1.48E-03	2.70E-05	3.99E-08	4.43E+00	8.18E-16	3.63E-15	5.54E+10	2.34E-19	1.30E-08
Pu-238	8.78E+01	1,705.70	2.18E-04	c	3.00E-05	c	1.57E+03	4.88E-18	7.67E-15	1.96E+13	8.10E-22	1.59E-08
Pu-239, 240	2.41E+04	1.11	1.42E-07	c	3.20E-05	c	1.02E+00	4.75E-18	4.86E-18	1.28E+10	1.58E-21	2.02E-11
Pu-241	1.44E+01	440.30	5.64E-05	1.35E-01	5.80E-07	7.85E-08	4.06E+02	7.25E-20	2.94E-17	5.07E+12	3.16E-23	1.60E-10
Co-60	5.27E+00	3.33	4.26E-07	1.02E-03	1.70E-08	1.74E-11	3.07E+00	1.26E-13	3.87E-13	3.84E+10	8.68E-17	3.33E-06
Pa-231	3.28E+04	42.18	5.40E-06	1.30E-02	8.90E-05	1.15E-06	3.89E+01	1.72E-15	6.69E-14	4.86E+11	1.02E-18	4.96E-07
Th-230	7.70E+04	110.26	1.41E-05	3.39E-02	2.80E-05	9.48E-07	1.02E+02	1.74E-17	1.77E-15	1.27E+12	6.47E-21	8.22E-09
Th-232	1.41E+10	51.06	6.54E-06	1.57E-02	2.90E-05	4.55E-07	4.71E+01	8.72E-18	4.10E-16	5.88E+11	2.79E-21	1.64E-09
Ac-228	6.99E-04	37.37	4.78E-06	1.15E-02	2.90E-08	3.33E-10	3.44E+01	4.78E-14	1.65E-12	4.31E+11	3.20E-17	1.38E-05
Ra-228	5.76E+00	37.37	4.78E-06	1.15E-02	1.70E-06	1.95E-08	3.44E+01	0.00E+00	0.00E+00	4.31E+11	0.00E+00	0.00E+00
Bi-207	3.22E+01	2.22	2.84E-07	6.82E-04	3.20E-09	2.18E-12	2.05E+00	7.54E-14	1.54E-13	2.56E+10	5.02E-17	1.28E-06
Bi-210	1.37E-02	2.96	3.79E-07	9.09E-04	6.00E-08	5.46E-11	2.73E+00	3.29E-17	8.97E-17	3.41E+10	1.93E-20	6.58E-10
Bi-210m	3.00E+06	2.96	3.79E-07	9.09E-04	2.10E-06	1.91E-09	2.73E+00	1.22E-14	3.33E-14	3.41E+10	7.37E-18	2.51E-07
Bi-241	3.78E-05	28.86	3.69E-06	8.87E-03	2.10E-08	1.86E-10	2.66E+01	7.65E-14	2.03E-12	3.32E+11	5.25E-17	1.75E-05
Ra-226	1.60E+03	48.10	6.16E-06	1.48E-02	2.20E-06	3.25E-08	4.43E+01	3.15E-16	1.40E-14	5.54E+11	1.70E-19	9.42E-08
Cs-137	3.02E+01	8.88	1.14E-06	2.73E-03	6.70E-09	1.83E-11	8.18E+00	7.74E-18	6.33E-17	1.02E+11	4.02E-21	4.11E-10
Ba-137m	8.08E-08	8.88	1.14E-06	2.73E-03	See Cs-137	See Cs-137	8.18E+00	2.88E-14	2.36E-13	1.02E+11	1.93E-17	1.97E-06
Eu-152	1.34E+01	3.33	4.26E-07	1.02E-03	2.70E-08	2.76E-11	3.07E+00	5.65E-14	1.73E-13	3.84E+10	3.75E-17	1.44E-06
Eu-154	8.50E+00	4.44	5.68E-07	1.36E-03	3.50E-08	4.77E-11	4.09E+00	6.14E-14	2.51E-13	5.11E+10	4.11E-17	2.10E-06
Np-237	2.14E+06	0.74	9.47E-08	2.27E-04	1.50E-05	3.41E-09	6.82E-01	1.03E-15	7.02E-16	8.52E+09	4.17E-19	3.55E-09
Pu-242	3.76E+05	1.11	1.42E-07	3.41E-04	3.10E-05	1.06E-08	1.02E+00	4.01E-18	4.10E-18	1.28E+10	6.85E-22	8.76E-12
Sr-90	2.86E+01	26.64	3.41E-06	8.18E-03	7.70E-08	6.30E-10	2.46E+01	7.53E-18	1.85E-16	3.07E+11	3.77E-21	1.16E-09
Y-90	7.30E-03	26.64	3.41E-06	8.18E-03	1.70E-09	1.39E-11	2.46E+01	1.90E-16	4.66E-15	3.07E+11	1.28E-19	3.93E-08
Tc-99	2.13E+05	50.32	6.44E-06	1.55E-02	3.20E-09	4.95E-11	4.64E+01	1.62E-18	7.51E-17	5.80E+11	6.72E-22	3.90E-10
H-3	1.23E+01	105.08	1.35E-05	c	4.50E-11	c	9.68E+01	3.31E-19	3.21E-17	1.21E+12	0.00E+00	0.00E+00
Total						5.21E-06			5.07E-12			4.27E-05

a. Based on exposure duration of 2,000 hyr^{1}.

b. Uppermost 30 cm of soil layer [adapted from Lyons (2003)].

c. H-3, Pu-238 and Pu-239 resuspension taken into account in derivation of effluent intakes

Table 4-24. Annual average ground layer external exposure, resuspension submersion external exposure, and resuspension submersion intake at Mound by radionuclide, 1980 through 1989.

Nuclide	Half-life (yr)	Mean soil (Bq/kg)	Airborne (Bq/m^3)	Submersion intake (Bq)[a]	ICRP (1995) DCF (Sv/Bq)	Submersion intake dose (Sv)	External submersion (Bq s/m^3)[a]	Sv/(Bq s m^{-3}) effective DCF	Effective dose (Sv)	Soil layer[b] (Bq s/m^3)[a]	Infinite thickness DCF Sv/(Bq s/m^3)	Soil exposure dose (Sv/yr)
Ac-227	2.18E+01	12.58	1.61E-06	3.86E-03	6.30E-04	2.43E-06	1.16E+01	5.82E-18	6.75E-17	1.45E+11	2.65E-21	3.84E-10
Th-227	5.12E-02	12.58	1.61E-06	3.86E-03	7.60E-06	2.94E-08	1.16E+01	4.88E-15	5.66E-14	1.45E+11	2.79E-18	4.04E-07
Am-241	4.32E+02	4.81	6.16E-07	1.48E-03	2.70E-05	3.99E-08	4.43E+00	8.18E-16	3.63E-15	5.54E+10	2.34E-19	1.30E-08
Pu-238	8.78E+01	1,846.30	2.36E-04	c	3.00E-05	c	1.70E+03	4.88E-18	8.30E-15	2.13E+13	8.10E-22	1.72E-08
Pu-239, 240	2.41E+04	1.11	1.42E-07	c	3.20E-05	c	1.02E+00	4.75E-18	4.86E-18	1.28E+10	1.58E-21	2.02E-11
Pu-241	1.44E+01	714.10	9.14E-05	2.19E-01	5.80E-07	1.27E-07	6.58E+02	7.25E-20	4.77E-17	8.23E+12	3.16E-23	2.60E-10
Co-60	5.27E+00	12.40	1.59E-06	3.81E-03	1.70E-08	6.47E-11	1.14E+01	1.26E-13	1.44E-12	1.43E+11	8.68E-17	1.24E-05
Pa-231	3.28E+04	42.18	5.40E-06	1.30E-02	8.90E-05	1.15E-06	3.89E+01	1.72E-15	6.69E-14	4.86E+11	1.02E-18	4.96E-07
Th-230	7.70E+04	110.26	1.41E-05	3.39E-02	2.80E-05	9.48E-07	1.02E+02	1.74E-17	1.77E-15	1.27E+12	6.47E-21	8.22E-09
Th-232	1.41E+10	51.06	6.54E-06	1.57E-02	2.90E-05	4.55E-07	4.71E+01	8.72E-18	4.10E-16	5.88E+11	2.79E-21	1.64E-09
Ac-228	6.99E-04	37.37	4.78E-06	1.15E-02	2.90E-08	3.33E-10	3.44E+01	4.78E-14	1.65E-12	4.31E+11	3.20E-17	1.38E-05
Ra-228	5.76E+00	37.37	4.78E-06	1.15E-02	1.70E-06	1.95E-08	3.44E+01	0.00E+00	0.00E+00	4.31E+11	0.00E+00	0.00E+00
Bi-207	3.22E+01	2.75	3.52E-07	8.46E-04	3.20E-09	2.71E-12	2.54E+00	7.54E-14	1.91E-13	3.17E+10	5.02E-17	1.59E-06
Bi-210	1.37E-02	2.96	3.79E-07	9.09E-04	6.00E-08	5.46E-11	2.73E+00	3.29E-17	8.97E-17	3.41E+10	1.93E-20	6.58E-10
Bi-210m	3.00E+06	2.96	3.79E-07	9.09E-04	2.10E-06	1.91E-09	2.73E+00	1.22E-14	3.33E-14	3.41E+10	7.37E-18	2.51E-07
Bi-241	3.78E-05	28.86	3.69E-06	8.87E-03	2.10E-08	1.86E-10	2.66E+01	7.65E-14	2.03E-12	3.32E+11	5.25E-17	1.75E-05
Ra-226	1.60E+03	48.10	6.16E-06	1.48E-02	2.20E-06	3.25E-08	4.43E+01	3.15E-16	1.40E-14	5.54E+11	1.70E-19	9.42E-08
Cs-137	3.02E+01	11.17	1.43E-06	3.43E-03	6.70E-09	2.30E-11	1.03E+01	7.74E-18	7.97E-17	1.29E+11	4.02E-21	5.17E-10
Ba-137m	8.08E-08	11.17	1.43E-06	3.43E-03	See Cs-137	See Cs-137	1.03E+01	2.88E-14	2.97E-13	1.29E+11	1.93E-17	2.48E-06
Eu-152	1.34E+01	5.59	7.15E-07	1.72E-03	2.70E-08	4.63E-11	5.15E+00	5.65E-14	2.91E-13	6.44E+10	3.75E-17	2.41E-06
Eu-154	8.50E+00	10.03	1.28E-06	3.08E-03	3.50E-08	1.08E-10	9.24E+00	6.14E-14	5.67E-13	1.16E+11	4.11E-17	4.75E-06
Np-237	2.14E+06	0.74	9.47E-08	2.27E-04	1.50E-05	3.41E-09	6.82E-01	1.03E-15	7.02E-16	8.52E+09	4.17E-19	3.55E-09
Pu-242	3.76E+05	1.11	1.42E-07	3.41E-04	3.10E-05	1.06E-08	1.02E+00	4.01E-18	4.10E-18	1.28E+10	6.85E-22	8.76E-12
Sr-90	2.86E+01	33.93	4.34E-06	1.04E-02	7.70E-08	8.03E-10	3.13E+01	7.53E-18	2.35E-16	3.91E+11	3.77E-21	1.47E-09
Y-90	7.30E-03	33.93	4.34E-06	1.04E-02	1.70E-09	1.77E-11	3.13E+01	1.90E-16	5.94E-15	3.91E+11	1.28E-19	5.00E-08
Tc-99	2.13E+05	50.32	6.44E-06	1.55E-02	3.20E-09	4.95E-11	4.64E+01	1.62E-18	7.51E-17	5.80E+11	6.72E-22	3.90E-10
H-3	1.23E+01	184.63	2.36E-05	c	4.50E-11	c	1.70E+02	3.31E-19	5.63E-17	2.13E+12	0.00E+00	0.00E+00
Total						5.26E-06			6.66E-12			5.62E-05

a. Based on an exposure duration of 2,000 h/yr.
b. Uppermost 30 cm of soil layer [adapted from Lyons (2003)].
c. H-3, Pu-238 and Pu-239 resuspension taken into account in derivation of effluent intakes

Table 4-25. Annual average ground layer external exposure, resuspension submersion external exposure, and resuspension submersion intake at Mound by radionuclide, 1970 through 1979.

Nuclide	Half-life (yr)	Mean soil (Bq/kg)	Airborne (Bq/m^3)	Submersion intake (Bq)[a]	ICRP (1995) DCF (Sv/Bq)	Submersion intake dose (Sv)	External submersion (Bq s/m^3)[a]	Sv/(Bq s m^{-3}) effective DCF	Effective dose (Sv)	Soil layer[b] (Bq s/m^3)[a]	Infinite thickness DCF Sv/(Bq s/m^3)	Soil exposure dose (Sv/yr)
Ac-227	2.18E+01	12.58	1.61E-06	3.86E-03	6.30E-04	2.43E-06	1.16E+01	5.82E-18	6.75E-17	1.45E+11	2.65E-21	3.84E-10
Th-227	5.12E-02	12.58	1.61E-06	3.86E-03	7.60E-06	2.94E-08	1.16E+01	4.88E-15	5.66E-14	1.45E+11	2.79E-18	4.04E-07
Am-241	4.32E+02	4.81	6.16E-07	1.48E-03	2.70E-05	3.99E-08	4.43E+00	8.18E-16	3.63E-15	5.54E+10	2.34E-19	1.30E-08
Pu-238	8.78E+01	1,998.00	2.56E-04	c	3.00E-05	c	1.84E+03	4.88E-18	8.99E-15	2.30E+13	8.10E-22	1.86E-08
Pu-239, 240	2.41E+04	1.11	1.42E-07	c	3.20E-05	c	1.02E+00	4.75E-18	4.86E-18	1.28E+10	1.58E-21	2.02E-11
Pu-241	1.44E+01	1,158.10	1.48E-04	3.56E-01	5.80E-07	2.06E-07	1.07E+03	7.25E-20	7.74E-17	1.33E+13	3.16E-23	4.22E-10
Co-60	5.27E+00	46.25	5.92E-06	1.42E-02	1.70E-08	2.42E-10	4.26E+01	1.26E-13	5.37E-12	5.33E+11	8.68E-17	4.62E-05
Pa-231	3.28E+04	42.18	5.40E-06	1.30E-02	8.90E-05	1.15E-06	3.89E+01	1.72E-15	6.69E-14	4.86E+11	1.02E-18	4.96E-07
Th-230	7.70E+04	110.26	1.41E-05	3.39E-02	2.80E-05	9.48E-07	1.02E+02	1.74E-17	1.77E-15	1.27E+12	6.47E-21	8.22E-09
Th-232	1.41E+10	51.06	6.54E-06	1.57E-02	2.90E-05	4.55E-07	4.71E+01	8.72E-18	4.10E-16	5.88E+11	2.79E-21	1.64E-09
Ac-228	6.99E-04	37.37	4.78E-06	1.15E-02	2.90E-08	3.33E-10	3.44E+01	4.78E-14	1.65E-12	4.31E+11	3.20E-17	1.38E-05
^{228}228	5.76E+00	37.37	4.78E-06	1.15E-02	1.70E-06	1.95E-08	3.44E+01	0.00E+00	0.00E+00	4.31E+11	0.00E+00	0.00E+00
Bi-207	3.22E+01	3.42	4.37E-07	1.05E-03	3.20E-09	3.36E-12	3.15E+00	7.54E-14	2.37E-13	3.93E+10	5.02E-17	1.97E-06
Bi-210	1.37E-02	2.96	3.79E-07	9.09E-04	6.00E-08	5.46E-11	2.73E+00	3.29E-17	8.97E-17	3.41E+10	1.93E-20	6.58E-10
Bi-210m	3.00E+06	2.96	3.79E-07	9.09E-04	2.10E-06	1.91E-09	2.73E+00	1.22E-14	3.33E-14	3.41E+10	7.37E-18	2.51E-07
Bi-214	3.78E-05	28.86	3.69E-06	8.87E-03	2.10E-08	1.86E-10	2.66E+01	7.65E-14	2.03E-12	3.32E+11	5.25E-17	1.75E-05
R-226	1.60E+03	48.10	6.16E-06	1.48E-02	2.20E-06	3.25E-08	4.43E+01	3.15E-16	1.40E-14	5.54E+11	1.70E-19	9.42E-08
Cs-137	3.02E+01	14.06	1.80E-06	4.32E-03	6.70E-09	2.89E-11	1.30E+01	7.74E-18	1.00E-16	1.62E+11	4.02E-21	6.51E-10
Ba-137m	8.08E-08	14.06	1.80E-06	4.32E-03	See Cs-137	See Cs-137	1.30E+01	2.88E-14	3.73E-13	1.62E+11	1.93E-17	3.13E-06
Eu-152	1.34E+01	9.36	1.20E-06	2.88E-03	2.70E-08	7.76E-11	8.63E+00	5.65E-14	4.87E-13	1.08E+11	3.75E-17	4.04E-06
Eu-154	8.50E+00	22.68	2.90E-06	6.97E-03	3.50E-08	2.44E-10	2.09E+01	6.14E-14	1.28E-12	2.61E+11	4.11E-17	1.07E-05
Np-237	2.14E+06	0.74	9.47E-08	2.27E-04	1.50E-05	3.41E-09	6.82E-01	1.03E-15	7.02E-16	8.52E+09	4.17E-19	3.55E-09
Pu-142	3.76E+05	1.11	1.42E-07	3.41E-04	3.10E-05	1.06E-08	1.02E+00	4.01E-18	4.10E-18	1.28E+10	6.85E-22	8.76E-12
Sr-90	2.86E+01	43.29	5.54E-06	1.33E-02	7.70E-08	1.02E-09	3.99E+01	7.53E-18	3.00E-16	4.99E+11	3.77E-21	1.88E-09
Y-90	7.30E-03	43.29	5.54E-06	1.33E-02	1.70E-09	2.26E-11	3.99E+01	1.90E-16	7.58E-15	4.99E+11	1.28E-19	6.38E-08
Tc-99	2.13E+05	50.32	6.44E-06	1.55E-02	3.20E-09	4.95E-11	4.64E+01	1.62E-18	7.51E-17	5.80E+11	6.72E-22	3.90E-10
H-3	1.23E+01	324.49	4.15E-05	c	4.50E-11	c	2.99E+02	3.31E-19	9.90E-17	3.74E+12	0.00E+00	0.00E+00
Po-210	3.79E-01	78.07	9.99E-06	c	2.20E-06	c	7.19E+01	4.16E-19	2.99E-17	8.99E+11	2.80E-22	2.52E-10
Total						5.34E-06			1.16E-11			9.87E-05

a. Based on an exposure duration of 2,000 h/yr.
b. Uppermost 30 cm of soil layer [adapted from Lyons (2003)].
c. H-3, Pu-239, Pu-238 and Po-210 resuspension taken into account in derivation of effluent intakes

Table 4-26. Annual average ground layer external exposure, resuspension submersion external exposure, and resuspension submersion intake at Mound by radionuclide, 1960 through 1969.

Nuclide	Half-life (yr)	Mean soil (Bq/kg)	Airborne (Bq/m^3)	Submersion intake (Bq)[a]	ICRP (1995) DCF (Sv/Bq)	Submersion intake dose (Sv)	External submersion (Bq s/m^3)[a]	Sv/(Bq s m^{-3}) effective DCF	Effective dose (Sv)	Soil layer[b] (Bq s/m^3)[a]	Infinite thickness DCF Sv/(Bq s/m^3)	Soil exposure dose (Sv/yr)
Ac-227	2.18E+01	12.58	1.61E-06	3.86E-03	6.30E-04	2.43E-06	1.16E+01	5.82E-18	6.75E-17	1.45E+11	2.65E-21	3.84E-10
Th-227	5.12E-02	12.58	1.61E-06	3.86E-03	7.60E-06	2.94E-08	1.16E+01	4.88E-15	5.66E-14	1.45E+11	2.79E-18	4.04E-07
Am-241	4.32E+02	4.81	6.16E-07	1.48E-03	2.70E-05	3.99E-08	4.43E+00	8.18E-16	3.63E-15	5.54E+10	2.34E-19	1.30E-08
Pu-238	8.78E+01	2,160.80	2.77E-04	c	3.00E-05	c	1.99E+03	4.88E-18	9.72E-15	2.49E+13	8.10E-22	2.02E-08
Pu-239, 240	2.41E+04	1.11	1.42E-07	c	3.20E-05	c	1.02E+00	4.75E-18	4.86E-18	1.28E+10	1.58E-21	2.02E-11
Pu-241	1.44E+01	1,875.90	2.40E-04	5.76E-01	5.80E-07	3.34E-07	1.73E+03	7.25E-20	1.25E-16	2.16E+13	3.16E-23	6.83E-10
Co-60	5.27E+00	172.05	2.20E-05	5.29E-02	1.70E-08	8.99E-10	1.59E+02	1.26E-13	2.00E-11	1.98E+12	8.68E-17	1.72E-04
Pa-231	3.28E+04	42.18	5.40E-06	1.30E-02	8.90E-05	1.15E-06	3.89E+01	1.72E-15	6.69E-14	4.86E+11	1.02E-18	4.96E-07
Th-230	7.70E+04	110.26	1.41E-05	3.39E-02	2.80E-05	9.48E-07	1.02E+02	1.74E-17	1.77E-15	1.27E+12	6.47E-21	8.22E-09
Th-232	1.41E+10	51.06	6.54E-06	1.57E-02	2.90E-05	4.55E-07	4.71E+01	8.72E-18	4.10E-16	5.88E+11	2.79E-21	1.64E-09
Ac-228	6.99E-04	37.37	4.78E-06	1.15E-02	2.90E-08	3.33E-10	3.44E+01	4.78E-14	1.65E-12	4.31E+11	3.20E-17	1.38E-05
Ra-228	5.76E+00	37.37	4.78E-06	1.15E-02	1.70E-06	1.95E-08	3.44E+01	0.00E+00	0.00E+00	4.31E+11	0.00E+00	0.00E+00
Bi-207	3.22E+01	4.22	5.40E-07	1.30E-03	3.20E-09	4.15E-12	3.89E+00	7.54E-14	2.93E-13	4.86E+10	5.02E-17	2.44E-06
Bi-210	1.37E-02	2.96	3.79E-07	9.09E-04	6.00E-08	5.46E-11	2.73E+00	3.29E-17	8.97E-17	3.41E+10	1.93E-20	6.58E-10
Bi-10m	3.00E+06	2.96	3.79E-07	9.09E-04	2.10E-06	1.91E-09	2.73E+00	1.22E-14	3.33E-14	3.41E+10	7.37E-18	2.51E-07
Bi-214	3.78E-05	28.86	3.69E-06	8.87E-03	2.10E-08	1.86E-10	2.66E+01	7.65E-14	2.03E-12	3.32E+11	5.25E-17	1.75E-05
Ra-226	1.60E+03	48.10	6.16E-06	1.48E-02	2.20E-06	3.25E-08	4.43E+01	3.15E-16	1.40E-14	5.54E+11	1.70E-19	9.42E-08
Cs-137	3.02E+01	17.69	2.26E-06	5.43E-03	6.70E-09	3.64E-11	1.63E+01	7.74E-18	1.26E-16	2.04E+11	4.02E-21	8.19E-10
Ba-137m	8.08E-08	17.69	2.26E-06	5.43E-03	See Cs-137	See Cs-137	1.63E+01	2.88E-14	4.69E-13	2.04E+11	1.93E-17	3.93E-06
Eu-152	1.34E+01	15.73	2.01E-06	4.83E-03	2.70E-08	1.30E-10	1.45E+01	5.65E-14	8.19E-13	1.81E+11	3.75E-17	6.79E-06
Eu-154	8.50E+00	51.43	6.58E-06	1.58E-02	3.50E-08	5.53E-10	4.74E+01	6.14E-14	2.91E-12	5.92E+11	4.11E-17	2.44E-05
Np-237	2.14E+06	0.74	9.47E-08	2.27E-04	1.50E-05	3.41E-09	6.82E-01	1.03E-15	7.02E-16	8.52E+09	4.17E-19	3.55E-09
Pu-242	3.76E+05	1.11	1.42E-07	3.41E-04	3.10E-05	1.06E-08	1.02E+00	4.01E-18	4.10E-18	1.28E+10	6.85E-22	8.76E-12
Sr-90	2.86E+01	55.13	7.06E-06	1.69E-02	7.70E-08	1.30E-09	5.08E+01	7.53E-18	3.83E-16	6.35E+11	3.77E-21	2.39E-09
Y-90	7.30E-03	55.13	7.06E-06	1.69E-02	1.70E-09	2.88E-11	5.08E+01	1.90E-16	9.65E-15	6.35E+11	1.28E-19	8.13E-08
Tc-99	2.13E+05	50.32	6.44E-06	1.55E-02	3.20E-09	4.95E-11	4.64E+01	1.62E-18	7.51E-17	5.80E+11	6.72E-22	3.90E-10
H-3	1.23E+01	569.80	7.29E-05	1.75E-01	4.50E-11	7.88E-12	5.25E+02	3.31E-19	1.74E-16	6.56E+12	0.00E+00	0.00E+00
Po-210	3.79E-01	493	6.31E-05	c	2.20E-06	c	4.54E+02	4.16E-19	1.89E-16	5.68E+12	2.80E-22	1.59E-09
Total						5.47E-06			2.84E-11			2.43E-04

a. Based on an exposure duration of 2,000 h/yr.

b. Uppermost 30 cm of soil layer [adapted from Lyons (2003)].

c. H-3, Pu-239, Pu-238 and Po-210 resuspension taken into account in derivation of effluent intakes

Table 4-27. Annual average ground layer external exposure, resuspension submersion external exposure, and resuspension submersion intake at Mound by radionuclide, 1950 through 1959.

Nuclide	Half-life (yr)	Mean soil (Bq/kg)	Airborne (Bq/m^3)	Submersion intake (Bq)[a]	ICRP (1995) DCF (Sv/Bq)	Submersion intake dose (Sv)	External submersion ($Bq\ s/m^3$)[a]	$Sv/(Bq\ s\ m^{-3})$ effective DCF	Effective dose (Sv)	Soil layer[b] ($Bq\ s/m^3$)[a]	Infinite thickness DCF $Sv/(Bq\ s/m^3)$	Soil exposure dose (Sv/yr)
Ac-227	2.18E+01	12.58	1.61E-06	3.86E-03	6.30E-04	2.43E-06	1.16E+01	5.82E-18	6.75E-17	1.45E+11	2.65E-21	3.84E-10
Th-227	5.12E-02	12.58	1.61E-06	3.86E-03	7.60E-06	2.94E-08	1.16E+01	4.88E-15	5.66E-14	1.45E+11	2.79E-18	4.04E-07
Am-241[d]	4.32E+02	--	--	--	--	--	--	--	--	--	--	--
Pu-238[d]	--	--	--	--	--	--	--	--	--	--	--	--
Pu-239, 240[d]	--	--	--	--	--	--	--	--	--	--	--	--
Pu-241[d]	--	--	--	--	--	--	--	--	--	--	--	--
Co-60	5.27E+00	640.10	8.19E-05	1.97E-01	1.70E-08	3.34E-09	5.90E+02	1.26E-13	7.43E-11	7.37E+12	8.68E-17	6.40E-04
Pa-231	3.28E+04	42.18	5.40E-06	1.30E-02	8.90E-05	1.15E-06	3.89E+01	1.72E-15	6.69E-14	4.86E+11	1.02E-18	4.96E-07
Th-230	7.70E+04	110.26	1.41E-05	3.39E-02	2.80E-05	9.48E-07	1.02E+02	1.74E-17	1.77E-15	1.27E+12	6.47E-21	8.22E-09
Th-232	1.41E+10	51.06	6.54E-06	1.57E-02	2.90E-05	4.55E-07	4.71E+01	8.72E-18	4.10E-16	5.88E+11	2.79E-21	1.64E-09
Ac-228	6.99E-04	37.37	4.78E-06	1.15E-02	2.90E-08	3.33E-10	3.44E+01	4.78E-14	1.65E-12	4.31E+11	3.20E-17	1.38E-05
Ra-228	5.76E+00	37.37	4.78E-06	1.15E-02	1.70E-06	1.95E-08	3.44E+01	0.00E+00	0.00E+00	4.31E+11	0.00E+00	0.00E+00
Bi-207	3.22E+01	5.25	6.73E-07	1.61E-03	3.20E-09	5.16E-12	4.84E+00	7.54E-14	3.65E-13	6.05E+10	5.02E-17	3.04E-06
Bi-210	1.37E-02	2.96	3.79E-07	9.09E-04	6.00E-08	5.46E-11	2.73E+00	3.29E-17	8.97E-17	3.41E+10	1.93E-20	6.58E-10
Bi-210m	3.00E+06	2.96	3.79E-07	9.09E-04	2.10E-06	1.91E-09	2.73E+00	1.22E-14	3.33E-14	3.41E+10	7.37E-18	2.51E-07
Bi-214	3.78E-05	28.86	3.69E-06	8.87E-03	2.10E-08	1.86E-10	2.66E+01	7.65E-14	2.03E-12	3.32E+11	5.25E-17	1.75E-05
Ra-226	1.60E+03	48.10	6.16E-06	1.48E-02	2.20E-06	3.25E-08	4.43E+01	3.15E-16	1.40E-14	5.54E+11	1.70E-19	9.42E-08
Cs-137	3.02E+01	22.27	2.85E-06	6.84E-03	6.70E-09	4.58E-11	2.05E+01	7.74E-18	1.59E-16	2.57E+11	4.02E-21	1.03E-09
Ba-137m	8.08E-08	22.27	2.85E-06	6.84E-03	See Cs-137	See Cs-137	2.05E+01	2.88E-14	5.91E-13	2.57E+11	1.93E-17	4.95E-06
Eu-152	1.34E+01	26.38	3.38E-06	8.10E-03	2.70E-08	2.19E-10	2.43E+01	5.65E-14	1.37E-12	3.04E+11	3.75E-17	1.14E-05
Eu-154	8.50E+00	115.81	1.48E-05	3.56E-02	3.50E-08	1.25E-09	1.07E+02	6.14E-14	6.55E-12	1.33E+12	4.11E-17	5.48E-05
Np-237	2.14E+06	0.74	9.47E-08	2.27E-04	1.50E-05	3.41E-09	6.82E-01	1.03E-15	7.02E-16	8.52E+09	4.17E-19	3.55E-09
Pu-242[d]	--	--	--	--	--	--	--	--	--	--	--	--
Sr-90	2.86E+01	70.30	9.00E-06	2.16E-02	7.70E-08	1.66E-09	6.48E+01	7.53E-18	4.88E-16	8.10E+11	3.77E-21	3.05E-09
Y-90	7.30E-03	70.30	9.00E-06	2.16E-02	1.70E-09	3.67E-11	6.48E+01	1.90E-16	1.23E-14	8.10E+11	1.28E-19	1.04E-07
Tc-99	2.13E+05	50.32	6.44E-06	1.55E-02	3.20E-09	4.95E-11	4.64E+01	1.62E-18	7.51E-17	5.80E+11	6.72E-22	3.90E-10
H-3	1.23E+01	1,002.70	1.28E-04	c	4.50E-11	c	9.24E+02	3.31E-19	3.06E-16	1.16E+13	0.00E+00	0.00E+00
Po-210	3.79E-01	126.17	1.61E-05	c	2.20E-06	c	1.16E+02	4.16E-19	4.84E-17	1.45E+12	2.80E-22	4.07E-10
						5.09E-06			8.71E-11			7.47E-04

a. Based on an exposure duration of 2,000 h/yr.
b. Uppermost 30 cm of soil layer [adapted from Lyons (2003)].
c. Po-210 resuspension taken into account in derivation of effluent intakes
d. Plutonium and Americium not environmental contaminants until 1960

Table 4-28. Annual average ground layer external exposure, resuspension submersion external exposure, and resuspension submersion intake at Mound by radionuclide, 1949.

Nuclide	Half-life (yr)	Mean soil (Bq/kg)	Airborne (Bq/m^3)	Submersion intake (Bq)[a]	ICRP (1995) DCF (Sv/Bq)	Submersion intake dose (Sv)	External submersion (Bq s/m^3)[a]	Sv/(Bq s m^{-3}) effective DCF	Effective dose (Sv)	Soil layer[b] (Bq s/m^3)[a]	Infinite thickness DCF Sv/(Bq s/m^3)	Soil exposure dose (Sv/yr)
Ac-227	2.18E+01	12.58	1.61E-06	3.86E-03	6.30E-04	**2.43E-06**	1.16E+01	5.82E-18	6.75E-17	1.45E+11	2.65E-21	3.84E-10
Th-227	5.12E-02	12.58	1.61E-06	3.86E-03	7.60E-06	2.94E-08	1.16E+01	4.88E-15	5.66E-14	1.45E+11	2.79E-18	4.04E-07
Am-241[d]	4.32E+02	--	--	--	--	--	--	--	--	--	--	--
Pu-238[d]	--	--	--	--	--	--	--	--	--	--	--	--
Pu-239, 240[d]	--	--	--	--	--	--	--	--	--	--	--	--
Pu-241[d]	--	--	--	--	--	--	--	--	--	--	--	--
Co-60	5.27E+00	732.60	9.38E-05	2.25E-01	1.70E-08	3.83E-09	6.75E+02	1.26E-13	8.51E-11	8.44E+12	8.68E-17	**7.33E-04**
Pa-231	3.28E+04	42.18	5.40E-06	1.30E-02	8.90E-05	**1.15E-06**	3.89E+01	1.72E-15	6.69E-14	4.86E+11	1.02E-18	4.96E-07
Th-230	7.70E+04	110.26	1.41E-05	3.39E-02	2.80E-05	**9.48E-07**	1.02E+02	1.74E-17	1.77E-15	1.27E+12	6.47E-21	8.22E-09
Th-232	1.41E+10	51.06	6.54E-06	1.57E-02	2.90E-05	**4.55E-07**	4.71E+01	8.72E-18	4.10E-16	5.88E+11	2.79E-21	1.64E-09
Ac-228	6.99E-04	37.37	4.78E-06	1.15E-02	2.90E-08	3.33E-10	3.44E+01	4.78E-14	1.65E-12	4.31E+11	3.20E-17	**1.38E-05**
Ra-228	5.76E+00	37.37	4.78E-06	1.15E-02	1.70E-06	1.95E-08	3.44E+01	0.00E+00	0.00E+00	4.31E+11	0.00E+00	0.00E+00
Bi-207	3.22E+01	5.37	6.87E-07	1.65E-03	3.20E-09	5.27E-12	4.94E+00	7.54E-14	3.73E-13	6.18E+10	5.02E-17	3.10E-06
Bi-210	1.37E-02	2.96	3.79E-07	9.09E-04	6.00E-08	5.46E-11	2.73E+00	3.29E-17	8.97E-17	3.41E+10	1.93E-20	6.58E-10
Bi-210m	3.00E+06	2.96	3.79E-07	9.09E-04	2.10E-06	1.91E-09	2.73E+00	1.22E-14	3.33E-14	3.41E+10	7.37E-18	2.51E-07
Bi-214	3.78E-05	28.86	3.69E-06	8.87E-03	2.10E-08	1.86E-10	2.66E+01	7.65E-14	2.03E-12	3.32E+11	5.25E-17	**1.75E-05**
Ra-226	1.60E+03	48.10	6.16E-06	1.48E-02	2.20E-06	**3.25E-08**	4.43E+01	3.15E-16	1.40E-14	5.54E+11	1.70E-19	9.42E-08
Cs-137	3.02E+01	22.79	2.92E-06	7.00E-03	6.70E-09	4.69E-11	2.10E+01	7.74E-18	1.63E-16	2.63E+11	4.02E-21	1.06E-09
Ba-137m	8.08E-08	22.79	2.92E-06	7.00E-03	See Cs-137	See Cs-137	2.10E+01	2.88E-14	6.05E-13	2.63E+11	1.93E-17	**5.07E-06**
Eu-152	1.34E+01	27.75	3.55E-06	8.52E-03	2.70E-08	2.30E-10	2.56E+01	5.65E-14	1.44E-12	3.20E+11	3.75E-17	**1.20E-05**
Eu-154	8.50E+00	125.80	1.61E-05	3.86E-02	3.50E-08	1.35E-09	1.16E+02	6.14E-14	7.12E-12	1.45E+12	4.11E-17	**5.96E-05**
Np-237	2.14E+06	0.74	9.47E-08	2.27E-04	1.50E-05	3.41E-09	6.82E-01	1.03E-15	7.02E-16	8.52E+09	4.17E-19	3.55E-09
Pu-242[d]	--	--	--	--	--	--	--	--	--	--	--	--
Sr-90	2.86E+01	71.78	9.19E-06	2.21E-02	7.70E-08	1.70E-09	6.62E+01	7.53E-18	4.98E-16	8.27E+11	3.77E-21	3.12E-09
Y-90	7.30E-03	71.78	9.19E-06	2.21E-02	1.70E-09	3.75E-11	6.62E+01	1.90E-16	1.26E-14	8.27E+11	1.28E-19	1.06E-07
Tc-99	2.13E+05	50.32	6.44E-06	1.55E-02	3.20E-09	4.95E-11	4.64E+01	1.62E-18	7.51E-17	5.80E+11	6.72E-22	3.90E-10
H-3	1.23E+01	1,058.20	1.35E-04	c	4.50E-11	c	9.75E+02	3.31E-19	3.23E-16	1.22E+13	0.00E+00	0.00E+00
Po-210	3.79E-01	48,396.00	6.19E-03	c	2.20E-06	c	4.46E+04	4.16E-19	1.86E-14	5.58E+14	2.80E-22	1.56E-07
						5.09E-06			9.85E-11			8.45E-04

a. Based on an exposure duration of 2,000 h/yr.
b. Uppermost 30 cm of soil layer [adapted from Lyons (2003)].
c. H-3 and Po-210 resuspension taken into account in derivation of effluent intakes
d. Plutonium and Americium not environmental contaminants until 1960

Table 4-29. Mean and maximum environmental external radiation levels at Mound by year.

Year	Mound Mean Site-Wide (Sv)	SM/PP Hill Area Maximum (Sv)	Year	Mound Mean Site-Wide (Sv)	SM/PP Hill Area Maximum (Sv)
2003	--	--	1975	7.14E-05	4.70E-04
2002	4.27E-05	2.81E-04	1974	9.87E-05	6.50E-04
2001	4.27E-05	2.81E-04	1973	9.87E-05	6.50E-04
2000	4.27E-05	2.81E-04	1972	9.87E-05	6.50E-04
1999	4.27E-05	2.81E-04	1971	9.87E-05	6.50E-04
1998	4.27E-05	2.81E-04	1970	9.87E-05	6.50E-04
1997	4.27E-05	2.81E-04	1969	1.49E-04	9.81E-04
1996	4.27E-05	2.81E-04	1968	1.49E-04	9.81E-04
1995	4.27E-05	2.81E-04	1967	1.49E-04	9.81E-04
1994	4.27E-05	2.81E-04	1966	1.49E-04	9.81E-04
1993	4.27E-05	2.81E-04	1965	1.49E-04	9.81E-04
1992	4.27E-05	2.81E-04	1964	2.42E-04	1.59E-03
1991	4.27E-05	2.81E-04	1963	2.42E-04	1.59E-03
1990	4.27E-05	2.81E-04	1962	2.42E-04	1.59E-03
1989	4.77E-05	3.14E-04	1961	2.42E-04	1.59E-03
1988	4.77E-05	3.14E-04	1960	2.42E-04	1.59E-03
1987	4.77E-05	3.14E-04	1959	4.17E-04	2.74E-03
1986	4.77E-05	3.14E-04	1958	4.17E-04	2.74E-03
1985	4.77E-05	3.14E-04	1957	4.17E-04	2.74E-03
1984	5.62E-05	3.70E-04	1956	4.17E-04	2.74E-03
1983	5.62E-05	3.70E-04	1955	4.17E-04	2.74E-03
1982	5.62E-05	3.70E-04	1954	7.47E-04	4.92E-03
1981	5.62E-05	3.70E-04	1953	7.47E-04	4.92E-03
1980	5.62E-05	3.70E-04	1952	7.47E-04	4.92E-03
1979	7.14E-05	4.70E-04	1951	7.47E-04	4.92E-03
1978	7.14E-05	4.70E-04	1950	7.47E-04	4.92E-03
1977	7.14E-05	4.70E-04	1949	8.45E-04	5.56E-03
1976	7.14E-05	4.70E-04			

4.3 UNCERTAINTIES

An estimate of the uncertainty associated with the median environmental intakes at the Dayton Facilities and Mound Laboratory is presented in Section 4.1.2 and in Table 4-21. These estimates were made by assuming that the intakes are lognormally distributed and that the median intakes represent the 50th percentile intake rate. For the Dayton Facilities, the maximum permissible ^{210}Po air concentration is assumed to represent the upper 95th percentile intake resulting in a GSD of 1.6. For Mound the calculated site-wide, annual maximum intakes presented in Table 4-20 are assumed to represent the upper 95th percentile intake. The resulting geometric standard deviations (GSDs) are presented in Table 4-21.

An estimate of the uncertainty associated with the ambient dose at the Dayton Facilities has been made by assuming that the ambient dose is lognormally distributed and that the median annual dose calculated in Section of 4.1.4.3 represents the 50th percentile dose. Exposure to the “tolerance” or permissible level of 15 cSv per year is assumed to represent the upper 95th percentile intake. The resulting geometric standard deviation (GSD) is 3.6. For Mound the calculated mean ambient dose presented in Table 4-29 is assumed to represent the 50th percentile dose. The maximum ambient dose associated with the SM/PP hill area is assumed to represent the upper 95th percentile ambient dose resulting in an annual GSD of 3.12.

Due to the lack of available environmental air monitoring data for Dayton Units III and IV, the environmental intakes for both Dayton Units were determined using the highest monthly median air concentration measured at Dayton Unit III in December 1947. Based on a review of available data, the environmental airborne ^{210}Po at both facilities would likely be comparable.

Effluent release rate data from Mound was unavailable for some operational time periods. Consequently, extrapolations were necessary to estimate intakes for years in which no onsite air monitoring data were available. Effluent intake data for ^{210}Po from 1954 through 1966 were based on an assumption that the annual increase in the effluent release rate (source term) was 20% greater than the earliest year for which monitoring data were published (i.e., 20 μCi/d from 1949 through 1953). Beginning in 1967 through 1970, the ^{210}Po data are based on reported ^{238}Pu effluent source terms (scaled to infer ^{210}Po based on the ratio of ^{210}Po to ^{238}Pu on air filter samples). Similarly, annual tritium oxide intakes from 1954 through 1958 were backwards extrapolated from the 1959 source term (the first year for which such data were published—31,527 Ci/yr) using an annual assumed reduction factor of 10%. These assumptions are believed to be a reasonable depiction of the trend in facility operations during the extrapolated time frames, and the total activity released in effluent compares favorable to the inventory of released radionuclides reported by Mound presented below.

Table 4-30. Radionuclide releases to the atmosphere (Curies) from Mound 1949 to 1973.

Radionuclide	**Release Reported by Mound[a] (Ci)**	**Release used in this analysis (Ci)**
^{238,239}Pu	3.60E-01 ± 50%	3.60E-01
^{210}Po	4.9E-01 ± 50%	6.0E-01
^{3}H	2, 85E+06 ± 25%	2.98E+06
^{227}Ac (purified)	5.3E-06 ± 100%	5.3E-06
^{226}Ra, ^{227}Ac, ^{228}Th and their associated progeny	1.6E-01 ± 200%	1.6E-01

a. Storey 1973

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GLOSSARY

curie
A special unit of activity. One curie exactly equals 3.7×10^{10} nuclear transitions per second.

dose equivalent (H)
The product of the absorbed dose (D), the quality factor (Q), and any other modifying factors. The special unit is the rem. When D is expressed in Gy, H is in Sieverts (Sv). (1 Sv = 100 rem.)

dosimetry
The science of assessing absorbed dose, dose equivalent, effective dose equivalent, etc., from external and/or internal sources of radiation.

exposure
As used in the technical sense, a measure expressed in roentgens (R) of the ionization produced by photon radiation (i.e., gamma and X-rays) in air.

gamma rays (G or γ)
Electromagnetic radiation (photons) originating in atomic nuclei and accompanying many nuclear reactions (e.g., fission, radioactive decay, and neutron capture). Physically, gamma rays are identical to X-rays of high energy, the only essential difference being that X-rays do not originate in the nucleus.

ionizing radiation
Electromagnetic or particulate radiation capable of producing charged particles through interactions with matter.

photon
A unit or "particle" of electromagnetic radiation consisting of X- and/or gamma rays.

photon – X-ray
Electromagnetic radiation of energies between 10 keV and 100 keV whose source can be an X-ray machine or radionuclide.

radioisotope thermoelectric generator (RTG)
A power supply using thermoelectric unicouples to convert heat generated from radioactive decay to electricity.

radiation
Alpha, beta, neutron, and photon radiation.

radioactivity
The spontaneous emission of radiation, generally alpha or beta particles, gamma rays, and neutrons from unstable nuclei.

rem
A unit of dose equivalent, equal to the product of the number of rad absorbed and the "quality factor."

roentgen (R or r)

A unit of exposure to gamma (or X-ray) radiation. It is defined precisely as the quantity of gamma (or X) rays that will produce a total charge of 2.58×10^{-4} coulomb in 1 kg of dry air STP. An exposure of 1 R is approximately equivalent to an absorbed dose of 1 rad in soft tissue for higher (~>100 keV) energy photons.

shielding

A material or obstruction that absorbs (or attenuates) radiation and thus tends to protect personnel or materials from radiation.

X-ray

Ionizing electromagnetic radiation of external nuclear origin or a radiograph

ATTACHMENT 4A
DOSE COEFFICIENTS

Table 4A-1. Dose coefficients for contaminated soil to an infinite depth [Sv/(Bq s m^{-3})].[a]

Isotope	Gonad	Breast	Lung	R marrow	Bone surface	Thyroid	Remainder	Effective dose equivalent	Skin
Ac-227	2.76E-21	2.88E-21	2.43E-21	2.22E-21	7.20E-21	2.27E-21	2.29E-21	2.65E-21	3.22E-21
Am-241	2.53E-19	2.74E-19	2.01E-19	1.57E-19	8.43E-19	1.94E-19	1.86E-19	1.34E-19	3.10E-19
Ce-141	1.77E-18	1.84E-18	1.58E-18	1.47E-18	4.34E-18	1.47E-18	1.49E-18	7.93E-18	1.94E-18
Cs-137	4.27E-21	4.50E-21	3.61E-21	3.25E-21	1.09E-20	3.43E-21	3.41E-21	4.02E-21	9.34E-20
Co-60	9.08E-17	9.22E-17	8.36E-17	8.39E-17	1.18E-16	7.82E-17	8.51E-17	8.68E-17	9.94E-17
Pu-238	1.26E-21	1.6E-21	2.99E-22	3.32E-22	1.57E-21	4.04E-22	4.00E-22	8.10E-22	5.09E-21
Pu-239/240	1.82E-21	1.99E-21	1.31E-21	1.25E-21	3.40E-21	1.27E-21	1.28E-21	1.58E-21	4.87E-21
Pu-241	3.28E-23	3.42E-23	2.89E-23	2.60E-23	9.16E-23	2.70E-23	2.70E-23	3.16E-23	3.78E-23
Pa-231	1.08E-18	1.11E-18	9.52E-19	9.26E-19	1.96E-18	8.90E-19	9.13E-19	1.02E-18	1.20E-18
Sr-90	4.02E-21	4.25E-21	3.37E-21	3.00E-21	1.06E-20	3.21E-21	3.17E-21	3.77E-21	1.50E-20
Th-230	6.88E-21	7.38E-21	5.72E-21	5.03E-21	1.91E-20	5.41E-21	5.39E-21	6.47E-21	9.79E-21
Th-232	3.07E-21	3.38E-21	2.36E-21	2.04E-21	8.51E-21	2.26E-21	2.24E-21	2.79E-21	5.55E-21
Th-234	1.34E-19	1.41E-19	1.17E-19	1.01E-19	4.17E-19	1.10E-19	1.09E-19	1.29E-19	1.50E-19
U-234	2.53E-21	2.89E-21	1.64E-21	1.47E-21	5.96E-21	1.62E-21	1.61E-21	2.15E-21	5.99E-21
U-235	4.00E-18	4.16E-18	3.59E-18	3.40E-18	9.04E-18	3.35E-18	3.41E-18	3.86E-18	4.40E-18
U-238	8.19E-22	1.06E-21	2.34E-22	2.18E-22	1.32E-21	2.19E-22	2.86E-22	5.52E-22	3.55E-21
Ac-228	3.36E-17	3.43E-17	3.07E-17	3.06E-17	4.70E-17	2.86E-17	2.96E-17	3.20E-17	3.87E-17
Bi-207	5.27E-17	5.38E-17	4.80E-17	4.77E-17	7.44E-17	4.47E-17	4.64e-17	5.02E-17	5.87e-17
Bi-210	2.03E-20	2.12E-20	1.77E-20	1.64E-20	4.71E-20	1.66E-20	1.67E-20	1.93E-20	1.20E-20
Bi-210m	7.72E-18	7.99E-18	6.91E-18	6.72E-18	1.42E-17	6.45E-18	6.62E-18	7.37E-18	8.48E-18
Bi-214	5.52E-17	5.57E-17	5.05E-17	5.07E-17	7.24E-17	4.75E-17	4.89E-17	5.25E-17	6.51E-17
Ra-226	1.76E-19	1.83E-19	1.58E-19	1.50E-19	3.93E-19	1.47E-19	1.50E-19	1.70E-19	1.94E-19
Eu-152	3.36E-17	3.43E-17	3.10E-17	3.09E-17	4.73E-17	2.90E-17	2.99E-17	3.22E-17	3.69e-17
Eu-154	3.66E-17	3.74E-17	3.39E-17	3.36E-17	5.08E-17	3.18E-17	3.27E-17	3.52E-17	4.10E-17
Np-237	4.37E-19	4.59E-19	3.78E-19	3.34E-19	1.25E-18	3.55E-19	3.53E-19	4.17E-19	5.03E-19
Pu-242	1.04E-21	1.23E-21	2.75E-22	2.93E-22	1.41E-21	3.57E-22	3.52E-22	6.85E-22	4.08E-21
Tc-99	7.35E-22	7.90E-22	5.71E-22	4.83E-22	2.10E-21	5.56E-22	5.39E-22	6.70E-22	9.06E-22
Po-210	2.94E-22	3.01E-22	2.68E-22	2.67E-22	4.10e-22	2.49E-22	2.59E-22	2.80E-22	3.25E-22

Table 4A-2. Dose coefficients for air submersion [Sv/(Bq s m^{-3})].[a]

Isotope	Gonad	Breast	Lung	R marrow	Bone surface	Thyroid	Remainder	Effective dose equivalent	Skin
Pu-238	6.56E-18	1.27E-17	1.06E-18	1.68E-18	9.30E-18	4.01E-18	1.99E-18	4.88E-18	4.09E-17
Pu-239/240	6.36E-18	1.23E-17	2.65E-18	2.67E-18	9.47E-18	3.92E-18	2.86E-18	4.75E-18	3.92E-17
Th-228	9.12E-17	1.09E-16	8.33E-17	7.32E-17	2.64E-16	8.88E-17	7.84E-17	9.20E-17	1.50E-16
Th-230	1.80E-17	2.38E-17	1.43E-17	1.22E-17	5.29E-17	1.63E-17	1.37E-17	1.74E-17	4.51E-17
Th-232	9.34E-18	1.36E-17	6.37E-18	5.52E-18	2.60E-17	7.90E-18	6.34E-18	8.72E-18	3.44E-17
Ac-227	5.78E-18	6.98E-18	5.22E-18	4.59E-18	1.68E-17	5.60E-18	4.92E-18	5.82E-18	1.10E-17
Ac-228	4.67E-14	5.30E-14	4.66E-14	4.56E-14	7.39E-14	4.79E-14	4.48E-14	4.78E-14	7.88E-14
Am-241	8.58E-16	1.07E-15	6.74E-16	5.21E-16	2.87E-15	7.83E-16	6.34E-16	8.18E-16	1.28E-15
Co-60	1.23E-13	1.39E-13	1.24E-13	1.23E-13	1.78E-13	1.27E-13	1.20E-13	1.26E-13	1.45E-13
Pa-231	1.71E-15	1.99E-15	1.62E-15	1.52E-15	3.64E-15	1.70E-15	1.54E-15	1.72E-15	2.44E-15
Bi-207	7.34E-14	8.38E-14	7.35E-14	7.17E-14	1.19E-13	7.55E-14	7.04E-14	7.54E-14	9.31E-14
Bi-210	3.32E-17	3.95E-17	2.95E-17	2.60E-17	8.98E-17	3.22E-17	2.79E-17	3.29E-17	2.30E-14
Cs-137	7.96E-18	9.67E-18	6.68E-18	5.70E-18	2.29E-17	7.55E-18	6.34E-18	7.74E-18	8.63E-15
Bi-210m	1.20E-14	1.37E-14	1.17E-14	1.10E-14	2.59E-14	1.21E-14	1.11E-14	1.22E-14	1.63E-14
Bi-214	7.44E-14	8.42E-14	7.51E-14	7.43E-14	1.09E-13	7.67E-14	7.26E-14	7.65E-14	1.28E-13
Np-237	1.04E-15	1.26E-15	9.02E-16	7.69E-16	3.20E-15	9.94E-16	8.50E-16	1.03E-15	1.54E-15
Eu-152	5.53E-14	6.29E-14	5.50E-14	5.37E-14	8.89E-14	5.66E-14	5.28E-14	5.65E-14	6.90E-14
Eu-154	6.00E-14	6.81E-14	5.99E-14	5.87E-14	9.43E-14	6.15E-14	5.75E-14	6.14E-14	8.29E-14
Pu-242	5.34E-18	1.03E-17	9.69E-19	1.43E-18	7.90E-18	3.32E-18	1.68E-18	4.01E-18	3.27E-17
Sr-90									
Tc-99	1.74E-18	2.20E-18	1.29E-18	1.05E-18	5.17E-18	1.57E-18	1.24E-18	1.62E-18	2.74E-15
Po-210	4.08E-19	4.63E-19	4.06E-19	3.97e-19	6.39E-19	4.18E-19	3.89E-19	4.16E-19	4.18E-19

a. Eckerman, K. F., and J. C. Ryman, 1993

ATTACHMENT 4B
MOUND OFFSITE ENVIRONMENTAL AIR-SAMPLING DATA FOR 1948 TO SEPTEMBER 1959

LIST OF TABLES

Table 4B-1. Mound offsite air-sampling data for 1948 to 1959.

Reference	Description of data	Maximum (cpm/cm³)	Maximum (dpm/cm³)[a]	Maximum (μCi/cm³)
1948				
Bradley and Haring 1948a	Missing pages - No offsite air sample data available for September.	--	--	--
Bradley and Haring 1948b	67 offsite samples were collected during October: 62.7% of results were 0 cpm/m³ 26.9% of results were 1-10 cpm/m³ 6.0% of results were 11 to 20 cpm/m³ 4.4% of results were 21 to 40 cpm/m³ 0% of results were > 41 cpm/m³	4.1E-05	2.05E-04	9.23E-11
Bradley and Haring 1948c	Missing pages - No offsite air sample data available for November.	--	--	--
Bradley and Haring 1948d	68 offsite samples were collected during December: 54.4% of the results were 0 cpm/m³ 33.8% of the results were 1-10 cpm/m³ 5.9% of the results were 11 to 20 cpm/m³ 4.5% of the results were 21 to 40 cpm/m³ 0% of the results were 41 to 80 cpm/m³ 31.4% of the results were > 80 cpm/m³	8.0E-05	4.00E-04	1.80E-10
1949				
Bradley and Haring 1949a	Missing pages - No offsite air sample data available	--	--	--
Bradley and Haring 1949b	66 offsite samples were collected during February: 94.8% of the results were 1-10 cpm/m³ 2.6% of the results were 11 to cpm/m³ 1.3% of the results were 21 to cpm/m³ 0% of the results were 41-80 cpm/m³ 1.3% of the results were > 80 cpm/m³	8.0E-05	4.00E-04	1.80E-10
Bradley and Haring 1949c	49 offsite samples were collected during March: 47.3% of the results were 0 cpm/m³ 34.0% of the results were 1-10 cpm/m³ 17.0% of the results were 11 to 20 cpm/m³ 0% of the results were 21 to 40 cpm/m³ 1.7% of the results were 41-80 cpm/m³ 0% of the results were > 80 cpm/m³	8.0E-05	4.00E-04	1.80E-10
Bradley and Haring 1949d	106 offsite samples were collected during April: 40.6% of the results were 0 cpm/m³ 56.6% of the results were 1-10 cpm/m³ 2.8% of the results were 11 to 20 cpm/m³ 0% of the results were > 20 cpm/m³.	2.0E-05	1.00E-04	4.50E-11
Bradley and Haring 1949a	62 offsite samples were collected during May: 83.9% of the results were 0 cpm/m³ 14.5% of the results were 1-10 cpm/m³ 0% of the results were 11 to 20 cpm/m³ 0% of the results were 21 to 40 cpm/m³ 1.6% of the results were 41 to 80 cpm/m³ 0% of the results were > 80 cpm/m³	8.0E-5	4.0E-4	1.8E-10
Bradley and Haring 1949b	*June offsite air sample data pages missing.*	--	--	--
Bradley and Haring 1949c	61 offsite samples were collected during July: 63.9% of the results were 0 cpm/m³ 34.4% of the results were 1-10 cpm/m³ 1.7% of the results were 11 to 20 cpm/m³ 0% of the results were > 20 cpm/m³	2.0E-5	9.0E-12	4.5E-11
Bradley and Haring 1949d	64 offsite samples were collected during August: 67.2% of the results were 0 cpm/m³ 34.4% of the results were 1-10 cpm/m³ 1.5% of the results were 11 to 20 cpm/m³ 0% of the results were > 20 cpm/m³	2.0E-5	9.0E-12	4.5E-11
Bradley and Haring 1949e	16 offsite samples were collected during September: 1.25% of the results were 0 cpm/m³ 56.25% of the results were 1-10 cpm/m³ 6.25% of the results were 11 to 20 cpm/m³ 6.25% of the results were 21 to 40 cpm/m³ 0% of the results were > 40 cpm/m³	4.0E-05	2.00E-04	9.01E-11
Bradley and Haring 1949f	62 offsite samples were collected down wind from Mound Laboratory in October: 37.1% of the results were 0 dpm/m³ 62.9% of the results were 1 to 20 dpm/m³ 0% of the results were > 20 dpm/m³	--	2.00E-05	9.01E-12

Table 4B-1 (Continued). Mound offsite air-sampling data for 1948 to 1959.

Reference	Description of data	Maximum (cpm/cm^3)	Maximum (dpm/cm^3)[a]	Maximum (µCi/cm^3)
Bradley and Haring 1949g	61 offsite samples were collected down wind from Mound Laboratory in November: 55.7% of the results were 0 dpm/m^3 44.3% of the results were 1 to 20 dpm/m^3 0% of the results were > 20 dpm/m^3	--	2.00E-05	9.01E-12
Bradley and Haring 1949h	53 offsite samples were collected down wind from Mound Laboratory December: 17.0% of the results were 0 dpm/m^3 83.0% of the results were 1 to 20 dpm/m^3 0% of the results were > 20 dpm/m^3.	--	2.00E-05	9.01E-12
1950				
Bradley and Haring 1950a	75 offsite samples were collected during January: 57.3% of the results were 0dpm/m^3 42.6% of the results were 1-10 dpm/m^3 0% of the results were > 20 dpm/m^3	--	2.00E-05	9.01E-12
Bradley and Haring 1950b	74 offsite samples were collected during February: 52.7% of the results were 0 dpm/m^3 47.3% of the results were 1-10 dpm/m^3 0% of the results were > 20 dpm/m^3	--	2.00E-05	9.01E-12
Bradley and Haring 1950c	85 offsite samples were collected during March: 63.5% of the results were 0 dpm/m^3 36.5% of the results were 1-20 dpm/m^3 0% of the results were > 20 dpm/m^3	--	2.00E-05	9.01E-12
Bradley and Haring 1950d	90 offsite samples were collected during April: 61.1% of the results were 0 dpm/m^3 38.9% of the results were 1-20 dpm/m^3 0% of the results were > 20 dpm/m^3	--	2.00E-05	9.01E-12
Bradley and Haring 1950e	75 offsite samples were collected during May: 70.4% of the results were 0 dpm/m^3 29.6% of the results were 1-20 dpm/m^3 0% of the results were > 20 dpm/m^3	--	2.00E-05	9.01E-12
Bradley and Haring 1950f	74 offsite samples were collected during June: 55.4% of the results were 0 dpm/m^3 44.6% of the results were 1-20 dpm/m^3 0% of the results were > 20 dpm/m^3	--	2.00E-05	9.01E-12
Bradley and Haring 1950g	89 offsite samples were collected during July: 61.8% of the results were 0 dpm/m^3 38.2% of the results were 1-20 dpm/m^3 0% of the results were > 20 dpm/m^3	--	2.00E-05	9.01E-12
Bradley and Haring 1950h	69 offsite samples were collected during August: 62.3% of the results were 0 dpm/m^3 37.3% of the results were 1-20 dpm/m^3 0% of the results were > 20 dpm/m^3	--	2.00E-05	9.01E-12
Bradley and Haring 1950i	84 offsite samples were collected during September: 45.2% of the results were 0 dpm/m^3 54.8% of the results were 1-20 dpm/m^3 0% of the results were > 20 dpm/m^3	--	2.00E-05	9.01E-12
Bradley and Haring 1950j	74 offsite samples were collected during October: 59.5% of the results were 0 dpm/m^3 40.5% of the results were 1-20 dpm/m^3 0% of the results were > 20 dpm/m^3	--	2.00E-05	9.01E-12
Bradley and Haring 1950k	78 offsite samples were collected during November: 83.3% of the results were 0 dpm/m^3 16.7% of the results were 1-20 dpm/m^3 0% of the results were > 20 dpm/m^3	--	2.00E-05	9.01E-12
Bradley and Haring 1950l	27 offsite samples were collected during December: 63% of the results were 0 dpm/m^3 37% of the results were 1-20 dpm/m^3 0% of the results were > 20 dpm/m^3	--	2.00E-05	9.01E-12
1951				
Bradley and Burbage 1951a	85 offsite samples were collected during January: 83.6% of the results were 0 dpm/m^3 16.4% of the results were 1-20 dpm/m^3 0% of the results were > 20 dpm/m^3	--	2.00E-05	9.01E-12

Table 4B-1 (Continued). Mound offsite air-sampling data for 1948 to 1959.

Reference	Description of data	Maximum (cpm/cm^3)	Maximum (dpm/cm^3)[a]	Maximum (µCi/cm^3)
Bradley and Burbage 1951b	85 offsite samples were collected during February: 78.8% of the results were 0 dpm/m^3 21.2% of the results were 1-20 dpm/m^3 0% of the results were > 20 dpm/m^3	--	2.00E-05	9.01E-12
Bradley and Burbage 1951c	73 offsite samples were collected during March: 71.2% of the results were 0 dpm/m^3 28.8% of the results were 1-20 dpm/m^3 0% of the results were > 20 dpm/m^3	--	2.00E-05	9.01E-12
Bradley and Burbage 1951d	78 offsite samples were collected during April: 78.2% of the results were 0 dpm/m^3 21.8% of the results were 1-20 dpm/m^3 0% of the results were > 20 dpm/m^3	--	2.00E-05	9.01E-12
Bradley and Burbage 1951e	*May offsite air sample data pages missing.*	--	--	--
Bradley and Burbage 1951f	71 offsite samples were collected during June: 66.2% of the results were 0 dpm/m^3 33.8% of the results were 1-20 dpm/m^3 0% of the results were > 20 dpm/m^3	--	2.00E-05	9.01E-12
Bradley and Burbage 1951g	55 offsite samples were collected during July: 61.8% of the results were 0 dpm/m^3 38.2% of the results were 1-20 dpm/m^3 0% of the results were > 20 dpm/m^3	--	2.00E-05	9.01E-12
Bradley and Burbage 1951h	85 offsite samples were collected during August: 95.3% of the results were 0 dpm/m^3 4.7% of the results were 1-20 dpm/m^3 0% of the results were > 20 dpm/m^3	--	2.00E-05	9.01E-12
Bradley and Burbage 1951i	42 offsite samples were collected during September: 0% of the results were > 10 dpm/m^3	--	1.00E-05	4.50E-12
Bradley and Burbage 1951j	94 offsite samples were collected during October: 93 of the results were 0 dpm/m^3 1 result was 6 dpm/m^3	--	6.00E-06	2.70E-12
Bradley and Burbage 1951k	57 offsite samples were collected during November: 55 of the results were 0 dpm/m^3 2 results were between 1 and 10 dpm/m^3	--	1.00E-05	4.50E-12
Bradley and Burbage 1951l	44 offsite samples were collected during November: 35 of the results were 0 dpm/m^3 9 results were < 20 dpm/m^3	--	2.00E-05	9.01E-12
1952				
Bradley and Burbage 1952a	87 offsite samples were collected during January: 67 of the results were 0 dpm/m^3 20 results were between 1 and 10 dpm/m^3	--	--	--
Bradley and Burbage 1952b	60 offsite samples were collected during February: 50 of the results were 0 dpm/m^3 10 results were between 1 and 10 dpm/m^3	--	1.00E-05	4.50E-12
Bradley and Burbage 1952c	71 offsite samples were collected during March: 47 of the results were 0 dpm/m^3 14 results were less than 20 dpm/m^3	--	2.00E-05	9.01E-12
Bradley and Burbage 1952d	78 offsite samples were collected during April: 43 of the results were 0 dpm/m^3 35 results were less than 20 dpm/m^3	--	2.00E-05	9.01E-12
Bradley and Burbage 1952e	33 offsite samples were collected during May: 24 of the results were 0 dpm/m^3 9 results were less than 20 dpm/m^3	--	2.00E-05	9.01E-12
Bradley and Burbage 1952f	86 offsite samples were collected during June: 51 of the results were 0 dpm/m^3 35 results were less than 20 dpm/m^3	--	2.00E-05	9.01E-12
Bradley and Burbage 1952g	83 offsite samples were collected during July: 41 of the results were 0 dpm/m^3 41 results were between 1 and 20 dpm/m^3 1 result was between 20 and 40 dpm/m^3	--	4.00E-05	1.80E-11
Bradley 1952a	41 offsite samples were collected during August: 20 of the results were 0 dpm/m^3 21 results were between 1 and 20 dpm/m^3	--	2.00E-05	9.01E-12

Table 4B-1 (Continued). Mound offsite air-sampling data for 1948 to 1959.

Reference	Description of data	Maximum		
		(cpm/cm^3)	(dpm/cm^3)[a]	($\mu Ci/cm^3$)
Bradley 1952b	66 offsite samples were collected during September: 32 of the results were 0 dpm/m^3 32 results were between 1 and 20 dpm/m^3 2 results were between 21 and 40 dpm/m^3	--	4.00E-05	1.80E-11
Bradley 1952c	82 offsite samples were collected during October: 50 of the results were 0 dpm/m^3 31 results were between 1 and 20 dpm/m^3 1 result was between 21 and 40 dpm/m^3	--	4.00E-05	1.80E-11
Bradley 1952d	56 offsite samples were collected during November: 35 of the results were 0 dpm/m^3 ("below background") 21 results were between 1 and 20 dpm/m^3	--	2.00E-05	9.01E-12
Bradley 1952e	78 offsite samples were collected during December: 55 of the results were 0 dpm/m^3 21 results were between 1 and 20 dpm/m^3 2 results were between 21 and 40 dpm/m^3	--	4.00E-05	1.80E-11
1953				
Bradley 1953b	65 offsite samples were collected during January: Thirty-six of these samples gave no evidence of airborne contamination. Of the remaining 29, the highest yield was 17.3 dpm/m^3.	--	1.73E-05	7.80E-12
Bradley 1953c	61 offsite samples were collected during February: 42 of the results were 0 dpm/m^3 19 results were between 1 and 16 dpm/m^3	--	1.60E-05	7.20E-12
Bradley 1953d	73 offsite samples were collected during March: 71% of the results were 0 dpm/m^3 The 2 highest results were 15 dpm/m^3	--	1.50E-05	6.80E-12
Bradley 1953e	29 offsite samples were collected during April: 65% of the results were 0 dpm/m^3 The highest result was 11 dpm/m^3	--	1.10E-05	5.00E-12
Bradley 1953f	25 offsite samples were collected during May: 44% of the results were 0 dpm/m^3 The highest result was 10 dpm/m^3	--	1.00E-05	4.50E-12
Bradley 1953g	9 offsite samples were collected during June: 55% of the results were 0 dpm/m^3 The highest result was 16 dpm/m^3	--	1.60E-05	7.20E-12
Bradley 1953h	8 offsite samples were collected during July: 7 of the results were 0 dpm/m^3 1 result was 3 dpm/m^3	--	3.00E-06	1.40E-12
Bradley 1953i	Zero offsite samples were collected during August.	--	--	--
Bradley 1953j	9 offsite samples were collected during September: The highest result was 4 dpm/m^3	--	4.00E-06	1.80E-12
Bradley 1953k	17 offsite samples were collected during October: The highest result was 14.4 dpm/m^3	--	1.40E-05	6.50-12
Bradley 1953l	18 offsite samples were collected during November: The highest result was 10.6 dpm/m^3	--	1.06E-05	4.80E-12
Bradley 1953m	31 offsite samples were collected during December: The highest result was 5.4 dpm/m^3	--	5.40E-06	2.40E-12
1954				
Bradley 1954a	Zero offsite samples were collected during January.	--	--	--
Bradley 1954b	35 offsite samples were collected during February: The highest result was 7 dpm/m^3	--	7.00E-06	3.20E-12
Bradley 1954c	31 offsite samples were collected during March: 16% of the results were 0 dpm/m^3 The highest result was 3 dpm/m^3	--	3.00E-06	1.40E-12
Bradley 1954d	Complete data for April, May, and June is missing.	--	--	--
Bradley 1954e	47 samples were collected during July, August, and September: 19 of the results were 0 $\mu Ci/cm^3$ The maximum result was 1×10^{-12} $\mu Ci/cm^3$	--	--	1.0E-12
Meyer 1955a	84 samples were collected during October, November, and December 25 of the results were 0 $\mu Ci/cm^3$ The maximum result was 3.3×10^{-12} $\mu Ci/cm^3$	--	--	3.3E-12

Table 4B-1 (Continued). Mound offsite air-sampling data for 1948 to 1959.

Reference	Description of data	Maximum		
		(cpm/cm³)	(dpm/cm³)[a]	(μCi/cm³)
1955				
Meyer 1955b	79 samples were collected during January, February, and March: 32 of the results were 0 μCi/cm³ The maximum result was 2.7×10^{-13} μCi/cm³	--	--	2.7×10^{-13}
Meyer 1955c	79 samples were collected during April, May, and June: 59 of the results were 0 μCi/cm³ The maximum result was 3×10^{-12} μCi/cm³	--	--	3.0×10^{-12}
Meyer 1955d	65 samples were collected during July, August, and September: 64 of the results were 0 μCi/cm³ The maximum result was 1.1×10^{-12} μCi/cm³	--	--	1.1×10^{-12}
Meyer 1956a	67 samples were collected during October, November, and December: 65 of the results were 0 μCi/cm³ The maximum result was 5.8×10^{-13} μCi/cm³	--	--	5.8×10^{-13}
1956				
Meyer 1956b	30 samples were collected during January, February, and March: 25 of the results were 0 μCi/cm³ The maximum result was 1.93×10^{-12} μCi/cm³ Po	--	--	1.93×10^{-12}
Meyer 1956c	65 samples were collected during April, May, and June: 50 of the results were 0 μCi/cm³ The maximum result was 7.2×10^{-13} μCi/cm³ Po	--	--	7.2×10^{-13}
--	*Data for July, August, and September is unavailable.*	--	--	--
Meyer 1957a	67 samples were collected during October, November, and December 58 of the results were 0 μCi/cm³ The maximum result was 1.95×10^{-11} μCi/cm³ Po	--	--	1.95×10^{-11}
1957				
Meyer 1957b	67 samples were collected during January, February, and March 62 of the results were 0 μCi/cm³ The maximum result was 1.27×10^{-12} μCi/cm³ Po	--	--	1.27×10^{-12}
Meyer 1957c	67 samples were collected during April, May, and June: 56 of the results were 0 μCi/cm³ The maximum result was 3.85×10^{-12} μCi/cm³ Po	--	--	3.85×10^{-12}
Meyer 1957d	67 samples were collected during July, August, and September: 33 of the results were 0 μCi/cm³ The maximum result was 2.75×10^{-12} μCi/cm³ Po	--	--	2.75×10^{-12}
Meyer 1958a	67 samples were collected during October, November, and December 51 of the results were 0 μCi/cm³ The maximum result was 1.28×10^{-12} μCi/cm³ Po	--	--	1.28×10^{-12}
1958				
Meyer 1958b	66 samples were collected during January, February, and March: 51 of the results were 0 μCi/cm³ The maximum result was 4.46×10^{-12} μCi/cm³ Po	--	--	4.46×10^{-12}
Meyer 1958c	55 samples were collected during April, May, and June: 51 of the results were 0 μCi/cm³ The maximum result was 1.03×10^{-12} μCi/cm³ Po	--	--	1.03×10^{-12}
Meyer 1958d	76 samples were collected during July, August, and September: 69 of the results were 0μCi/cm³ The maximum result was 6.56×10^{-11} μCi/cm³ Po	--	--	6.56×10^{-11}
Meyer 1959a	67 samples were collected during October, November, and December: 62 of the results were 0 μCi/cm³ The maximum result was 6.31×10^{-13} μCi/cm³ Po	--	--	6.31×10^{-13}
1959				
Meyer 1959b	67 samples were collected during January, February, and March: 59 of the results were 0 μCi/cm³ The maximum result was 7.03×10^{-13} μCi/cm³ Po	--	--	7.03×10^{-13}
--	*Data for April, May, and June is unavailable.*	z	--	--
Meyer 1959c	36 samples were collected during July, August, and September: 35 of the results were 0 μCi/cm³ The maximum result was 3.87×10^{-13} μCi/cm³	--	--	3.87×10^{-13}

a. 20% detector efficiency assumed to convert α cpm cm^{-3} to α dpm cm^{-3}.
b. -- = no data

ATTACHMENT 4C
MOUND ENVIRONMENTAL AIR-SAMPLING DATA FOR 1959 TO 1972

LIST OF TABLES

Table 4C-1. Mound offsite air-monitoring data for 1959.[a]

	HTO offsite concentration (10^{-12} µCi/ml)						^{210}Po offsite concentration (10^{-18} µCi/ml)[b]					
Location	Samples	LDL	Min	Max	Mean	Mean	Samples	LDL	Min	Max	Mean	Mean
12 locations – 0 to 5 miles	--	(c)	(c)	(c)	--	--	--	--	--	--	123,000	--
15 locations – 5 to 15 miles	--	(c)	(c)	(c)	--	--	--	--	--	--	118,000	--
20 locations – 15 to 30 miles	--	(c)	(c)	(c)	--	--	--	--	--	--	94,000	--
14 locations – 30 to 40 miles	--	(c)	(c)	(c)	--	--	--	--	--	--	116,000	--
N	--	--	--	--	--	--	--	--	--	--	4	--
Min	--	--	--	--	--	--	--	--	--	--	94,000	--
Max	--	--	--	--	--	--	--	--	--	--	123,000	--
Median	--	--	--	--	--	--	--	--	--	--	117,000	--
Mean	--	--	--	--	--	--	--	--	--	--	112,750	--
StdDev	--	--	--	--	--	--	--	--	--	--	12,842	--
	Effluent intake concentration					(d)	Effluent intake concentration					(d)
Reference	Monsanto 1960											

a. LDL = lower detection limit; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.
b. Gross alpha including naturally occurring alpha.
c. All values not detectable prior to 1967 (Anderson, Sheehan, and Meyer 1966).
d. Not used (derived by alternate method).

Table 4C-2. Mound offsite air-monitoring data for 1960.[a]

	HTO offsite concentration (10^{-12} µCi/ml)						Pu – Po offsite concentration (10^{-18} µCi/ml)[b]					
Location	Samples	LDL	Min	Max	Mean	Mean	Samples	LDL	Min	Max	Mean	Mean
All locations 1st Qrt.	119	(c)	(c)	(c)	--	--	119	--	--	--	27,100	--
All locations 2nd Qrt.	146	(c)	(c)	(c)	--	--	146	--	--	--	24,200	--
All locations 3rd Qrt.	117	(c)	(c)	(c)	--	--	117	--	--	1,171	10,500	--
All locations 4th Qrt.	154	(c)	(c)	(c)	--	--	154	--	--	3,153	19,800	--
N	536	--	--	--	--	--	536	--	--	2	4	--
Min	--	--	--	--	--	--	--	--	--	117,100	10,500	--
Max	--	--	--	--	--	--	--	--	--	315,300	27,100	--
Median	--	--	--	--	--	--	--	--	--	216,200	22,000	--
Mean	--	--	--	--	--	--	--	--	--	216,200	20,400	--
StdDev	--	--	--	--	--	--	--	--	--	140,149	7,250	--
	Effluent intake concentration					(d)	Effluent intake concentration					(d)
Reference	Monsanto 1961a											

a. LDL = lower detection limit; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.
b. Gross alpha; no discrimination between Pu and Po.
c. All values not detectable prior to 1967(Anderson, Sheehan, and Meyer 1966).
d. Not used (derived by alternate method).

Table 4C-3. Mound offsite air-monitoring data for 1961.[a]

	HTO offsite concentration (10^{-12} µCi/ml)						Pu – Po offsite concentration (10^{-18} µCi/ml)[b]					
Location	Samples	LDL	Min	Max	Mean	Mean	Samples	LDL	Min	Max	Mean	Mean
All locations 1st Qrt.	154	(c)	(c)	(c)	(c)	(c)	154	--	--	90,100	9,300	--
All locations 3rd Qrt.	179	(c)	(c)	(c)	(c)	(c)	155	--	--	54,000	12,000	--
All locations 4th Qrt.	183	(c)	(c)	(c)	(c)	(c)	159	--	--	1,413,000	25,400	--
N	516		--	--	--	--	468	--	--	3	3	--
Min	--	--	--	--	--	--	--	--	--	54,000	9,300	--
Max	--	--	--	--	--	--	--	--	--	1,413,000	25,400	--
Median	--	--	--	--	--	--	--	--		90,100	12,000	--
Mean	--	--	--	--	--	--	--	--		519,033	15,567	--
StdDev	--	--	--	--	--	--	--	--		774,408	8,622	--
	Effluent intake concentration					(d)	Effluent intake concentration					(d)
Reference	Monsanto 1961b, Adams 1961, Adams 1962a											

a. LDL = lower detection limit; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.
b. Downwind sample gross alpha; no discrimination between Pu and Po.
c. All values not detectable prior to 1967 (Anderson, Sheehan, and Meyer 1966).
d. Not used (derived by alternate method).

Table 4C-4. Mound offsite air-monitoring data for 1962.[a]

	HTO offsite concentration (10^{-12} μCi/ml)						Pu – Po offsite concentration (10^{-18} μCi/ml)[b]					
Location	Samples	LDL	Min	Max	Mean	Meani	Samples	LDL	Min	Max	Mean	Mean
Upwind locations	18	(c)	(c)	(c)	(c)	(c)	18	--	--	9,400	1,100	--
Downwind locations	115	(c)	(c)	(c)	(c)	(c)	115	--	--	60,700	1,900	--
N	133	--	--	--	--	--	133	--	--	2	2	--
Min	--	--	--	--	--	--		--	--	9,400	1,100	--
Max	--	--	--	--	--	--		--	--	60,700	1,900	--
Median	--	--	--	--	--	--		--	--	35,050	1,500	--
Mean	--	--	--	--	--	--		--	--	35,050	1,500	--
StdDev	--	--	--	--	--	--		--	--	36,275	566	--
	Effluent intake concentration					(d)	Effluent intake concentration					(d)
Reference	Adams 1962b, Adams and Meyer 1963a											

a. LDL = lower detection limit; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.
b. Gross alpha; no discrimination between Pu and Po.
c. All values not detectable prior to 1967 (Anderson, Sheehan, and Meyer 1966).
d. Not used (derived by alternate method).

Table 4C-5. Mound offsite air-monitoring data for January – June 1963.[a]

	HTO offsite concentration (10^{-12} μCi/ml)						Pu – Po offsite concentration (10^{-18} μCi/ml)[b]					
Location	Samples	LDL	Min	Max	Mean	Mean	Samples	LDL	Min	Max	Mean	Mean
Upwind locations	26	(c)	(c)	(c)	(c)	(c)	26	--	--	20,700	3,400	--
Downwind locations	154	(c)	(c)	(c)	(c)	(c)	154	--	--	41,800	3,000	--
N	180	--	--	--	--	--	180	--	--	2	2	--
Min	--	--	--	--	--	--	--	--	--	20,700	3,000	--
Max	--	--	--	--	--	--	--	--	--	41,800	3,400	--
Median	--	--	--	--	--	--	--	--	--	31,250	3,200	--
Mean	--	--	--	--	--	--	--	--	--	31,250	3,200	--
StdDev	--	--	--	--	--	--	--	--	--	14,920	283	--
	Effluent intake concentration					(d)	Effluent intake concentration					(d)
Reference	Adams and Meyer 1963b											

a. LDL = lower detection limit; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.
b. Gross alpha; no discrimination between Pu and Po.
c. All values not detectable prior to 1967 (Anderson, Sheehan, and Meyer 1966).
d. Not used (derived by alternate method).

Table 4C-6. Mound offsite air-monitoring data for 1964.[a]

	HTO offsite concentration (10^{-12} μCi/ml)						Pu – Po offsite concentration (10^{-18} μCi/ml)[b]					
Location	Samples	LDL	Min	Max	Mean	Mean	Samples	LDL	Min	Max	Mean	Mean
Upwind locations	94	(c)	(c)	(c)	(c)	(c)	94	--	--	43,700	2,550	--
Downwind locations	566	(c)	(c)	(c)	(c)	(c)	566	--	--	144,000	3,600	--
N	660	--	--	--	--	--	660	--	--	2	2	--
Min	--	--	--	--	--	--	--	--	--	43,700	2,550	--
Max	--	--	--	--	--	--	--	--	--	144,000	3,600	--
Median	--	--	--	--	--	--	--	--	--	93,850	3,075	--
Mean	--	--	--	--	--	--	--	--	--	93,850	3,075	--
StdDev	--	--	--	--	--	--	--	--	--	70,923	742	--
	Effluent intake concentration					(d)	Effluent intake concentration					(d)
Reference	Adams and Meyer 1964a, 1965a											

a. -- = no data; BEL = below environmental level; LDL = lower detection limit; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.
b. Gross alpha; no discrimination between Pu and Po.
c. All values not detectable prior to 1967 (Anderson, Sheehan, and Meyer 1966).
d. Not used (derived by alternate method).

Table 4C-7. Mound offsite air-monitoring data for 1965.[a]

	HTO offsite concentration (10^{-12} µCi/ml)						Pu – Po offsite concentration (10^{-18} µCi/ml)[b]					
Location	**Samples**	**LDL**	**Min**	**Max**	**Mean**	**Meani**	**Samples**	**LDL**	**Min**	**Max**	**Mean**	**Mean**
Upwind locations	104	(c)	(c)	(c)	(c)	(c)	104	--	--	27,000	2,500	--
Downwind locations	620	(c)	(c)	(c)	(c)	(c)	620	--	--	82,800	2,600	--
N	724	--	--	--	--	--	724	--	--	2	2	--
Min	--	--	--	--	--	--	--	--	--	27,000	2,500	--
Max	--	--	--	--	--	--	--	--	--	82,800	2,600	--
Median	--	--	--	--	--	--	--	--	--	54,900	2,550	--
Mean	--	--	--	--	--	--	--	--	--	54,900	2,550	--
StdDev	--	--	--	--	--	--	--	--	--	39,457	71	--
	Effluent intake concentration					(d)	Effluent intake concentration					(d)
Reference	Adams and Meyer 1965b, Adams, Anderson and Meyer 1966											

a. LDL = lower detection limit; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.
b. Gross alpha; no discrimination between Pu and Po.
c. All values not detectable prior to 1967 (Anderson, Sheehan, and Meyer 1966).
d. Not used (derived by alternate method).

Table 4C-8. Mound offsite air-monitoring data for 1966.[a]

	HTO offsite concentration (10^{-12} µCi/ml)						Pu – Po offsite concentration (10^{-18} µCi/ml)[b]					
Location	**Samples**	**LDL**	**Min**	**Max**	**Mean**	**Mean**	**Samples**	**LDL**	**Min**	**Max**	**Mean**	**Mean**
0-3 miles upwind	77	(c)	(c)	(c)	(c)	(c)	77	3,500	--	16,800	3,900	--
0-3 miles downwind	127	(c)	(c)	(c)	(c)	(c)	127	3,500	--	534,200	11,100	--
3-5 miles downwind	82	(c)	(c)	(c)	(c)	(c)	82	3,500	--	12,900	4,300	--
5-10 miles downwind	82	(c)	(c)	(c)	(c)	(c)	82	3,500	--	54,600	5,000	--
10-15 miles downwind	87	(c)	(c)	(c)	(c)	(c)	87	3,500	--	23,200	5,000	--
15-20 miles downwind	123	(c)	(c)	(c)	(c)	(c)	123	3,500	--	11,120	5,600	--
N	578	--	--	--	--	--	578	--	--	6	6	--
Min	--	--	--	--	--	--	--	3,500	--	11,120	3,900	--
Max	--	--	--	--	--	--	--	3,500	--	534,200	11,100	--
Median	--	--	--	--	--	--	--	3,500	--	20,000	5,000	--
Mean	--	--	--	--	--	--	--	3,500	--	108,803	5,817	--
StdDev	--	--	--	--	--	--	--	--	--	209,013	2,656	--
	Effluent intake concentration					(d)	Effluent intake concentration					(d)
Reference	Anderson, Sheehan, and Meyer 1966, 1967a											

a. LDL = lower detection limit unknown confidence level; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.
b. Gross alpha; no discrimination between Pu and Po.
c. All values not detectable prior to 1967 (Anderson, Sheehan, and Meyer 1966).
d. Not used (derived by alternate method).

Table 4C-9. Mound offsite air-monitoring data for 1967.[a]

Location	HTO offsite concentration (10^{-12} µCi/ml)						^{238}Pu offsite concentration (10^{-18} µCi/ml)[b]					
	Samples	LDL	Min	Max	Mean	Mean	Samples	LDL	Min	Max	Mean	Mean
0-3 miles upwind	33	8,000	--	25,000	8,650	--	46	1,300	--	282,200	12,000	--
0-3 miles downwind	32	8,000	--	26,900	9,020	--	46	900	--	121,700	9,900	--
3-5 miles downwind	31	8,000	--	12,790	8,080	--	46	1,300	--	111,400	11,100	--
5-10 miles downwind	31	8,000	--	10,690	8,090	--	45	1,300	--	14,200	4,700	--
10-15 miles downwind	29	8,000	--	8,000	8,000	--	46	1,300	--	98,400	8,300	--
15-20 miles downwind	24	8,000	--	9,400	8,090	--	46	900	--	27,300	4,500	--
N	180	--	--	6	6	--	275	--	--	6	6	--
Min	--	8,000	--	8,000	8,000	--	--	900	--	14,200	4,500	--
Max	--	8,000	--	26,900	9,020	--	--	1,300	--	282,200	12,000	--
Median	--	8,000	--	11,740	8,090	--	--	1,300	--	104,900	9,100	--
Mean	--	8,000	--	15,463	8,322	--	--	1,167	--	109,200	8,417	--
StdDev	--	--	--	8,296	416	--	--		--	95,853	3,207	--
	Effluent intake concentration					(c)	Effluent intake concentration					(c)
Reference	Anderson, Sheehan and Meyer 1967b, 1968a											

Table 4C-9 (Continued).

Location	^{210}Po offsite concentration (10^{-18} µCi/ml)[b]					
	Samples	LDL	Min	Max	Mean	Mean
0-3 miles upwind	45	8,000	--	669,000	33,300	--
0-3 miles downwind	44	5,300	--	104,700	15,300	--
3-5 miles downwind	45	8,000	--	689,200	35,200	--
5-10 miles downwind	45	8,000	--	99,100	22,500	--
10-15 miles downwind	45	8,000	--	80,000	19,700	--
15-20 miles downwind	44	5,300	--	36,600	14,100	--
N	268	--	--	6	6	--
Min	--	5,300	--	36,600	14,100	--
Max	--	8,000	--	689,200	35,200	--
Median	--	8,000	--	101,900	21,100	--
Mean	--	7,100	--	279,767	23,350	--
StdDev	--		--	310,311	8,987	--
	Effluent intake concentration					(c)
Source	Anderson, Sheehan, and Meyer 1968a, Table 5					

a. LDL = lower detection limit unknown confidence level; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.
b. Gross alpha attributed to Pu-238 after separation of Po (naturally occurring alpha is included).
c. Not used (derived by alternate method).

Table 4C-10. Mound offsite air-monitoring data for 1968.[a]

Location	HTO offsite concentration (10^{-12} µCi/ml)						^{238}Pu offsite concentration (10^{-18} µCi/ml)[b]					
	Samples	LDL	Min	Max	Mean	Mean	Samples	LDL	Min	Max	Mean	Mean
0-3 miles upwind	40	2,000	--	16,550	3,690	--	38	1,300	--	37,900	11,900	--
0-3 miles downwind	40	2,000	--	41,740	4,050	--	38	900	--	36,500	9,200	--
3-5 miles downwind	40	2,000	--	10,950	2,730	--	24	1,300	--	81,100	14,700	--
5-10 miles downwind	40	2,000	--	12,850	3,010	--	23	1,300	--	55,000	13,100	--
10-15 miles downwind	40	2,000	--	10,150	2,890	--	23	1,300	--	36,500	12,900	--
15-20 miles downwind	40	2,000	--	16,900	3,210	--	22	900	--	54,400	9,100	--
N	240	--	--	6	6	--	168	--	--	6	6	--
Min	--	2,000	--	10,150	2,730	--	--	900	--	36,500	9,100	--
Max	--	2,000	--	41,740	4,050	--	--	1,300	--	81,100	14,700	--
Median	--	2,000	--	14,700	3,110	--	--	1,300	--	46,150	12,400	--
Mean	--	2,000	--	18,190	3,263	--	--	1,167	--	50,233	11,817	--
StdDev	--		--	11,870	508	--	--		--	17,448	2,252	--
	Effluent intake concentration					(c)	Effluent intake concentration					(c)
Reference	Anderson, Sheehan, and Meyer 1968b, 1969a											

Table 4C-10 (Continued).

Location	^{210}Po offsite concentration (10^{-18} µCi/ml)[b]					
	Samples	LDL	Min	Max	Mean	Mean
0-3 miles upwind	40	8,000	--	440,200	32,900	--
0-3 miles downwind	40	5,300	--	404,200	35,100	--
3-5 miles downwind	40	8,000	--	396,600	34,900	--
5-10 miles downwind	40	8,000	--	331,500	31,300	--
10-15 miles downwind	40	8,000	--	312,700	33,700	--
15-20 miles downwind	40	5,300	--	236,800	23,100	--
N	240	--	--	6	6	--
Min	--	5,300	--	236,800	23,100	--
Max	--	8,000	--	440,200	35,100	--
Median	--	8,000	--	364,050	33,300	--
Mean	--	7,100	--	353,667	31,833	--
StdDev	--		--	74,448	4,500	--
	Effluent intake concentration					(c)
Source	Anderson, Sheehan, and Meyer 1969a, Table 5					

a. LDL = lower detection limit unknown confidence level; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.
b. Gross alpha attributed to Pu-238 after separation of Po (naturally occurring alpha is included).
c. Not used (derived by alternate method).

Table 4C-11. Mound offsite air-monitoring data for 1969.[a]

	HTO offsite concentration (10^{-12} µCi/ml)						^{238}Pu offsite concentration (10^{-18} µCi/ml)[b]					
Location	**Samples**	**LDL**	**Min**	**Max**	**Mean**	**Mean**	**Samples**	**LDL**	**Min**	**Max**	**Mean**	**Mean**
0-3 miles upwind	35	1,000	--	5,480	1,390	--	37	1,300	--	12,700	5,400	--
0-3 miles downwind	35	1,000	--	12,190	1,400	--	38	900	--	61,100	6,800	--
3-5 miles downwind	34	1,000	--	3,990	1,120	--	38	1,300	--	183,300	10,500	--
5-10 miles downwind	34	1,000	--	2,390	1,060	--	37	1,300	--	16,000	6,300	--
10-15 miles downwind	34	1,000	--	1,510	1,020	--	38	1,300	--	19,700	5,900	--
15-20 miles downwind	33	1,000	--	3,580	1,110	--	37	900	--	15,600	4,200	--
N	205	--	--	6	6	--	225	--	--	6	6	--
Min	--	1,000	--	1,510	1,020	--	--	900	--	12,700	4,200	--
Max	--	1,000	--	12,190	1,400	--	--	1,300	--	183,300	10,500	--
Median	--	1,000	--	3,785	1,115	--	--	1,300	--	17,850	6,100	--
Mean	--	1,000	--	4,857	1,183	--	--	1,167	--	51,400	6,517	--
StdDev	--	--	--	3,843	168	--	--		--	67,125	2,144	--
	Effluent intake concentration					(c)	Effluent intake concentration					(c)
Reference	Anderson, Sheehan, and Meyer 1969b; Anderson and Sheehan 1970											

Table 4C-11 (Continued).

	^{210}Po offsite concentration (10^{-18} µCi/ml)[b]					
Location	**Samples**	**LDL**	**Min**	**Max**	**Mean**	**Mean**
0-3 miles upwind	37	8,000	--	39,500	15,600	--
0-3 miles downwind	38	5,300	--	35,800	9,400	--
3-5 miles downwind	37	8,000	--	38,900	14,500	--
5-10 miles downwind	38	8,000	--	64,900	15,600	--
10-15 miles downwind	39	8,000	--	30,300	14,400	--
15-20 miles downwind	37	5,300	--	35,700	10,400	--
N	226	--	--	6	6	--
Min	--	5,300	--	30,300	9,400	--
Max	--	8,000	--	64,900	15,600	--
Median	--	8,000	--	37,350	14,450	--
Mean	--	7,100	--	40,850	13,317	--
StdDev	--		--	12,226	2,715	--
	Effluent intake concentration					(c)
Source	Anderson and Sheehan 1970, Table 5					

a. LDL = lower detection limit unknown confidence level; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.
b. Gross alpha attributed to Pu-238 after separation of Po (naturally occurring alpha is included).
c. Not used (derived by alternate method).

Table 4C-12. Mound offsite air-monitoring data for 1970.[a]

	HTO offsite concentration (10^{-12} µCi/ml)					
Location	Samples	LDL	Min	Max	Mean	Mean
0-miles upwind	82	200	--	--	480	--
0-3 3 miles downwind	83	200	--	--	3,910	--
3-5 miles downwind	83	200	--	--	610	--
5-10 miles downwind	84	200	--	--	420	--
10-15 miles downwind	84	200	--	--	520	--
15-20 miles downwind	84	200	--	--	430	--
N	500	--	--	--	6	--
Min	--	200	--	--	420	--
Max	--	200	--	--	3,910	--
Median	--	200	--	--	500	--
Mean	--	200	--	--	1,062	--
StdDev	--	--	--	--	1,397	--
	Effluent intake concentration					(b)
Reference	Monsanto 1971a,b					

	^{238}Pu offsite concentration (10^{-18} µCi/ml)					
Location	Samples	LDL	Min	Max	Mean	Mean
0-miles upwind	81	1,300	--	--	3,300	--
0-3 3 miles downwind	81	900	--	--	2,900	--
3-5 miles downwind	81	1,300	--	--	3,300	--
5-10 miles downwind	81	1,300	--	--	2,700	--
10-15 miles downwind	81	1,300	--	--	2,700	--
15-20 miles downwind	81	900	--	--	2,300	--
N	486		--	--	6	--
Min	--	900	--	--	2,300	--
Max	--	1,300	--	--	3,300	--
Median	--	1,300	--	--	2,800	--
Mean	--	1,167	--	--	2,867	--
StdDev	--	--	--	--	388	--
	Effluent intake concentration					(b)
Reference						

	^{210}Po offsite concentration (10^{-18} µCi/ml)					
Location	Samples	LDL	Min	Max	Mean	Mean
0-miles upwind	84	8,000	--	--	14,000	--
0-3 3 miles downwind	84	5,000	--	--	8,000	--
3-5 miles downwind	83	8,000	--	--	10,000	--
5-10 miles downwind	84	8,000	--	--	11,000	--
10-15 miles downwind	84	8,000	--	--	12,000	--
15-20 miles downwind	84	5,000	--	--	8,000	--
N	503		--	--	6	--
Min	--	5,000	--	--	8,000	--
Max	--	8,000	--	--	14,000	--
Median	--	8,000	--	--	10,500	--
Mean	--	7,000	--	--	10,500	--
StdDev	--	--	--	--	2,345	--
	Effluent intake concentration					(b)
Reference						

a. LDL = lower detection limit at 95% confidence level; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.

b. Not used (derived by alternate method).

Table 4C-13. Mound air-monitoring data for 1971.[a]

	HTO concentration (10^{-12} µCi/ml)					
Location	Samples	LDL	Min	Max	Mean	
0-3 miles upwind	136	40	--	--	610	
0-3 miles downwind	136	40	--	--	2,880	
3-5 miles downwind	136	40	--	--	760	
5-10 miles downwind	136	40	--	--	410	
Southern Perimeter	--	--	--	--	140	
Northern Perimeter	--	--	--	--	4,800	
Site center	--	--	--	--	5,400	
N	816	--	--	--	--	
Min	--	40	--	--	--	
Max	--	40	--	--	--	
Median	--	40	--	--	--	
Mean	--	40	--	--	--	
StdDev	--	--	--	--	--	
	Effluent intake concentration					4,800
Reference	Monsanto 1972; Carfagno and Westendorf 1972a					

	^{238}Pu concentration(10^{-18} µCi/ml)					
Location	Samples	LDL	Min	Max	Mean	
0-3 miles upwind	116	30	--	--	2,270	
0-3 miles downwind	116	30	--	--	2,960	
3-5 miles downwind	115	30	--	--	1,540	
5-10 miles downwind	110	30	--	--	1,630	
Southern Perimeter	--	--	--	--	500	
Northern Perimeter	--	--	--	--	300	
Site center	--	--	--	--	400	
N	677	--	--	--	--	
Min	--	30	--	--	--	
Max	--	30	--	--	--	
Median	--	30	--	--	--	
Mean	--	30	--	--	--	
StdDev	--	--	--	--	--	
	Effluent intake concentration					400
Reference						

	^{210}Po Concentration (10^{-18} µCi ml^{-1})					
Location	Samples	LDL	Min	Max	Mean	
0-3 miles upwind	134	2,000	--	--	12,000	
0-3 miles downwind	134	2,000	--	--	1,000	
3-5 miles downwind	134	2,000	--	--	10,000	
5-10 miles downwind	134	2,000	--	--	14,000	
Southern Perimeter	--	--	--	--	2,000	
Northern Perimeter	--	--	--	--	2,000	
Site center	--	--	--	--	4,000	
N	804	--	--	--	--	
Min	--	2,000	--	--	--	
Max	--	2,000	--	--	--	
Median	--	2,000	--	--	--	
Mean	--	2,000	--	--	--	
StdDev	--	--	--	--	--	
	Effluent intake concentration					2,000
Reference						

a. LDL = lower detection limit at 95% confidence level; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.

Table 4C-14. Mound air-monitoring data for 1972.[a]

	HTO concentration (10^{-12} µCi/ml)						^{238}Pu concentration(10^{-18} µCi/ml)						^{210}Po concentration (10^{-18} µCi/ml)					
Location	**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	26	3	<3.0	290	77		26	1	10	928	400		26	20	930	3,700	2,300	
212 *On*	26	3	<3.0	2,200	200		26	1	10	129	58		26	20	700	2,400	1,300	
213 *On*	26	3	<3.0	1,250	110		26	1	8	1,101	400		26	20	660	2,600	1,200	
214 *On*	26	3	<3.0	690	82		26	1	39	153	140		26	20	740	4,500	1,300	
215 *On*	26	3	<3.0	430	51		26	1	18	33	22		26	20	590	2,300	1,200	
N	130	5	0	5	5		130	5	5	5	5		130	5	5	5	5	
Min	--	3	BEL	290	51		--	1	8	33	22		--	20	590	2,300	1,200	
Max	--	3	BEL	2,200	200		--	1	39	1,101	400		--	20	930	4,500	2,300	
Median	--	3.00	ND	690.00	82.00		--	0.50	10.00	153.00	140.00		--	20.00	700.00	2,600.00	1,300.00	
Mean	--	3.00	ND	972.00	104.00		--	0.50	17.00	468.80	204.00		--	20.00	724.00	3,100.00	1,460.00	
StdDev	--	0.00	ND	778.41	57.61		--	0.00	12.88	503.90	183.96		--	0.00	127.79	961.77	472.23	
101 *Off*	46	3	<3.0	580	101		46	1	11	95	34		46	20	520	3,700	1,300	
102 *Off*	37	3	<3.0	250	61		3	1	(b)	(b)	69		--	--	--	--	--	
103 *Off*	45	3	<3.0	1,640	81		44	1	5	188	56		--	--	--	--	--	
104 *Off*	42	3	<3.0	270	30		45	1	6	51	20		--	--	--	--	--	
105 *Off*	45	3	<3.0	110	12		45	1	4	27	10		--	--	--	--	--	
106 *Off*	45	3	<3.0	59	8		45	1	3	78	13		--	--	--	--	--	
107 *Off*	43	3	<3.0	25	4		25	1	2	11	5		--	--	--	--	--	
108 *Off*	44	3	<3.0	16	3		43	1	3	14	8		42	20	600	2,900	1,300	
109 *Off*	45	3	<3.0	21	4		41	1	2	9	5		--	--	--	--	--	
110 *Off*	43	3	<3.0	79	5		27	1	4	7	5		--	--	--	--	--	
N	435	10	0	10	10		364	10	9	9	10		88	2	2	2	2	
Min	--	3	BEL	16	3		--	1	2	7	5		--	20	520	2,900	1,300	
Max	--	3	BEL	1,640	101		--	1	11	188	69		--	20	600	3,700	1,300	
Median	--	3.00	--	95	10		--	0.50	3.50	27.00	11.30		--	20.00	560.00	3,300.00	1,300.00	
Mean	--	3.00	--	305	31		--	0.50	4.36	53.38	22.43		--	20.00	560.00	3,300.00	1,300.00	
StdDev	--	0.00	--	500	37		--	0.00	2.73	59.78	23.14		--	0.00	56.57	565.69	0.00	
EL					--						--						--	
Reference	Carfagno and Westendorf 1972b, 1973a																	
	Effluent intake concentration					82.00	Effluent intake concentration					140.00	Effluent intake concentration					1,300.00

a. -- = no data; BEL = below environmental level; BRB = below reagent blank; EL = environmental (activity concentration) level; LDL = lower detection limit at 95% confidence level; ; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.

b. Pu-238 sample location 102 value is composite of three samples.

ATTACHMENT 4D
MOUND ENVIRONMENTAL AIR-SAMPLING DATA FOR 1973 TO 2001

LIST OF TABLES

Table 4D-1. Mound air-monitoring data for 1973.[a]

	HTO concentration (10^{-12} μCi/ml)						^{238}Pu concentration(10^{-18} μCi/ml)						^{210}Po concentration (10^{-18} μCi/ml)					
Location	**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	52	3	<3.0	280.00	59.00		51	0.5	180.00	2850.00	940.00		51	20	590	6,500	1,500	
212 *On*	52	3	<3.0	880.00	81.00		51	0.5	47.00	600.00	160.00		51	20	480	2,000	1,100	
213 *On*	52	3	<3.0	670	97.00		51	0.5	130	9000	1390		52	20	500	5,500	1,100	
214 *On*	50	3	<3.0	570	79		48	0.5	59	180	110		49	20	260	3,300	1,000	
215 *On*	51	3	<3.0	340.00	33.00		50	0.5	18.00	350.00	68.00		51	20	500	1,900	1,000	
N	257	5	0	5	5		251	5	5	5	5		254	5	5	5	5	
Min		3	BEL	280.00	33.00			0.5	18.00	180.00	68.00			20.0	260	1,900	1,000	
Max		3	BEL	880.00	97.00			0.5	180.00	9000.00	1390.00			20.0	260	1,900	1,500	
Median		3	--	570.00	79.00			0.5	59.00	600.00	160.00			20.0	500	3,300	1,100	
Mean		3	--	548.00	69.80			0.5	86.80	2596.00	533.60			20.0	466	3,840	1,140	
StdDev		0	--	245.30	24.60			0.0	66.41	3739.70	598.83			0.0	123	2,078	207	
101 *Off*	49	3	<3.0	810.00	87.00		50	0.36	11.00	157.00	47.00		50	20	370	2,400	1,100	
102 *Off*	51	3	<3.0	970.00	124.00		43	0.36	9.90	146.00	56.00		--	--	--	--	--	
103 *Off*	52	3	<3.0	3040.00	115.00		52	0.36	4.60	184.00	58.00		--	--	--	--	--	
104 *Off*	51	3	<3.0	570.00	40.00		51	0.36	4.00	444.00	51.00		--	--	--	--	--	
105 *Off*	52	3	<3.0	350.00	14.00		51	0.36	0.60	55.00	16.00		--	--	--	--	--	
106 *Off*	51	3	<3.0	130.00	12.00		40	0.36	0.50	21.00	7.80		--	--	--	--	--	
107 *Off*	52	3	<3.0	200.00	15.00		45	0.36	<0.36	61.00	8.80		--	--	--	--	--	
108 *Off*	52	3	<3.0	110.00	8.00		52	0.36	2.60	143.00	25.00		52	20	450	2,200	1,300	
109 *Off*	52	3	<3.0	660.00	26.00		49	0.36	0.60	594.00	52.00		--	--	--	--	--	
110 *Off*	52	3	<3.0	80.00	8.00		38	0.36	<0.36	19.00	4.60		--	--	--	--	--	
111 *Off*	52	3	<3.0	80.00	9.00		52	0.36	<0.36	26.00	4.00		--	--	--	--	--	
112 *Off*	50	3	<3.0	490.00	37.00		50	0.36	0.70	60.00	16.00		--	--	--	--	--	
113 *Off*	51	3	<3.0	130.00	13.00		46	0.36	<0.36	11.00	4.20		--	--	--	--	--	
114 *Off*	51	3	<3.0	110.00	10.00		51	0.36	<0.36	12.00	2.50		--	--	--	--	--	
115 *Off*	50	3	<3.0	80.00	10.00		49	0.36	<0.36	12.00	3.10		--	--	--	--	--	
116 *Off*	49	3	<3.0	210.00	14.00		48	0.36	<0.36	18.00	3.90		--	--	--	--	--	
117 *Off*	50	3	<3.0	100.00	9.00		50	0.36	<0.36	10.00	1.90		--	--	--	--	--	
118 *Off*	45	3	<3.0	910.00	45.00		30	0.36	2.80	26.00	9.10		--	--	--	--	--	
119 *Off*	41	3	<3.0	60.00	5.00		41	0.36	<0.36	20.00	3.90		--	--	--	--	--	
120 *Off*	42	3	<3.0	100.00	9.00		42	0.36	<0.36	12.00	3.00		--	--	--	--	--	
121 *Off*	44	3	<3.0	50.00	7.00		42	0.36	<0.36	10.00	2.60		--	--	--	--	--	
N	1,039	21	0	21	21		972	21	10	21	21		102	2	2	2	2	
Min		3	BEL	50.00	5.00			0.36	0.5	10.00	1.90			20	370	2,200	1,100	
Max		3	BEL	3,040.00	124.00			0.36	11	594.00	58.00			20	450	2,400	1,300	
Median		3	--	130.00	13.00			0.36	2.70	26.00	7.80			20	410	2,300	1,200	
Mean		3	--	440.00	29.38			0.36	3.73	97.19	18.11			20	410	2,300	1,200	
StdDev		0	--	667.52	35.56			0.00	3.85	152.62	20.74			0	57	141	141	
BEL[b]					5						3.9						--	
Reference	Carfagno and Westendorf 1973b, 1974																	
	Effluent intake concentration					74.00	Effluent intake concentration					156.10	Effluent intake concentration					1,100.00

a. -- = no data; BEL = below environmental level; BRB = below reagent blank; EL = environmental (activity concentration) level; LDL = lower detection limit at 95% confidence level; ; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.

b. BEL values from sample location 119.

Table 4D-2. Mound air-monitoring data for 1974.[a,b]

Location	HTO concentration (10^{-12} µCi/ml)					
	Samples	LDL	Min	Max	Mean	
211 *On*	53	3	<3.0	550.00	86.00	
212 *On*	50	3	<3.0	1220.00	110.00	
213 *On*	53	3	20.00	3330	320.00	
214 *On*	53	3	<3.0	1440	170	
215 *On*	53	3	<3.0	1750.00	160.00	
N	262	5	1	5	5	
Min		3	20.00	550.00	86.00	
Max		3	20.00	3330.00	320.00	
Median		3	--	1440.00	160.00	
Mean		3	--	1658.00	169.20	
StdDev		0	--	1033.33	91.18	
101 *Off*	53	2	<2.0	900.00	110.00	
102 *Off*	53	2	<2.0	1700.00	140.00	
103 *Off*	53	2	<2.0	2490.00	148.00	
104 *Off*	53	2	<2.0	520.00	49.00	
105 *Off*	53	2	<2.0	510.00	54.00	
106 *Off*	53	2	<2.0	230.00	29.00	
107 *Off*	52	2	<2.0	260.00	21.00	
108 *Off*	52	2	<2.0	140.00	16.00	
109 *Off*	53	2	<2.0	130.00	15.00	
110 *Off*	52	2	<2.0	90.00	17.00	
111 *Off*	52	2	<2.0	60.00	11.00	
112 *Off*	53	2	<2.0	530.00	40.00	
113 *Off*	53	2	<2.0	50.00	9.00	
114 *Off*	53	2	<2.0	60.00	8.00	
115 *Off*	53	2	<2.0	160.00	12.00	
116 *Off*	53	2	<2.0	100.00	10.00	
117 *Off*	53	2	<2.0	40.00	7.00	
118 *Off*	53	2	<2.0	1800.00	87.00	
119 *Off*	52	2	<2.0	40.00	7.00	
120 *Off*	53	2	<2.0	30.00	6.00	
121 *Off*	53	2	<2.0	30.00	8.00	
N	1108	21	0	21	21	
Min		2	BEL	30.00	6.00	
Max		2	BEL	2490.00	148.00	
Median		2	--	140.00	16.00	
Mean		2	--	470.00	38.29	
StdDev		0	--	690.22	44.76	
EL[c]					7	
Reference	Carfagno and Robinson 1975					
					Effluent intake concentration	153.00

Location	^{238}Pu concentration(10^{-18} µCi/ml)					
	Samples	LDL	Min	Max	Mean	
211 *On*	52	0.4	51.00	3920.00	810.00	
212 *On*	50	0.4	60.00	530.00	190.00	
213 *On*	53	0.4	200	1900	570	
214 *On*	53	0.4	67	460	170	
215 *On*	52	0.4	23.00	190.00	82.00	
N	260	5	5	5	5	
Min		0.4	23.00	190.00	82.00	
Max		0.4	200.00	3920.00	810.00	
Median		0.4	60.00	530.00	190.00	
Mean		0.4	80.20	1400.00	364.40	
StdDev		0.0	69.03	1557.64	311.76	
101 *Off*	52	0.36	23.00	316.00	100.00	
102 *Off*	53	0.36	9.60	293.00	60.00	
103 *Off*	53	0.36	18.00	335.00	64.00	
104 *Off*	53	0.36	3.80	34.00	13.00	
105 *Off*	35	0.36	3.30	36.00	12.00	
106 *Off*	22	0.36	2.10	21.00	6.30	
107 *Off*	30	0.36	0.60	37.00	6.00	
108 *Off*	47	0.36	0.60	84.00	32.00	
109 *Off*	53	0.36	1.20	16.00	5.60	
110 *Off*	18b	0.36	1.90	43.00	13.00	
111 *Off*	53	0.36	0.90	32.00	7.80	
112 *Off*	53	0.36	2.80	79.00	20.00	
113 *Off*	53	0.36	0.80	23.00	5.60	
114 *Off*	53	0.36	1.70	15.00	6.30	
115 *Off*	50	0.36	0.30	71.00	10.00	
116 *Off*	47	0.36	0.70	35.00	5.60	
117 *Off*	48	0.36	0.70	32.00	7.30	
118 *Off*	53	0.36	4.00	32.00	14.00	
119 *Off*	48	0.36	1.10	5.40	1.90	
120 *Off*	53	0.36	1.60	19.00	4.30	
121 *Off*	53	0.36	0.50	28.00	5.50	
N	980	21	21	21	21	
Min		0.36	0.3	5.40	1.90	
Max		0.36	23	335.00	100.00	
Median		0.36	1.60	34.00	7.80	
Mean		0.36	3.77	75.54	19.06	
StdDev		0.00	5.98	102.23	25.15	
EL[c]					1.9	
Reference						
					Effluent intake concentration	188.10

Location	^{210}Po concentration (10^{-18} µCi/ml)					
	Samples	LDL	Min	Max	Mean	
211 *On*	52	20	310.00	2800.00	1100.00	
212 *On*	50	20	420.00	2200.00	1200.00	
213 *On*	53	20	600.00	2500.00	1100.00	
214 *On*	53	20	630.00	2500.00	1100.00	
215 *On*	52	20	460.00	2400.00	1100.00	
N	260	5	5	5	5	
Min		20.0	310.0	2200.0	1100.0	
Max		20.0	310.0	2200.0	1200.0	
Median		20.0	460.00	2500.00	1100.00	
Mean		20.0	484.00	2480.00	1120.00	
StdDev		0.0	132.02	216.79	44.72	
101 *Off*	52	20	590.00	3000.00	1200.00	
102 *Off*	--	--	--	--	--	
103 *Off*	--	--	--	--	--	
104 *Off*	--	--	--	--	--	
105 *Off*	--	--	--	--	--	
106 *Off*	--	--	--	--	--	
107 *Off*	--	--	--	--	--	
108 *Off*	47	20	430.00	2400.00	1300.00	
109 *Off*	--	--	--	--	--	
110 *Off*	--	--	--	--	--	
111 *Off*	--	--	--	--	--	
112 *Off*	--	--	--	--	--	
113 *Off*	--	--	--	--	--	
114 *Off*	--	--	--	--	--	
115 *Off*	--	--	--	--	--	
116 *Off*	--	--	--	--	--	
117 *Off*	--	--	--	--	--	
118 *Off*	--	--	--	--	--	
119 *Off*	--	--	--	--	--	
120 *Off*	--	--	--	--	--	
121 *Off*	--	--	--	--	--	
N	99	2	2	2	2	
Min		20	430	2400	1200	
Max		20	590	3000	1300	
Median		20	510	2700.00	1250.00	
Mean		20	510	2700.00	1250.00	
StdDev		0	113.14	424.26	70.71	
EL[c]					--	
Reference						
					Effluent intake concentration	1,100.00

a. -- = no data; BEL = below environmental level; BRB = below reagent blank; EL = environmental (activity concentration) level; LDL = lower detection limit at 95% confidence level; ; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.

b. Pu-239 samples from location 110 were collected only during the fall season, concentrations are typically lower; Min values less than LDL included as reported; however, these values should be interpreted as "BEL"; tritium 'Mean' concentrations "Onsite" and "Offsite" included LDL values for averaging purposes.

c. EL values from sample location 119.

Table 4D-3. Mound air-monitoring data for 1975.[a,b]

	HTO concentration (10^{-12} µCi/ml)						^{238}Pu concentration(10^{-18} µCi/ml)						^{239}Pu concentration (10^{-18} µCi/ml)					
Location	**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	52	12.2	<12.2	100.00	31.00		52	0.9	68.00	729.00	212.00		52	0.52	--	--	22.00	
212 *On*	50	12.2	<12.2	90.00	33.00		49	0.9	23.00	142.00	52.00		49	0.52	--	--	21.00	
213 *On*	52	12.2	<12.2	117	31.00		52	0.9	87	10959	1033		52	0.52	--	--	41	
214 *On*	52	12.2	<12.2	290	34		44	0.9	13	173	67		44	0.52	--	--	25	
215 *On*	51	12.2	<12.2	83.00	20.00		51	0.9	17.00	91.00	38.00		51	0.52	--	--	22.00	
N	257	5	0	5	5		248	5	5	5	5		248	5	0	0	5	
Min		12.2	BEL	83.00	20.00			0.9	13.00	91.00	38.00			0.5	BEL	BEL	21.00	
Max		12.2	BEL	290.00	34.00			0.9	87.00	10959.00	1033.00			0.5	BEL	BEL	41.00	
Median		12.2	--	100.00	31.00			0.9	23.00	173.00	67.00			0.5	--	--	22.00	
Mean		12.2	--	136.00	29.80			0.9	41.60	2418.80	280.40			0.5	--	--	26.20	
StdDev		0	--	87.03	5.63			0.0	33.64	4781.12	426.48			0.0	--	--	8.41	
101 *Off*	52	7.2	<7.2	42.00	13.00		52	0.79	3.70	56.00	23.00		52	0.46	--	--	29.00	
102 *Off*	52	7.2	<7.2	49.00	16.00		52	0.79	5.80	30.00	14.00		52	0.46	--	--	29.00	
103 *Off*	52	7.2	<7.2	52.00	14.00		52	0.79	4.50	31.00	13.00		52	0.46	--	--	23.00	
104 *Off*	52	7.2	<7.2	27.00	9.00		52	0.79	2.30	94.00	14.00		52	0.46	--	--	22.00	
105 *Off*	52	7.2	<7.2	68.00	11.00		41	0.79	0.80	54.00	9.40		41	0.46	--	--	19.00	
106 *Off*	27	7.2	<7.2	11.00	7.30		13	0.79	2.70	3.50	3.20		13	0.46	--	--	38.00	
107 *Off*	27	7.2	<7.2	14.00	7.90		25	0.79	1.60	16.00	6.20		25	0.46	--	--	36.00	
108 *Off*	52	7.2	<7.2	21.00	7.80		52	0.79	1.10	16.00	7.50		52	0.46	--	--	19.00	
109 *Off*	27	7.2	<7.2	18.00	8.00		25	0.79	0.80	8.60	3.30		25	0.46	--	--	37.00	
110 *Off*	52	7.2	<7.2	16.00	7.40		52	0.79	<.79	4.70	2.30		52	0.46	--	--	19.00	
111 *Off*	52	7.2	<7.2	13.00	7.40		52	0.79	<.79	5.30	3.30		52	0.46	--	--	22.00	
112 *Off*	52	7.2	<7.2	46.00	10.00		52	0.79	1.20	4.90	3.50		52	0.46	--	--	31.00	
113 *Off*	27	7.2	<7.2	13.00	7.60		25	0.79	1.40	1.80	1.60		25	0.46	--	--	40.00	
114 *Off*	23	7.2	<7.2	14.00	7.70		22	0.79	1.50	2.10	1.80		22	0.46	--	--	40.00	
115 *Off*	52	7.2	<7.2	17.00	7.50		52	0.79	<.79	3.80	1.70		52	0.46	--	--	26.00	
116 *Off*	27	7.2	<7.2	12.00	7.40		25	0.79	1.00	1.30	1.20		25	0.46	--	--	35.00	
117 *Off*	23	7.2	<7.2	13.00	7.70		21	0.79	1.50	7.40	4.80		21	0.46	--	--	34.00	
118 *Off*	52	7.2	<7.2	18.00	8.90		52	0.79	1.40	7.60	4.40		52	0.46	--	--	18.00	
119 *Off*	51	7.2	<7.2	13.00	7.40		50	0.79	<.79	2.00	1.40		50	0.46	--	--	19.00	
120 *Off*	27	7.2	<7.2	8.70	7.20		25	0.79	1.70	1.80	1.80		25	0.46	--	--	35.00	
121 *Off*	27	7.2	<7.2	10.00	7.30		25	0.79	1.40	1.80	1.60		25	0.46	--	--	37.00	
122 *Off*	--	--	--	--	--		44	0.79	6.40	74.00	17.00		44	0.46	--	--	16.00	
N	858	21	0	21	21		861	22	18	22	22		861	22	0	0	22	
Min		7.2	BEL	8.70	7.20			0.79	0.8	1.30	1.20			0.46	BEL	BEL	16.00	
Max		7.2	BEL	68.00	16.00			0.79	6.4	94.00	23.00			0.46	BEL	BEL	40.00	
Median		7.2	--	16.00	7.70			0.79	1.50	6.35	3.40			0.46	--	--	29.00	
Mean		7.2	--	23.60	8.93			0.79	2.27	19.44	6.36			0.46	--	--	28.36	
StdDev		0	--	17.00	2.50			0.00	1.70	26.49	6.10			0	--	--	8.24	
EL[c]					2						3						19	
Reference	Farmer, Robinson, and Carfagno 1976																	
	Effluent intake concentration					29.00	Effluent intake concentration					64.00	Effluent intake concentration					3.00

a. -- = no data; BEL = below environmental level; BRB = below reagent blank; EL = environmental (activity concentration) level; LDL = lower detection limit at 95% confidence level; ; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.

b. Min values less than LDL included as reported; however, these values should be interpreted as "BEL"; tritium 'Mean' concentrations "Onsite" and "Offsite" included LDL values for averaging purposes; Pu-238 'Mean' concentrations "Offsite" included LDL values for averaging purposes.

c. EL values from sample location 119.

Table 4D-4. Mound air-monitoring data for 1976.[a,b]

	HTO concentration (10^{-12} µCi/ml)[c]						^{238}Pu concentration(10^{-18} µCi/ml)[d]						^{239}Pu concentration (10^{-18} µCi/ml)[e]					
Location	**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	49	7.4	<7.4	86.00	18.00		52	0.8	2.60	373.00	87.00		52	0.45	--	--	5.90	
212 *On*	48	7.4	<7.4	52.00	20.00		52	0.8	14.00	110.00	35.00		52	0.45	--	--	5.40	
213 *On*	51	7.4	<7.4	200	28.00		52	0.8	72	776	267		52	0.45	--	--	13	
214 *On*	50	7.4	<7.4	102	22		47	0.8	17	379	91		47	0.45	--	--	8.1	
215 *On*	50	7.4	<7.4	339.00	24.00		50	0.8	7.50	68.00	33.00		50	0.45	--	--	6.00	
N	248	5	0	5	5		253	5	5	5	5		253	5	0	0	5	
Min		7.4	BEL	52.00	18.00			0.8	2.60	68.00	33.00			0.5	BEL	BEL	5.40	
Max		7.4	BEL	339.00	28.00			0.8	72.00	776.00	267.00			0.5	BEL	BEL	13.00	
Median		7.4	--	102.00	22.00			0.8	14.00	373.00	87.00			0.5	--	--	6.00	
Mean		7.4	--	155.80	22.40			0.8	22.62	341.20	102.60			0.5	--	--	7.68	
StdDev		0	--	116.25	3.85			0.0	28.17	282.66	95.94			0.0	--	--	3.15	
101 *Off*	51	4.5	<4.5	136.00	13.00		52	0.77	2.60	144.00	39.00		52	0.43	--	--	6.70	
102 *Off*	51	4.5	<4.5	192.00	15.00		52	0.77	7.60	74.00	26.00		52	0.43	--	--	5.20	
103 *Off*	51	4.5	<4.5	75.00	11.00		52	0.77	5.90	75.00	29.00		52	0.43	--	--	8.50	
104 *Off*	49	4.5	<4.5	38.00	9.40		52	0.77	<0.77	19.00	7.90		52	0.43	--	--	5.20	
105 *Off*	51	4.5	<4.5	53.00	8.90		52	0.77	<0.77	4.70	2.10		52	0.43	--	--	4.80	
108 *Off*	50	4.5	<4.5	41.00	8.90		44	0.77	0.80	7.10	3.90		44	0.43	--	--	4.40	
110 *Off*	51	4.5	<4.5	54.00	9.00		52	0.77	<0.77	4.20	1.70		52	0.43	--	--	4.60	
111 *Off*	51	4.5	<4.5	18.00	8.10		52	0.77	1.60	10.00	4.10		52	0.43	--	--	5.90	
112 *Off*	51	4.5	<4.5	31.00	9.20		51	0.77	1.20	4.30	2.60		51	0.43	--	--	5.10	
115 *Off*	51	4.5	<4.5	35.00	8.50		52	0.77	0.40	14.00	2.10		52	0.43	--	--	5.50	
118 *Off*	50	4.5	<4.5	19.00	9.00		51	0.77	3.50	17.00	6.50		51	0.43	--	--	5.60	
119 *Off*	51	4.5	<4.5	35.00	8.80		52	0.27	<0.27	0.60	0.50		52	0.43	--	--	3.80	
122 *Off*	--	--	--	--	--		51	0.77	5.50	107.00	38.00		51	0.43	--	--	6.00	
123 *Off*	25	4.5	<4.5	31.00	11.00		25	0.77	31.00	294.00	160.00		25	0.43	--	--	5.10	
N	633	13	0	13	13		690	14	10	14	14		690	14	0	0	14	
Min		4.5	BEL	18.00	8.10			0.27	0.4	0.60	0.50			0.43	BEL	BEL	3.80	
Max		4.5	BEL	192.00	15.00			0.77	31	294.00	160.00			0.43	BEL	BEL	8.50	
Median		4.5	--	38.00	9.00			0.77	3.05	15.50	5.30			0.43	--	--	5.20	
Mean		4.5	--	58.31	9.98			0.73	6.01	55.35	23.10			0.43	--	--	5.46	
StdDev		0	--	50.58	2.01			0.13	9.11	82.22	41.85			0	--	--	1.13	
EL[f]		0	--		2						3						3.8	
Reference	Farmer, Robinson, and Carfagno 1977																	
				Effluent intake concentration		20.00				Effluent intake concentration		84.00				Effluent intake concentration		2.20

a. -- = no data; BEL = below environmental level; BRB = below reagent blank; EL = environmental (activity concentration) level; LDL = lower detection limit at 95% confidence level; ; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.

b. Min values less than LDL included as reported; however, these values should be interpreted as "BEL"; tritium 'Mean' concentrations "Onsite" and "Offsite" included LDL values for averaging purposes; Pu-238 'Mean' concentrations "Offsite" included LDL values for averaging purposes.

c. Tritium oxide "Onsite" LDL in air during the first half of the year was 16.5 × 10-12 µCi/ml and 7.4 × 10-12 µCi/ml for the second half. Tritium oxide "Offsite" LDL in air during the first half of the year was 9.9 × 10-12 µCi/ml and 4.5 × 10-12 µCi/ml for the second half.

d. Pu-238 "Onsite" LDL in air during the first half of the year was 0.81 × 10-18 µCi/ml and 0.27 × 10-18 µCi/ml for the second half. Pu-238 "Offsite" LDL in air during the first half of the year was 0.77 × 10-18 µCi/ml and .27 E-18 µCi/ml for the second half.

e. Pu-239 "Onsite" LDL in air during the first half of the year was 0.45 × 10-18 µCi/ml and 0.15 × 10-18 µCi/ml for the second half. Pu-239 "Offsite" LDL in air during the first half of the year was 0.43 × 10-18 µCi/ml and 0.15 × 10-18 µCi/ml for the second half.

f. EL values from sample location 119.

Table 4D-5. Mound air-monitoring data for 1977.[a,b]

	HTO concentration (10^{-12} μCi/ml)						^{238}Pu concentration(10^{-18} μ/ m^{1})						^{239}Pu concentration (10^{-18} μCi/ml)					
Location	**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	51	7.3	<7.3	278.00	18.00		43	2.6	24.00	101.00	51.00		43	1.21	--	--	20.00	
212 *On*	40	7.3	<7.3	143.00	30.00		43	2.6	9.80	117.00	25.00		43	1.21	--	--	19.00	
213 *On*	35	7.3	<7.3	67	20.00		43	2.6	42	148	81		43	1.21	--	--	31	
214 *On*	52	7.3	<7.3	68	16		43	2.6	9.8	85	31		43	1.21	--	--	19	
215 *On*	52	7.3	<7.3	64.00	16.00		43	2.6	3.70	29.00	13.00		43	1.21	--	--	17.00	
N	230	5	0	5	5		215	5	5	5	5		215	5	0	0	5	
Min		7.3	BEL	64.00	16.00			2.6	3.70	29.00	13.00			1.2	BEL	BEL	17.00	
Max		7.3	BEL	278.00	30.00			2.6	42.00	148.00	81.00			1.2	BEL	BEL	31.00	
Median		7.3	--	68.00	18.00			2.6	9.80	101.00	31.00			1.2	--	--	19.00	
Mean		7.3	--	124.00	20.00			2.6	17.86	96.00	40.20			1.2	--	--	21.20	
StdDev		0	--	92.28	5.83			0.0	15.42	44.10	26.63			0.0	--	--	5.59	
101 *Off*	52	2.9	<2.9	21.60	6.40		51	0.76	1.50	32.00	10.00		51	0.33	--	--	24.00	
102 *Off*	52	2.9	<2.9	97.30	12.30		52	0.76	5.20	13.00	8.10		52	0.33	--	--	22.00	
103 *Off*	52	2.9	<2.9	27.70	7.20		51	0.76	4.20	8.80	6.20		51	0.33	--	--	21.00	
104 *Off*	52	2.9	<2.9	12.70	4.40		52	0.76	2.20	5.00	3.70		52	0.33	--	--	22.00	
105 *Off*	52	2.9	<2.9	14.50	4.00		52	0.76	<.76	2.30	1.50		52	0.33	--	--	20.00	
108 *Off*	52	2.9	<2.9	9.40	3.70		48	0.76	<.76	2.90	1.50		48	0.33	--	--	27.00	
110 *Off*	52	2.9	<2.9	12.20	4.00		51	0.76	<.76	1.50	0.90		51	0.33	--	--	23.00	
111 *Off*	52	2.9	<2.9	75.30	6.20		52	0.76	<.76	3.20	2.10		52	0.33	--	--	25.00	
112 *Off*	52	2.9	<2.9	21.00	5.90		48	0.76	<.76	2.10	1.60		48	0.33	--	--	21.00	
115 *Off*	52	2.9	<2.9	26.60	5.60		51	0.76	<.76	2.10	1.30		51	0.33	--	--	25.00	
118 *Off*	52	2.9	<2.9	23.70	5.70		51	0.76	2.50	12.00	7.50		51	0.33	--	--	25.00	
119 *Off*	51	2.9	<2.9	23.30	4.40		51	0.76	<.76	1.10	1.00		51	0.33	--	--	21.00	
122 *Off*	--	--	--	--	--		47	2.58	6.10	63.00	21.00		47	1.21	--	--	16.00	
123 *Off*	52	2.9	<2.9	43.60	8.80		52	2.58	5.40	96.00	29.00		52	1.21	--	--	21.00	
124 *Off*	52	2.9	<2.9	59.80	9.40		52	2.58	3.50	42.00	17.00		52	1.21	--	--	24.00	
N	727	14	0	14	14		761	15	8	15	15		761	15	0	0	15	
Min		2.9	BEL	9.40	3.70			0.76	1.5	1.10	0.90			0.33	BEL	BEL	16.00	
Max		2.9	BEL	97.30	12.30			2.58	6.1	96.00	29.00			1.21	BEL	BEL	27.00	
Median		2.9	--	23.50	5.80			0.76	3.85	5.00	3.70			0.33	--	--	22.00	
Mean		2.9	--	33.48	6.29			1.12	3.83	19.13	7.49			0.506	--	--	22.47	
StdDev		0	--	26.34	2.45			0.75	1.67	27.95	8.53			0.364	--	--	2.70	
EL [c]					2						3						21	
Reference	Farmer, Robinson, and Carfagno 1978																	
	Effluent intake concentration					16.00	Effluent intake concentration					28.00	Effluent intake concentration					0.00

a. -- = no data; BEL = below environmental level; BRB = below reagent blank; EL = environmental (activity concentration) level; LDL = lower detection limit at 95% confidence level; ; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.

b. Min values less than LDL included as reported; however, these values should be interpreted as "BEL"; tritium 'Mean' concentrations "Onsite" and "Offsite" included LDL values for averaging purposes; Pu-238 'Mean' concentrations "Offsite" included LDL values for averaging purposes; Pu-239 'Mean' concentration "215 On" included LDL values for averaging purposes.

c. EL values from sample location 119.

Table 4D-6. Mound air-monitoring data for 1978.[a]

	HTO incremental concentration (10^{-12} µCi/ml)						^{238}Pu incremental concentration(10^{-18} µCi/ml)						^{239,240}Pu concentration (10^{-18} µCi/ml)					
Location	**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	52	1.2	EL[b]	36.10	3.40		12	0.8	3.20	33.00	25.00		12	0.4	6	55.00	26.00	
212 *On*	52	1.2	EL	30.30	6.20		12	0.8	6.40	26.00	13.00		12	0.4	7.2	51.00	27.00	
213 *On*	52	1.2	EL	41.2	9.00		12	0.8	21	240	110		12	0.4	6.1	56.00	27	
214 *On*	50	1.2	EL	38	8.7		12	0.8	3.8	96	32		12	0.4	5	52.00	26	
215 *On*	52	1.2	EL	38.70	4.50		12	0.8	2.00	37.00	11.00		12	0.4	5	47.00	25.00	
N	258	5	0	5	5		60	5	5	5	5		60	5	5	5	5	
Min		1.2	BEL	30.30	3.40			0.8	2.00	26.00	11.00			0.4	5.00	47.00	25.00	
Max		1.2	BEL	41.20	9.00			0.8	21.00	240.00	110.00			0.4	7.20	56.00	27.00	
Median		1.2	--	38.00	6.20			0.8	3.80	37.00	25.00			0.4	6.00	52.00	26.00	
Mean		1.2	--	36.86	6.36			0.8	7.28	86.40	38.20			0.4	5.86	52.20	26.20	
StdDev		0	--	4.10	2.48			0.0	7.84	90.31	41.06			0.0	0.92	3.56	0.84	
101 *Off*	52	1.2	EL	40.30	4.40		4	0.8	EL	4.90	1.50		4	0.3	8.9	49.00	28.00	
102 *Off*	52	1.2	EL	56.50	8.60		4	0.8	EL	11.00	5.00		4	0.3	8	60.00	32.00	
103 *Off*	52	1.2	EL	87.80	5.20		4	0.8	4.40	97.00	29.00		4	0.3	7	45.00	27.00	
104 *Off*	52	1.2	EL	35.70	3.40		4	0.8	EL	2.50	1.10		4	0.3	7.9	47.00	26.00	
105 *Off*	52	1.2	EL	28.10	2.00		4	0.8	EL	1.10	EL		4	0.3	6.6	53.00	27.00	
108 *Off*	52	1.2	EL	44.90	1.70		4	0.8	EL	1.70	EL		4	0.3	11	77.00	39.00	
110 *Off*	52	1.2	EL	26.80	1.40		4	0.8	EL	0.40	EL		4	0.3	8.1	54.00	29.00	
111 *Off*	52	1.2	EL	41.70	3.00		4	0.8	EL	4.40	1.00		4	0.3	8.1	72.00	33.00	
112 *Off*	52	1.2	EL	41.20	2.90		4	0.8	EL	1.10	EL		4	0.3	7.1	55.00	30.00	
115 *Off*	52	1.2	EL	22.00	0.70		4	0.8	--	--	EL		4	0.3	6.4	50.00	27.00	
118 *Off*	52	1.2	EL	17.80	1.90		4	0.8	EL	29.00	7.90		4	0.3	8.3	72.00	36.00	
122 *Off*	27	1.2	EL	28.90	5.60		12	0.8	0.80	21.00	7.80		12	0.4	3.5	44.00	22.00	
123 *Off*	51	1.2	EL	35.60	7.30		12	0.8	1.30	250.00	28.00		12	0.4	6.8	60.00	30.00	
124 *Off*	52	1.2	EL	50.40	6.00		12	0.8	1.10	40.00	13.00		12	0.4	5.8	60.00	30.00	
N	702	14	0	14	14		80	14	4	13	9		80	14	14	14	14	
Min		1.2	BEL	17.80	0.70			0.8	0.8	0.40	1.00			0.3	3.5	44.00	22.00	
Max		1.2	BEL	87.80	8.60			0.8	4.4	250.00	29.00			0.4	11	77.00	39.00	
Median		1.2	--	38.00	3.20			0.8	1.20	4.90	7.80			0.3	7.5	54.50	29.50	
Mean		1.2	--	39.84	3.86			0.80	1.90	35.70	10.48			0.321	7.3929	57.00	29.71	
StdDev		0	--	17.51	2.38			0.00	1.68	69.76	10.95			0.043	1.7013	10.50	4.30	
EL[c]					4.5						1.6						22	
Reference	Farmer and Carfagno 1979																	
	Effluent intake concentration					6.20	Effluent intake concentration					25.00	Effluent intake concentration					4.00

a. -- = no data; BEL = below environmental level; BRB = below reagent blank; EL = environmental (activity concentration) level; LDL = lower detection limit at 95% confidence level; ; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.

b. EL indicates that 'Min' and 'Mean' values included as reported; however, these values should be interpreted as "BEL".

c. EL values from sample location 119.

Table 4D-7. Mound air-monitoring data for 1979.[a]

	HTO incremental concentration (10^{-12} µCi/ml)						^{238}Pu incremental concentration (10^{-18} µCi/ml)						$^{239,240}Pu$ concentration (10^{-18} µCi/ml)					
Location	**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	52	0.3	EL	24.80	8.30		12	1.5	5.40	33.00	21.00		12	0.8	2.4	16.00	8.40	
212 *On*	51	0.3	0.41	26.20	9.50		12	1.5	4.00	37.00	16.00		12	0.8	2.8	12.00	8.30	
213 *On*	52	0.3	0.12	37.4	13.50		12	1.5	19	880	190		12	0.8	2.5	21.00	11	
214 *On*	52	0.3	EL	40.9	8.6		12	1.5	5.1	39	13		12	0.8	2.8	14.00	8.1	
215 *On*	51	0.3	EL	37.10	7.40		12	1.5	2.30	18.00	6.30		12	0.8	1.8	15.00	7.90	
N	258	5	2	5	5		60	5	5	5	5		60	5	5	5	5	
Min		0.3	0.12	24.80	7.40			1.5	2.30	18.00	6.30			0.8	1.80	12.00	7.90	
Max		0.3	0.41	40.90	13.50			1.5	19.00	880.00	190.00			0.8	2.80	21.00	11.00	
Median		0.3	0.27	37.10	8.60			1.5	5.10	37.00	16.00			0.8	2.50	15.00	8.30	
Mean		0.3	0.27	33.28	9.46			1.5	7.16	201.40	49.26			0.8	2.46	15.60	8.74	
StdDev		0	0.21	7.27	2.38			0.0	6.73	379.44	78.86			0.0	0.41	3.36	1.28	
101 *Off*	52	0.3	EL	28.30	5.30		4	0.5	0.6	7.00	2.90		4	0.4	3.9	17.00	8.70	
102 *Off*	52	0.3	EL	27.40	10.40		4	0.5	4.60	8.70	6.20		4	0.4	2.8	16.00	8.70	
103 *Off*	52	0.3	0.40	47.40	6.50		4	0.5	1.30	6.10	3.60		4	0.4	2.9	17.00	8.50	
104 *Off*	52	0.3	EL	28.20	3.90		4	0.5	0.70	5.60	3.50		4	0.4	3.4	19.00	10.00	
105 *Off*	52	0.3	EL	16.80	2.80		4	0.5	0.10	1.70	0.90		4	0.4	2.9	19.00	9.10	
108 *Off*	52	0.3	EL	18.10	1.00		4	0.5	0.20	1.10	0.60		4	0.4	4.2	20.00	11.00	
110 *Off*	52	0.3	EL	4.20	0.60		4	0.5	EL	1.20	0.50		4	0.4	2.8	19.00	9.50	
111 *Off*	52	0.3	EL	4.60	0.50		4	0.5	0.08	2.20	1.10		4	0.4	3.4	20.00	9.50	
112 *Off*	52	0.3	EL	12.80	2.20		4	0.5	0.20	0.70	0.40		4	0.4	2.7	16.00	8.80	
115 *Off*	52	0.3	EL	7.50	0.30		4	0.5	EL	0.40	0.03		4	0.4	3	18.00	9.20	
118 *Off*	52	0.3	EL	19.10	2.90		4	0.5	0.70	9.40	3.50		4	0.4	2.8	19.00	9.90	
122 *Off*	52	0.3	EL	29.70	6.20		12	1.5	1.40	8.80	3.70		12	0.8	2.2	12.00	7.40	
123 *Off*	52	0.3	EL	41.80	7.60		12	1.5	3.40	110.00	35.00		12	0.8	2.1	21.00	9.60	
124 *Off*	52	0.3	0.60	60.30	11.00		12	1.5	3.10	29.00	12.00		12	0.8	2.6	20.00	9.80	
N	728	14	2	14	14		80	14	12	14	14		80	14	14	14	14	
Min		0.3	0.4	4.20	0.30			0.5	0.08	0.40	0.03			0.4	2.1	12.00	7.40	
Max		0.3	0.6	60.30	11.00			1.5	4.6	110.00	35.00			0.8	4.2	21.00	11.00	
Median		0.3	0.5	23.25	3.40			0.5	0.70	5.85	3.20			0.4	2.85	19.00	9.35	
Mean		0.3	0.5	24.73	4.37			0.71	1.37	13.71	5.28			0.486	2.9786	18.07	9.26	
StdDev		0	0.1414	16.48	3.58			0.43	1.51	28.66	9.11			0.17	0.582	2.34	0.85	
EL[c]					0.6						0.5						7.8	
Reference	Farmer and Carfagno 1980																	
	Effluent intake concentration					8.60	Effluent intake concentration					16.00	Effluent intake concentration					0.50

a. -- = no data; BEL = below environmental level; BRB = below reagent blank; EL = environmental (activity concentration) level; LDL = lower detection limit at 95% confidence level; ; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.

b. EL indicates that 'Min' and 'Mean' values included as reported; however, these values should be interpreted as "BEL".

c. EL values from sample location 119.

Table 4D-8. Mound air-monitoring data for 1980.[a]

	HTO incremental concentration (10^{-12} µCi/ml)						^{238}Pu incremental concentration (10^{-18} µCi/ml)						^{239,240}Pu concentration (10^{-18} µCi/ml)					
Location	**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	51	3	EL	101.00	88.80		12	1.6	6.40	160.00	38.00		12	0.3	1.2	12.00	4.30	
212 *On*	49	3	4.1	5090.00	413.00		12	1.6	3.10	26.00	8.80		12	0.3	1.3	9.30	4.00	
213 *On*	47	3	2.00	1870	215.00		12	1.6	15	21	58		12	0.3	1.8	12.00	4.9	
214 *On*	47	3	2.60	685	85.8		12	1.6	2.1	12	6.6		12	0.3	1.3	7.70	3.1	
215 *On*	46	3	EL	280.00	39.00		12	1.6	0.50	25.00	5.50		12	0.3	1.2	9.10	3.70	
N	240	5	3	5	5		60	5	5	5	5		60	5	5	5	5	
Min		3	2.00	101.00	39.00			1.6	0.50	12.00	5.50			0.3	1.20	7.70	3.10	
Max		3	4.10	5090.00	413.00			1.6	15.00	160.00	58.00			0.3	1.80	12.00	4.90	
Median		3	2.60	685.00	88.80			1.6	3.10	25.00	8.80			0.3	1.30	9.30	4.00	
Mean		3	2.90	1605.20	168.32			1.6	5.42	48.80	23.38			0.3	1.36	10.02	4.00	
StdDev		0	1.08	2066.37	151.58			0.0	5.77	62.41	23.59			0.0	0.25	1.91	0.67	
101 *Off*	47	3	EL	469.00	49.60		4	0.2	0.7	3.00	2.00		4	0.1	1.9	11.00	5.50	
102 *Off*	49	3	2.3	1630.00	137.00		4	0.2	2.40	15.00	6.70		4	0.1	3.2	8.40	4.80	
103 *Off*	49	3	EL	588.00	66.60		4	0.2	3.10	11.00	5.40		4	0.1	2.2	8.60	4.90	
104 *Off*	49	3	EL	84.40	14.00		4	0.2	1.00	5.20	2.30		4	0.1	2.8	8.10	4.70	
105 *Off*	49	3	EL	29.10	5.40		4	0.2	EL	1.80	0.60		4	0.1	2.5	8.30	4.90	
108 *Off*	47	3	EL	132.00	6.00		4	0.2	EL	0.60	0.20		4	0.1	2.5	9.50	5.10	
110 *Off*	47	3	EL	22.50	1.80		4	0.2	EL	1.90	0.50		4	0.1	2.5	8.30	5.10	
111 *Off*	49	3	EL	11.50	0.10		4	0.2	0.60	1.40	1.00		4	0.1	2.1	10.00	5.10	
112 *Off*	50	3	EL	43.80	7.10		4	0.2	EL	1.00	0.40		4	0.1	2.6	7.40	4.20	
115 *Off*	45	3	EL	7.50	EL		4	0.2	EL	1.80	0.40		4	0.1	2	7.90	4.20	
118 *Off*	47	3	EL	62.50	8.60		4	0.2	0.50	1.30	0.90		4	0.1	2	9.80	4.80	
122 *Off*	52	3	EL	667.00	42.10		12	1.6	EL	7.00	2.60		12	0.3	0.9	8.20	0.33	
123 *Off*	47	3	EL	184.00	45.30		12	1.6	0.60	78.00	14.00		12	0.3	1.9	10.00	4.40	
124 *Off*	51	3	EL	570.00	76.00		12	1.6	EL	20.00	6.40		12	0.3	1.8	13.00	4.50	
N	678	14	1	14	13		80	14	7	14	14		80	14	14	14	14	
Min		3	2.3	7.50	0.10			0.2	0.5	0.60	0.20			0.1	0.9	7.40	0.33	
Max		3	2.3	1630.00	137.00			1.6	3.1	78.00	14.00			0.3	3.2	13.00	5.50	
Median		3	--	108.20	14.00			0.2	0.70	2.45	1.50			0.1	2.15	8.50	4.80	
Mean		3	--	321.52	35.35			0.50	1.27	10.64	3.10			0.143	2.2071	9.18	4.47	
StdDev		0	--	448.15	40.21			0.60	1.04	20.28	3.88			0.085	0.5484	1.50	1.25	
EL[c]					2						0.2						3.4	
Reference	Farmer and Carfagno 1981																	
					Effluent intake concentration	88.80					Effluent intake concentration	8.80					Effluent intake concentration	0.60

a. -- = no data; BEL = below environmental level; BRB = below reagent blank; EL = environmental (activity concentration) level; LDL = lower detection limit at 95% confidence level; ; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.

b. EL indicates that 'Min' and 'Mean' values included as reported; however, these values should be interpreted as "BEL".

c. EL values from sample location 119.

Table 4D-9. Mound air-monitoring data for 1981.[a]

	HTO incremental concentration (10^{-12} µCi/ml)						^{238}Pu incremental concentration (10^{-18}µCi/ml)						^{239,240}Pu concentration (10^{-18} µCi/ml)					
Location	**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	51	7	EL[b]	434.00	71.80		12	1.7	16.60	2040.00	364.00		12	0.3	2.1	47.90	16.60	
212 *On*	52	7	EL	455.00	67.60		12	1.7	0.70	34.70	10.30		12	0.3	1.2	39.20	12.60	
213 *On*	49	7	EL	726	78.50		12	1.7	11.6	268	66.1		12	0.3	1.2	36.20	13.6	
214 *On*	48	7	EL	247	44.5		12	1.7	3.2	88.1	20.7		12	0.3	2.3	36.50	13.8	
215 *On*	50	7	EL	329.00	30.40		12	1.7	1.60	14.40	6.00		12	0.3	1.2	37.10	14.80	
N	250	5	0	5	5		60	5	5	5	5		60	5	5	5	5	
Min		7	BEL	247.00	30.40			1.7	0.70	14.40	6.00			0.3	1.20	36.20	12.60	
Max		7	BEL	726.00	78.50			1.7	16.60	2040.00	364.00			0.3	2.30	47.90	16.60	
Median		7	--	434.00	67.60			1.7	3.20	88.10	20.70			0.3	1.20	37.10	13.80	
Mean		7	--	438.20	58.56			1.7	6.74	489.04	93.42			0.3	1.60	39.38	14.28	
StdDev		0	--	181.39	20.28			0.0	7.00	872.75	153.13			0.0	0.55	4.90	1.51	
101 *Off*	50	7	EL	369.00	70.20		4	0.3	0.2	2.60	1.10		4	0.1	4.2	46.20	18.60	
102 *Off*	51	7	0.2	357.00	61.00		4	0.3	2.20	5.70	4.00		4	0.1	2.4	43.60	18.30	
103 *Off*	51	7	EL	666.00	61.70		4	0.3	2.90	14.30	7.00		4	0.1	2.9	42.40	17.70	
104 *Off*	51	7	EL	233.00	29.20		4	0.3	1.90	3.50	2.50		4	0.1	2.7	39.90	17.10	
105 *Off*	51	7	EL	129.00	22.50		4	0.3	0.70	1.20	0.90		4	0.1	2.1	36.50	15.70	
108 *Off*	49	7	EL	86.40	11.00		4	0.3	EL	0.90	0.40		4	0.1	3.4	57.50	23.20	
110 *Off*	52	7	EL	91.40	11.90		4	0.3	EL	2.20	0.90		4	0.1	2.6	45.40	18.40	
111 *Off*	49	7	EL	79.70	7.20		4	0.3	0.20	0.60	0.30		4	0.1	2.2	43.80	17.70	
112 *Off*	51	7	EL	91.70	12.90		4	0.3	0.30	1.10	0.60		4	0.1	2.2	42.60	17.40	
115 *Off*	50	7	EL	30.70	1.60		3	0.3	0.30	0.90	0.60		3	0.1	11	34.70	19.30	
118 *Off*	49	7	EL	846.00	31.20		4	0.3	0.90	3.40	2.20		4	0.1	2.4	48.10	20.40	
122 *Off*	52	7	EL	514.00	31.90		12	1.7	EL	3.70	1.60		12	0.3	1.3	35.90	13.00	
123 *Off*	51	7	EL	776.00	52.60		12	1.7	1.20	109.00	16.50		12	0.3	2.2	48.60	17.10	
124 *Off*	50	7	EL	899.00	59.40		12	1.7	EL	94.20	15.80		12	0.3	1.8	46.30	17.00	
N	707	14	1	14	14		79	14	10	14	14		79	14	14	14	14	
Min		7	0.2	30.70	1.60			0.3	0.2	0.60	0.30			0.1	1.3	34.70	13.00	
Max		7	0.2	899.00	70.20			1.7	2.9	109.00	16.50			0.3	11	57.50	23.20	
Median		7	--	295.00	30.20			0.3	0.80	3.00	1.35			0.1	2.4	43.70	17.70	
Mean		7	--	369.21	33.16			0.60	1.08	17.38	3.89			0.143	3.1	43.68	17.92	
StdDev		0	--	315.19	23.51			0.60	0.95	35.97	5.50			0.085	2.3778	5.95	2.29	
EL[c]					6.5						0.1						16.3	
Reference	Farmer and Carfagno 1982																	
	Effluent intake concentration					67.6	Effluent intake concentration					20.70	Effluent intake concentration					0.00

a. -- = no data; BEL = below environmental level; BRB = below reagent blank; EL = environmental (activity concentration) level; LDL = lower detection limit at 95% confidence level; ; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.

b. EL indicates that 'Min' and 'Mean' values included as reported; however, these values should be interpreted as "BEL".

c. EL values from sample location 119.

Table 4D-10. Mound air-monitoring data for 1982.[a]

	HTO incremental concentration (10^{-12} µCi/ml)						^{238}Pu incremental concentration (10^{-18} µCi/ml)						^{239,240}Pu concentration (10^{-18} µCi/ml)					
Location	**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	52	5	EL[b]	158.00	52.60		12	1.0	16.60	630.00	88.00		12	0.2	1	5.80	2.90	
212 *On*	50	5	EL	107.00	39.30		12	1.0	2.50	34.60	8.50		12	0.2	0.3	5.20	2.50	
213 *On*	48	5	EL	610	56.50		12	1.0	17.2	125	38.3		12	0.2	0.1	5.50	2.4	
214 *On*	41	5	EL	90	30.2		12	1.0	7.3	50.2	23.9		12	0.2	0.4	5.70	2.8	
215 *On*	46	5	EL	64.80	20.70		12	1.0	1.60	15.10	5.20		12	0.2	0.02	4.80	2.40	
N	237	5	0	5	5		60	5	5	5	5		60	5	5	5	5	
Min		5	BEL	64.80	20.70			1.0	1.60	15.10	5.20			0.2	0.02	4.80	2.40	
Max		5	BEL	610.00	56.50			1.0	17.20	630.00	88.00			0.2	1.00	5.80	2.90	
Median		5	--	107.00	39.30			1.0	7.30	50.20	23.90			0.2	0.30	5.50	2.50	
Mean		5	--	205.96	39.86			1.0	9.04	170.98	32.78			0.2	0.36	5.40	2.60	
StdDev		0	--	228.43	15.00			0.0	7.50	259.95	33.57			0.0	0.39	0.41	0.23	
101 *Off*	32	5	EL	175.00	47.00		4	0.3	0.5	4.10	1.80		4	0.1	0.03	6.20	2.60	
102 *Off*	52	5	EL	188.00	35.70		4	0.3	2.10	6.30	4.20		4	0.1	0.3	5.30	2.60	
103 *Off*	50	5	EL	102.00	31.30		4	0.3	1.00	6.80	3.70		4	0.1	0.2	4.70	2.30	
104 *Off*	51	5	EL	63.80	10.90		4	0.3	0.90	2.30	1.40		4	0.1	0.4	4.40	2.20	
105 *Off*	50	5	EL	42.70	8.10		4	0.3	0.10	1.20	0.60		4	0.1	0.2	4.50	2.10	
108 *Off*	46	5	EL	47.70	7.30		4	0.3	EL	0.30	EL		4	0.1	0.5	6.30	2.70	
110 *Off*	51	5	EL	47.50	6.30		4	0.3	EL	0.40	EL		4	0.1	0.3	4.30	2.00	
111 *Off*	49	5	EL	40.40	5.70		4	0.3	EL	0.80	0.30		4	0.1	0.4	5.40	2.60	
112 *Off*	51	5	EL	41.20	8.10		4	0.3	EL	0.50	0.10		4	0.1	0.4	5.60	2.50	
115 *Off*	51	5	EL	36.70	1.10		4	0.3	EL	0.30	0.10		4	0.1	0.5	4.10	2.00	
118 *Off*	37	5	EL	51.40	6.60		4	0.3	EL	1.40	0.80		4	0.1	0.4	5.40	2.70	
122 *Off*	51	5	EL	90.10	17.00		12	1	0.20	5.00	2.50		12	2	--	5.30	2.30	
123 *Off*	52	5	EL	278.00	28.00		12	1	4.30	65.10	17.10		12	2	0.4	6.30	2.60	
124 *Off*	43	5	EL	70.70	20.00		12	1	1.50	10.90	4.30		12	2	0.4	5.90	2.50	
N	666	14	0	14	14		80	14	8	14	12		80	14	13	14	14	
Min		5	BEL	36.70	1.10			0.3	0.1	0.30	0.10			0.1	0.03	4.10	2.00	
Max		5	BEL	278.00	47.00			1	4.3	65.10	17.10			2	0.5	6.30	2.70	
Median		5	--	57.60	9.50			0.3	0.95	1.85	1.60			0.1	0.4	5.35	2.50	
Mean		5	--	91.09	16.65			0.45	1.33	7.53	3.08			0.507	0.3408	5.26	2.41	
StdDev		0	--	72.52	13.80			0.30	1.37	16.87	4.68			0.809	0.1327	0.76	0.25	
EL[c]					7.3						0.3						2.6	
Reference	Carfagno and Farmer 1983																	
					Effluent intake concentration	39.30					Effluent intake concentration	23.90					Effluent intake concentration	0.00

a. -- = no data; BEL = below environmental level; BRB = below reagent blank; EL = environmental (activity concentration) level; LDL = lower detection limit at 95% confidence level; ; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.

b. EL indicates that 'Min' and 'Mean' values included as reported; however, these values should be interpreted as "BEL".

c. EL values from sample location 119.

Table 4D-11. Mound air-monitoring data for 1983.[a]

	HTO incremental concentration (10^{-12} µCi/ml)						^{238}Pu incremental concentration (10^{-18} µCi/ml)						^{239,240}Pu concentration (10^{-18} µCi/ml)					
Location	**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	49	4	EL[b]	120.00	35.30		12	1.0	7.60	114.00	29.40		12	0.3	0.3	13.50	2.30	
212 *On*	49	4	EL	158.00	32.10		12	1.0	2.50	10.70	6.00		12	0.3	0.4	15.50	2.30	
213 *On*	46	4	EL	225	42.50		12	1.0	38.4	151	74.2		12	0.3	0.3	17.80	3	
214 *On*	52	4	EL	445	34.3		12	1.0	3.3	29.3	13.2		12	0.3	0.2	15.10	2.2	
215 *On*	51	4	EL	173.00	21.20		12	1.0	1.30	6.00	2.70		12	0.3	0.1	14.10	1.90	
N	247	5	0	5	5		60	5	5	5	5		60	5	5	5	5	
Min		4	BEL	120.00	21.20			1.0	1.30	6.00	2.70			0.3	0.10	13.50	1.90	
Max		4	BEL	445.00	42.50			1.0	38.40	151.00	74.20			0.3	0.40	17.80	3.00	
Median		4	--	173.00	34.30			1.0	3.30	29.30	13.20			0.3	0.30	15.10	2.30	
Mean		4	--	224.20	33.08			1.0	10.62	62.20	25.10			0.3	0.26	15.20	2.34	
StdDev		0	--	129.05	7.70			0.0	15.71	66.07	29.32			0.0	0.11	1.66	0.40	
101 *Off*	51	4	EL	68.20	25.30		4	0.3	0.3	1.30	0.80		4	0.2	0.6	9.10	2.90	
102 *Off*	51	4	EL	97.30	26.00		4	0.3	0.70	7.10	2.60		4	0.2	0.6	7.10	2.40	
103 *Off*	48	4	EL	102.00	19.70		4	0.3	1.50	12.60	6.30		4	0.2	0.7	7.60	2.50	
104 *Off*	49	4	EL	45.60	7.80		4	0.3	0.30	13.60	4.10		4	0.2	0.6	6.90	2.30	
105 *Off*	49	4	EL	39.50	7.70		4	0.3	0.20	1.00	0.50		4	0.2	0.5	7.60	2.50	
108 *Off*	51	4	EL	28.80	4.50		4	0.3	EL	0.20	EL		4	0.2	0.6	5.20	1.90	
110 *Off*	50	4	EL	45.00	2.40		4	0.3	EL	1.00	0.40		4	0.2	0.2	6.30	2.10	
111 *Off*	51	4	EL	35.40	4.60		4	0.3	EL	1.20	0.50		4	0.2	0.7	4.80	1.90	
112 *Off*	52	4	EL	29.00	7.30		4	0.3	EL	0.60	0.20		4	0.2	0.3	8.00	2.50	
115 *Off*	51	4	EL	15.20	0.20		4	0.3	EL	1.80	0.50		4	0.2	0.3	6.60	2.20	
118 *Off*	50	4	EL	53.50	7.50		4	0.3	EL	0.70	0.40		4	0.2	0.6	9.60	3.10	
122 *Off*	50	4	EL	172.00	21.50		12	1	EL	9.40	1.80		12	3	0.02	8.90	1.50	
123 *Off*	52	4	EL	197.00	30.70		12	1	2.30	33.10	12.20		12	3	--	20.50	2.70	
124 *Off*	51	4	EL	266.00	32.60		12	1	1.40	12.70	5.80		12	3	0.3	22.10	2.80	
N	706	14	0	14	14		80	14	7	14	13		80	14	13	14	14	
Min		4	BEL	15.20	0.20			0.3	0.2	0.20	0.20			0.2	0.02	4.80	1.50	
Max		4	BEL	266.00	32.60			1	2.3	33.10	12.20			3	0.7	22.10	3.10	
Median		4	--	49.55	7.75			0.3	0.70	1.55	0.80			0.2	0.6	7.60	2.45	
Mean		4	--	85.32	14.13			0.45	0.96	6.88	2.78			0.8	0.4631	9.31	2.38	
StdDev		0	--	75.16	11.28			0.30	0.80	9.14	3.54			1.192	0.2146	5.27	0.44	
EL[c]					1.4						0.2						1	
Reference	Carfagno and Farmer 1984																	
	Effluent intake concentration					34.30	Effluent intake concentration					13.20	Effluent intake concentration					1.30

a. -- = no data; BEL = below environmental level; BRB = below reagent blank; EL = environmental (activity concentration) level; LDL = lower detection limit at 95% confidence level; ; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.

b. EL indicates that 'Min' and 'Mean' values included as reported; however, these values should be interpreted as "BEL".

c. EL values from sample location 119.

Table 4D-12. Mound air-monitoring data for 1984.[a]

	HTO incremental concentration (10^{-12} µCi/ml)						^{238}Pu incremental concentration (10^{-18} µCi/ml)						^{239,240}Pu concentration (10^{-18} µCi/ml)					
Location	**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	49	7	EL[b]	160.00	22.10		12	1.0	9.20	99.70	41.90		12	0.2	--	2.10	1.00	
212 *On*	50	7	EL	67.90	21.10		12	1.0	1.80	74.80	17.10		12	0.2	0.1	1.90	0.60	
213 *On*	49	7	EL	142	28.30		12	1.0	18.3	270	126		12	0.2	0.3	2.10	1.1	
214 *On*	53	7	EL	173	26.7		12	1.0	0.5	63.8	23.2		12	0.2	0.2	2.10	0.7	
215 *On*	51	7	EL	183.00	21.50		12	1.0	EL	14.00	5.00		12	0.2	0.1	1.60	0.60	
N	252	5	0	5	5		60	5	4	5	5		60	5	4	5	5	
Min		7	BEL	67.90	21.10			1.0	0.50	14.00	5.00			0.2	0.10	1.60	0.60	
Max		7	BEL	183.00	28.30			1.0	18.30	270.00	126.00			0.2	0.30	2.10	1.10	
Median		7	--	160.00	22.10			1.0	5.50	74.80	23.20			0.2	0.15	2.10	0.70	
Mean		7	--	145.18	23.94			1.0	7.45	104.46	42.64			0.2	0.18	1.96	0.80	
StdDev		0	--	45.84	3.32			0.0	8.19	97.65	48.47			0.0	0.10	0.22	0.23	
101 *Off*	53	7	EL	117.00	18.80		4	0.3	1.2	5.00	2.90		4	0.2	0.3	1.00	0.60	
102 *Off*	51	7	EL	69.90	17.20		4	0.3	1.20	36.10	11.20		4	0.2	0.4	0.70	0.60	
103 *Off*	53	7	EL	39.60	11.50		3	0.3	2.70	6.20	4.60		3	0.2	0.4	0.70	0.50	
104 *Off*	52	7	EL	84.30	8.70		4	0.3	0.70	4.40	2.30		4	0.2	0.1	0.90	0.40	
105 *Off*	53	7	EL	38.40	5.00		4	0.3	0.08	1.50	0.80		4	0.2	0.2	0.50	0.30	
108 *Off*	50	7	EL	31.80	2.60		4	0.3	0.10	2.20	0.70		4	0.2	0.2	0.70	0.50	
110 *Off*	34	7	EL	28.80	0.90		3	0.3	EL	0.70	0.20		3	0.2	0.1	0.50	0.30	
111 *Off*	48	7	EL	18.90	EL		4	0.3	0.01	0.40	0.20		4	0.2	0.2	0.90	0.50	
112 *Off*	51	7	EL	44.50	1.10		4	0.3	EL	0.50	0.20		4	0.2	0.2	0.70	0.40	
115 *Off*	53	7	EL	21.20	EL		4	0.3	EL	0.70	0.30		4	0.2	0.2	0.70	0.40	
118 *Off*	52	7	EL	36.80	1.90		4	0.3	1.10	13.70	5.00		4	0.2	0.2	0.80	0.50	
122 *Off*	51	7	EL	58.10	14.40		12	1	EL	6.90	2.10		12	0.2	0.2	0.80	0.50	
123 *Off*	51	7	EL	92.00	15.80		12	1	1.50	49.00	15.00		12	0.2	0.3	1.30	0.70	
124 *Off*	52	7	EL	137.00	16.10		12	1	1.70	126.90	22.00		12	0.2	0.2	2.10	0.60	
N	704	14	0	14	12		78	14	10	14	14		78	14	14	14	14	
Min		7	BEL	18.90	0.90			0.3	0.01	0.40	0.20			0.2	0.1	0.50	0.30	
Max		7	BEL	137.00	18.80			1	2.7	126.90	22.00			0.2	0.4	2.10	0.70	
Median		7	--	42.05	10.10			0.3	1.15	4.70	2.20			0.2	0.2	0.75	0.50	
Mean		7	--	58.45	9.50			0.45	1.03	18.16	4.82			0.2	0.2286	0.88	0.49	
StdDev		0	--	36.67	6.93			0.30	0.85	34.55	6.65			3E-09	0.0914	0.41	0.12	
EL[c]					4.1						0.002						0.4	
Reference	Carfagno and Farmer 1985																	
	Effluent intake concentration					22.10	Effluent intake concentration					23.20	Effluent intake concentration					0.30

a. -- = no data; BEL = below environmental level; BRB = below reagent blank; EL = environmental (activity concentration) level; LDL = lower detection limit at 95% confidence level; ; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.

b. EL indicates that 'Min' and 'Mean' values included as reported; however, these values should be interpreted as "BEL".

c. EL values from sample location 119.

Table 4D-13. Mound air-monitoring data for 1985.[a]

	HTO incremental concentration (10^{-12} μCi/ml)						^{238}Pu incremental concentration (10^{-18} μCi/ml)						^{239,240}Pu concentration (10^{-18} μCi/ml)					
Location	**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	52	14	EL[b]	167.00	32.70		12	0.7	17.20	1269.00	182.00		12	0.38	--	7.97	1.21	
212 *On*	50	14	1.54	115.00	29.70		12	0.7	2.26	42.80	16.80		12	0.38	--	0.93	0.31	
213 *On*	49	14	EL	104	27.30		12	0.7	35	369	153		12	0.38	0.1	3.03	0.99	
214 *On*	52	14	EL	189	24.8		12	0.7	12.1	772	126		12	0.38	--	2.29	0.76	
215 *On*	52	14	EL	134.00	19.80		12	0.7	0.96	137.00	16.50		12	0.38	--	1.59	0.37	
N	255	5	1	5	5		60	5	5	5	5		60	5	1	5	5	
Min		14	1.54	104.00	19.80			0.7	0.96	42.80	16.50			0.4	0.10	0.93	0.31	
Max		14	1.54	189.00	32.70			0.7	35.00	1269.00	182.00			0.4	0.10	7.97	1.21	
Median		14	--	134.00	27.30			0.7	12.10	369.00	126.00			0.4	--	2.29	0.76	
Mean		14	--	141.80	26.86			0.7	13.50	517.96	98.86			0.4	--	3.16	0.73	
StdDev		0	--	35.60	4.91			0.0	13.80	505.39	77.62			0.0	--	2.80	0.39	
101 *Off*	42	14	EL	40.40	17.40		3	0.14	1.13	4.95	2.46		3	0.08	0.07	0.42	0.25	
102 *Off*	51	14	3.94	70.90	29.20		4	0.14	3.10	14.70	8.05		4	0.08	0.15	0.38	0.27	
103 *Off*	52	14	EL	43.60	10.90		4	0.14	2.20	10.80	6.35		4	0.08	0.24	0.55	0.39	
104 *Off*	52	14	EL	52.30	9.39		4	0.14	1.04	2.89	1.73		4	0.08	0.12	0.26	0.17	
105 *Off*	49	14	EL	26.60	4.89		4	0.14	0.46	6.03	2.47		4	0.08	0.09	0.25	0.17	
108 *Off*	50	14	EL	21.20	2.30		4	0.14	EL	0.19	EL		4	0.08	0.22	0.42	0.33	
110 *Off*	49	14	EL	26.20	0.99		4	0.14	EL	0.15	0.04		4	0.08	0.01	0.33	0.16	
111 *Off*	51	14	EL	20.80	EL		4	0.14	0.08	0.32	0.21		4	0.08	0.09	0.44	0.21	
112 *Off*	52	14	EL	19.50	2.45		4	0.14	0.01	2.61	0.85		4	0.08	0.08	0.38	0.22	
115 *Off*	45	14	EL	11.60	EL		4	0.14	EL	0.01	0.15		4	0.08	0.1	0.39	0.23	
118 *Off*	50	14	EL	31.70	6.49		4	0.14	1.06	17.40	10.80		4	0.08	0.16	0.41	0.29	
122 *Off*	51	14	EL	68.30	11.70		12	0.69	0.66	37.40	8.43		12	0.38	--	0.87	0.33	
123 *Off*	52	14	EL	116.00	20.20		12	0.69	1.06	352.00	40.20		12	0.38	0.08	3.72	0.84	
124 *Off*	50	14	EL	55.50	18.20		12	0.69	2.16	56.80	13.70		12	0.38	--	0.70	0.20	
N	696	14	1	14	12		79	14	11	14	13		79	14	12	14	14	
Min		14	3.94	11.60	0.99			0.14	0.005	0.01	0.04			0.08	0.01	0.25	0.16	
Max		14	3.94	116.00	29.20			0.69	3.1	352.00	40.20			0.38	0.24	3.72	0.84	
Median		14	--	36.05	10.15			0.14	1.06	5.49	2.47			0.08	0.095	0.42	0.24	
Mean		14	--	43.19	11.18			0.26	1.18	36.16	7.34			0.144	0.1175	0.68	0.29	
StdDev		0	--	27.99	8.62			0.23	0.95	92.38	10.85			0.128	0.0652	0.89	0.17	
EL[c]					2.54						0.15						0.13	
Reference	Carfagno and Farmer 1986																	
					Effluent intake concentration	27.30					Effluent intake concentration	126.00					Effluent intake concentration	0.63

a. -- = no data; BEL = below environmental level; BRB = below reagent blank; EL = environmental (activity concentration) level; LDL = lower detection limit at 95% confidence level; ; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.

b. EL indicates that 'Min' and 'Mean' values included as reported; however, these values should be interpreted as "BEL".

c. EL values from sample location 119.

Table 4D-14. Mound air-monitoring data for 1986.[a]

	HTO incremental concentration (10^{-12} µCi/ml)						^{238}Pu incremental concentration (10^{-18} µCi/ml)						^{239,240}Pu concentration (10^{-18} µCi/ml)					
Location	**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	50	17	EL[b]	94.00	23.80		11	0.2	8.29	388.00	125.00		11	0.15	--	3.76	0.92	
212 *On*	51	17	EL	75.30	21.10		12	0.2	4.19	194.00	53.40		12	0.15	--	0.82	0.31	
213 *On*	50	17	2.19	123	40.90		12	0.2	53	447	178		12	0.15	0.53	5.53	1.47	
214 *On*	50	17	EL	100	21.3		12	0.2	7.35	372	93.4		12	0.15	--	1.55	0.63	
215 *On*	51	17	EL	64.40	15.50		12	0.2	1.55	127.00	22.40		12	0.15	--	1.14	0.31	
N	252	5	1	5	5		59	5	5	5	5		59	5	1	5	5	
Min		17	2.19	64.40	15.50			0.2	1.55	127.00	22.40			0.2	0.53	0.82	0.31	
Max		17	2.19	123.00	40.90			0.2	53.00	447.00	178.00			0.2	0.53	5.53	1.47	
Median		17	--	94.00	21.30			0.2	7.35	372.00	93.40			0.2	--	1.55	0.63	
Mean		17	--	91.34	24.52			0.2	14.88	305.60	94.44			0.2	--	2.56	0.73	
StdDev		0	--	22.73	9.65			0.0	21.48	137.43	60.81			0.0	--	2.02	0.49	
101 *Off*	48	17	EL	85.80	24.50		4	0.08	0.49	10.20	3.50		4	0.04	0.07	0.41	0.25	
102 *Off*	50	17	EL	120.00	23.20		4	0.08	3.41	38.30	14.30		4	0.04	0.05	0.37	0.28	
103 *Off*	49	17	EL	31.90	8.57		4	0.08	3.08	23.80	10.50		4	0.04	0.03	0.39	0.24	
104 *Off*	50	17	EL	60.50	11.00		4	0.08	0.41	19.80	5.91		4	0.04	0.01	0.62	0.27	
105 *Off*	50	17	EL	35.30	3.96		4	0.08	0.27	26.40	7.06		4	0.04	0.08	0.41	0.27	
108 *Off*	51	17	EL	37.20	5.61		4	0.08	EL	0.26	EL		4	0.04	0.15	0.41	0.22	
110 *Off*	49	17	EL	32.90	3.68		4	0.08	EL	0.33	0.05		4	0.04	0.25	0.58	0.29	
111 *Off*	52	17	EL	59.00	3.63		4	0.08	EL	0.56	0.30		4	0.04	0.09	0.23	0.15	
112 *Off*	47	17	EL	38.90	4.02		4	0.08	0.18	13.30	3.52		4	0.04	0.08	0.21	0.13	
115 *Off*	50	17	EL	188.00	6.73		4	0.08	EL	0.81	0.27		4	0.04	0.11	0.28	0.15	
118 *Off*	48	17	EL	32.00	4.50		4	0.08	0.58	3.96	1.94		4	0.04	0.07	0.38	0.20	
122 *Off*	52	17	EL	93.60	13.70		12	0.23	0.93	77.30	9.90		12	0.15	--	1.01	0.26	
123 *Off*	43	17	EL	53.50	12.00		10	0.23	1.49	66.50	26.70		10	0.15	--	0.99	0.36	
124 *Off*	48	17	EL	89.60	21.20		12	0.23	1.14	82.30	20.70		12	0.15	--	1.43	0.37	
N	687	14	0	14	14		78	14	10	14	13		78	14	11	14	14	
Min		17	BEL	31.90	3.63			0.08	0.18	0.26	0.05			0.04	0.01	0.21	0.13	
Max		17	BEL	188.00	24.50			0.23	3.41	82.30	26.70			0.15	0.25	1.43	0.37	
Median		17	--	56.25	7.65			0.08	0.76	16.55	5.91			0.04	0.08	0.41	0.26	
Mean		17	--	68.44	10.45			0.11	1.20	25.99	8.05			0.064	0.09	0.55	0.25	
StdDev		0	--	44.36	7.55			0.06	1.15	29.27	8.29			0.047	0.065	0.35	0.07	
EL[c]					0.91						0.16						0.18	
Reference	Carfagno and Farmer 1987																	
					Effluent intake concentration	21.30					Effluent intake concentration	93.40					Effluent intake concentration	0.45

a. -- = no data; BEL = below environmental level; BRB = below reagent blank; EL = environmental (activity concentration) level; LDL = lower detection limit at 95% confidence level; ; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.

b. EL indicates that 'Min' and 'Mean' values included as reported; however, these values should be interpreted as "BEL".

c. EL values from sample location 119.

Table 4D-15. Mound air-monitoring data for 1987.[a]

	HTO incremental concentration (10^{-12} μCi/ml)						^{238}Pu incremental concentration (10^{-18} μCi/ml)						^{239,240}Pu concentration (10^{-18} μCi/ml)					
Location	**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	51	16	EL[b]	95.00	28.20		12	0.3	29.70	141.00	79.00		12	0.14	0.24	2.35	0.83	
212 *On*	51	16	EL	148.00	33.70		12	0.3	6.40	56.20	15.00		12	0.14	--	0.75	0.28	
213 *On*	51	16	EL	144	38.80		12	0.3	65.4	860	189		12	0.14	--	3.43	0.7	
214 *On*	51	16	EL	176	33.3		11	0.3	9.2	95.5	43.5		11	0.14	--	0.73	0.29	
215 *On*	47	16	EL	152.00	21.70		12	0.3	1.79	21.70	8.40		12	0.14	--	0.60	0.19	
N	251	5	0	5	5		59	5	5	5	5		59	5	1	5	5	
Min		16	BEL	95.00	21.70			0.3	1.79	21.70	8.40			0.1	0.24	0.60	0.19	
Max		16	BEL	176.00	38.80			0.3	65.40	860.00	189.00			0.1	0.24	3.43	0.83	
Median		16	--	148.00	33.30			0.3	9.20	95.50	43.50			0.1	--	0.75	0.29	
Mean		16	--	143.00	31.14			0.3	22.50	234.88	66.98			0.1	--	1.57	0.46	
StdDev		0	--	29.58	6.47			0.0	26.25	352.27	73.69			0.0	--	1.26	0.29	
101 *Off*	51	16	EL	258.00	29.20		4	0.05	0.11	12.70	4.10		4	0.02	0.07	0.30	0.17	
102 *Off*	52	16	0.64	85.60	23.50		4	0.05	3.29	20.00	8.60		4	0.02	0.07	0.21	0.16	
103 *Off*	52	16	EL	63.50	17.20		4	0.05	1.93	17.70	8.60		4	0.02	0.11	0.19	0.16	
104 *Off*	48	16	EL	52.40	9.87		4	0.05	0.85	3.44	2.38		4	0.02	0.02	0.23	0.14	
105 *Off*	50	16	EL	39.40	9.39		4	0.05	0.42	1.65	0.79		4	0.02	0.01	0.47	0.16	
108 *Off*	48	16	EL	47.70	7.68		4	0.05	0.01	0.10	0.05		4	0.02	0.06	0.23	0.11	
110 *Off*	51	16	EL	51.30	5.90		4	0.05	EL	0.32	0.03		4	0.02	--	0.37	0.14	
111 *Off*	52	16	EL	16.30	2.47		4	0.05	0.07	0.58	0.28		4	0.02	0.05	0.19	0.13	
112 *Off*	52	16	EL	42.30	6.62		4	0.05	0.02	0.54	0.27		4	0.02	0.03	0.11	0.09	
115 *Off*	52	16	EL	31.70	2.79		4	0.05	0.07	0.13	0.02		4	0.02	0.06	0.22	0.12	
118 *Off*	50	16	EL	69.80	9.33		4	0.05	0.62	1.42	1.03		4	0.02	0.06	0.18	0.11	
122 *Off*	49	16	EL	45.20	8.14		12	0.34	0.27	10.60	5.28		12	0.14	--	0.71	0.14	
123 *Off*	48	16	EL	261.00	24.60		10	0.34	2.49	41.60	10.70		11	0.14	--	1.36	0.25	
124 *Off*	48	16	EL	75.20	23.30		12	0.34	2.44	172.10	22.00		12	0.14	--	0.73	0.24	
N	703	14	1	14	14		78	14	13	14	14		79	14	10	14	14	
Min		16	0.64	16.30	2.47			0.05	0.01	0.10	0.02			0.02	0.01	0.11	0.09	
Max		16	0.64	261.00	29.20			0.34	3.29	172.10	22.00			0.14	0.11	1.36	0.25	
Median		16	--	51.85	9.36			0.05	0.42	2.55	1.71			0.02	0.06	0.23	0.14	
Mean		16	--	81.39	12.86			0.11	0.97	20.21	4.58			0.046	0.054	0.39	0.15	
StdDev		0	--	77.53	8.88			0.12	1.15	45.27	6.23			0.051	0.0288	0.34	0.05	
EL[c]					--						0.07						0.13	
Reference	Carfagno and Farmer 1988																	
	Effluent intake concentration					33.30	Effluent intake concentration					43.50	Effluent intake concentration					0.22

a. -- = no data; BEL = below environmental level; BRB = below reagent blank; EL = environmental (activity concentration) level; LDL = lower detection limit at 95% confidence level; ; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.

b. EL indicates that 'Min' and 'Mean' values included as reported; however, these values should be interpreted as "BEL".

c. EL values from sample location 119.

Table 4D-16. Mound air-monitoring data for 1988.[a]

	HTO incremental concentration (10^{-12} µCi/ml)						^{238}Pu incremental concentration (10^{-18}µCi/ml)						^{239,240}Pu concentration (10^{-18} µCi/ml)					
Location	**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	50	13	EL[b]	147.00	20.80		12	0.3	9.00	313.00	80.00		12	0.2	--	2.90	0.80	
212 *On*	51	13	1.4	81.10	24.10		12	0.3	2.00	85.00	13.00		12	0.2	--	0.80	0.20	
213 *On*	51	13	2.3	502	40.60		12	0.3	21	146	61		12	0.2	--	1.30	0.6	
214 *On*	51	13	EL	165	24.5		11	0.3	5	354	58		11	0.2	--	1.10	0.4	
215 *On*	52	13	EL	189.00	22.20		12	0.3	1.00	19.00	6.00		12	0.2	--	0.70	0.30	
N	255	5	2	5	5		59	5	5	5	5		59	5	0	5	5	
Min		13	1.40	81.10	20.80			0.3	1.00	19.00	6.00			0.2	BEL	0.70	0.20	
Max		13	2.30	502.00	40.60			0.3	21.00	354.00	80.00			0.2	BEL	2.90	0.80	
Median		13	1.85	165.00	24.10			0.3	5.00	146.00	58.00			0.2	--	1.10	0.40	
Mean		13	1.85	216.82	26.44			0.3	7.60	183.40	43.60			0.2	--	1.36	0.46	
StdDev		0	0.64	164.38	8.05			0.0	8.11	144.92	32.35			0.0	--	0.89	0.24	
101 *Off*	52	13	EL	109.00	13.30		4	0.1	0.1	2.40	1.40		4	0.2	0.2	0.80	0.40	
102 *Off*	52	13	EL	42.10	14.50		4	0.1	1.70	20.40	8.20		4	0.2	0.2	0.30	0.20	
103 *Off*	51	13	EL	163.00	16.20		4	0.1	1.60	31.10	13.30		4	0.2	0.2	0.60	0.40	
104 *Off*	52	13	EL	60.50	10.70		4	0.1	0.20	4.70	2.40		4	0.2	0.03	0.40	0.20	
105 *Off*	52	13	EL	25.40	5.70		4	0.1	EL	0.60	0.30		4	0.2	0.1	0.90	0.40	
108 *Off*	50	13	EL	33.10	4.90		4	0.1	EL	0.20	0.00		4	0.2	0.1	0.20	0.20	
110 *Off*	51	13	EL	12.60	1.50		4	0.1	EL	EL	EL		4	0.2	0.1	0.20	0.10	
111 *Off*	51	13	EL	17.80	1.20		4	0.1	EL	0.70	0.30		4	0.2	0.2	0.30	0.20	
112 *Off*	52	13	EL	53.90	5.10		4	0.1	EL	0.30	0.10		4	0.2	0.1	0.20	0.10	
115 *Off*	52	13	EL	13.20	1.10		4	0.1	EL	0.40	EL		4	0.2	0.2	0.40	0.30	
118 *Off*	51	13	EL	34.20	5.50		4	0.1	0.40	1.90	1.10		4	0.2	0.1	0.30	0.20	
122 *Off*	50	13	EL	107.00	15.80		12	0.3	0.50	20.20	7.50		12	0.02	--	0.60	0.20	
123 *Off*	52	13	EL	241.00	21.40		11	0.3	0.50	20.50	8.00		11	0.02	--	0.40	0.10	
124 *Off*	50	13	EL	100.00	17.00		12	0.3	2.40	16.30	7.10		12	0.02	--	0.50	0.20	
N	718	14	0	14	14		79	14	8	13	12		79	14	11	14	14	
Min		13	BEL	12.60	1.10			0.1	0.1	0.20	0.00			0.02	0.03	0.20	0.10	
Max		13	BEL	241.00	21.40			0.3	2.4	31.10	13.30			0.2	0.2	0.90	0.40	
Median		13	--	48.00	8.20			0.1	0.50	2.40	1.90			0.2	0.1	0.40	0.20	
Mean		13	--	72.34	9.56			0.14	0.93	9.21	4.14			0.16	0.14	0.44	0.23	
StdDev		0	--	65.99	6.78			0.09	0.85	10.83	4.45			0.08	0.06	0.22	0.11	
EL[c]					2						0.2						0.2	
Reference	Carfagno and Farmer 1989																	
					Effluent intake concentration	24.10					Effluent intake concentration	58.00					Effluent intake concentration	0.20

a. -- = no data; BEL = below environmental level; BRB = below reagent blank; EL = environmental (activity concentration) level; LDL = lower detection limit at 95% confidence level; ; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.

b. EL indicates that 'Min' and 'Mean' values included as reported; however, these values should be interpreted as "BEL".

c. EL values from sample location 119.

Table 4D-17. Mound air-monitoring data for 1989.[a]

	HTO incremental concentration (10^{-12} µCi/ml)						^{238}Pu incremental Concentration (10^{-18} µCi/ml)						^{239,240}Pu concentration (10^{-18} µCi/ml)					
Location	**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	50	29	0.2	179.00	25.00		12	0.3	2.00	107.00	23.00		12	0.1	--	1.10	0.30	
212 *On*	50	29	EL[b]	173.00	28.00		12	0.3	EL	8.00	3.00		12	0.1	--	1.20	0.20	
213 *On*	51	29	8	138	31.00		12	0.3	12	263	46		12	0.1	--	2.90	0.6	
214 *On*	50	29	1	98	24		12	0.3	3	57	15		12	0.1	--	2.80	0.4	
215 *On*	51	29	EL	83.00	22.00		12	0.3	1.00	15.00	4.00		12	0.1	--	0.50	0.10	
N	252	5	3	5	5		60	5	4	5	5		60	5	0	5	5	
Min		29	0.20	83.00	22.00			0.3	1.00	8.00	3.00			0.1	BEL	0.50	0.10	
Max		29	8.00	179.00	31.00			0.3	12.00	263.00	46.00			0.1	BEL	2.90	0.60	
Median		29	1.00	138.00	25.00			0.3	2.50	57.00	15.00			0.1	--	1.20	0.30	
Mean		29	3.07	134.20	26.00			0.3	4.50	90.00	18.20			0.1	--	1.70	0.32	
StdDev		0	4.29	43.18	3.54			0.0	5.07	104.47	17.60			0.0	--	1.08	0.19	
101 *Off*	53	29	EL	36.00	13.00		4	0.1	0.2	0.70	0.50		4	0.03	--	0.20	0.09	
102 *Off*	52	29	EL	106.00	19.00		4	0.1	0.90	2.50	1.60		4	0.03	--	0.30	0.10	
103 *Off*	51	29	EL	47.00	12.00		4	0.1	0.80	2.30	1.60		4	0.03	0.03	0.20	0.10	
104 *Off*	53	29	EL	37.00	10.00		4	0.1	0.20	1.00	0.70		4	0.03	--	0.10	0.08	
105 *Off*	52	29	EL	32.00	6.00		4	0.1	0.20	1.50	0.50		4	0.03	--	0.30	0.10	
108 *Off*	52	29	EL	14.00	2.00		4	0.1	EL	0.10	EL		4	0.03	0.08	0.10	0.09	
110 *Off*	52	29	EL	13.00	2.00		4	0.1	EL	0.20	EL		4	0.03	--	0.10	0.03	
111 *Off*	53	29	EL	19.00	2.00		4	0.1	0.10	0.50	0.20		4	0.03	0.04	1.00	0.30	
112 *Off*	53	29	EL	204.00	10.00		4	0.1	EL	0.30	0.20		4	0.03	0.05	0.30	0.10	
115 *Off*	53	29	EL	22.00	2.00		4	0.1	EL	0.10	EL		4	0.03	0.05	0.20	0.10	
118 *Off*	53	29	EL	22.00	6.00		4	0.1	0.10	1.00	0.60		4	0.03	--	0.30	0.10	
122 *Off*	53	29	EL	68.00	12.00		12	0.3	0.60	8.30	2.40		12	0.1	--	0.70	0.20	
123 *Off*	53	29	EL	79.00	17.00		12	0.3	1.00	8.10	3.80		12	0.1	--	0.30	0.04	
124 *Off*	53	29	EL	51.00	14.00		12	0.3	1.30	7.80	3.90		12	0.1	--	1.20	0.08	
N	736	14	0	14	14		80	14	10	14	11		80	14	5	14	14	
Min		29	BEL	13.00	2.00			0.1	0.1	0.10	0.20			0.03	0.03	0.10	0.03	
Max		29	BEL	204.00	19.00			0.3	1.3	8.30	3.90			0.1	0.08	1.20	0.30	
Median		29	--	36.50	10.00			0.1	0.40	1.00	0.70			0.03	0.05	0.30	0.10	
Mean		29	--	53.57	9.07			0.14	0.54	2.46	1.45			0.045	0.05	0.38	0.11	
StdDev		0	--	50.94	5.81			0.09	0.44	3.13	1.37			0.03	0.0187	0.34	0.07	
EL[c]					0.9						0.04						0.1	
Reference	Carfagno and Farmer 1990																	
					Effluent intake concentration	25.00					Effluent intake concentration	15.00					Effluent intake concentration	0.30

a. -- = no data; BEL = below environmental level; BRB = below reagent blank; EL = environmental (activity concentration) level; LDL = lower detection limit at 95% confidence level; ; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.

b. EL indicates that 'Min' and 'Mean' values included as reported; however, these values should be interpreted as "BEL".

c. EL values from sample location 119.

Table 4D-18. Mound air-monitoring data for 1990.[a,b]

	HTO incremental concentration (10^{-12} µCi/ml)						^{238}Pu incremental concentration (10^{-18} µCi/ml)						^{239,240}Pu incremental concentration (10^{-18} µCi/ml)					
Location	**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	52	29	0.54	222.36	18.57		12	0.5	5.53	89.58	16.43		12	0.4	-0.43	0.38	0.07	
212 *On*	52	29	1.44	49.70	15.72		12	0.5	1.49	9.69	4.32		12	0.4	-0.24	0.51	0.10	
213 *On*	52	29	0.87	125	38.39		12	0.5	9.47	79.44	35.04		12	0.4	0.05	0.84	0.28	
214 *On*	50	29	-1.44	154.3	20.7		12	0.5	2.24	12.93	5.64		12	0.4	-0.04	0.48	0.04	
215 *On*	52	29	-2.54	72.45	15.21		12	0.5	0.55	3.86	1.83		12	0.4	-0.18	0.12	-0.02	
N	258	5	5	5	5		60	5	5	5	5		60	5	5	5	5	
Min		29	-2.54	49.70	15.21			0.5	0.55	3.86	1.83			0.4	-0.43	0.12	-0.02	
Max		29	1.44	222.36	38.39			0.5	9.47	89.58	35.04			0.4	0.05	0.84	0.28	
Median		29	0.54	125.04	18.57			0.5	2.24	12.93	5.64			0.4	-0.18	0.48	0.07	
Mean		29	-0.23	124.77	21.71			0.5	3.86	39.10	12.65			0.4	-0.17	0.47	0.09	
StdDev		0	1.69	68.50	9.58			0.0	3.66	41.73	13.70			0.0	0.19	0.26	0.11	
101 *Off*	51	29	-2.48	32.02	12.25		4	0.1	0.28	1.17	0.57		4	0.1	-0.06	0.05	0.01	
102 *Off*	52	29	1.82	59.33	14.50		4	0.1	1.75	3.54	2.67		4	0.1	-0.01	0.03	0.00	
103 *Off*	52	29	-1.07	28.61	9.03		4	0.1	1.45	149.28	39.47		4	0.1	-0.02	0.42	0.15	
104 *Off*	52	29	-6.19	35.99	7.19		4	0.1	0.34	0.92	0.55		4	0.1	-0.08	-0.01	-0.04	
105 *Off*	52	29	-2.48	25.69	3.62		4	0.1	0.10	0.46	0.26		4	0.1	0.03	0.12	0.06	
108 *Off*	52	29	-8.94	13.86	2.62		4	0.1	-0.05	0.24	0.06		4	0.1	-0.02	0.06	0.02	
110 *Off*	52	29	-6.39	12.90	0.88		4	0.1	-0.04	0.15	0.05		4	0.1	-0.1	0.04	-0.02	
111 *Off*	52	29	-6.79	12.25	1.05		4	0.1	-0.03	0.30	0.12		4	0.1	0.02	0.08	0.06	
112 *Off*	51	29	-5.53	21.68	4.44		4	0.1	-0.04	0.16	0.07		4	0.1	-0.01	0.02	0.01	
115 *Off*	52	29	-6.21	11.69	0.82		4	0.1	-0.25	0.15	-0.05		4	0.1	-0.02	0.12	0.04	
118 *Off*	52	29	-7.56	22.22	3.57		4	0.1	-0.06	4.83	1.48		12	0.4	-0.02	0.05	0.02	
122 *Off*	50	29	-3.83	52.00	6.95		12	0.5	0.52	5.79	1.58		12	0.4	-0.41	0.24	-0.07	
123 *Off*	51	29	-2.89	38.43	7.51		12	0.5	0.85	18.50	4.18		12	0.4	-0.12	0.52	0.06	
124 *Off*	51	29	-3.56	39.50	8.16		12	0.5	-0.25	14.16	3.85		12	0.4	-0.39	0.28	-0.01	
N	722	14	14	14	14		80	14	14	14	14		88	14	14	14	14	
Min		29	-8.94	11.69	0.82			0.1	-0.25	0.15	-0.05			0.1	-0.41	-0.01	-0.07	
Max		29	1.82	59.33	14.50			0.5	1.75	149.28	39.47			0.4	0.03	0.52	0.15	
Median		29	-4.68	27.15	5.70			0.1	0.04	1.05	0.56			0.1	-0.02	0.07	0.02	
Mean		29	-4.436	29.01	5.90			0.19	0.33	14.26	3.92			0.186	-0.0864	0.14	0.02	
StdDev		0	2.8886	14.90	4.23			0.17	0.62	39.27	10.33			0.141	0.1395	0.16	0.05	
EL					2.63						0.06						0.07	
Reference	EG&G 1991																	
	Effluent intake concentration					18.60	Effluent intake concentration					5.64	Effluent intake concentration					0.07

a. -- = no data; BEL = below environmental level; BRB = below reagent blank; EL = environmental (activity concentration) level; LDL = lower detection limit at 95% confidence level; ; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.

b. Negative 'Min' values included as reported; however, these values should be interpreted as "BEL".

Table 4D-19. Mound air-monitoring data for 1991.[a,b]

	HTO incremental concentration (10^{-12} µCi/ml)						^{238}Pu incremental concentration (10^{-18} µCi/ml)						^{239,240}Pu incremental concentration (10^{-18} µCi/ml)					
Location	**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	51	16	-0.35	42.41	11.65		12	0.7	4.90	49.72	15.73		12	0.3	-0.42	0.46	0.10	
212 *On*	49	16	-4.93	54.88	13.05		11	0.7	1.29	9.16	4.92		11	0.3	-0.47	0.30	-0.04	
213 *On*	50	16	10.04	112.61	38.91		12	0.7	12.14	69.36	34.23		12	0.3	-0.37	0.89	0.03	
214 *On*	51	16	-3.06	28.69	9.97		12	0.7	2.27	24.65	7.7		12	0.3	-0.27	0.43	-0.05	
215 *On*	51	16	-9.88	31.45	6.18		12	0.7	1.20	27.73	6.82		12	0.3	-0.34	0.17	-0.03	
N	252	5	5	5	5		59	5	5	5	5		59	5	5	5	5	
Min		16	-9.88	28.69	6.18			0.7	1.20	9.16	4.92			0.3	-0.47	0.17	-0.05	
Max		16	10.04	112.61	38.91			0.7	12.14	69.36	34.23			0.3	-0.27	0.89	0.10	
Median		16	-3.06	42.41	11.65			0.7	2.27	27.73	7.70			0.3	-0.37	0.43	-0.03	
Mean		16	-1.64	54.01	15.95			0.7	4.36	36.12	13.88			0.3	-0.37	0.45	0.00	
StdDev		0	7.40	34.35	13.09			0.0	4.60	23.55	12.10			0.0	0.08	0.27	0.06	
101 *Off*	50	16	-5.46	31.14	6.85		4	0.2	0.2	0.73	0.42		4	0.1	-0.14	0.02	-0.05	
102 *Off*	52	16	-11.16	27.79	8.27		4	0.2	0.58	2.88	1.77		4	0.1	-0.1	0.04	-0.05	
103 *Off*	52	16	-13.2	20.20	5.83		4	0.2	1.05	3.51	2.50		4	0.1	-0.02	0.04	0.01	
104 *Off*	52	16	-9.66	22.43	3.45		4	0.2	0.31	6.33	2.59		4	0.1	-0.07	0.03	-0.01	
105 *Off*	52	16	-10.3	32.85	4.52		4	0.2	0.04	2.63	0.88		4	0.1	-0.05	0.03	-0.01	
108 *Off*	52	16	-10.61	12.79	1.74		4	0.2	-0.18	0.05	-0.11		4	0.1	-0.04	0.04	-0.01	
110 *Off*	52	16	-13.2	20.88	0.70		4	0.2	-0.45	0.10	-0.19		4	0.1	-0.01	0.08	0.03	
111 *Off*	50	16	-11.34	11.42	0.44		4	0.2	-0.25	0.48	0.12		4	0.1	-0.28	0.10	-0.05	
112 *Off*	51	16	-6.64	13.43	2.02		4	0.2	-0.18	0.72	0.06		4	0.1	-0.09	0.09	-0.04	
115 *Off*	52	16	-12.7	12.93	0.58		4	0.2	-0.16	0.32	-0.01		4	0.1	-0.35	-0.02	-0.11	
118 *Off*	52	16	-10.25	24.59	2.76		4	0.2	-0.07	5.05	1.50		4	0.1	-0.13	-0.01	-0.06	
122 *Off*	51	16	-4.1	25.63	7.39		12	0.7	-0.52	2.77	1.34		12	0.3	-0.35	0.17	-0.08	
123 *Off*	52	16	-4.21	74.37	9.06		12	0.7	-0.01	6.10	2.63		12	0.3	-0.3	0.33	0.01	
124 *Off*	51	16	-12.85	40.50	6.93		12	0.7	0.01	50.58	10.01		12	0.3	-0.51	0.27	-0.02	
N	721	14	14	14	14		80	14	14	14	14		80	14	14	14	14	
Min		16	-13.2	11.42	0.44			0.2	-0.52	0.05	-0.19			0.1	-0.51	-0.02	-0.11	
Max		16	-4.1	74.37	9.06			0.7	1.05	50.58	10.01			0.3	-0.01	0.33	0.03	
Median		16	-10.46	23.51	3.99			0.2	-0.04	2.70	1.11			0.1	-0.115	0.04	-0.03	
Mean		16	-9.691	26.50	4.32			0.31	0.03	5.88	1.68			0.143	-0.1743	0.09	-0.03	
StdDev		0	3.2649	16.20	3.04			0.21	0.41	13.05	2.61			0.085	0.155	0.10	0.04	
EL					1.85						0.24						0.1	
Reference	EG&G 1992a																	
					Effluent intake concentration	11.65					Effluent intake concentration	7.70					Effluent intake concentration	0.00

a. -- = no data; BEL = below environmental level; BRB = below reagent blank; EL = environmental (activity concentration) level; LDL = lower detection limit at 95% confidence level; ; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.

b. Negative 'Min' values included as reported; however, these values should be interpreted as "BEL".

Table 4D-20. Mound air-monitoring data for 1992.[a]

	HTO incremental concentration (10^{-12} µCi/ml)						^{238}Pu concentration (10^{-18} µCi/ml)						^{239,240}Pu incremental concentration (10^{-18} µCi/ml)					
Location	**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**	-- --	**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	49	20	BEL	133.14	16.55		12	0.8	3.07	14.99	6.42		12	0.6	BEL	1.16	0.29	
212 *On*	51	20	BEL	39.62	7.43		12	0.8	0.95	8.04	2.83		12	0.6	BEL	0.67	0.16	
213 *On*	20	20	BEL	43.21	13.78		5	0.8	12.94	31.78	22.33		5	0.6	0.09	0.78	0.35	
213R *On*	28	20	BEL	55.20	9.11		7	0.8	3.28	15.76	10.52		7	0.6	BEL	1.34	0.37	
214 *On*	20	20	BEL	20.24	4.28		5	0.8	1.24	14.17	6.79		5	0.6	BEL	0.55	0.26	
214R *On*	31	20	BEL	55.24	8.09		7	0.8	2.88	12.51	5.83		7	0.6	BEL	1.48	0.24	
215 *On*	52	20	BEL	24.15	4.11		12	0.8	0.94	11.34	3.58		12	0.6	BEL	0.64	0.19	
216 *On*	31	20	BEL	36.21	5.14		7	0.8	0.77	14.53	4.53		7	0.6	BEL	0.41	0.002	
217 *On*	30	20	BEL	34.02	1.90		7	0.8	0.31	2.73	1.26		7	0.6	BEL	0.24	0.01	
N	312	9	0	9	9		74	9	9	9	9		74	9	1	9	9	
Min		20	BEL	20.24	1.90			0.8	0.31	2.73	1.26			0.6	0.09	0.24	0.00	
Max		20	BEL	133.14	16.55			0.8	12.94	31.78	22.33			0.6	0.09	1.48	0.37	
Median		20	--	39.62	7.43			0.8	1.24	14.17	5.83			0.6	--	0.67	0.24	
Mean		20	--	49.00	7.82			0.8	2.93	13.98	7.12			0.6	--	0.81	0.21	
StdDev		0	--	33.75	4.77			0.0	3.91	7.84	6.30			0.0	--	0.43	0.13	
101 *Off*	52	20	BEL	43.97	6.57		4	0.5	BEL	0.70	0.32		4	0.04	BEL	0.13	0.05	
102 *Off*	49	20	BEL	39.71	8.74		4	0.5	0.40	7.84	2.58		4	0.04	0.07	0.11	0.09	
103 *Off*	50	20	BEL	35.53	4.32		4	0.5	1.05	2.62	1.77		4	0.04	BEL	0.06	BEL	
104 *Off*	51	20	BEL	40.54	2.86		4	0.5	0.28	1.06	0.53		4	0.04	0.01	0.10	0.06	
105 *Off*	52	20	BEL	33.89	3.84		4	0.5	BEL	0.58	0.27		4	0.04	BEL	0.08	0.02	
108 *Off*	52	20	BEL	25.69	0.27		4	0.5	BEL	1.92	0.41		4	0.04	BEL	0.08	0.03	
110 *Off*	51	20	BEL	34.80	0.07		4	0.5	BEL	1.26	0.24		4	0.04	BEL	0.08	0.03	
111 *Off*	51	20	BEL	18.01	BEL		4	0.5	BEL	0.72	0.17		4	0.04	BEL	0.03	0.01	
112 *Off*	52	20	BEL	25.78	BEL		4	0.5	BEL	1.01	0.46		4	0.04	BEL	0.01	BEL	
115 *Off*	48	20	BEL	17.61	BEL		4	0.5	0.04	0.24	0.12		4	0.04	BEL	0.13	0.03	
118 *Off*	52	20	BEL	31.80	1.66		4	0.5	0.11	1.67	0.68		4	0.04	BEL	0.04	BEL	
122 *Off*	51	20	BEL	27.83	3.31		12	0.8	0.37	2.13	0.96		12	0.6	BEL	0.40	0.11	
123 *Off*	51	20	BEL	45.66	6.33		12	0.8	1.09	4.81	2.55		12	0.6	BEL	1.32	0.17	
124 *Off*	50	20	BEL	59.39	5.65		12	0.8	0.46	19.67	4.38		12	0.6	BEL	1.36	0.15	
N	712	14	0	14	11		80	14	8	14	14		80	14	2	14	11	
Min		20	BEL	17.61	0.07			0.5	0.04	0.24	0.12			0.04	0.01	0.01	0.01	
Max		20	BEL	59.39	8.74			0.8	1.09	19.67	4.38			0.6	0.07	1.36	0.17	
Median		20	--	34.35	3.84			0.5	0.39	1.47	0.50			0.04	0.04	0.09	0.05	
Mean		20	--	34.30	3.97			0.56	0.48	3.30	1.10			0.16	0.04	0.28	0.07	
StdDev		0	--	11.30	2.72			0.13	0.39	5.13	1.26			0.238	0.0424	0.46	0.05	
EL					6.59						--						0.05	
Reference	EG&G 1993, Bauer 1993																	
	Effluent intake concentration					7.43	Effluent intake concentration					5.83	Effluent intake concentration					0.24

a. -- = no data; BEL = below environmental level; BRB = below reagent blank; EL = environmental (activity concentration) level; LDL = lower detection limit at 95% confidence level; ; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.

Table 4D-21. Mound air-monitoring data for 1993.[a]

	HTO incremental concentration (10^{-12} µCi/ml)						^{238}Pu incremental concentration (10^{-18} µCi/ml)						^{239,240}Pu incremental concentration (10^{-18} µCi/ml)					
Location	**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	50	19	BEL	205.40	6.76		12	0.2	2.16	13.11	6.04		12	0.2	BEL	1.78	0.38	
212 *On*	50	19	BEL	192.47	5.45		12	0.2	1.21	24.57	8.51		12	0.2	BEL	1.82	0.58	
213R *On*	52	19	BEL	183.54	4.43		12	0.2	10.86	86.49	41.45		12	0.2	0.17	4.18	1.33	
214R *On*	51	19	BEL	223.44	3.88		12	0.2	1.03	18.54	7.10		12	0.2	BEL	1.12	0.39	
215 *On*	52	19	BEL	179.96	1.20		12	0.2	1.41	6.60	3.41		12	0.2	BEL	0.96	0.30	
216 *On*	52	19	BEL	195.66	1.31		12	0.2	2.35	117.49	21.61		12	0.2	0.08	6.60	1.15	
217 *On*	51	19	BEL	186.20	BEL		12	0.2	0.58	12.93	2.78		12	0.2	BEL	1.26	0.26	
N	358	7	0	7	6		84	7	7	7	7		84	7	2	7	7	
Min		19	BEL	179.96	1.20			0.2	0.58	6.60	2.78			0.2	0.08	0.96	0.26	
Max		19	BEL	223.44	6.76			0.2	10.86	117.49	41.45			0.2	0.17	6.60	1.33	
Median		19	--	192.47	4.16			0.2	1.41	18.54	7.10			0.2	0.13	1.78	0.39	
Mean		19	--	195.24	3.84			0.2	2.80	39.96	12.99			0.2	0.13	2.53	0.63	
StdDev		0	--	15.05	2.23			0.0	3.61	43.66	14.04			0.0	0.06	2.10	0.43	
101 *Off*	51	19	BEL	188.92	3.38		4	0.06	0.65	24.08	7.01		4	0.08	BEL	0.05	BEL	
102 *Off*	51	19	BEL	202.45	4.40		4	0.06	1.51	7.63	3.76		4	0.08	0.03	0.30	0.19	
103 *Off*	50	19	BEL	226.90	1.19		4	0.06	1.66	4.56	3.22		4	0.08	BEL	0.34	0.12	
104 *Off*	51	19	BEL	201.15	BEL		4	0.06	0.56	6.63	2.19		4	0.08	0.01	0.63	0.19	
105 *Off*	49	19	BEL	217.19	BEL		4	0.06	0.48	1.76	1.19		3	0.08	BEL	0.18	0.10	
108 *Off*	51	19	BEL	252.41	BEL		4	0.06	BEL	0.06	BEL		4	0.08	0.03	0.41	0.15	
110 *Off*	51	19	BEL	210.32	BEL		4	0.06	BEL	0.04	BEL		4	0.08	BEL	0.75	0.14	
111 *Off*	51	19	BEL	264.65	BEL		4	0.06	0.02	0.48	0.15		4	0.08	BEL	0.06	0.03	
112 *Off*	50	19	BEL	199.57	BEL		4	0.06	0.06	0.31	0.18		4	0.08	0.03	0.08	0.05	
115 *Off*	51	19	BEL	218.53	BEL		4	0.06	BEL	0.58	0.11		4	0.08	BEL	0.08	0.03	
118 *Off*	49	19	BEL	203.49	1.29		4	0.06	0.63	3.28	1.95		4	0.08	BEL	0.38	0.08	
122 *Off*	51	19	BEL	227.59	1.15		12	0.2	0.29	2.53	1.07		12	0.2	BEL	0.71	0.15	
123 *Off*	52	19	BEL	545.60	4.82		12	0.2	2.00	12.13	5.90		12	0.2	BEL	0.77	0.24	
124 *Off*	50	19	BEL	176.27	2.00		12	0.2	0.62	27.55	6.52		12	0.2	BEL	0.51	0.22	
N	708	14	0	14	7		80	14	11	14	12		79	14	4	14	13	
Min		19	BEL	176.27	1.15			0.06	0.02	0.04	0.11			0.08	0.01	0.05	0.03	
Max		19	BEL	545.60	4.82			0.20	2.00	27.55	7.01			0.20	0.03	0.77	0.24	
Median		19	--	213.76	2.00			0.06	0.62	2.91	2.07			0.08	0.03	0.36	0.14	
Mean		19	--	238.22	2.60			0.09	0.77	6.54	2.77			0.11	0.03	0.38	0.13	
StdDev		0	--	91.51	1.58			0.06	0.66	8.90	2.52			0.05	0.01	0.27	0.07	
EL					12.2						0.07						0.09	
Reference	EG&G 1994a																	
	Effluent intake concentration					4.16	Effluent intake concentration					7.10	Effluent intake concentration					0.39

a. -- = no data; BEL = below environmental level; BRB = below reagent blank; EL = environmental (activity concentration) level; LDL = lower detection limit at 95% confidence level; ; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.

Table 4D-22. Mound air-monitoring data for 1994.[a]

	HTO incremental concentration (10^{-12} µCi/ml)						^{238}Pu incremental concentration (10^{-18} µCi/ml)						^{239,240}Pu incremental concentration (10^{-18} µCi/ml)					
Location[b]	**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	51	35	BEL	44.27	7.54		12	0.12	2.40	23.56	8.28		12	0.2	BEL	1.31	0.44	
211T *On*	--	--	--	--	--		12	0.12	1.76	15.78	6.63		12	0.2	BEL	1.47	0.34	
212 *On*	50	28	BEL	47.88	4.82		12	0.12	1.85	18.17	7.21		12	0.2	BEL	0.92	0.26	
212T *On*	--	--	--	--	--		12	0.12	3.07	17.16	7.37		12	0.2	BEL	0.73	0.25	
213R *On*	50	28	BEL	24.29	3.55		12	0.12	29.57	1,994.6	354.26		12	0.2	0.06	14.14	3.50	
213RT *On*	--	--	--	--	--		12	0.12	8.64	1,292.2	259.65		12	0.2	0.47	6.71	2.14	
214R *On*	48	28	BEL	30.75	4.29		12	0.12	2.52	11.22	5.55		12	0.2	BEL	1.05	0.32	
214RT *On*	--	--	--	--	--		12	0.12	1.85	11.27	5.50		12	0.2	BEL	1.02	0.30	
215 *On*	48	28	BEL	26.40	3.69		12	0.12	0.20	5.20	2.56		12	0.2	BEL	0.71	0.17	
215T *On*	--	--	--	--	--		12	0.12	0.85	73.19	9.17		12	0.2	BEL	1.76	0.28	
216 *On*	49	28	BEL	23.71	1.97		12	0.12	0.64	30.53	11.27		12	0.2	BEL	1.19	0.42	
216T *On*	--	--	--	--	--		12	0.12	1.05	29.99	8.36		12	0.2	BEL	0.92	0.35	
217 *On*	49	28	BEL	42.48	2.11		12	0.12	0.40	6.89	2.59		12	0.2	BEL	0.84	0.15	
217T *On*	--	--	--	--	--		12	0.12	0.20	21.90	4.28		12	0.2	BEL	0.30	0.10	
N	345	7	0	7	7		168	14	14	14	14		168	14	2	14	14	
Min		28	BEL	23.71	1.97			0.12	0.2	5.20	2.56			0.2	0.06	0.30	0.10	
Max		35	BEL	47.88	7.54			0.12	29.57	1994.60	354.26			0.2	0.47	14.14	3.50	
Median		28	--	30.75	3.69			0.12	1.805	20.04	7.29			0.2	0.265	1.04	0.31	
Mean		29	--	34.25	4.00			0.12	3.92857	253.69	49.48			0.2	0.265	2.36	0.64	
StdDev		2.65	--	10.31	1.88			0	7.68072	604.89	110.68			3E-09	0.2899	3.73	0.96	
101 *Off*	48	23	BEL	61.51	5.96		4	0.03	0.52	1.27	0.81		4	0.05	0.10	0.38	0.19	
102 *Off*	50	23	BEL	28.22	4.90		4	0.03	1.96	6.92	4.42		4	0.05	BEL	0.74	0.32	
103 *Off*	50	23	BEL	26.34	2.14		4	0.03	1.68	7.63	3.60		4	0.05	BEL	0.12	0.04	
104 *Off*	52	23	BEL	26.31	1.98		4	0.03	0.82	3.51	1.85		4	0.05	BEL	0.08	0.03	
105 *Off*	51	23	BEL	25.35	1.25		4	0.03	0.11	0.43	0.32		4	0.05	BEL	0.05	0.01	
108 *Off*	50	23	BEL	34.27	0.74		4	0.03	BEL	2.10	0.60		4	0.05	0.03	0.95	0.28	
110 *Off*	50	23	BEL	23.85	0.52		4	0.03	BEL	0.34	0.07		4	0.05	BEL	0.13	0.05	
111 *Off*	48	23	BEL	29.03	BEL		4	0.03	0.11	0.20	0.16		4	0.05	BEL	0.60	0.18	
112 *Off*	50	23	BEL	36.66	2.09		4	0.03	0.16	0.39	0.26		4	0.05	BEL	0.15	0.04	
115 *Off*	51	23	BEL	28.99	0.75		4	0.03	0.05	0.14	0.10		4	0.05	BEL	0.16	0.05	
118 *Off*	48	23	BEL	28.98	0.75		4	0.03	0.66	1.10	0.86		4	0.05	BEL	0.26	0.06	
122 *Off*	51	23	BEL	35.15	3.37		12	0.12	0.32	2.20	1.37		12	0.2	BEL	0.32	0.11	
123 *Off*	50	23	BEL	33.36	5.65		12	0.12	1.48	8.40	4.12		12	0.2	BEL	0.83	0.21	
124 *Off*	50	23	BEL	40.51	8.09		12	0.12	2.44	47.32	13.19		12	0.2	BEL	1.61	0.44	
N	699	14	0	14	13		80	14	12	14	14		80	14	2	14	14	
Min		23	BEL	23.85	0.52			0.03	0.05	0.14	0.07			0.05	0.03	0.05	0.01	
Max		23	BEL	61.51	8.09			0.12	2.44	47.32	13.19			0.20	0.10	1.61	0.44	
Median		23	--	29.01	2.09			0.03	0.59	1.69	0.84			0.05	0.07	0.29	0.09	
Mean		23	--	32.75	2.94			0.05	0.86	5.85	2.27			0.08	0.07	0.46	0.14	
StdDev		0	--	9.57	2.46			0.04	0.82	12.28	3.50			0.06	0.05	0.45	0.13	
EL					3.22						0.05						0.07	
Reference	EG&G 1995b																	
	Effluent intake concentration					3.69	Effluent intake concentration					7.29	Effluent intake concentration					0.31

a. -- = no data; BEL = below environmental level; BRB = below reagent blank; EL = environmental (activity concentration) level; LDL = lower detection limit at 95% confidence level; ; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.

b. T indicates 2-m sampling height.

Table 4D-23. Mound air-monitoring data for 1995.[a]

	HTO incremental concentration (10^{-12} µCi/ml)						^{238}Pu incremental concentration (10^{-18} µCi/ml)						^{239,240}Pu incremental concentration (10^{-18} µCi/ml)					
Location[b]	**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	52	26	BEL	25.08	3.35		12	0.86	2.49	35.96	9.88		12	0.6	BEL	0.75	0.16	
211T *On*	--	--	--	--	--		12	0.86	1.11	37.39	8.68		12	0.6	BEL	0.47	0.01	
212 *On*	51	23	BEL	20.27	2.70		12	0.86	0.90	11.42	4.95		12	0.6	BEL	1.08	0.03	
212T *On*	--	--	--	--	--		12	0.86	BEL	13.22	3.21		12	0.6	BEL	0.71	0.03	
213R *On*	50	23	BEL	21.36	2.11		12	0.86	17.04	2,430.5	326.87		12	0.6	BEL	7.15	0.97	
213RT *On*	--	--	--	--	--		12	0.86	14.36	1,881.1	264.60		12	0.6	BEL	6.86	1.58	
214R *On*	50	23	BEL	20.20	2.38		12	0.86	1.53	27.15	6.57		12	0.6	BEL	3.61	0.45	
214RT *On*	--	--	--	--	--		12	0.86	0.31	7.75	4.54		12	0.6	BEL	0.73	0.08	
215 *On*	52	23	BEL	20.85	0.83		12	0.86	BEL	49.38	5.40		12	0.6	BEL	1.04	0.04	
215T *On*	--	--	--	--	--		12	0.86	BEL	5.6	2.26		12	0.6	BEL	0.38	BEL	
216 *On*	52	23	BEL	18.38	0.43		12	0.86	BEL	69.95	15.33		12	0.6	BEL	2.77	0.37	
216T *On*	--	--	--	--	--		12	0.86	BEL	107.41	13.50		12	0.6	BEL	1.08	BEL	
217 *On*	49	23	BEL	15.28	0.42		12	0.86	BEL	7.59	1.95		12	0.6	BEL	0.80	BEL	
217T *On*	--	--	--	--	--		12	0.86	BEL	9.80	1.64		12	0.6	BEL	0.34	BEL	
N	356	7	0	7	7		168	14	7	14	14		168	14	0	14	10	
Min		23	BEL	15.28	0.42			0.86	0.31	5.60	1.64			0.6	BEL	0.34	0.01	
Max		26	BEL	25.08	3.35			0.86	17.04	2430.50	326.87			0.6	BEL	7.15	1.58	
Median		23	--	20.27	2.11			0.86	1.53	31.56	5.99			0.6	--	0.92	0.12	
Mean		23.4	--	20.20	1.75			0.86	5.39	335.30	47.81			0.6	--	1.98	0.37	
StdDev		1.1	--	2.98	1.18			0.00	7.12	779.29	105.82			0.0	--	2.32	0.52	
101 *Off*	53	18	BEL	24.87	2.83		4	0.07	0.16	0.74	0.40		4	0.1	BEL	0.13	0.01	
102 *Off*	50	18	BEL	23.35	2.37		4	0.07	1.55	4.07	2.28		4	0.1	BEL	0.37	0.13	
103 *Off*	52	18	BEL	17.80	0.69		4	0.07	0.61	5.31	2.48		4	0.1	BEL	0.30	0.12	
104 *Off*	53	18	BEL	22.00	0.50		4	0.07	0.05	0.73	0.45		4	0.1	BEL	0.68	0.23	
105 *Off*	51	18	BEL	19.13	1.01		4	0.07	0.06	11.36	3.37		4	0.1	BEL	0.39	0.16	
108 *Off*	53	18	BEL	23.16	BEL		4	0.07	BEL	0.20	0.03		4	0.1	BEL	0.16	BEL	
110 *Off*	50	18	BEL	9.13	BEL		4	0.07	BEL	0.16	0.04		4	0.1	0.01	0.16	0.09	
111 *Off*	53	18	BEL	16.45	BEL		4	0.07	BEL	0.11	0.03		4	0.1	BEL	0.05	BEL	
112 *Off*	51	18	BEL	22.01	BEL		4	0.07	BEL	2.19	0.72		4	0.1	BEL	0.23	0.07	
115 *Off*	50	18	BEL	13.66	BEL		4	0.07	0.05	0.35	0.20		4	0.1	BEL	0.24	0.11	
118 *Off*	53	18	BEL	23.88	1.00		4	0.07	0.12	3.20	1.51		4	0.1	BEL	0.18	0.02	
122 *Off*	34	18	BEL	21.69	0.20		9	0.86	BEL	6.79	1.26		9	0.6	BEL	1.12	BEL	
123 *Off*	52	18	BEL	23.62	3.57		12	0.86	0.35	6.77	2.82		12	0.6	BEL	0.44	BEL	
124 *Off*	50	18	BEL	40.05	4.27		12	0.86	0.46	20.46	6.19		12	0.6	BEL	1.41	0.16	
N	705	14	0	14	9		77	14	9	14	14		77	14	1	14	10	
Min		18	BEL	9.13	0.20			0.07	0.05	0.11	0.03			0.1	0.01	0.05	0.01	
Max		18	BEL	40.05	4.27			0.86	1.55	20.46	6.19			0.6	0.01	1.41	0.23	
Median		18	--	22.01	1.01			0.07	0.16	2.70	0.99			0.1	--	0.27	0.12	
Mean		18	--	21.49	1.83			0.24	0.38	4.46	1.56			0.2	--	0.42	0.11	
StdDev		0	--	6.97	1.47			0.34	0.48	5.70	1.75			0.2	--	0.40	0.07	
EL				BEL	4.61					BEL	0.04					BEL	0.04	
Reference	EG&G 1996																	
					Effluent intake concentration	2.11					Effluent intake concentration	5.99					Effluent intake concentration	0.12

a. -- = no data; BEL = below environmental level; BRB = below reagent blank; LDL = lower detection limit at 95% confidence level; ; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.

b. T indicates 2-m sampling height.

Table 4D-24. Mound air-monitoring data for 1996.[a]

	HTO incremental concentration (10^{-12} µCi/ml)					
Location[b]	**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	52	35	BEL	32.51	9.43	
211T *On*	--	--	--	--	--	
212 *On*	51	30	BEL	114.80	9.12	
212T *On*	--	--	--	--	--	
213R *On*	50	30	BEL	50.07	9.16	
213RT *On*	--	--	--	--	--	
214R *On*	50	30	BEL	25.45	6.94	
214RT *On*	--	--	--	--	--	
215 *On*	52	30	BEL	20.26	5.55	
215T *On*	--	--	--	--	--	
216 *On*	52	30	BEL	27.29	5.77	
216T *On*	--	--	--	--	--	
217 *On*	49	30	BEL	23.62	4.89	
217T *On*	--	--	--	--	--	
N	356	7	0	7	7	
Min		30	BEL	20.26	4.89	
Max		35	BEL	114.80	9.43	
Median		30	--	27.29	6.94	
Mean		30.7	--	42.00	7.27	
StdDev		1.9	--	33.56	1.94	
101 *Off*	49	23	BEL	41.76	5.09	
102 *Off*	52	23	BEL	129.01	9.45	
103 *Off*	52	23	BEL	41.84	4.73	
104 *Off*	52	23	BEL	23.05	4.44	
105 *Off*	51	23	BEL	24.41	6.02	
	51	23	BEL	17.42	1.75	
	52	23	BEL	19.69	0.80	
108 *Off*	52	23	BEL	22.61	0.99	
110 *Off*	52	23	BEL	22.97	2.07	
111 *Off*	52	23	BEL	16.73	1.62	
112 *Off*	52	23	BEL	18.43	3.16	
115 *Off*	51	23	BEL	23.22	3.81	
118 *Off*	52	23	BEL	24.33	6.82	
122 *Off*	50	23	BEL	33.85	5.69	
123 *Off*	11	23	BEL	17.16	3.86	
124 *Off*	11	23	BEL	15.83	4.17	
N	742	16	0	16	16	
Min		23	BEL	15.83	0.80	
Max		23	BEL	129.01	9.45	
Median		23	--	23.01	4.02	
Mean		23	--	30.77	4.03	
StdDev		0	--	27.43	2.32	
EL					4.64	
Reference	EG&G 1997					
			Effluent intake concentration			6.94

	^{238}Pu incremental concentration (10^{-18} µCi/ml)					
Location[b]	**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	12	0.5	2.34	13.28	5.42	
211T *On*	12	0.5	1.50	12.68	4.27	
212 *On*	12	0.5	1.37	20.01	5.76	
212T *On*	12	0.5	0.78	10.42	4.05	
213R *On*	12	0.5	33.35	216.55	89.12	
213RT *On*	12	0.5	17.08	205.52	65.86	
214R *On*	12	0.5	1.12	65.17	17.12	
214RT *On*	12	0.5	1.81	95.57	20.59	
215 *On*	12	0.5	1.06	124.83	27.64	
215T *On*	12	0.5	1.25	236.86	51.59	
216 *On*	12	0.5	1.04	13.70	5.03	
216T *On*	12	0.5	1.18	13.99	6.12	
217 *On*	12	0.5	0.18	4.51	1.43	
217T *On*	12	0.5	0.34	6.19	1.69	
N	168	14	14	14	14	
Min		0.5	0.18	4.51	1.43	
Max		0.5	33.35	236.86	89.12	
Median		0.5	1.22	17.00	5.94	
Mean		0.5	4.60	74.23	21.84	
StdDev		0.0	9.31	86.97	27.61	
101 *Off*	4	0.4	0.03	0.38	0.25	
102 *Off*	4	0.4	0.64	18.58	5.86	
103 *Off*	4	0.4	1.13	3.87	2.32	
104 *Off*	4	0.4	0.33	2.79	1.22	
105 *Off*	4	0.4	0.00	0.37	0.19	
	4	0.4	BEL	0.07	BEL	
	4	0.4	BEL	0.35	0.06	
108 *Off*	4	0.4	BEL	0.24	0.12	
110 *Off*	4	0.4	BEL	0.29	0.13	
111 *Off*	4	0.4	BEL	0.06	BEL	
112 *Off*	4	0.4	0.04	3.22	1.18	
115 *Off*	12	0.5	0.09	3.70	1.07	
118 *Off*	12	0.5	1.10	45.95	14.83	
122 *Off*	12	0.5	0.89	24.40	6.45	
123 *Off*	3	0.4	0.92	4.34	2.26	
124 *Off*	3	0.4	1.62	8.27	3.91	
N	86	16	11	16	14	
Min		0.4	0.00	0.06	0.06	
Max		0.5	1.62	45.95	14.83	
Median		0.4	0.64	3.01	1.20	
Mean		0.42	0.62	7.31	2.85	
StdDev		0.04	0.56	12.47	4.04	
EL					--	
Reference						
			Effluent intake concentration			5.94

	$^{239,240}Pu$ incremental concentration (10^{-18} µCi/ml)					
Location[b]	**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	12	0.4	BEL	0.52	BEL	
211T *On*	12	0.4	BEL	0.62	BEL	
212 *On*	12	0.4	BEL	1.00	0.001	
212T *On*	12	0.4	BEL	0.12	BEL	
213R *On*	12	0.4	BEL	1.46	0.18	
213RT *On*	12	0.4	BEL	0.71	0.04	
214R *On*	12	0.4	BEL	19.16	1.49	
214RT *On*	12	0.4	BEL	3.90	0.35	
215 *On*	12	0.4	BEL	0.29	0.01	
215T *On*	12	0.4	BEL	1.46	0.18	
216 *On*	12	0.4	BEL	1.18	0.08	
216T *On*	12	0.4	BEL	0.21	BEL	
217 *On*	12	0.4	BEL	0.38	BEL	
217T *On*	12	0.4	BEL	1.35	0.01	
N	168	14	0	14	9	
Min		0.4	BEL	0.12	0.00	
Max		0.4	BEL	19.16	1.49	
Median		0.4	--	0.86	0.08	
Mean		0.4	--	2.31	0.26	
StdDev		0.0	--	4.94	0.48	
101 *Off*	4	0.2	BEL	1.71	0.62	
102 *Off*	4	0.2	BEL	1.48	0.47	
103 *Off*	4	0.2	BEL	0.07	BEL	
104 *Off*	4	0.2	BEL	0.28	0.01	
105 *Off*	4	0.2	BEL	0.15	BEL	
	4	0.2	BEL	0.60	0.07	
	4	0.2	BEL	0.27	0.04	
108 *Off*	4	0.2	BEL	BEL	BEL	
110 *Off*	4	0.2	BEL	0.80	0.03	
111 *Off*	4	0.2	BEL	0.56	0.13	
112 *Off*	4	0.2	BEL	0.66	0.22	
115 *Off*	12	0.4	BEL	BEL	BEL	
118 *Off*	12	0.4	BEL	1.61	0.11	
122 *Off*	12	0.4	BEL	1.52	BEL	
123 *Off*	3	0.2	BEL	BEL	BEL	
124 *Off*	3	0.2	BEL	BEL	BEL	
N	86	16	0	12	9	
Min		0.2	BEL	0.07	0.01	
Max		0.4	BEL	1.71	0.62	
Median		0.2	--	0.63	0.11	
Mean		0.24	--	0.81	0.19	
StdDev		0.08	--	0.61	0.21	
EL					0.25	
Reference						
			Effluent intake concentration			0.08

a. -- = no data; BEL = below environmental level; BRB = below reagent blank; EL = environmental (activity concentration) level; LDL = lower detection limit at 95% confidence level; ; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.

b. T indicates 2-m sampling height.

Table 4D-25. Mound air-monitoring data for 1997.[a]

	HTO incremental concentration (10^{-12} µCi/ml)					
Location[b]	**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	49	35	BEL	27.08	9.04	
212 *On*	53	31	BEL	80.13	11.80	
213 *On*	53	31	BEL	39.75	9.93	
214 *On*	53	31	BEL	35.32	7.19	
215 *On*	32	31	BEL	26.76	6.30	
215T *On*	--	--	--	--	--	
216 *On*	53	31	BEL	18.24	5.77	
217 *On*	49	31	BEL	18.92	1.97	
N	342	7	0	7	7	
Min		31	BEL	18.24	1.97	
Max		35	BEL	80.13	11.80	
Median		31	--	27.08	7.19	
Mean		31.6	--	35.17	7.43	
StdDev		1.5	--	21.33	3.21	
101 *Off*	51	22	BEL	40.64	3.08	
102 *Off*	52	22	BEL	51.14	6.51	
103 *Off*	52	22	BEL	59.79	4.93	
104 *Off*	52	22	BEL	26.96	2.93	
105 *Off*	49	22	BEL	43.57	3.44	
111 *Off*	51	22	BEL	37.57	2.04	
112 *Off*	52	22	BEL	24.08	1.03	
115 *Off*	49	22	BEL	22.99	0.13	
118 *Off*	52	22	BEL	39.67	1.92	
122 *Off*	51	22	BEL	30.73	4.03	
123 *Off*	51	22	BEL	41.64	6.11	
124 *Off*	50	22	BEL	41.56	8.58	
CLN *Off*	52	22	BEL	27.25	2.02	
CLS *Off*	50	22	BEL	31.15	3.65	
N	714	14	0	14	14	
Min		22	BEL	22.99	0.13	
Max		22	BEL	59.79	8.58	
Median		22	--	38.62	3.26	
Mean		22	--	37.05	3.60	
StdDev		0	--	10.59	2.30	
EL					5.74	
Reference	BWXT 1998					
	Effluent intake concentration					7.19

	^{238}Pu incremental concentration (10^{-18} µCi/ml)					
Location[b]	**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	12	0.5	2.17	33.50	9.31	
212 *On*	12	0.5	1.25	5.19	3.02	
213 *On*	12	0.5	2.89	141.76	33.35	
214 *On*	12	0.5	5.85	56.08	31.89	
215 *On*	9	0.5	22.54	81.56	44.66	
215T *On*	9	0.5	41.38	98.76	57.70	
216 *On*	12	0.5	1.58	9.87	3.54	
217 *On*	12	0.5	0.12	1.93	0.80	
N	90	8	8	8	8	
Min		0.5	0.12	1.93	0.80	
Max		0.5	41.38	141.76	57.70	
Median		0.5	2.53	44.79	20.60	
Mean		0.5	9.7225	53.58	23.03	
StdDev		0.0	14.7	50.61	21.77	
101 *Off*	4	0.2	0.26	0.60	0.44	
102 *Off*	4	0.2	1.00	6.69	3.26	
103 *Off*	4	0.2	0.76	2.26	1.38	
104 *Off*	12	0.5	0.09	2.27	0.75	
105 *Off*	4	0.2	0.27	0.83	0.45	
111 *Off*	4	0.2	BEL	0.18	0.50	
112 *Off*	4	0.2	0.22	0.51	0.37	
115 *Off*	4	0.2	BEL	0.84	0.15	
118 *Off*	4	0.2	0.12	0.44	0.27	
122 *Off*	12	0.5	BEL	19.58	4.33	
123 *Off*	12	0.5	6.37	318.17	65.59	
124 *Off*	12	0.5	1.02	9.33	3.98	
CLN *Off*	12	0.5	0.66	44.34	14.26	
CLS *Off*	12	0.5	1.65	28.30	11.92	
N	104	14	11	14	14	
Min		0.2	0.09	0.18	0.15	
Max		0.5	6.37	318.17	65.59	
Median		0.2	0.66	2.27	1.07	
Mean		0.33	1.13	31.02	7.69	
StdDev		0.15	1.80	83.69	17.25	
EL					0.06	
Reference						
	Effluent intake concentration					20.60

	^{239,240}Pu incremental concentration (10^{-18} µCi/ml)					
Location[b]	**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	12	0.3	BEL	0.20	BEL	
212 *On*	12	0.3	BEL	BEL	BEL	
213 *On*	12	0.3	BEL	0.85	BEL	
214 *On*	12	0.3	BEL	0.10	BEL	
215 *On*	9	0.3	BEL	0.33	BEL	
215T *On*	8	0.3	BEL	0.25	BEL	
216 *On*	12	0.3	BEL	BEL	BEL	
217 *On*	12	0.3	BEL	0.31	BEL	
N	89	8	0	6	0	
Min		0.3	BEL	0.10	BEL	
Max		0.3	BEL	0.85	BEL	
Median		0.3	--	0.28	--	
Mean		0.3	--	0.34	--	
StdDev		0.0	--	0.26	--	
101 *Off*	4	0.1	BEL	BEL	BEL	
102 *Off*	4	0.1	BEL	1.31	BEL	
103 *Off*	4	0.1	BEL	BEL	BEL	
104 *Off*	4	0.1	BEL	0.09	BEL	
105 *Off*	4	0.1	BEL	0.45	0.14	
111 *Off*	4	0.1	BEL	1.27	0.06	
112 *Off*	4	0.1	BEL	BEL	BEL	
115 *Off*	4	0.1	BEL	BEL	BEL	
118 *Off*	4	0.1	BEL	0.79	BEL	
122 *Off*	12	0.3	BEL	1.67	BEL	
123 *Off*	12	0.3	BEL	0.65	BEL	
124 *Off*	12	0.3	BEL	0.09	BEL	
CLN *Off*	12	0.3	BEL	0.58	BEL	
CLS *Off*	12	0.3	BEL	0.22	BEL	
N	96	14	0	10	2	
Min		0.1	BEL	0.09	0.06	
Max		0.3	BEL	1.67	0.14	
Median		0.1	--	0.62	0.10	
Mean		0.17	--	0.71	0.10	
StdDev		0.10	--	0.55	0.06	
EL					0.43	
Reference						
	Effluent intake concentration					0.00

Table 4D-25 (Continued).[a]

	^{228}Th incremental concentration (10^{-18} µCi/ml)						^{230}Th incremental concentration (10^{-18} µCi/ml)						^{232}Th incremental concentration (10^{-18} µCi/ml)					
Location[b]	**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**	
213 *On*	12	0.7	BEL	8.25	1.61		12	1.1	BEL	13.6	2.77		12	0.6	BEL	5.10	0.21	
215T *On*	9	0.7	1.12	11.57	4.38		9	1.1	BEL	17.5	6.17		9	0.6	BEL	10.04	4.07	
216 *On*	12	0.7	BEL	4.8	BEL		12	1.1	BEL	7.87	BEL		12	0.6	BEL	5.68	BEL	
N	33	3	1	3	2		33	3	0	3	2		33	3	0	3	2	
Min		0.7	1.12	4.80	1.61			1.1	BEL	7.87	2.77			0.6	BEL	5.10	0.21	
Max		0.7	1.12	11.57	4.38			1.1	BEL	17.5	6.17			0.6	BEL	10.04	4.07	
Median		0.7	--	8.25	3.00			1.1	--	13.6	4.47			0.6	--	5.68	2.14	
Mean		0.7	--	8.21	3.00			1.1	--	13	4.47			0.6	--	6.94	2.14	
StdDev		0.0	--	3.39	1.96			0.0	--	4.85	2.4			0.0	--	2.70	2.73	
124 *Off*	12	0.7	BEL	10.63	1.53		12	1.1	BEL	14.2	2.37		12	0.6	BEL	10.35	0.45	
N	12	1	0	1	1		12	0	0	1	1		12	1	0	1	1	
Min		0.7	BEL	10.63	1.53			BEL	BEL	14.2	2.37			0.6	BEL	10.35	0.45	
Max		0.7	BEL	10.63	1.53			BEL	BEL	14.2	2.37			0.6	BEL	10.35	0.45	
Median		--	--	--	--		--	--					--	--	--	--	--	
Mean		--	--	--	--		--	--					--	--	--	--	--	
StdDev		--	--	--	--		--	--					--	--	--	--	--	
EL					7.37						8.3					6.57	6.52	
	Effluent intake concentration					3.00	Effluent intake concentration					4.47	Effluent intake concentration					2.14

a. -- = no data; BEL = below environmental level; BRB = below reagent blank; EL = environmental (activity concentration) level; LDL = lower detection limit at 95% confidence level; ; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.

b. T indicates 2-m sampling height.

Table 4D-26. Mound air-monitoring data for 1998.[a]

	HTO incremental concentration (10^{-12} µCi/ml)						^{238}Pu incremental concentration (10^{-18} µCi/ml)						^{239,240}Pu incremental concentration (10^{-18} µCi/ml)					
Location[b]	**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	51	33	BEL	38.17	12.72		12	1.0	BEL	7.13	1.69		12	0.5	BEL	5.93	0.07	
212 *On*	51	30	BEL	64.83	13.44		12	1.0	BEL	1.66	BEL		12	0.5	BEL	BEL	BEL	
213 *On*	51	30	BEL	37.93	9.93		12	1.0	BEL	13.33	5.38		12	0.5	BEL	0.97	BEL	
214 *On*	51	30	BEL	31.19	10.19		12	1.0	BEL	24.22	7.60		12	0.5	BEL	0.14	BEL	
215 *On*	52	30	BEL	40.71	10.38		12	1.0	BEL	15.65	4.84		9	0.5	BEL	0.06	BEL	
215T *On*	--	--	--	--	--		12	1.0	BEL	20.83	5.69		8	0.5	BEL	0.76	BEL	
216 *On*	49	30	BEL	27.28	7.95		12	1.0	BEL	12.28	0.06		12	0.5	BEL	0.16	BEL	
217 *On*	50	30	BEL	30.34	6.69		12	1.0	BEL	BEL	BEL		12	0.5	BEL	0.04	BEL	
218 *On*	24	30	BEL	44.72	8.45		6	1.0	BEL	1.72	BEL		6	0.5	BEL	0.31	BEL	
N	379	8	0	8	8		102	9	0	8	6		95	9	0	8	1	
Min		30	BEL	27.28	6.69			1	BEL	1.66	0.06			0.5	BEL	0.04	0.07	
Max		33	BEL	64.83	13.44			1	BEL	24.22	7.60			0.5	BEL	5.93	0.07	
Median		30	--	38.05	10.06			1	--	12.81	5.11			0.5	--	0.24	--	
Mean		30.4	--	39.40	9.97			1	--	12.10	4.21			0.5	--	1.05	--	
StdDev		1.1	--	11.81	2.30			0.0	--	8.27	2.79			0.0	--	2.00	--	
101 *Off*	51	28	BEL	61.37	8.09		4	0.2	BEL	15.60	1.53		4	0.2	BEL	BEL	BEL	
102 *Off*	51	28	BEL	89.10	11.57		4	0.2	BEL	14.00	2.34		4	0.2	BEL	BEL	BEL	
103 *Off*	50	28	BEL	41.06	6.96		4	0.2	BEL	11.30	1.44		4	0.2	BEL	BEL	BEL	
104 *Off*	51	28	BEL	36.58	8.53		12	1.0	BEL	0.11	BEL		12	0.5	BEL	3.10	BEL	
105 *Off*	51	28	BEL	42.56	4.12		4	0.2	BEL	13.68	1.60		4	0.2	BEL	BEL	BEL	
111 *Off*	51	28	BEL	31.25	2.08		4	0.2	BEL	19.27	2.76		4	0.2	BEL	BEL	BEL	
112 *Off*	51	28	BEL	25.85	5.32		4	0.2	BEL	14.98	1.87		4	0.2	BEL	BEL	BEL	
115 *Off*	49	28	BEL	28.88	4.65		4	0.2	BEL	9.22	0.20		4	0.2	BEL	BEL	BEL	
118 *Off*	51	28	BEL	37.41	5.91		4	0.2	BEL	13.64	1.18		4	0.2	BEL	BEL	BEL	
122 *Off*	19	28	BEL	20.64	3.23		5	1.0	BEL	24.35	5.73		5	0.5	BEL	BEL	BEL	
123 *Off*	9	28	BEL	10.00	3.87		3	0.2	2.96	21.93	9.36		3	0.5	BEL	BEL	BEL	
124 *Off*	51	28	BEL	47.12	11.36		12	1.0	BEL	2.10	BEL		12	0.5	BEL	0.01	BEL	
CLN *Off*	39	28	BEL	57.13	5.60		11	1.0	BEL	16.15	2.30		11	0.5	BEL	BEL	BEL	
CLS *Off*	21	28	BEL	35.09	7.64		5	1.0	1.21	40.62	11.15		5	0.5	BEL	0.58	BEL	
N	595	14	0	14	14		80	14	2	14	12		80	14	0	3	0	
Min		28	BEL	10.00	2.08			0.2	1.21	0.11	0.20			0.2	BEL	0.01	BEL	
Max		28	BEL	89.10	11.57			1.0	2.96	40.62	11.15			0.5	BEL	3.10	BEL	
Median		28	--	37.00	5.76			0.2	2.09	14.49	2.09			0.2	--	0.58	--	
Mean		28	--	40.29	6.35			0.49	2.09	15.50	3.46			0.329	--	1.23	--	
StdDev		0	--	19.49	2.85			0.40	1.24	9.80	3.46			0.154	--	1.64	--	
EL				BEL	3.68					BEL	3.33					BEL	0.62	
Reference	BWXT 1999																	
	Effluent intake concentration					10.06	Effluent intake concentration					5.11	Effluent intake concentration					0.07

Table 4D-26 (Continued).[a]

	^{228}Th incremental concentration (10^{-18} µCi/ml)						^{230}Th incremental concentration (10^{-18} µCi/ml)						^{232}Th incremental concentration (10^{-18} µCi/ml)					
Location[b]	**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**	
213 *On*	12	0.6	BEL	3.20	BEL		12	0.9	BEL	3.29	BEL		12	0.6	BEL	6.50	0.40	
215T *On*	12	0.6	BEL	3.22	BEL		12	0.9	BEL	4.01	BEL		12	0.6	BEL	4.75	0.14	
216 *On*	12	0.6	BEL	1.22	BEL		12	0.9	BEL	6.43	BEL		12	0.6	BEL	2.65	0.18	
218 *On*	6	0.6	BEL	1.33	BEL		6	0.9	BEL	1.71	BEL		6	0.6	BEL	3.53	BEL	
N	42	4	0	4	0		42	4	0	4	0		42	4	0	4	3	
Min		0.6	BEL	1.22	BEL			0.9	BEL	1.71	BEL			0.6	BEL	2.65	0.14	
Max		0.6	BEL	3.22	BEL			0.9	BEL	6.43	BEL			0.6	BEL	6.50	0.40	
Median		0.6	--	2.27	--			0.9	--	3.65	--			0.6	--	4.14	0.18	
Mean		0.6	--	2.24	--			0.9	--	3.86	--			0.6	--	4.36	0.24	
StdDev		0.0	--	1.12	--			0.0	--	1.96	--			0.0	--	1.67	0.14	
124 *Off*	12	0.6	BEL	5.57	BEL		12	0.9	BEL	9.29	BEL		12	0.6	BEL	4.06	0.44	
N	12	1	0	1	0		12	1	0	1	0		12	1	0	1	1	
Min		0.6	BEL	5.57	BEL			0.9	BEL	9.29	BEL			0.6	BEL	4.06	0.44	
Max		0.6	BEL	5.57	BEL			0.9	BEL	9.29	BEL			0.6	BEL	4.06	0.44	
Median		--	--	--	--			--	--	--	--			--	--	--	--	
Mean		--	--	--	--			--	--	--	--			--	--	--	--	
StdDev		--	--	--	--			--	--	--	--			--	--	--	--	
EL					7.64						8.11						5.58	
	Effluent intake concentration					0.00	Effluent intake concentration					0.00	Effluent intake concentration					0.18

a. -- = no data; BEL = below environmental level; BRB = below reagent blank; EL = environmental (activity concentration) level; LDL = lower detection limit at 95% confidence level; ; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.

b. T indicates 2-m sampling height.

Table 4D-27. Mound air-monitoring data for 1999.[a]

	HTO incremental concentration (10^{-12} µCi/ml)						^{238}Pu incremental concentration (10^{-18} µCi/ml)						^{239,240}Pu incremental concentration (10^{-18} µCi/ml)					
Location[b]	**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	51	35	BEL	38.75	10.67		12	0.7	BEL	0.30	BEL		12	0.6	BEL	3.09	0.13	
212 *On*	36	31	BEL	98.41	19.86		8	0.7	BEL	BEL	BEL		8	0.6	BEL	0.32	BEL	
213 *On*	50	31	BEL	56.60	9.91		12	0.7	BEL	9.49	1.30		12	0.6	BEL	1.52	0.24	
214 *On*	51	31	BEL	34.47	8.12		12	0.7	BEL	5.53	BEL		12	0.6	BEL	0.78	BEL	
215 *On*	48	31	BEL	33.21	8.80		12	0.7	BEL	0.79	BEL		12	0.6	BEL	0.93	BEL	
215T *On*	--	--	--	--	--		12	0.7	BEL	2.66	BEL		12	0.6	BEL	1.17	BEL	
216 *On*	49	31	BEL	29.82	7.01		12	0.7	BEL	12.08	BEL		12	0.6	BEL	0.68	0.08	
217 *On*	51	31	BEL	61.29	5.95		10	0.7	BEL	BEL	BEL		10	0.6	BEL	0.92	BEL	
218 *On*	51	31	BEL	41.63	5.12		12	0.7	BEL	37.92	1.56		12	0.6	BEL	1.16	0.16	
N	387	8	0	8	8		102	9	0	7	2		102	9	0	9	4	
Min		31	BEL	29.82	5.12			0.7	BEL	0.30	1.30			0.6	BEL	0.32	0.08	
Max		35	BEL	98.41	19.86			0.7	BEL	37.92	1.56			0.6	BEL	3.09	0.24	
Median		31	--	40.19	8.45			0.7	--	5.53	1.43			0.6	--	0.93	0.15	
Mean		31.5	--	49.27	9.43			0.7	--	9.82	1.43			0.6	--	1.17	0.15	
StdDev		1.4	--	22.79	4.62			0.0	--	13.14	0.18			0.0	--	0.79	0.07	
101 *Off*	50	47	BEL	26.12	4.10		4	0.1	BEL	2.41	BEL		4	0.1	BEL	0.02	BEL	
102 *Off*	48	47	BEL	44.26	7.46		4	0.1	BEL	10.52	2.83		4	0.1	BEL	0.32	BEL	
103 *Off*	49	47	BEL	72.32	3.98		4	0.1	BEL	8.34	0.02		4	0.1	BEL	BEL	BEL	
104 *Off*	50	47	BEL	35.52	3.21		12	0.7	BEL	BEL	BEL		12	0.6	BEL	0.80	0.01	
105 *Off*	50	47	BEL	27.73	2.61		4	0.1	BEL	10.34	BEL		4	0.1	BEL	BEL	BEL	
111 *Off*	47	47	BEL	21.86	0.42		4	0.1	BEL	10.34	BEL		4	0.1	BEL	BEL	BEL	
112 *Off*	48	47	BEL	25.74	3.45		3	0.1	BEL	3.47	BEL		3	0.1	BEL	BEL	BEL	
115 *Off*	49	47	BEL	20.43	BEL		4	0.1	BEL	12.91	0.37		4	0.1	BEL	BEL	BEL	
118 *Off*	44	47	BEL	28.55	1.07		4	0.1	BEL	9.11	BEL		4	0.1	BEL	0.91	0.01	
124 *Off*	49	47	BEL	51.50	7.73		12	0.7	BEL	BEL	BEL		12	0.6	BEL	0.91	BEL	
CLN *Off*	50	47	BEL	22.78	3.05		11	0.7	BEL	BEL	BEL		12	0.6	BEL	1.54	BEL	
N	534	11	0	11	10		66	11	0	8	3		67	11	0	6	2	
Min		47	BEL	20.43	0.42			0.1	BEL	2.41	0.02			0.1	BEL	0.02	0.01	
Max		47	BEL	72.32	7.73			0.7	BEL	12.91	2.83			0.6	BEL	1.54	0.01	
Median		47	--	27.73	3.33			0.1	--	9.73	0.37			0.1	--	0.86	0.01	
Mean		47	--	34.26	3.71			0.26	--	8.43	1.07			0.2	--	0.75	0.01	
StdDev		0	--	15.93	2.36			0.28	--	3.65	1.53			0.2	--	0.53	0.00	
EL					4.02						6.6						0.64	
Reference	BWXT 2000																	
					Effluent intake concentration	8.45					Effluent intake concentration	1.43					Effluent intake concentration	0.15

Table 4D-27 (Continued).[a]

	^{228}Th incremental concentration (10^{-18} µCi/ml)					
Location[b]	**Samples**	**LDL**	**Min**	**Max**	**Mean**	
213 *On*	12	0.6	BEL	14.78	5.55	
215T *On*	12	0.6	BEL	10.64	4.02	
216 *On*	12	0.6	BEL	18.52	5.18	
218 *On*	12	0.6	BEL	19.56	3.02	
N	48	4	0	4	4	
Min		0.6	BEL	10.64	3.02	
Max		0.6	BEL	19.56	5.55	
Median		0.6	--	16.65	4.60	
Mean		0.6	--	15.88	4.44	
StdDev		0.0	--	4.05	1.15	
124 *Off*	12	0.6	BEL	13.72	3.22	
N	12	1	0	1	1	
Min		0.6	BEL	13.72	3.22	
Max		0.6	BEL	13.72	3.22	
Median		--	--	--	--	
Mean		--	--	--	--	
StdDev		--	--	--	--	
EL					5.46	
	Effluent intake concentration					4.60

	^{230}Th incremental concentration (10^{-18} µCi/ml)					
Location[b]	**Samples**	**LDL**	**Min**	**Max**	**Mean**	
213 *On*	12	1.1	BEL	21.88	5.79	
215T *On*	12	1.1	BEL	13.37	3.82	
216 *On*	12	1.1	BEL	23.17	5.00	
218 *On*	12	1.1	BEL	17.7	1.98	
N	48	4	0	4	4	
Min		1.1	BEL	13.37	1.98	
Max		1.1	BEL	23.17	5.79	
Median		1.1	--	19.79	4.41	
Mean		1.1	--	19.03	4.15	
StdDev		0.0	--	4.44	1.66	
124 *Off*	12	1.3	BEL	13.72	3.22	
N	12	1	0	1	1	
Min		1.3	BEL	13.72	3.22	
Max		1.3	BEL	13.72	3.22	
Median		--	--	--	--	
Mean		--	--	--	--	
StdDev		--	--	--	--	
EL					6.44	
	Effluent intake concentration					4.41

	^{232}Th incremental concentration (10^{-18} µCi/ml)					
Location[b]	**Samples**	**LDL**	**Min**	**Max**	**Mean**	
213 *On*	12	0.5	BEL	13.25	4.62	
215T *On*	12	0.5	BEL	28.99	4.96	
216 *On*	12	0.5	BEL	17.40	4.22	
218 *On*	12	0.5	BEL	20.77	2.0	
N	48	4	0	4	4	
Min		0.5	BEL	13.25	2.00	
Max		0.5	BEL	28.99	4.96	
Median		0.5	--	19.09	4.42	
Mean		0.5	--	20.10	3.95	
StdDev		0.0	--	6.68	1.33	
124 *Off*	12	0.5	BEL	20.77	2.0	
N	12	1	0	1	1	
Min		0.5	BEL	20.77	2.00	
Max		0.5	BEL	20.77	2.00	
Median		--	--	--	--	
Mean		--	--	--	--	
StdDev		--	--	--	--	
EL					4.78	
	Effluent intake concentration					4.42

a. -- = no data; BEL = below environmental level; BRB = below reagent blank; EL = environmental (activity concentration) level; LDL = lower detection limit at 95% confidence level; ; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.

b. T indicates 2-m sampling height.

Table 4D-28. Mound air-monitoring data for 2000.[a]

	HTO incremental concentration (10^{-12} µCi/ml)						^{238}Pu incremental concentration (10^{-18} µCi/ml)						^{239,240}Pu incremental concentration (10^{-18} µCi/ml)					
Location[b]	**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	48	26	BEL	43.02	2.95		12	0.5	0.47	108.03	11.09		12	0.4	BEL	0.66	BEL	
212 *On*	41	23	BEL	20.26	4.42		11	0.5	0.43	4.22	1.42		11	0.4	BEL	3.05	0.17	
213 *On*	49	23	BEL	27.22	3.51		12	0.5	3.98	15.54	7.99		12	0.4	BEL	0.38	BEL	
214 *On*	48	23	BEL	28.67	2.00		12	0.5	0.14	7.18	1.74		12	0.4	BEL	0.27	BEL	
215 *On*	50	23	BEL	19.97	2.49		11	0.5	0.27	8.87	3.00		11	0.4	BEL	BEL	BEL	
215T *On*	--	--	--	--	--		12	0.5	0.17	16.51	4.08		12	0.4	BEL	0.87	BEL	
216 *On*	49	23	BEL	40.15	2.06		12	0.5	1.03	11.61	4.11		12	0.4	BEL	0.75	BEL	
217 *On*	50	23	BEL	23.53	0.96		12	0.5	BEL	1.02	0.33		12	0.4	BEL	1.32	BEL	
218 *On*	51	23	BEL	33.26	0.93		12	0.5	0.24	42.22	5.81		12	0.4	BEL	0.96	BEL	
N	386	8	0	8	8		106	9	8	9	9		106	9	0	8	1	
Min		23	BEL	19.97	0.93			0.5	0.14	1.02	0.33			0.4	BEL	0.27	0.17	
Max		26	BEL	43.02	4.42			0.5	3.98	108.03	11.09			0.4	BEL	3.05	0.17	
Median		23	--	27.95	2.28			0.5	0.35	11.61	4.08			0.4	--	0.81	--	
Mean		23.4	--	29.51	2.42			0.5	0.84	23.91	4.40			0.4	--	1.03	--	
StdDev		1.1	--	8.69	1.20			0.0	1.3	33.74	3.43			0.0	--	0.88	--	
101 *Off*	49	28	BEL	13.02	BEL		4	0.2	BEL	4.70	2.23		4	0.1	BEL	0.06	BEL	
102 *Off*	49	28	BEL	23.84	2.34		4	0.2	0.31	1.13	0.73		4	0.1	BEL	BEL	BEL	
103 *Off*	51	28	BEL	41.49	1.26		4	0.2	0.41	0.94	0.62		4	0.1	BEL	BEL	BEL	
104 *Off*	51	28	BEL	28.63	0.02		12	0.5	BEL	1.62	0.31		12	0.4	BEL	1.35	BEL	
105 *Off*	51	28	BEL	24.85	BEL		4	0.2	BEL	0.25	0.07		4	0.1	BEL	0.61	BEL	
111 *Off*	49	28	BEL	14.07	BEL		4	0.2	BEL	0.68	0.15		4	0.1	BEL	0.35	BEL	
112 *Off*	51	28	BEL	10.53	BEL		4	0.2	BEL	0.07	BEL		4	0.1	BEL	0.34	BEL	
115 *Off*	51	28	BEL	7.51	BEL		4	0.2	BEL	0.05	BEL		4	0.1	BEL	BEL	BEL	
118 *Off*	51	28	BEL	13.68	BEL		4	0.2	0.04	0.53	0.26		4	0.1	BEL	BEL	BEL	
124 *Off*	51	28	BEL	26.57	3.41		12	0.5	0.72	2.90	1.55		12	0.4	BEL	0.45	BEL	
CLN *Off*	51	28	BEL	24.68	BEL		12	0.5	BEL	1.55	0.56		12	0.4	BEL	0.34	BEL	
N	555	11	0	11	4		68	11	4	11	9		68	11	0	7	0	
Min		28	BEL	7.51	0.02			0.2	0.04	0.05	0.07			0.1	BEL	0.06	BEL	
Max		28	BEL	41.49	3.41			0.5	0.72	4.70	2.23			0.4	BEL	1.35	BEL	
Median		28	--	23.84	1.80			0.2	0.36	0.94	0.56			0.1	--	0.35	--	
Mean		28	--	20.81	1.76			0.28	0.37	1.31	0.72			0.2	--	0.50	--	
StdDev		0	--	10.01	1.45			0.14	0.28	1.40	0.72			0.1	--	0.41	--	
EL					5.71						0.09						0.76	
Reference	BWXT 2001																	
	Effluent intake concentration					2.28	Effluent intake concentration					4.08	Effluent intake concentration					0.17

Table 4D-28 (Continued).[a]

	^{228}Th incremental concentration (10^{-18} µCi/ml)						^{230}Th incremental concentration (10^{-18} µCi/ml)						^{232}Th incremental concentration (10^{-18} µCi/ml)					
Location[b]	**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**	
213 *On*	12	1.0	BEL	22.54	7.43		12	1.3	BEL	24.83	9.02		12	0.5	BEL	22.11	6.60	
215T *On*	12	1.0	0.03	9.58	2.84		12	1.3	BEL	12.02	2.72		12	0.5	BEL	7.62	1.72	
216 *On*	12	1.0	BEL	8.82	4.57		12	1.3	BEL	13.59	5.51		12	0.5	BEL	11.04	4.10	
218 *On*	12	1.0	BEL	5.77	2.27		12	1.3	BEL	3.89	1.21		12	0.5	BEL	4.05	1.04	
N	48	4	1	4	4		48	4	0	4	4		48	4	0	4	4	
Min		1.0	0.03	5.77	2.27			1.3	BEL	3.89	1.21			0.5	BEL	4.05	1.04	
Max		1.0	0.03	22.54	7.43			1.3	BEL	24.83	9.02			0.5	BEL	22.11	6.60	
Median		1.0	--	9.20	3.71			1.3	--	12.81	4.12			0.5	--	9.33	2.91	
Mean		1.0	--	11.68	4.28			1.3	--	13.58	4.62			0.5	--	11.21	3.37	
StdDev		0.0	--	7.43	2.32			0.0	--	8.62	3.43			0.0	--	7.81	2.52	
124 *Off*	12	1.0	BEL	11.96	2.62		12	1.3	BEL	10.33	2.74		12	0.5	BEL	7.97	1.96	
N	12	1	0	1	1		12	1	0	1	1		12	1	0	1	1	
Min		1	BEL	11.96	2.62			1.3	BEL	10.33	2.74			0.5	BEL	7.97	1.96	
Max		1	BEL	11.96	2.62			1.3	BEL	10.33	2.74			0.5	BEL	7.97	1.96	
Median		--	--	--	--			--	--	--	--			--	--	--	--	
Mean		--	--	--	--			--	--	--	--			--	--	--	--	
StdDev		--	--	--	--			--	--	--	--			--	--	--	--	
EL					5.18						5.42						4.06	
	Effluent intake concentration					3.71	Effluent intake concentration					4.12	Effluent intake concentration					2.91

a. -- = no data; BEL = below environmental level; BRB = below reagent blank; EL = environmental (activity concentration) level; LDL = lower detection limit at 95% confidence level; ; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.

b. T indicates 2-m sampling height.

Table 4D-29. Mound air-monitoring data for 2001.[a]

	HTO incremental concentration (10^{-12} µCi/ml)						^{238}Pu incremental concentration (10^{-18} µCi/ml)						^{239,240}Pu incremental concentration (10^{-18} µCi/ml)					
Location[b]	**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	48	26	BEL	26.01	5.06		12	0.6	1.46	20.16	5.51		12	0.7	BEL	0.69	0.01	
213 *On*	50	23	BEL	44.09	7.61		12	0.6	1.26	121.73	15.19		12	0.7	BEL	1.62	BEL	
214 *On*	51	23	BEL	24.72	4.60		12	0.6	0.72	5.69	2.90		12	0.7	BEL	0.70	BEL	
215 *On*	51	23	BEL	30.61	2.82		11	0.6	BRB	4.50	1.61		11	0.7	BEL	1.85	0.2	
215T *On*	--	--	--	--	--		12	0.6	0.24	5.74	1.62		12	0.7	BEL	1.64	BEL	
216 *On*	49	23	BEL	52.39	5.24		12	0.6	0.39	22.27	5.58		12	0.7	BEL	0.51	0.03	
218 *On*	49	23	BEL	48.81	2.98		12	0.6	0.96	7.01	4.01		12	0.7	BEL	1.09	BEL	
N	298	6	0	6	6		83	7	6	7	7		83	7	0	7	3	
Min		23	BEL	24.72	2.82			0.6	0.24	4.50	1.61			0.7	BEL	0.51	0.01	
Max		26	BEL	52.39	7.61			0.6	1.46	121.73	15.19			0.7	BEL	1.85	0.2	
Median		23	--	37.35	**4.83**			0.6	0.84	7.01	4.01			0.7	--	1.09	0.03	
Mean		23.5	--	37.77	4.72			0.6	0.84	26.73	5.20			0.7	--	1.16	0.08	
StdDev		1.2	--	12.13	1.75			0.0	0.48	42.53	4.70			0.0	--	0.5	0.1	
101 *Off*	51	15	BEL	37.24	3.99		4	0.1	BRB	0.20	0.09		4	0.1	BEL	0.49	BEL	
102 *Off*	49	15	BEL	64.72	6.09		4	0.1	0.25	0.40	0.32		4	0.1	BEL	0.15	BEL	
103 *Off*	51	15	BEL	63.13	4.76		4	0.1	0.46	5.55	1.91		4	0.1	BEL	0.17	BEL	
104 *Off*	51	15	BEL	19.57	1.33		12	0.6	BRB	1.44	0.25		12	0.7	BEL	0.61	BEL	
105 *Off*	50	15	BEL	20.50	0.28		4	0.1	0.02	0.12	0.06		4	0.1	BEL	1.40	0.17	
111 *Off*	34	15	BEL	5.56	BEL		4	0.1	BRB	0.29	0.09		4	0.1	BEL	1.17	0.11	
112 *Off*	51	15	BEL	27.65	0.83		4	0.1	BRB	0.08	BRB		4	0.1	BEL	1.56	0.38	
115 *Off*	51	15	BEL	12.72	BEL		4	0.1	BRB	0.04	0.01		4	0.1	BEL	1.17	0.26	
118 *Off*	50	15	BEL	34.08	0.17		4	0.1	BRB	0.30	0.14		4	0.1	BEL	0.53	0.05	
124 *Off*	48	15	BEL	76.74	7.28		12	0.6	0.22	2.45	1.32		12	0.7	BEL	0.49	0.003	
CLN *Off*	49	15	BEL	30.32	3.91		11	0.6	0.10	2.11	0.91		11	0.7	BEL	0.90	0.11	
212 *Off*	51	23	BEL	75.94	9.79		12	0.6	0.61	4.57	1.56		12	0.7	BEL	0.56	BEL	
217 *Off*	42	23	BEL	19.28	1.88		11	0.6	0.01	1.55	0.40		11	0.7	BEL	1.09	0.04	
N	628	13	0	13	11		90	13	7	13	12		90	13	0	13	8	
Min		15	BEL	5.56	0.17			0.1	0.01	0.04	0.01			0.1	BEL	0.15	0.00	
Max		23	BEL	76.74	9.79			0.6	0.61	5.55	1.91			0.7	BEL	1.56	0.38	
Median		15	--	30.32	3.91			0.1	0.22	0.40	0.29			0.1	--	0.61	0.11	
Mean		16.2	--	37.50	3.66			0.29	0.24	1.47	0.59			0.33	--	0.79	0.14	
StdDev		3.0	--	25.19	3.38			0.25	0.25	1.89	0.71			0.30	--	0.44	0.13	
EL					2.5						BRB						0.4	
Reference	BWXT 2002																	
	Effluent intake concentration					4.83	Effluent intake concentration					4.01	Effluent intake concentration					0.03

Table 4D-29 (Continued).[a]

	^{228}Th incremental concentration (10^{-18} µCi/ml)					
Location[b]	**Samples**	**LDL**	**Min**	**Max**	**Mean**	
213 *On*	12	0.8	BEL	20.97	4.01	
215T *On*	12	0.8	BEL	13.56	3.29	
216 *On*	12	0.8	BEL	12.48	4.30	
218 *On*	12	0.8	BEL	12.05	3.56	
N	48	4	0	4	4	
Min		0.8	BEL	12.05	3.29	
Max		0.8	BEL	20.97	4.30	
Median		0.8	--	13.02	3.79	
Mean		0.8	--	14.77	3.79	
StdDev		0.0	--	4.19	0.45	
124 *Off*	12	0.8	BEL	12.35	1.67	
N	12	1	0	1	1	
Min		0.8	BEL	12.35	1.67	
Max		0.8	BEL	12.35	1.67	
Median		--	--	--	--	
Mean		--	--	--	--	
StdDev		--	--	--	--	
EL					5.2	
	Effluent intake concentration					3.79

	^{230}Th incremental concentration (10^{-18} µCi/ml)					
Location[b]	**Samples**	**LDL**	**Min**	**Max**	**Mean**	
213 *On*	12	1.5	BEL	20.99	3.91	
215T *On*	12	1.5	BEL	9.69	2.80	
216 *On*	12	1.5	BEL	9.74	3.28	
218 *On*	12	1.5	BEL	14.52	2.17	
N	48	4	0	4	4	
Min		1.5	BEL	9.69	2.17	
Max		1.5	BEL	20.99	3.91	
Median		1.5	--	12.13	3.04	
Mean		1.5	--	13.74	3.04	
StdDev		0.0	--	5.34	0.74	
124 *Off*	12	1.5	BEL	11.77	0.95	
N	12	1	0	1	1	
Min		1.5	BEL	11.77	0.95	
Max		1.5	BEL	11.77	0.95	
Median		--	--	--	--	
Mean		--	--	--	--	
StdDev		--	--	--	--	
EL					6.39	
	Effluent intake concentration					3.04

	^{232}Th incremental concentration (10^{-18} µCi/ml)					
Location[b]	**Samples**	**LDL**	**Min**	**Max**	**Mean**	
213 *On*	12	0.4	BEL	14.31	2.82	
215T *On*	12	0.4	BEL	7.00	2.13	
216 *On*	12	0.4	BEL	8.15	2.37	
218 *On*	12	0.4	BEL	11.01	1.67	
N	48	4	0	4	4	
Min		0.4	BEL	7.00	1.67	
Max		0.4	BEL	14.31	2.82	
Median		0.4	--	9.58	2.25	
Mean		0.4	--	10.12	2.25	
StdDev		0.0	--	3.26	0.48	
124 *Off*	12	0.4	BEL	9.97	0.94	
N	12	1	0	1	1	
Min		0.4	BEL	9.97	0.94	
Max		0.4	BEL	9.97	0.94	
Median		--	--	--	--	
Mean		--	--	--	--	
StdDev		--	--	--	--	
EL					4.56	
	Effluent intake concentration					2.25

a. -- = no data; BEL = below environmental level; BRB = below reagent blank; EL = environmental (activity concentration) level; LDL = lower detection limit at 95% confidence level; ; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.

b. T indicates 2-m sampling height.

Table 4D-30. Mound air-monitoring data for 2002.[a]

	HTO incremental concentration (10^{-12} µCi/ml)						^{238}Pu incremental concentration (10^{-18} µCi/ml)						^{239,240}Pu incremental concentration (10^{-18} µCi/ml)					
Location[b]	**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	31	31	BEL	24.12	4.10		12	0.6	0.98	9.05	3.06		12	0.6	BEL	0.75	0.11	
213 *On*	50	28	BEL	26.94	4.83		12	0.6	1.41	13.85	4.92		12	0.6	BEL	1.58	0.30	
214 *On*	29	48	BEL	60.18	2.89		12	0.6	0.48	61.48	9.37		12	0.6	BEL	1.69	0.27	
215 *On*	50	48	BEL	134.45	11.31		12	0.6	0.21	11.37	2.11		12	0.6	BEL	1.36	0.19	
215T *On*	--	--	--	--	--		12	0.6	0.24	8.38	2.18		12	0.6	BEL	1.11	0.19	
216 *On*	49	48	BEL	38.04	2.09		12	0.6	0.79	11.88	3.76		12	0.6	BEL	1.71	0.33	
218 *On*	51	28	BEL	32.31	1.60		12	0.6	0.07	26.31	5.08		12	0.6	BEL	0.73	0.19	
N	260	6		6	6		84	7	7	7	7		84	7		7	7	
Min		28	BEL	24.12	1.60				0.07	8.38	2.11				BEL	0.73	0.11	
Max		48	BEL	134.45	11.31				1.41	26.31	9.37				BEL	1.69	0.33	
Median					**3.50**						3.76						0.19	
Mean					4.72						4.28						0.23	
101 *Off*	50	48	BEL	64.75	3.96		4	0.2	BRB	0.20	0.07		4	0.1	BEL	BEL	BEL	
102 *Off*	50	48	BEL	52.54	6.14		4	0.2	0.29	1.76	0.77		4	0.1	BEL	0.35	BEL	
103 *Off*	50	48	BEL	104.05	3.42		4	0.2	0.29	0.53	0.41		4	0.1	BEL	0.15	BEL	
104 *Off*	49	48	BEL	42.04	0.11		12	0.6	BRB	1.73	0.33		12	0.7	BEL	0.68	0.18	
105 *Off*	50	48	BEL	26.67	BEL		4	0.2	BRB	0.15	0.04		4	0.1	BEL	BEL	BEL	
111 *Off*	50	48	BEL	21.38	BEL		4	0.2	BRB	0.09	0.01		4	0.1	BEL	BEL	BEL	
112 *Off*	48	48	BEL	16.78	BEL		4	0.2	BRB	0.05	BRB		4	0.1	BEL	BEL	BEL	
115 *Off*	49	48	BEL	15.93	BEL		4	0.2	BRB	0.08	BRB		4	0.1	BEL	BEL	BEL	
118 *Off*	50	48	BEL	44.59	0.54		4	0.2	0.05	0.38	0.17		4	0.1	BEL	0.14	0.05	
124 *Off*	49	48	BEL	79.09	6.69		12	0.6	BRB	2.68	1.10		12	0.6	BEL	0.25	BEL	
CLN *Off*	50	48	BEL	46.55	2.23		12	0.6	0.08	2.02	0.63		12	0.6	BEL	0.84	0.13	
212 *Off*	29	48	BEL	226.74	13.14		12	0.6	0.23	4.29	1.57		12	0.6	BEL	1.03	0.20	
217 *Off*	29	48	BEL	29.94	0.13		12	0.6	BRB	1.68	0.27		12	0.6	BEL	0.83	0.19	
N	603	13	13	13	13		92	13	13	13	13		90	13	13	13	13	
Min		15	BEL	15.93	BEL			0.2	0.05	0.05	BRB			0.1	BEL	0.15	BEL	
Max		23	BEL	226.74	13.14			0.6	0.29	4.29	1.57			0.6	BEL	0.14	0.20	
Median																		
Mean																		
EL					7.38						BRB						0.27	
Reference	BWXT 2002																	
	Effluent intake concentration					3.50	Effluent intake concentration					3.76	Effluent intake concentration					0.19

Table 4D-30 (Continued).[a]

	^{228}Th incremental concentration (10^{-18} µCi/ml)					
Location[b]	**Samples**	**LDL**	**Min**	**Max**	**Mean**	
213 *On*	12	0.7	BEL	6.43	BEL	
215T *On*	12	0.7	BEL	2.91	BEL	
216 *On*	12	0.7	BEL	9.39	BEL	
218 *On*	12	0.7	BEL	27.42	0.55	
N	48	4	4	4	4	
Min			BEL	2.92	BEL	
Max			BEL	27.42	0.55	
Median					0	
Mean					0.14	
124 *Off*	12		BEL	1.99	BEL	
N	12		1	1	1	
Min		0.7	BEL	1.99	1.67	
Max		0.7	BEL	1.99	1.67	
Median						
Mean						
StdDev						
EL					10.01	
	Effluent intake concentration					0.00

	^{230}Th incremental concentration (10^{-18} µCi/ml)					
Location[b]	**Samples**	**LDL**	**Min**	**Max**	**Mean**	
213 *On*	12	1.3	BEL	0.52	BEL	
215T *On*	12	1.3	BEL	2.74	BEL	
216 *On*	12	1.3	BEL	3.67	BEL	
218 *On*	12	1.3	BEL	18.50	BEL	
N	48	4	4	4	4	
Min			BEL	0.52	BEL	
Max			BEL	18.50	BEL	
Median					0.00	
Mean					0.00	
124 *Off*			BEL	BEL	BEL	
N	12	1	1	1	1	
Min			BEL	BEL	BEL	
Max			BEL	BEL	BEL	
Median		--	--	--	--	
Mean		--	--	--	--	
StdDev		--	--	--	--	
EL					14.17	
	Effluent intake concentration					0.00

	^{232}Th incremental concentration (10^{-18} µCi/ml)					
Location[b]	**Samples**	**LDL**	**Min**	**Max**	**Mean**	
213 *On*	12	0.5	BEL	5.46	BEL	
215T *On*	12	0.5	BEL	3.22	BEL	
216 *On*	12	0.5	BEL	6.72	BEL	
218 *On*	12	0.5	BEL	23.34	0.30	
N	48	4	4	4	4	
Min				3.22	BEL	
Max				23.34	0.30	
Median					0	
Mean					0.075	
124 *Off*	12	0.4	BEL	2.05	BEL	
N	12	1	0	1	1	
Min		0.4	BEL	2.05	BEL	
Max		0.4	BEL	2.05	BEL	
Median		--	--	--	--	
Mean		--	--	--	--	
StdDev		--	--	--	--	
EL					4.56	
	Effluent intake concentration					0.00

c. -- = no data; BEL = below environmental level; BRB = below reagent blank; EL = environmental (activity concentration) level; LDL = lower detection limit at 95% confidence level; ; Min = minimum; Max = maximum; N = number of samples; StdDev = standard deviation.

d. T indicates 2-m sampling height.