ORAU TEAM
Dose Reconstruction
Project for NIOSH

Oak Ridge Associated Universities I Dade Moeller I MJW Technical Services

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Subject Expert(s): Donald N. Stewart and Robert M. Leib

Approval:	Signature on File Donald N. Stewart, Document Owner	Approval Date:	01/31/2013
Concurrence:	Signature on File John M. Byrne, Objective 1 Manager	Concurrence Date:	01/28/2013
Concurrence:	Susan Winslow Signature on File for Edward F. Maher, Objective 3 Manager	Concurrence Date:	01/30/2013
Concurrence:	Vickie S. Short Signature on File for Kate Kimpan, Project Director	Concurrence Date:	01/28/2013
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PUBLICATION RECORD

EFFECTIVE DATE	REVISION NUMBER	DESCRIPTION
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03/13/2009	00 PC-1	Approved page change initiated to remove information pertaining to Monsanto Chemical Company, the subject of a class of employees added to the Special Exposure Cohort. The changes necessitated the reordering and renumbering of tables on the following pages: 9, 10, 12 - 34 in Sections 4.2 and 4.3. NIOSH required language was revised on pages 7 and 8 in Section 4.1. Updated NIOSH reference on page 48. No sections were deleted. Incorporates formal internal and NIOSH review comments. Training required: As determined by the Task Manager. Initiated by Donald N. Stewart. Signature on File 03/04/2009 Donald N. Stewart, Document Owner Signature on File 03/04/2009 John M. Byrne, Task 3 Manager Signature on File 03/04/2009 Edward F. Maher, Task 5 Manager Signature on File 03/11/2009 Kate Kimpan, Project Director Signature on File 03/13/2009 James W. Neton, Associate Director for Science
02/07/2013	01	Revision initiated to add Special Exposure Cohort Section 4.1.3. Revised Table 4-1 to include end of operation and end of remediation. Revised Section 4.3 to provide direction for assigning environmental dose from 2003 to 2010. Made editorial changes and removed text and references for the Dayton Project. Incorporates formal internal and NIOSH review comments. Training required: As determined by the Objective Manager. Initiated by Donald N. Stewart and Robert M. Leib.

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ACRONYMS AND ABBREVIATIONS

ANL	Argonne National Laboratory
Bq	becquerel
CFR	Code of Federal Regulations
Ci	curie
CLN	Center Line North
cm	centimeter
cpm	counts per minute
d	day
D&D	decontamination and decommissioning
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
gal	gallon
GP	General Purpose
GPHS	General Purpose Heat Source
GSD	geometric standard deviation
HEPA	high-efficiency particulate air
hr	hour
HTO	tritiated water vapor
ICRP	International Commission on Radiological Protection
kg	kilogram
km	kilometer
LDL	lower detection limit
LLW	low-level radioactive waste
m	meter
mCi	millicurie
MED	Manhattan Engineering District
mi	mile
mL	milliliter
mph	miles per hour
mR	milliroentgen
mrem	millirem
NIOSH	National Institute for Occupational Safety and Health
pCi	picocurie
POC	probability of causation
PP	Plutonium Processing
qtr	quarter
RTG	radioisotopic thermoelectric generator

s	second
SM	Special Metallurgical
SNM	special nuclear material
SRS	Savannah River Site
Sv	sievert
SW	Semi-Works
TBD	technical basis document
U.S.C.	United States Code
WSF	Waste Staging Facility
yr	year
TRU	transuranic
µCi	microcurie
µg	microgram
µR	microroentgen
α	alpha
§	section or sections

4.1 INTRODUCTION

Technical basis documents and site profile documents are not official determinations made by the National Institute for Occupational Safety and Health (NIOSH) but are rather general working documents that provide historical background information and guidance to assist in 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 NIOSH staff 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 [DOE] facility” as defined in the Energy Employees Occupational Illness Compensation Program Act [EEOICPA; 42 U.S.C. § 7384l(5) and (12)]. EEOICPA defines a DOE facility as “any building, structure, or premise, including the grounds upon which such building, structure, or premise is located … in which operations are, or have been, conducted by, or on behalf of, the Department of Energy (except for buildings, structures, premises, grounds, or operations … pertaining to the Naval Nuclear Propulsion Program)” [42 U.S.C. § 7384l(12)]. Accordingly, except for the exclusion for the Naval Nuclear Propulsion Program noted above, any facility that performs or performed DOE operations of any nature whatsoever is a DOE facility encompassed by EEOICPA.

For employees of DOE or its contractors with cancer, the DOE facility definition only determines eligibility for a dose reconstruction, which is a prerequisite to a compensation decision (except for members of the Special Exposure Cohort). The compensation decision for cancer claimants is based on a section of the statute entitled “Exposure in the Performance of Duty.” That provision [42 U.S.C. § 7384n(b)] says that an individual with cancer “shall be determined to have sustained that cancer in the performance of duty for purposes of the compensation program if, and only if, the cancer … was at least as likely as not related to employment at the facility [where the employee worked], as determined in accordance with the POC [probability of causation[1]] guidelines established under subsection (c) …” [42 U.S.C. § 7384n(b)]. Neither the statute nor the probability of causation guidelines (nor the dose reconstruction regulation, 42 C.F.R. Pt. 82) restrict the “performance of duty” referred to in 42 U.S.C. § 7384n(b) to nuclear weapons work (NIOSH 2010).

The statute also includes a definition of a DOE facility that excludes “buildings, structures, premises, grounds, or operations covered by Executive Order No. 12344, dated February 1, 1982 (42 U.S.C. 7158 note), pertaining to the Naval Nuclear Propulsion Program” [42 U.S.C. § 7384l(12)]. While this definition excludes Naval Nuclear Propulsion Facilities from being covered under the Act, the section of EEOICPA that deals with the compensation decision for covered employees with cancer [i.e., 42 U.S.C. § 7384n(b), entitled “Exposure in the Performance of Duty”] does not contain such an exclusion. Therefore, the statute requires NIOSH to include all occupationally-derived radiation exposures at covered facilities in its dose reconstructions for employees at DOE facilities, including radiation exposures related to the Naval Nuclear Propulsion Program. As a result, all internal and external occupational radiation exposures are considered valid for inclusion in a dose reconstruction. No efforts are made to determine the eligibility of any fraction of total measured exposure for inclusion in dose reconstruction. NIOSH, however, does not consider the following exposures to be occupationally derived (NIOSH 2010):

- Background radiation, including radiation from naturally occurring radon present in conventional structures
- Radiation from X-rays received in the diagnosis of injuries or illnesses or for therapeutic reasons

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1 The U.S. Department of Labor (DOL) is ultimately responsible under the EEOICPA for determining the POC.

4.1.1 Purpose

The occupational environmental dose is the dose received by workers on the job but outside the operational buildings at the Mound Laboratory. Annual inhalation intakes of radioactive material at Mound Laboratory have been estimated based on onsite environmental air monitoring station results from 1971 through 2002. For years in which onsite air monitoring data were unavailable (before 1971) and total Mound stack effluent data were available, empirically derived onsite atmospheric dispersion factors (plutonium, polonium particulates, and hydrogen gas/vapor χ/Q values) 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 1973 through 1983. Ingestion intakes and ambient external dose were estimated using radionuclide concentrations measured in 30-cm-thick soil samples. The site remediation period ended in 2010, and there is no potential for receiving environmental dose after this year. The doses and intakes estimated for 2002 can be assigned for energy employees from 2003 to 2010 as an assumption that is favorable to claimants.

4.1.2 Scope

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

4.1.3 Special Exposure Cohort Petition Information for the Mound Plant

Classes Added to the SEC

> *Employees of the Department of Energy (DOE), its predecessor agencies, and DOE contractors or subcontractors who worked in any areas at the Mound Plant site from October 1, 1949, through February 28, 1959, for a number of work days aggregating at least 250 work days or in combination with work days within the parameters established for one or more other classes of employees in the SEC* (SEC-0090; Leavitt 2008).

> *All employees of the Department of Energy (DOE), its predecessor agencies, and its contractors and subcontractors who had at least one tritium bioassay sample and worked at the Mound Plant in Miamisburg, Ohio from March 1, 1959 through March 5, 1980, for a number of work days aggregating at least 250 work days, occurring either solely under this employment, or in combination with work days within the parameters established for one or more other classes of employees in the Special Exposure Cohort* (SEC-00171; Sebelius 2010).

> *All employees of the Department of Energy (DOE), its predecessor agencies, and their contractors and subcontractors who worked at the Mound Plant in Miamisburg, Ohio, from September 1, 1972 through December 31, 1972, or from January 1, 1975 through December 31, 1976, for a number of work days aggregating at least 250 work days, occurring either solely under this employment or in combination with work days within the parameters established for one or more other classes of employees included in the Special Exposure Cohort* (Sebelius 2012).

Dose reconstruction guidance in this document for periods before March 6, 1980, is presented to provide a technical basis for partial dose reconstructions for claims not covered in the SEC class through March 5, 1980. Although NIOSH found that it is not possible to completely reconstruct radiation doses for the SEC classes above, NIOSH intends to use any internal and external monitoring data that may become available for an individual claim (and that can be interpreted using existing NIOSH dose reconstruction processes or procedures). Therefore, dose reconstructions for employees who worked in any areas of the Mound Plant during the periods from October 1, 1949 through February 28, 1959, or September 1, 1972 through December 31, 1972, or January 1, 1975 through December 31, 1976; or who worked in R or SW Buildings (as indicated by tritium bioassay) during the period from March 1, 1959 through March 5, 1980, but who do not qualify for inclusion in the SEC, may be performed using these data as appropriate.

4.2 MOUND LABORATORY

Mound Laboratory was an integrated research, development, and production facility performing work in support of DOE weapon and nonweapon programs with emphasis on chemical explosives and nuclear technology. The organization that would later operate the 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 Engineer District (MED). Work occurred at the Monsanto 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 1993a, 1999; Monsanto 1975).

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 1.6×10^5 µCi of ^{227}Ac, ^{226}Ra, ^{228}Th and their radioactive progeny (Storey 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 µCi 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 materials. Since 1980, KYLE (classified), Tritium Emission Recovery Facility, Hydrogen Isotope Separations System, 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 before transfer to Building 38 for

repackaging. The SNM was in the form of metal, metal oxide, residue, or combinations thereof; these materials were 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 radioisotopic 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 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) provided storage and staging for solid low-level radioactive waste (LLW) containers before offsite shipment. The facility could store as many as 186 metal boxes, stage lined and unlined 30- or 55-gal metal drums with or without overpack, and staged closed wooden boxes that contained 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 was used to store miscellaneous hazardous wastes until they could be shipped off the site for disposal. The wastes were 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 occurred in this facility. Building 72 was a steel-framed building with metal panel siding on three walls.

Table 4-1 lists significant programs and events that occurred at the Mound site that are potentially relevant to dose reconstruction.

Table 4-1. 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 Room 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-gal drums.
1955	Repackaging of 6,000 55-gal 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 g 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 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 began 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.
2003	Operations ceased.
2010	Remediation activities completed.

a. Adapted from DOE (1993a, 1999, 2011), and EPA (2003).

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. In addition, 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 quantities up to a kilogram was used in research, development, and production operations; however, *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 (Special Metallurgical) Building was constructed to provide 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 (Plutonium Processing 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 kg 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 B, C, and D list environmental air-monitoring data from 1948 to September 1959, 1959 to 1972, and 1973 to 2002, 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 before 1971 is limited because the air samples were not collected in one location around the clock. Therefore, it is not certain if the offsite concentrations reflect a maximum or even average concentration. As a consequence, the offsite data cannot be used to infer onsite airborne radionuclide concentrations.

A program to acquire onsite meteorological data began in 1972 (Bimutis and Mote 1976). The average onsite wind speed was approximately 8 mph (13 km/hr) and the predominant wind direction was from the southwest. From 1972 to 2002, air-monitoring data were obtained from a network of 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 2002 (see Tables C-13, C-14, and D-1 through D-29). For years in which onsite air monitoring data were unavailable (before 1971) and effluent data were 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 4-2 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 C-13, C-14, and D-1 through D-30) were reported as "incremental" to reflect that the measured "environmental level" concentration at the control (28 mi upwind) location was subtracted from the concentration at the monitoring stations. As a consequence, if 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 (before 1971) and effluent data were 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 decontamination and decommissioning (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.

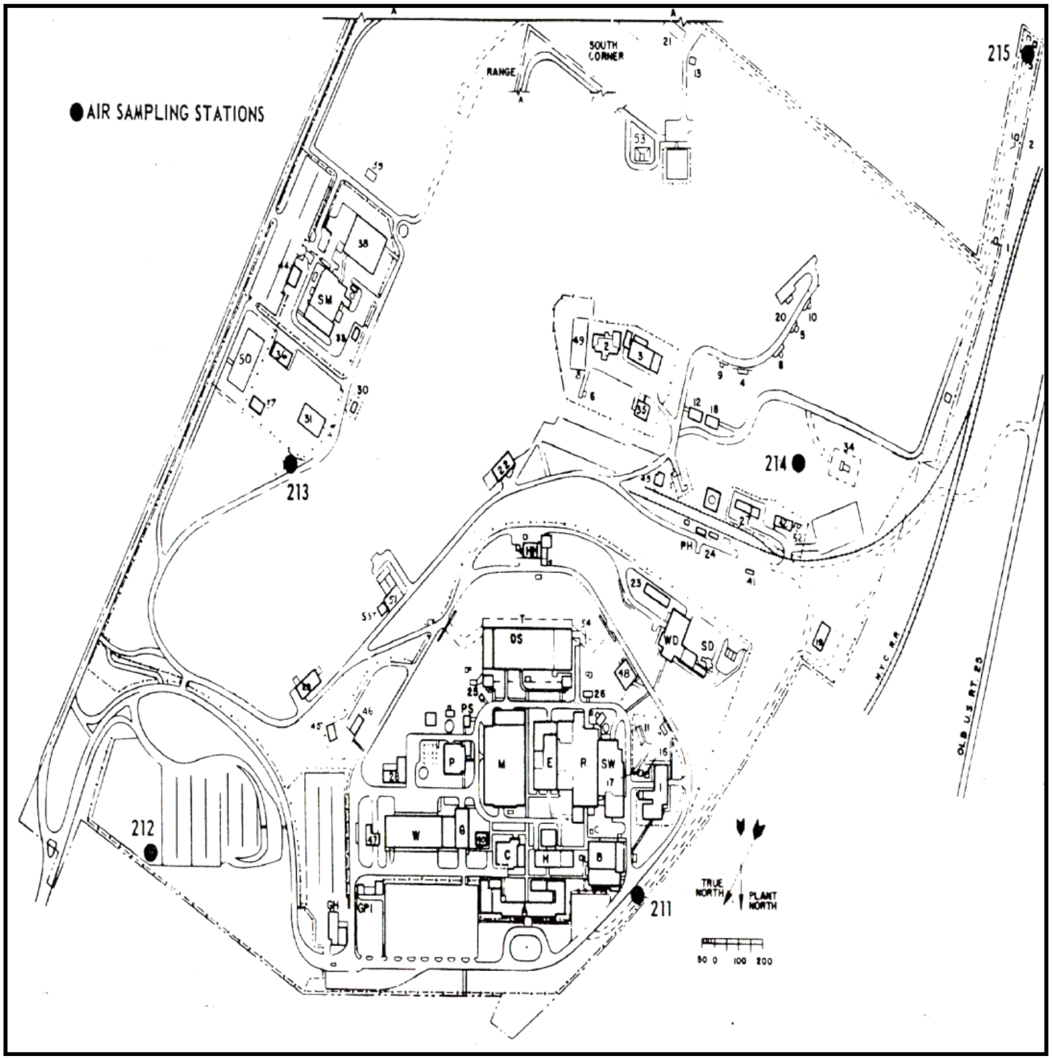

Figure 4-1. Mound onsite airborne radioactivity monitoring locations.

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 the Savannah River Site (SRS), as listed below. As a result, the scaling factor (activity concentration ratio) table (Table 4-3) infers concentrations of trace radionuclides and $^{239, 240}$Pu for years in which effluent or air monitoring station data include only ^{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 4-4.). 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 in comparison with 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 probably the result of ^{239,240}Pu effluent emissions associated with ^{239,240}Pu research rather than the SRS feed material profile.

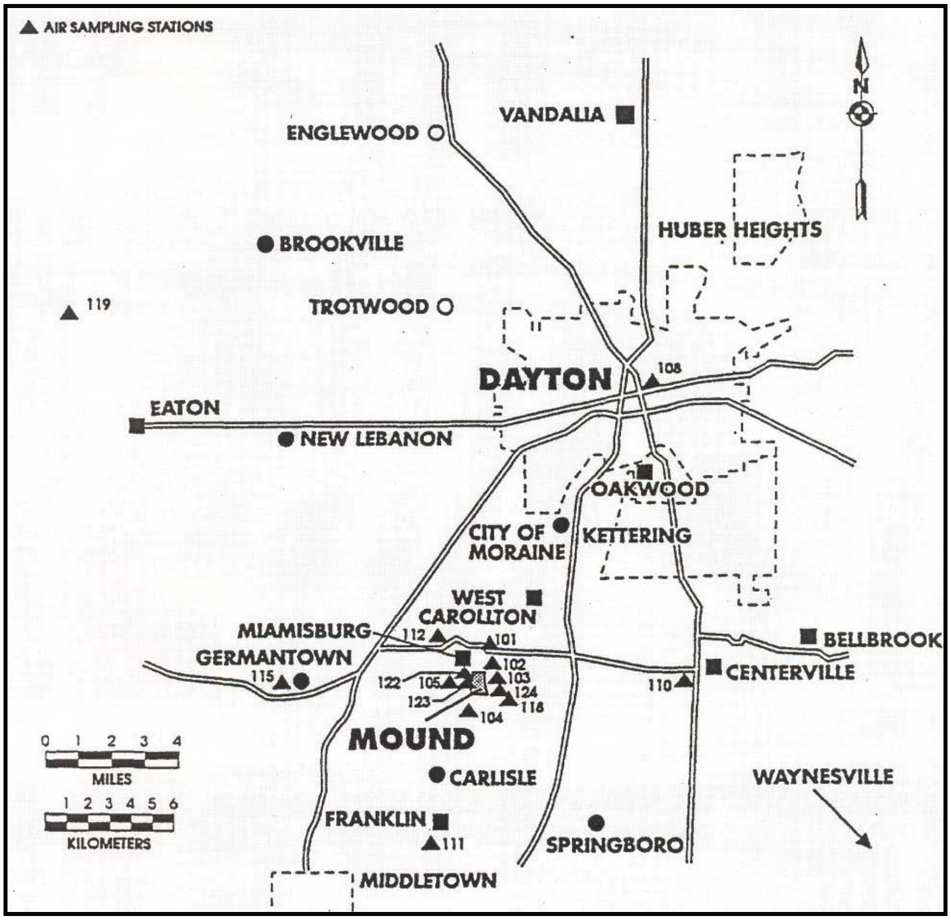

Figure 4-2. Mound offsite airborne radioactivity monitoring locations.

Table 4-2. Site-wide annual median effluent intake concentrations by radionuclide (µCi/mL).

Year	Pu-238	Po-210	HTO	Pu-239, -240	Th-232	Th-230	Th-228	Ra-226	Ac-227
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	--	--	--	--	--

Year	Pu-238	Po-210	HTO	Pu-239, -240	Th-232	Th-230	Th-228	Ra-226	Ac-227
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	--	--	--	--	--
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	--	--	--	--	--	--	--

Table 4-3. SRS plutonium dioxide feed material and Mound scaling factors.

Radionuclide	Half-life (yr)	Specific activity (Ci/g)	Reported weight fraction	Activity concentration (Ci/g)	Theoretical activity fraction	Pu-238 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	--

Radionuclide	Half-life (yr)	Specific activity (Ci/g)	Reported weight fraction	Activity concentration (Ci/g)	Theoretical activity fraction	Pu-238 activity concentration ratios	
						Theoretical	Corrected[a]
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 Pu-238 to Pu-239, 240 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 Pu-238 and Pu-239 at maximum sampler location and corrected for offsite contributions of Pu-238 and Pu-239, 240 indicated at the location of the minimum Pu-238 and Pu-239, 240 offsite concentrations. (These data are presented in Table 4-4.)

b. EG&G (1995a).

c. DOE (1993a).

Table 4-4. 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]				Pu-238:Pu-239, -240 net activity concentration ratio
	Highest onsite Pu-238	Lowest offsite Pu-238	Highest onsite Pu-239, -240	Lowest offsite Pu-239, -240	
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 D, Tables D-3 through D-8.

The relative internal dose contribution from radionuclides in SRS plutonium dioxide feed material has been assessed using International Commission on Radiological Protection (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 should neglect the internal dose contribution from trace radionuclides other than ^{239,240}Pu in effluent associated with the feed material. See Table 4-5.

Table 4-5. SRS plutonium dioxide feed material relative dose contribution.

Radionuclide	ICRP (1995) 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[a]	3.00E-05	1.37E+01	9.28E-01	2.78E-05	9.65E+01
Pu-239,240[a]	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

a. Dosimetrically significant.

For years in which onsite air monitoring data were unavailable (before 1971) and total annual stack effluent data were 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 4-6). 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: 8.61×10^{-5} s/m^3 for plutonium, 5.12×10^{-4} s/m^3 for polonium, and 2.56×10^{-7} s/m^3 for tritium (Table 4-7). The calculated dispersion factor data for the 11- and 1-year period are listed in Table 4-7 below.

Table 4-6. Total Mound site radioactive effluent discharges, 1949–1983.[a]

Year	Pu-238 (µCi)	Po-210:Pu-238 ratio[b]	Po-210 (µCi)	H-3 (Ci)	Ra-226 (µCi)	Ac-227 (µCi)	Th-228 (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 (1993a). "--" means no data.
b. From 1967 through 1972, the ratio of Po-210 to Pu-238 is based on radionuclide-specific (Pu-238 and Po-210) analyses of offsite (onsite for 1972) air samples obtained at the 0- to 3-mi roving locations from 1967 to 1972 (see Attachment C, Tables C-9 through C-14).

c. 1973 and 1974 Po-210 effluent data (Carfagno and Westendorf 1974; Carfagno and Robinson 1975).
d. Elevated Pu-238 levels due to R Building operations before the SM Building becoming operational in 1961. In 1962, a second bank of high-efficiency particulate air (HEPA) filters was installed in the SM Building plenum (DOE 1993a).
e. For 1954 through 1966, it is assumed that the Po-210 release rate increased 20% each year from the constant 1949-through-1953 value.
f. For 1954 through 1958, it is assumed that the HTO release rate decreased 10% each year from that reported for 1959.

Polonium production and research at Mound were discontinued in the early 1970s (DOE 1993a). 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 D&D of the Mound polonium processing facilities (DOE 1993a). As a consequence, the 1974 polonium effluent and air monitoring results listed in Table 4-7 were not used in the χ/Q derivation for polonium.

Table 4-7. Inferred onsite dispersion factors by radionuclide, 1973–1983.

	χ/Q (sec/m^3)		
Year	**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 Pu-238 χ/Q.
b. Year of maximum H-3 χ/Q.
c. Year of maximum Po-210 χ/Q due to Mound D&D Program activity.
d. Po-210 χ/Q used in this analysis based on 1973 data.

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 1971 through 2002 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 4-6 combined with the derived atmospheric dispersion factor for ^{238}Pu from Table 4-7 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 in air samples) combined with the derived atmospheric dispersion factor for polonium from Table 4-6 to infer median onsite environmental concentrations. As discussed above, polonium effluent discharge data are available only for 1953, 1973 and 1974; as a consequence, for 1949 through 1953 it is assumed that the ^{210}Po effluent source term remained constant at the 20-µCi per day level (Bradley 1953a). For 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 4-6). 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 4-7) to infer onsite environmental concentrations.

For HTO, the data from 1971 through 2002 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 4-6) combined with the derived atmospheric dispersion factor derived for tritium in Table 4-7 to infer onsite environmental concentrations. No data were available for 1954 through 1958. To estimate the amounts of tritium effluent, 1958 was assumed to be 90% of the measured effluent for 1959 (31,527 Ci/yr); 1957 was assumed to be 90% of the value assigned to 1958, etc. For 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 4-2 lists the annual average effluent median intake concentrations used to calculate annual claimant intakes described in Section 4.2.3.

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 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 1.6×10^5 µCi of ^{227}Ac, ^{226}Ra, ^{228}Th and their radioactive progeny (Storey 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 before 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 are listed in Table 4-8. These data have been used to calculate the release rate of long-lived radionuclides (^{227}Ac, ^{226}Ra, and ^{228}Th) from the release reported by Storey (1973; 1.6×10^5 µCi) assuming equal quantities were released each year from 1951 through 1953 and assuming 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 4-8. 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 in Table 4-2 have been calculated assuming that the T west polonium stack was the source of the emissions with a dispersion factor (χ/Q) of 5.12×10^{-4} s/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 µCi of ^{227}Ac to the atmosphere (Storey 1973).

The median site-wide concentration of ^{227}Ac in Table 4-2 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 5.12×10^{-4} s/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 in Table 4-9 are derived by multiplying the annual median effluent air concentrations (Table 4-2) 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-hours per year. 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 absorption type most favorable to claimants should be chosen for dose reconstruction because of the various chemical forms of polonium, thorium, and plutonium used at Mound Laboratory.

Table 4-9. 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	--	--	--	--	--

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

4.2.3.2 Site-Wide Maximum Annual Average Effluent Inhalation Intakes

Site-wide maximum annual radionuclide intakes have been calculated to estimate the upper 95th-percentile effluent intake. These intakes have been calculated in a manner similar to the median intakes in Table 4-9. From 1971 to 2002, the maximum, annual average on-site air monitoring station results (Tables C-13, C-14, and D-1 through D-30) were used to determine intake concentrations.

For years in which onsite air monitoring data were unavailable (before 1971) and annual effluent data were 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 (listed in Table 4-7). 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: 6.03×10^{-4} s/m^3 for plutonium; 7.43×10^{-4} s/m^3 for polonium, actinium, and thorium; and 5.90×10^{-7} s/m^3 for gases or vapors (e.g., HT/HTO). The dispersion factor data used to infer maximum annual average radionuclide intakes are listed in Table 4-10. The maximum intakes listed in Table 4-11 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-hours per year. The tritium intake has been increased by a factor of 1.5 to account for skin absorption.

An estimate of the uncertainty associated with the median environmental intakes at Mound listed in Table 4-9 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 listed in Table 4-11 are assumed to represent the upper 95th-percentile intake. The resulting geometric standard deviations (GSDs) are listed in Table 4-12.

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 4-2 by 2,000 work-hours per year as listed in Table 4-13. To assess the magnitude of submersion dose, the values in Table 4-13 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. As a consequence, dose reconstructors need not consider submersion dose from effluents.

Table 4-10. Inferred maximum onsite dispersion factors by radionuclide, 1983–1973.

Year	χ/Q (s/m^3)		
	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
Minimum	3.87E-08	1.22E-04	7.43E-04
Maximum	3.43E-06	1.44E-03	7.43E-04
Mean	5.90E-07	6.03E-04	7.43E-04

Table 4-11. Site-wide maximum annual intakes at Mound (Bq).

Year	Pu-238	Po-210	HTO	Pu-239, -240	Th-232	Th-230	Th-228	Ac-227	Ra-226
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	--	--
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	--	--	--	--	--

Year	Pu-238	Po-210	HTO	Pu-239, -240	Th-232	Th-230	Th-228	Ac-227	Ra-226
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	--	--	--	--	--	--	--

Table 4-12. Geometric standard deviation for effluent intakes at Mound.

Year	Pu-238	Po-210	H-3	Pu-249, -240	Th-232	Th-230	Th-228	Ac-227	Ra-226
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	--	--	--	--	--

Year	Pu-238	Po-210	H-3	Pu-249, -240	Th-232	Th-230	Th-228	Ac-227	Ra-226
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	--	--	--	--	--
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	--	--	--	--	--	--
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 mi off site.

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 soil samples were obtained in 1990. In addition, the assumption that is favorable to claimants that the soil contamination is 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 in 1949, 1950, 1955, 1960, 1965, 1970, 1975, 1980 and 1985 to provide an estimate of radiological conditions for each time period (see Tables 4-14 through 4-19). 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 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 4-14 through 4-19 were inferred based on the relationship between the sum of ^{238}Pu effluent from 1960 to 1983 (362,670 µCi) and the decay-corrected soil concentration of ^{238}Pu in 1960 (2160.8 Bq/kg). The resulting ratio of 5.96×10^{-3} Bq/kg per µCi emitted was applied to the 1949 through 1974 annual ^{210}Po emissions. To account for the buildup and decay of ^{210}Po in soil, 16% of the previous year's ^{210}Po soil concentration was added to the next consecutive year's ^{210}Po soil concentration starting in 1950, because after 1 year, only 16% of the original ^{210}Po activity remains. The highest ^{210}Po soil concentration in the periods listed in Tables 4-14 through 4-19 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 (picocuries per gram) were converted to resuspension concentrations using the four-factor formula in ORAUT (2005, Equation 3-3). Resuspension air concentrations were used to calculate (1) external exposures by submersion and (2) submersion (resuspension) intakes (becquerels) by multiplying the air concentrations by 2,000 hr/yr and using a breathing rate of 2,400 m^3/yr 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 in Table 4-9 already accounts for soil resuspension intakes at the Mound site. The results are listed in Tables 4-14 through 4-19 and are applicable (persist) for the periods indicated.

The external submersion and submersion (resuspension) intakes are presented in Tables 4-14 through 4-19. The annual external submersion dose and submersion (resuspension) intake doses due to contaminated soil are less than 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 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 hr/yr to derive soil layer external exposures. These results (listed in Tables 4-14 through 4-19) are applicable to the radionuclides and periods applied to the resuspension intake assessment. Table 4-20 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 1993b). The maximum exposure rates documented in the survey report ranged from 20.5 to 23.5 µR/hr 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/hr 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). As a consequence, the maximum exposure rate is assumed to decay over time exactly like the site-wide average soil concentrations (see Table 4-20).

When assigning dose, the mean and maximum environmental external radiation levels should be multiplied by the ambient dose equivalent H*(10) dose conversion factor for an isotropic exposure geometry (NIOSH 2007).

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 listed in Tables 4-14 through 4-19 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 GSD is 3.12 for each year from 1949 through 2002.

Table 4-13. Annual average effluent submersion external exposures at Mound by year and radionuclide (Bq s/m^3).

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

Table 4-14. 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 hr/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 4-15. 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 hr/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 4-16. 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 hr/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 4-17. 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 hr/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 4-18. 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 hr/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 4-19. 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 hr/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.

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 in the operational buildings at Mound or from the storage of waste material or of irradiated bismuth slugs in facility buildings or onsite structures. The following discussion supports the conclusion that it is unlikely that gamma radiation from within the operational buildings of Mound contributed to the ambient environmental dose.

Table 4-20. Mean and maximum environmental external radiation levels (Sv) at Mound by year.

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

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 on the second floor of T Building, where the separation of ^{210}Po from bismuth took place (DOE 1993a).

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 on site in the 1960s and 1970s (DOE 1993a).

The most likely source of environmental exposure from gamma sources originating in Mound facilities would be associated with the ^{226}Ra-^{227}Ac program that separated ^{227}Ac from neutron-irradiated ^{226}Ra target material. The radium-actinium technology developed at Argonne National Laboratory (ANL) was transferred to Mound in early 1950. The General Purpose (GP) Building, later known as the SW Building, was constructed with a shielded process facility on the east side 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 runs contained 5 g 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/hr in the operational area adjacent to the cave to 7 R/hr inside the cave (Bradley 1952c). Based on the survey results, it is unlikely that gamma radiation 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 Mound. Nevertheless, several 1951 Monthly Health Physics Reports state that when routine beta and gamma surveys in operational areas detected radiation levels greater than 7.5 mR/hr, the area was either shielded or roped off (Bradley 1951f to 1951j). As a consequence, it is unlikely that gamma radiation from within the operational buildings at Mound contributed to the ambient environmental dose.

4.3 UNCERTAINTIES

Estimates of the median environmental intakes at the Mound Laboratory are presented in Section 4.2.3.2 and in Table 4-9. These estimates were made by assuming that the intakes are lognormally distributed and that the median intakes represent the 50th-percentile intake rate. For Mound, the calculated site-wide annual maximum intakes in Table 4-11 are assumed to represent the upper 95th-percentile intake. The resulting GSDs are listed in Table 4-12.

For Mound, the calculated mean ambient dose in Table 4-20 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.

Effluent release rate data from Mound was unavailable for some operational periods. As a consequence, 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 timeframes, and the total activity released in effluent compares favorably to the inventory of released radionuclides reported by Mound and listed in Table 4-21.

At the time of this revision, no additional data were available to estimate environmental external or internal doses after 2002. The doses and intakes estimated for 2002 can be assigned for energy employees from 2003 to 2010 as an assumption that is favorable to claimants. This assumption is favorable to the claimant because the amount of non-natural radioactivity at the Mound Site decreased during this period. Because remediation activities were completed in 2010, no occupational environmental dose should be assigned after that year.

Table 4-21. Radionuclide releases to the atmosphere (Ci) from Mound, 1949 to 1973.

Radionuclide	Release reported by Mound[a]	Release used in this analysis
Pu-238, -239	3.60E-01 ±50%	3.60E-01
Po-210	4.9E-01 ±50%	6.0E-01
H-3	2.85E+06 ±25%	2.98E+06
Ac-227 (purified)	5.3E-06 ±100%	5.3E-06
Ra-226, Ac-227, Th-228, and their associated progeny	1.6E-01 ±200%	1.6E-01

a. Storey (1973).

4.4 ATTRIBUTIONS AND ANNOTATIONS

All information requiring identification was addressed via references integrated into the reference section of this document.

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GLOSSARY

alpha radiation
Positively charged particle emitted from the nuclei of some radioactive elements. An alpha particle consists of two neutrons and two protons (a helium nucleus) and has an electrostatic charge of +2.

beta radiation
Charged particle emitted from some radioactive elements with a mass equal to 1/1,837 that of a proton. A negatively charged beta particle is identical to an electron. A positively charged beta particle is a positron.

curie (Ci)
Traditional unit of radioactivity equal to 37 billion (3.7×10^{10}) becquerels, which is approximately equal to the activity of 1 gram of pure ^{226}Ra.

decay
(1) Disintegration of atomic nuclei from spontaneous radioactivity including alpha, beta, and neutron radiation, often accompanied by gamma radiation. (2) Decrease in the amount of radioactive material over time due. See *half-life*.

dose
In general, the specific amount of energy from ionizing radiation that is absorbed per unit of mass. Effective and equivalent doses are in units of rem or sievert; other types of dose are in units of roentgens, rads, reps, or grays.

dose equivalent
In units of rem or sievert, product of absorbed dose in tissue multiplied by a weighting factor and sometimes by other modifying factors to account for the potential for a biological effect from the absorbed dose. See *dose*.

dose conversion factor (DCF)
Multiplier for conversion of potential dose to the personal dose equivalent to the organ of interest (e.g., liver or colon).

dosimetry
Measurement and calculation of internal and external radiation doses.

exposure
(1) In general, the act of being exposed to ionizing radiation. (2) Measure of the ionization produced by X- and gamma-ray photons in air in units of roentgens.

external dose
Dose received from radiation emitted by sources outside the body.

gamma radiation
Electromagnetic radiation (photons) of short wavelength and high energy (10 kiloelectron-volts to 9 megaelectron-volts) that originates in atomic nuclei and accompanies many nuclear reactions (e.g., fission, radioactive decay, and neutron capture). Gamma photons are identical to X-ray photons of high energy; the difference is that X-rays do not originate in the nucleus.

half-life

Time in which half of a given quantity of a particular radionuclide disintegrates (decays) into another nuclear form. During one half-life, the number of atoms of a particular radionuclide decreases by one half. Each radionuclide has a unique half-life ranging from millionths of a second to billions of years.

ionizing radiation

Radiation of high enough energy to remove an electron from a struck atom and leave behind a positively charged ion. High enough doses of ionizing radiation can cause cellular damage. Ionizing particles include alpha particles, beta particles, gamma rays, X-rays, neutrons, high-speed electrons, high-speed protons, photoelectrons, Compton electrons, positron/negatron pairs from photon radiation, and scattered nuclei from fast neutrons. See *alpha radiation*, *beta radiation*, *gamma radiation*, *neutron radiation*, *photon radiation*, and *X-ray radiation*.

neutron radiation

Radiation that consists of free neutrons unattached to other subatomic particles emitted from a decaying radionuclide. Neutron radiation can cause further fission in fissionable material such as the chain reactions in nuclear reactors, and nonradioactive nuclides can become radioactive by absorbing free neutrons.

nuclide

Stable or unstable isotope of any element. Nuclide relates to the atomic mass, which is the sum of the number of protons and neutrons in the nucleus of an atom. A radionuclide is an unstable nuclide.

occupational environmental dose

Dose received while on the grounds of a site but not inside a building or other facility.

parent

Radionuclide that decays to form a progeny radionuclide. See *progeny* and *decay*.

photon

Quantum of electromagnetic energy generally regarded as a discrete particle having zero rest mass, no electric charge, and an indefinitely long lifetime. The entire range of electromagnetic radiation that extends in frequency from 10^{23} cycles per second (hertz) to 0 hertz.

progeny

Nuclides that result from decay of other nuclides. Also called decay products and formerly called daughter products. See *parent*.

radiation

Subatomic particles and electromagnetic rays (photons) with kinetic energy that interact with matter through various mechanisms that involve energy transfer. See *ionizing radiation*.

radioisotopic thermoelectric generator (RTG)

Generator that obtains its power from passive (natural) radioactive decay using thermocouples to convert the heat of decay into electricity.

radioactive

Of, caused by, or exhibiting radioactivity.

radioactivity

Property possessed by some elements (e.g., uranium) or isotopes (e.g., ^{14}C) of spontaneously emitting energetic particles (electrons or alpha particles) by the disintegration of their atomic nuclei. See *radionuclide*.

radionuclide

Radioactive nuclide. See *radioactive* and *nuclide*.

rem

Traditional unit of radiation dose equivalent that indicates the biological damage caused by radiation equivalent to that caused by 1 rad of high-penetration X-rays multiplied by a quality factor. The sievert is the International System unit; 1 rem equals 0.01 sievert. The word derives from roentgen equivalent in man; rem is also the plural.

roentgen (R)

Unit of photon (gamma or X-ray) exposure for which the resultant ionization liberates a positive or negative charge equal to 2.58×10^{-4} coulombs per kilogram (or 1 electrostatic unit of electricity per cubic centimeter) of dry air at 0°C and standard atmospheric pressure. An exposure of 1 R is approximately equivalent to an absorbed dose of 1 rad in soft tissue for higher energy photons (generally greater than 100 kiloelectron-volts).

shielding

Material or obstruction that absorbs ionizing radiation and tends to protect personnel or materials from its effects.

Special Nuclear Material

Plutonium or uranium enriched to a higher-than-natural assay including ^{239}Pu, ^{233}U, uranium containing more than the natural abundance of ^{235}U, or any material artificially enriched in one of these isotopes.

X-ray radiation

Electromagnetic radiation (photons) produced by bombardment of atoms by accelerated particles. Once formed, there is no difference between X-rays and gamma rays, but gamma photons originate inside the nucleus of an atom.

ATTACHMENT A
DOSE COEFFICIENTS

Table A-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 A-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 and Ryman (1993).

ATTACHMENT B
MOUND OFFSITE ENVIRONMENTAL AIR-SAMPLING DATA FOR 1948 TO SEPTEMBER 1959
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Table B-1. Mound offsite air-sampling data for 1948 to 1959.

Reference	Description of data	Maximum		
		(cpm/cm³)	(dpm/cm³)[a]	(µCi/cm³)
1948				
Bradley 1948a	Missing pages - No offsite air sample data available for September.	--	--	--
Bradley 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 1948c	Missing pages - No offsite air sample data available for November.	--	--	--
Bradley 1949a	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 1949b	Missing pages - No offsite air sample data available	--	--	--
Bradley 1949c	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 1949d	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 1949e	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 1949f	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 1949g	*June offsite air sample data pages missing.*	--	--	--
Bradley 1949h	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 1949i	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 1949j	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

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

Reference	Description of data	Maximum		
Bradley 1949k	62 offsite samples were collected downwind from Mound Laboratory in October: 37.1% of the results were 0 dpm/m^3 62.9% 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 1949l	61 offsite samples were collected downwind 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 1950a	53 offsite samples were collected downwind 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 1950b	75 offsite samples were collected during January: 57.3% of the results were 0 dpm/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 1950c	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 1950d	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 1950e	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 1950f	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 1950g	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 1950h	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 1950i	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 1950j	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 1950k	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 1950l	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 1951a	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

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Reference	Description of data	Maximum		
1951				
Bradley 1951b	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
Bradley 1951c	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 1951d	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 1951e	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 1951f	*May offsite air sample data pages missing.*	--	--	--
Bradley 1951g	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 1951h	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 1951i	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 1951j	42 offsite samples were collected during September: 0% of the results were > 10 dpm/m^3	--	1.00E-05	4.50E-12
Bradley 1951k	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 1951l	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 1952a	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 1952b	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 1952c	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 1952d	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 1952e	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 1952f	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 1952g	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 1952h	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

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Reference	Description of data	Maximum		
Bradley 1952i	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
Bradley 1952j	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 1952k	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 1952l	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 1953b	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 1953c	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 1953d	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 1953e	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 1953f	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 1953g	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 1953h	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 1953i	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 1953j	Zero offsite samples were collected during August.	--	--	--
Bradley 1953k	9 offsite samples were collected during September: The highest result was 4 dpm/m^3	--	4.00E-06	1.80E-12
Bradley 1953l	17 offsite samples were collected during October: The highest result was 14.4 dpm/m^3	--	1.40E-05	6.50-12
Bradley 1953m	18 offsite samples were collected during November: The highest result was 10.6 dpm/m^3	--	1.06E-05	4.80E-12
Bradley 1954a	31 offsite samples were collected during December: The highest result was 5.4 dpm/m^3	--	5.40E-06	2.40E-12
1954				
Bradley 1954b	Zero offsite samples were collected during January.	--	--	--
Bradley 1954c	35 offsite samples were collected during February: The highest result was 7 dpm/m^3	--	7.00E-06	3.20E-12
Bradley 1954d	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 1954e	Complete data for April, May, and June is missing.	--	--	--
Bradley 1954f	47 samples were collected during July, August, and September: 19 of the results were 0 µCi/cm^3 The maximum result was 1×10^{-12} µ Ci/cm^3	--	--	1.0E-12

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Reference	Description of data	Maximum		
1955				
Meyer 1955a	84 samples were collected during October, November, and December 25 of the results were 0 µCi/cm^3 The maximum result was 3.3×10^{-12} µCi/cm^3	--	--	3.3E-12
Meyer 1955b	79 samples were collected during January, February, and March: 32 of the results were 0 µCi/cm^3 The maximum result was 2.7×10^{-13} µCi/cm^3	--	--	2.7×10^{-13}
Meyer 1955c	79 samples were collected during April, May, and June: 59 of the results were 0 µCi/cm^3 The maximum result was 3×10^{-12} µCi/cm^3	--	--	3.0×10^{-12}
Meyer 1955d	65 samples were collected during July, August, and September: 64 of the results were 0 µCi/cm^3 The maximum result was 1.1×10^{-12} µCi/cm^3	--	--	1.1×10^{-12}
Meyer 1956a	67 samples were collected during October, November, and December: 65 of the results were 0 µCi/cm^3 The maximum result was 5.8×10^{-13} µCi/cm^3	--	--	5.8×10^{-13}
1956				
Meyer 1956b	30 samples were collected during January, February, and March: 25 of the results were 0 µCi/cm^3 The maximum result was 1.93×10^{-12} µCi/cm^3 Po	--	--	1.93×10^{-12}
Meyer 1956c	65 samples were collected during April, May, and June: 50 of the results were 0 µCi/cm^3 The maximum result was 7.2×10^{-13} µCi/cm^3 Po	--	--	7.2×10^{-13}
Meyer 1956d	66 samples were collected during July, August, and September: 59 of the results were 0 µCi/cm^3 The maximum result was 1.38×10^{-12} µCi/cm^3 Po	--	--	1.38×10^{-12}
Meyer 1957a	67 samples were collected during October, November, and December 58 of the results were 0 µCi/cm^3 The maximum result was 1.95×10^{-11} µCi/cm^3 Po	--	--	1.95×10^{-11}
1957				
Meyer 1957b	67 samples were collected during January, February, and March 62 of the results were 0 µCi/cm^3 The maximum result was 1.27×10^{-12} µCi/cm^3 Po	--	--	1.27×10^{-12}
Meyer 1957c	67 samples were collected during April, May, and June: 56 of the results were 0 µCi/cm^3 The maximum result was 3.85×10^{-12} µCi/cm^3 Po	--	--	3.85×10^{-12}
Meyer 1957d	67 samples were collected during July, August, and September: 33 of the results were 0 µCi/cm^3 The maximum result was 2.75×10^{-12} µCi/cm^3 Po	--	--	2.75×10^{-12}
Meyer 1958a	67 samples were collected during October, November, and December 51 of the results were 0 µCi/cm^3 The maximum result was 1.28×10^{-12} µCi/cm^3 Po	--	--	1.28×10^{-12}
1958				
Meyer 1958b	66 samples were collected during January, February, and March: 51 of the results were 0 µCi/cm^3 The maximum result was 4.46×10^{-12} µCi/cm^3 Po	--	--	4.46×10^{-12}
Meyer 1958c	55 samples were collected during April, May, and June: 51 of the results were 0 µCi/cm^3 The maximum result was 1.03×10^{-12} µCi/cm^3 Po	--	--	1.03×10^{-12}
Meyer 1958d	76 samples were collected during July, August, and September: 69 of the results were 0 µCi /cm^3 The maximum result was 6.56×10^{-11} µCi/cm^3 Po	--	--	6.56×10^{-11}
Meyer 1959a	67 samples were collected during October, November, and December: 62 of the results were 0 µCi/cm^3 The maximum result was 6.31×10^{-13} µCi/cm^3 Po	--	--	6.31×10^{-13}
1959				
Meyer 1959b	67 samples were collected during January, February, and March: 59 of the results were 0 µCi/cm^3 The maximum result was 7.03×10^{-13} µCi/cm^3 Po	--	--	7.03×10^{-13}
--	*Data for April, May, and June is unavailable.*	z	--	--

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Meyer 1959c	36 samples were collected during July, August, and September: 35 of the results were 0 µCi/cm^3 The maximum result was 3.87×10^{-13} µCi/cm^3	--	--	3.87×10^{-13}

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

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Table C-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 before 1967 (Sheehan and Anderson 1966).
d. Not used (derived by alternate method).

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Table C-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 qtr	119	(c)	(c)	(c)	--	--	119	--	--	--	27,100	--
All locations 2nd qtr	146	(c)	(c)	(c)	--	--	146	--	--	--	24,200	--
All locations 3rd qtr	117	(c)	(c)	(c)	--	--	117	--	--	1,171	10,500	--
All locations 4th qtr	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 before 1967(Sheehan and Anderson 1966).
d. Not used (derived by alternate method).

Table C-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 qtr	154	(c)	(c)	(c)	(c)	(c)	154	--	--	90,100	9,300	--
All locations 3rd qtr	179	(c)	(c)	(c)	(c)	(c)	155	--	--	54,000	12,000	--
All locations 4th qtr	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, 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 before 1967 (Sheehan and Anderson 1966).
d. Not used (derived by alternate method).

Table C-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**	**Mean**	**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, 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 before 1967 (Sheehan and Anderson 1966).
d. Not used (derived by alternate method).

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Table C-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 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 before 1967 (Sheehan and Anderson 1966).
d. Not used (derived by alternate method).

Table C-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 1964, 1965a												

a. -- = no data; 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 before 1967 (Sheehan and Anderson 1966).
d. Not used (derived by alternate method).

Table C-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	Mean		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 1965b, Adams and Anderson 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 before 1967 (Sheehan and Anderson 1966).
d. Not used (derived by alternate method).

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Table C-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 mi upwind	77	(c)	(c)	(c)	(c)	(c)	77	3,500	--	16,800	3,900	--
0-3 mi downwind	127	(c)	(c)	(c)	(c)	(c)	127	3,500	--	534,200	11,100	--
3-5 mi downwind	82	(c)	(c)	(c)	(c)	(c)	82	3,500	--	12,900	4,300	--
5-10 mi downwind	82	(c)	(c)	(c)	(c)	(c)	82	3,500	--	54,600	5,000	--
10-15 mi downwind	87	(c)	(c)	(c)	(c)	(c)	87	3,500	--	23,200	5,000	--
15-20 mi 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	Sheehan and Anderson 1966; Anderson and Sheehan 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 before 1967 (Sheehan and Anderson 1966).
d. Not used (derived by alternate method).

Table C-9. Mound offsite air monitoring data for 1967.[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 mi upwind	33	8,000	--	25,000	8,650	--	46	1,300	--	282,200	12,000	--
0-3 mi downwind	32	8,000	--	26,900	9,020	--	46	900	--	121,700	9,900	--
3-5 mi downwind	31	8,000	--	12,790	8,080	--	46	1,300	--	111,400	11,100	--
5-10 mi downwind	31	8,000	--	10,690	8,090	--	45	1,300	--	14,200	4,700	--
10-15 mi downwind	29	8,000	--	8,000	8,000	--	46	1,300	--	98,400	8,300	--
15-20 mi 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 and Sheehan 1967b, 1968a											

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	^{210}Po offsite concentration (10^{-18} µCi/mL)[b]					
Location	Samples	LDL	Min	Max	Mean	Mean
0-3 mi upwind	45	8,000	--	669,000	33,300	--
0-3 mi downwind	44	5,300	--	104,700	15,300	--
3-5 mi downwind	45	8,000	--	689,200	35,200	--
5-10 mi downwind	45	8,000	--	99,100	22,500	--
10-15 mi downwind	45	8,000	--	80,000	19,700	--
15-20 mi 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 and Sheehan 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 C-10. Mound offsite air monitoring data for 1968.[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 mi upwind	40	2,000	--	16,550	3,690	--	38	1,300	--	37,900	11,900	--
0-3 mi downwind	40	2,000	--	41,740	4,050	--	38	900	--	36,500	9,200	--
3-5 mi downwind	40	2,000	--	10,950	2,730	--	24	1,300	--	81,100	14,700	--
5-10 mi downwind	40	2,000	--	12,850	3,010	--	23	1,300	--	55,000	13,100	--
10-15 mi downwind	40	2,000	--	10,150	2,890	--	23	1,300	--	36,500	12,900	--
15-20 mi 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 and Sheehan 1968b, 1969a											

	^{210}Po offsite concentration (10^{-18} µCi/mL)[b]					
Location	Samples	LDL	Min	Max	Mean	Mean
0-3 mi upwind	40	8,000	--	440,200	32,900	--
0-3 mi downwind	40	5,300	--	404,200	35,100	--
3-5 mi downwind	40	8,000	--	396,600	34,900	--
5-10 mi downwind	40	8,000	--	331,500	31,300	--
10-15 mi downwind	40	8,000	--	312,700	33,700	--
15-20 mi 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 and Sheehan 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).

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

Location	HTO offsite concentration (10^{-12} µCi/mL)					
	Samples	LDL	Min	Max	Mean	Mean
0-3 mi upwind	35	1,000	--	5,480	1,390	--
0-3 mi downwind	35	1,000	--	12,190	1,400	--
3-5 mi downwind	34	1,000	--	3,990	1,120	--
5-10 mi downwind	34	1,000	--	2,390	1,060	--
10-15 mi downwind	34	1,000	--	1,510	1,020	--
15-20 mi downwind	33	1,000	--	3,580	1,110	--
N	205	--	--	6	6	--
Min	--	1,000	--	1,510	1,020	--
Max	--	1,000	--	12,190	1,400	--
Median	--	1,000	--	3,785	1,115	--
Mean	--	1,000	--	4,857	1,183	--
StdDev	--	--	--	3,843	168	--
	Effluent intake concentration					(c)
Reference	Anderson and Sheehan 1969b; Anderson and Sheehan 1970					

Location	^{238}Pu offsite concentration (10^{-18} µCi/mL)[b]					
	Samples	LDL	Min	Max	Mean	Mean
0-3 mi upwind	37	1,300	--	12,700	5,400	--
0-3 mi downwind	38	900	--	61,100	6,800	--
3-5 mi downwind	38	1,300	--	183,300	10,500	--
5-10 mi downwind	37	1,300	--	16,000	6,300	--
10-15 mi downwind	38	1,300	--	19,700	5,900	--
15-20 mi downwind	37	900	--	15,600	4,200	--
N	225	--	--	6	6	--
Min	--	900	--	12,700	4,200	--
Max	--	1,300	--	183,300	10,500	--
Median	--	1,300	--	17,850	6,100	--
Mean	--	1,167	--	51,400	6,517	--
StdDev	--		--	67,125	2,144	--
	Effluent intake concentration					(c)

Location	^{210}Po offsite concentration (10^{-18} µCi/mL)[b]					
	Samples	LDL	Min	Max	Mean	Mean
0-3 mi upwind	37	8,000	--	39,500	15,600	--
0-3 mi downwind	38	5,300	--	35,800	9,400	--
3-5 mi downwind	37	8,000	--	38,900	14,500	--
5-10 mi downwind	38	8,000	--	64,900	15,600	--
10-15 mi downwind	39	8,000	--	30,300	14,400	--
15-20 mi 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 C-12. Mound offsite air monitoring data for 1970.[a]

Location	HTO offsite concentration (10^{-12} µCi/mL)						^{238}Pu offsite concentration (10^{-18} µCi/mL)						^{210}Po offsite concentration (10^{-18} µCi/mL)					
	Samples	LDL	Min	Max	Mean	Mean	Samples	LDL	Min	Max	Mean	Mean	Samples	LDL	Min	Max	Mean	Mean
0 mi upwind	82	200	--	--	480	--	81	1,300	--	--	3,300	--	84	8,000	--	--	14,000	--
0-3 3 mi downwind	83	200	--	--	3,910	--	81	900	--	--	2,900	--	84	5,000	--	--	8,000	--
3-5 mi downwind	83	200	--	--	610	--	81	1,300	--	--	3,300	--	83	8,000	--	--	10,000	--
5-10 mi downwind	84	200	--	--	420	--	81	1,300	--	--	2,700	--	84	8,000	--	--	11,000	--
10-15 mi downwind	84	200	--	--	520	--	81	1,300	--	--	2,700	--	84	8,000	--	--	12,000	--
15-20 mi downwind	84	200	--	--	430	--	81	900	--	--	2,300	--	84	5,000	--	--	8,000	--
N	500	--	--	--	6	--	486		--	--	6	--	503		--	--	6	--
Min	--	200	--	--	420	--	--	900	--	--	2,300	--	--	5,000	--	--	8,000	--
Max	--	200	--	--	3,910	--	--	1,300	--	--	3,300	--	--	8,000	--	--	14,000	--
Median	--	200	--	--	500	--	--	1,300	--	--	2,800	--	--	8,000	--	--	10,500	--
Mean	--	200	--	--	1,062	--	--	1,167	--	--	2,867	--	--	7,000	--	--	10,500	--
StdDev	--	--	--	--	1,397	--	--	--	--	--	388	--	--	--	--	--	2,345	--
	Effluent intake concentration					(b)	Effluent intake concentration					(b)	Effluent intake concentration					(b)
Reference	Monsanto 1971a, 1971b																	

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

Location	HTO concentration (10^{-12} µCi/mL)						^{238}Pu concentration(10^{-18} µCi/mL)						^{210}Po Concentration (10^{-18} µCi mL^{-1})					
	Samples	LDL	Min	Max	Mean		Samples	LDL	Min	Max	Mean		Samples	LDL	Min	Max	Mean	
0-3 mi upwind	136	40	--	--	610		116	30	--	--	2,270		134	2,000	--	--	12,000	
0-3 mi downwind	136	40	--	--	2,880		116	30	--	--	2,960		134	2,000	--	--	1,000	
3-5 mi downwind	136	40	--	--	760		115	30	--	--	1,540		134	2,000	--	--	10,000	
5-10 mi downwind	136	40	--	--	410		110	30	--	--	1,630		134	2,000	--	--	14,000	
Southern perimeter	--	--	--	--	140		--	--	--	--	500		--	--	--	--	2,000	
Northern perimeter	--	--	--	--	4,800		--	--	--	--	300		--	--	--	--	2,000	
Site center	--	--	--	--	5,400		--	--	--	--	400		--	--	--	--	4,000	
N	816	--	--	--	--		677	--	--	--	--		804	--	--	--	--	
Min	--	40	--	--	--		--	30	--	--	--		--	2,000	--	--	--	
Max	--	40	--	--	--		--	30	--	--	--		--	2,000	--	--	--	
Median	--	40	--	--	--		--	30	--	--	--		--	2,000	--	--	--	
Mean	--	40	--	--	--		--	30	--	--	--		--	2,000	--	--	--	
StdDev	--	--	--	--	--		--	--	--	--	--		--	--	--	--	--	
	Effluent intake concentration					4,800	Effluent intake concentration					400	Effluent intake concentration					2,000
Reference	Monsanto 1972; Carfagno and Westendorf 1972a																	

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

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

	HTO concentration (10^{-12} µCi/mL)						Pu-238 concentration (10^{-18} µCi/mL)						Po-210 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; EL = environmental (activity concentration) level; LDL = lower detection limit at 95% confidence level; Min = minimum; Max = maximum; N = number of samples; ND = none detected; StdDev = standard deviation.

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

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MOUND ENVIRONMENTAL AIR-SAMPLING DATA FOR 1973 TO 2002

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MOUND ENVIRONMENTAL AIR-SAMPLING DATA FOR 1973 TO 2002

Table D-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	
EL[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; 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.

ATTACHMENT D
MOUND ENVIRONMENTAL AIR-SAMPLING DATA FOR 1973 TO 2002

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

	HTO concentration (10^{-12} µCi/mL)						Pu-238 concentration (10^{-18} µCi/mL)						Po-210 concentration (10^{-18} µCi/mL)					
Location	**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**		**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	53	3	<3.0	550.00	86.00		52	0.4	51.00	3920.00	810.00		52	20	310.00	2800.00	1100.00	
212 *On*	50	3	<3.0	1220.00	110.00		50	0.4	60.00	530.00	190.00		50	20	420.00	2200.00	1200.00	
213 *On*	53	3	20.00	3330	320.00		53	0.4	200	1900	570		53	20	600.00	2500.00	1100.00	
214 *On*	53	3	<3.0	1440	170		53	0.4	67	460	170		53	20	630.00	2500.00	1100.00	
215 *On*	53	3	<3.0	1750.00	160.00		52	0.4	23.00	190.00	82.00		52	20	460.00	2400.00	1100.00	
N	262	5	1	5	5		260	5	5	5	5		260	5	5	5	5	
Min		3	20.00	550.00	86.00			0.4	23.00	190.00	82.00			20.0	310.0	2200.0	1100.0	
Max		3	20.00	3330.00	320.00			0.4	200.00	3920.00	810.00			20.0	310.0	2200.0	1200.0	
Median		3	--	1440.00	160.00			0.4	60.00	530.00	190.00			20.0	460.00	2500.00	1100.00	
Mean		3	--	1658.00	169.20			0.4	80.20	1400.00	364.40			20.0	484.00	2480.00	1120.00	
StdDev		0	--	1033.33	91.18			0.0	69.03	1557.64	311.76			0.0	132.02	216.79	44.72	
101 *Off*	53	2	<2.0	900.00	110.00		52	0.36	23.00	316.00	100.00		52	20	590.00	3000.00	1200.00	
102 *Off*	53	2	<2.0	1700.00	140.00		53	0.36	9.60	293.00	60.00		--	--	--	--	--	
103 *Off*	53	2	<2.0	2490.00	148.00		53	0.36	18.00	335.00	64.00		--	--	--	--	--	
104 *Off*	53	2	<2.0	520.00	49.00		53	0.36	3.80	34.00	13.00		--	--	--	--	--	
105 *Off*	53	2	<2.0	510.00	54.00		35	0.36	3.30	36.00	12.00		--	--	--	--	--	
106 *Off*	53	2	<2.0	230.00	29.00		22	0.36	2.10	21.00	6.30		--	--	--	--	--	
107 *Off*	52	2	<2.0	260.00	21.00		30	0.36	0.60	37.00	6.00		--	--	--	--	--	
108 *Off*	52	2	<2.0	140.00	16.00		47	0.36	0.60	84.00	32.00		47	20	430.00	2400.00	1300.00	
109 *Off*	53	2	<2.0	130.00	15.00		53	0.36	1.20	16.00	5.60		--	--	--	--	--	
110 *Off*	52	2	<2.0	90.00	17.00		18b	0.36	1.90	43.00	13.00		--	--	--	--	--	
111 *Off*	52	2	<2.0	60.00	11.00		53	0.36	0.90	32.00	7.80		--	--	--	--	--	
112 *Off*	53	2	<2.0	530.00	40.00		53	0.36	2.80	79.00	20.00		--	--	--	--	--	
113 *Off*	53	2	<2.0	50.00	9.00		53	0.36	0.80	23.00	5.60		--	--	--	--	--	
114 *Off*	53	2	<2.0	60.00	8.00		53	0.36	1.70	15.00	6.30		--	--	--	--	--	
115 *Off*	53	2	<2.0	160.00	12.00		50	0.36	0.30	71.00	10.00		--	--	--	--	--	
116 *Off*	53	2	<2.0	100.00	10.00		47	0.36	0.70	35.00	5.60		--	--	--	--	--	
117 *Off*	53	2	<2.0	40.00	7.00		48	0.36	0.70	32.00	7.30		--	--	--	--	--	
118 *Off*	53	2	<2.0	1800.00	87.00		53	0.36	4.00	32.00	14.00		--	--	--	--	--	
119 *Off*	52	2	<2.0	40.00	7.00		48	0.36	1.10	5.40	1.90		--	--	--	--	--	
120 *Off*	53	2	<2.0	30.00	6.00		53	0.36	1.60	19.00	4.30		--	--	--	--	--	
121 *Off*	53	2	<2.0	30.00	8.00		53	0.36	0.50	28.00	5.50		--	--	--	--	--	
N	1108	21	0	21	21		980	21	21	21	21		99	2	2	2	2	
Min		2	BEL	30.00	6.00			0.36	0.3	5.40	1.90			20	430	2400	1200	
Max		2	BEL	2490.00	148.00			0.36	23	335.00	100.00			20	590	3000	1300	
Median		2	--	140.00	16.00			0.36	1.60	34.00	7.80			20	510	2700.00	1250.00	
Mean		2	--	470.00	38.29			0.36	3.77	75.54	19.06			20	510	2700.00	1250.00	
StdDev		0	--	690.22	44.76			0.00	5.98	102.23	25.15			0	113.14	424.26	70.71	
EL[c]					7						1.9						--	
Reference	Carfagno and Robinson 1975																	
					Effluent intake concentration	153.00					Effluent intake concentration	188.10					Effluent intake concentration	1,100.00

a. -- = no data; BEL = below environmental level; 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.

ATTACHMENT D
MOUND ENVIRONMENTAL AIR-SAMPLING DATA FOR 1973 TO 2002

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

	HTO concentration (10^{-12} µCi/mL)						Pu-238 concentration (10^{-18} µCi/mL)						Pu-239 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; 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 D-4. Mound air monitoring data for 1976.[a,b]

	HTO concentration (10^{-12} µCi/mL)[c]						Pu-238 concentration (10^{-18} µCi/mL)[d]						Pu-239 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; 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 16.5E-12 µCi/mL and 7.4E-12 µCi/mL for the second half. Tritium oxide "Offsite" LDL in air during the first half of the year was 9.9E-12 µCi/mL and 4.5E-12 µCi/mL for the second half.

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

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

f. EL values from sample location 119.

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

	HTO concentration (10^{-12} µCi/mL)						Pu-238 concentration (10^{-18} µCi/mL)						Pu-239 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; 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.

ATTACHMENT D
MOUND ENVIRONMENTAL AIR-SAMPLING DATA FOR 1973 TO 2002

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

	HTO incremental concentration (10^{-12} µCi/mL)						Pu-238 incremental concentration (10^{-18} µCi/mL)						Pu-239, -240 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; 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 D-7. Mound air monitoring data for 1979.[a]

	HTO incremental concentration (10^{-12} µCi/mL)					
Location	**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	52	0.3	EL	24.80	8.30	
212 *On*	51	0.3	0.41	26.20	9.50	
213 *On*	52	0.3	0.12	37.4	13.50	
214 *On*	52	0.3	EL	40.9	8.6	
215 *On*	51	0.3	EL	37.10	7.40	
N	258	5	2	5	5	
Min		0.3	0.12	24.80	7.40	
Max		0.3	0.41	40.90	13.50	
Median		0.3	0.27	37.10	8.60	
Mean		0.3	0.27	33.28	9.46	
StdDev		0	0.21	7.27	2.38	
101 *Off*	52	0.3	EL	28.30	5.30	
102 *Off*	52	0.3	EL	27.40	10.40	
103 *Off*	52	0.3	0.40	47.40	6.50	
104 *Off*	52	0.3	EL	28.20	3.90	
105 *Off*	52	0.3	EL	16.80	2.80	
108 *Off*	52	0.3	EL	18.10	1.00	
110 *Off*	52	0.3	EL	4.20	0.60	
111 *Off*	52	0.3	EL	4.60	0.50	
112 *Off*	52	0.3	EL	12.80	2.20	
115 *Off*	52	0.3	EL	7.50	0.30	
118 *Off*	52	0.3	EL	19.10	2.90	
122 *Off*	52	0.3	EL	29.70	6.20	
123 *Off*	52	0.3	EL	41.80	7.60	
124 *Off*	52	0.3	0.60	60.30	11.00	
N	728	14	2	14	14	
Min		0.3	0.4	4.20	0.30	
Max		0.3	0.6	60.30	11.00	
Median		0.3	0.5	23.25	3.40	
Mean		0.3	0.5	24.73	4.37	
StdDev		0	0.1414	16.48	3.58	
EL[c]					0.6	
Reference	Farmer and Carfagno 1980					
	Effluent intake concentration					8.60

	Pu-238 incremental concentration (10^{-18} µCi/mL)					
Location	**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	12	1.5	5.40	33.00	21.00	
212 *On*	12	1.5	4.00	37.00	16.00	
213 *On*	12	1.5	19	880	190	
214 *On*	12	1.5	5.1	39	13	
215 *On*	12	1.5	2.30	18.00	6.30	
N	60	5	5	5	5	
Min		1.5	2.30	18.00	6.30	
Max		1.5	19.00	880.00	190.00	
Median		1.5	5.10	37.00	16.00	
Mean		1.5	7.16	201.40	49.26	
StdDev		0.0	6.73	379.44	78.86	
101 *Off*	4	0.5	0.6	7.00	2.90	
102 *Off*	4	0.5	4.60	8.70	6.20	
103 *Off*	4	0.5	1.30	6.10	3.60	
104 *Off*	4	0.5	0.70	5.60	3.50	
105 *Off*	4	0.5	0.10	1.70	0.90	
108 *Off*	4	0.5	0.20	1.10	0.60	
110 *Off*	4	0.5	EL	1.20	0.50	
111 *Off*	4	0.5	0.08	2.20	1.10	
112 *Off*	4	0.5	0.20	0.70	0.40	
115 *Off*	4	0.5	EL	0.40	0.03	
118 *Off*	4	0.5	0.70	9.40	3.50	
122 *Off*	12	1.5	1.40	8.80	3.70	
123 *Off*	12	1.5	3.40	110.00	35.00	
124 *Off*	12	1.5	3.10	29.00	12.00	
N	80	14	12	14	14	
Min		0.5	0.08	0.40	0.03	
Max		1.5	4.6	110.00	35.00	
Median		0.5	0.70	5.85	3.20	
Mean		0.71	1.37	13.71	5.28	
StdDev		0.43	1.51	28.66	9.11	
EL[c]					0.5	
Reference						
	Effluent intake concentration					16.00

	Pu-239, -240 concentration (10^{-18} µCi/mL)					
Location	**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	12	0.8	2.4	16.00	8.40	
212 *On*	12	0.8	2.8	12.00	8.30	
213 *On*	12	0.8	2.5	21.00	11	
214 *On*	12	0.8	2.8	14.00	8.1	
215 *On*	12	0.8	1.8	15.00	7.90	
N	60	5	5	5	5	
Min		0.8	1.80	12.00	7.90	
Max		0.8	2.80	21.00	11.00	
Median		0.8	2.50	15.00	8.30	
Mean		0.8	2.46	15.60	8.74	
StdDev		0.0	0.41	3.36	1.28	
101 *Off*	4	0.4	3.9	17.00	8.70	
102 *Off*	4	0.4	2.8	16.00	8.70	
103 *Off*	4	0.4	2.9	17.00	8.50	
104 *Off*	4	0.4	3.4	19.00	10.00	
105 *Off*	4	0.4	2.9	19.00	9.10	
108 *Off*	4	0.4	4.2	20.00	11.00	
110 *Off*	4	0.4	2.8	19.00	9.50	
111 *Off*	4	0.4	3.4	20.00	9.50	
112 *Off*	4	0.4	2.7	16.00	8.80	
115 *Off*	4	0.4	3	18.00	9.20	
118 *Off*	4	0.4	2.8	19.00	9.90	
122 *Off*	12	0.8	2.2	12.00	7.40	
123 *Off*	12	0.8	2.1	21.00	9.60	
124 *Off*	12	0.8	2.6	20.00	9.80	
N	80	14	14	14	14	
Min		0.4	2.1	12.00	7.40	
Max		0.8	4.2	21.00	11.00	
Median		0.4	2.85	19.00	9.35	
Mean		0.486	2.9786	18.07	9.26	
StdDev		0.17	0.582	2.34	0.85	
EL[c]					7.8	
Reference						
	Effluent intake concentration					0.50

a. -- = no data; BEL = below environmental level; 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 D-8. Mound air monitoring data for 1980.[a]

	HTO incremental concentration (10^{-12} µCi/mL)						Pu-238 incremental concentration (10^{-18} µCi/mL)						Pu-239, -240 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; 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.

ATTACHMENT D
MOUND ENVIRONMENTAL AIR-SAMPLING DATA FOR 1973 TO 2002

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

	HTO incremental concentration (10^{-12} µCi/mL)						Pu-238 incremental concentration (10^{-18} µCi/mL)						Pu-239, -240 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; 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.

ATTACHMENT D
MOUND ENVIRONMENTAL AIR-SAMPLING DATA FOR 1973 TO 2002

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

	HTO incremental concentration (10^{-12} µCi/mL)						Pu-238 incremental concentration (10^{-18} µCi/mL)						Pu-239, -240 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; 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.

ATTACHMENT D
MOUND ENVIRONMENTAL AIR-SAMPLING DATA FOR 1973 TO 2002

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

	HTO incremental concentration (10^{-12} µCi/mL)						Pu-238 incremental concentration (10^{-18} µCi/mL)						Pu-239, -240 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; 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 D-12. Mound air monitoring data for 1984.[a]

	HTO incremental concentration (10^{-12} µCi/mL)						Pu-238 incremental concentration (10^{-18} µCi/mL)						Pu-239, -240 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; 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 D-13. Mound air monitoring data for 1985.[a]

	HTO incremental concentration (10^{-12} μCi/mL)						Pu-238 incremental concentration (10^{-18} μCi/mL)						Pu-239, -240 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; 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.

ATTACHMENT D
MOUND ENVIRONMENTAL AIR-SAMPLING DATA FOR 1973 TO 2002

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

	HTO incremental concentration (10^{-12} µCi/mL)						Pu-238 incremental concentration (10^{-18} µCi/mL)						Pu-239, -240 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; 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.

ATTACHMENT D
MOUND ENVIRONMENTAL AIR-SAMPLING DATA FOR 1973 TO 2002

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

	HTO incremental concentration (10^{-12} µCi/mL)						Pu-238 incremental concentration (10^{-18} µCi/mL)						Pu-239, -240 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; 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.

ATTACHMENT D
MOUND ENVIRONMENTAL AIR-SAMPLING DATA FOR 1973 TO 2002

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

	HTO incremental concentration (10^{-12} µCi/mL)						Pu-238 incremental concentration (10^{-18}µCi/mL)						Pu-239, -240 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; 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 D-17. Mound air monitoring data for 1989.[a]

	HTO incremental concentration (10^{-12} µCi/mL)						Pu-238 incremental concentration (10^{-18} µCi/mL)						Pu-239, -240 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; 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 D-18. Mound air monitoring data for 1990.[a,b]

	HTO incremental concentration (10^{-12} µCi/mL)						Pu-238 incremental concentration (10^{-18} µCi/mL)						Pu-239, -240 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 and SAIC 1991																	
					Effluent intake concentration	18.60					Effluent intake concentration	5.64					Effluent intake concentration	0.07

a. -- = no data; 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 D-19. Mound air monitoring data for 1991.[a,b]

	HTO incremental concentration (10^{-12} µCi/mL)					
Location	**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	51	16	-0.35	42.41	11.65	
212 *On*	49	16	-4.93	54.88	13.05	
213 *On*	50	16	10.04	112.61	38.91	
214 *On*	51	16	-3.06	28.69	9.97	
215 *On*	51	16	-9.88	31.45	6.18	
N	252	5	5	5	5	
Min		16	-9.88	28.69	6.18	
Max		16	10.04	112.61	38.91	
Median		16	-3.06	42.41	11.65	
Mean		16	-1.64	54.01	15.95	
StdDev		0	7.40	34.35	13.09	
101 *Off*	50	16	-5.46	31.14	6.85	
102 *Off*	52	16	-11.16	27.79	8.27	
103 *Off*	52	16	-13.2	20.20	5.83	
104 *Off*	52	16	-9.66	22.43	3.45	
105 *Off*	52	16	-10.3	32.85	4.52	
108 *Off*	52	16	-10.61	12.79	1.74	
110 *Off*	52	16	-13.2	20.88	0.70	
111 *Off*	50	16	-11.34	11.42	0.44	
112 *Off*	51	16	-6.64	13.43	2.02	
115 *Off*	52	16	-12.7	12.93	0.58	
118 *Off*	52	16	-10.25	24.59	2.76	
122 *Off*	51	16	-4.1	25.63	7.39	
123 *Off*	52	16	-4.21	74.37	9.06	
124 *Off*	51	16	-12.85	40.50	6.93	
N	721	14	14	14	14	
Min		16	-13.2	11.42	0.44	
Max		16	-4.1	74.37	9.06	
Median		16	-10.46	23.51	3.99	
Mean		16	-9.691	26.50	4.32	
StdDev		0	3.2649	16.20	3.04	
EL					1.85	
Reference	EG&G and SAIC 1992					
					Effluent intake concentration	11.65

	Pu-238 incremental concentration (10^{-18} µCi/mL)					
Location	**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	12	0.7	4.90	49.72	15.73	
212 *On*	11	0.7	1.29	9.16	4.92	
213 *On*	12	0.7	12.14	69.36	34.23	
214 *On*	12	0.7	2.27	24.65	7.7	
215 *On*	12	0.7	1.20	27.73	6.82	
N	59	5	5	5	5	
Min		0.7	1.20	9.16	4.92	
Max		0.7	12.14	69.36	34.23	
Median		0.7	2.27	27.73	7.70	
Mean		0.7	4.36	36.12	13.88	
StdDev		0.0	4.60	23.55	12.10	
101 *Off*	4	0.2	0.2	0.73	0.42	
102 *Off*	4	0.2	0.58	2.88	1.77	
103 *Off*	4	0.2	1.05	3.51	2.50	
104 *Off*	4	0.2	0.31	6.33	2.59	
105 *Off*	4	0.2	0.04	2.63	0.88	
108 *Off*	4	0.2	-0.18	0.05	-0.11	
110 *Off*	4	0.2	-0.45	0.10	-0.19	
111 *Off*	4	0.2	-0.25	0.48	0.12	
112 *Off*	4	0.2	-0.18	0.72	0.06	
115 *Off*	4	0.2	-0.16	0.32	-0.01	
118 *Off*	4	0.2	-0.07	5.05	1.50	
122 *Off*	12	0.7	-0.52	2.77	1.34	
123 *Off*	12	0.7	-0.01	6.10	2.63	
124 *Off*	12	0.7	0.01	50.58	10.01	
N	80	14	14	14	14	
Min		0.2	-0.52	0.05	-0.19	
Max		0.7	1.05	50.58	10.01	
Median		0.2	-0.04	2.70	1.11	
Mean		0.31	0.03	5.88	1.68	
StdDev		0.21	0.41	13.05	2.61	
EL					0.24	
Reference						
					Effluent intake concentration	7.70

	Pu-239, -240 incremental concentration (10^{-18} µCi/mL)					
Location	**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	12	0.3	-0.42	0.46	0.10	
212 *On*	11	0.3	-0.47	0.30	-0.04	
213 *On*	12	0.3	-0.37	0.89	0.03	
214 *On*	12	0.3	-0.27	0.43	-0.05	
215 *On*	12	0.3	-0.34	0.17	-0.03	
N	59	5	5	5	5	
Min		0.3	-0.47	0.17	-0.05	
Max		0.3	-0.27	0.89	0.10	
Median		0.3	-0.37	0.43	-0.03	
Mean		0.3	-0.37	0.45	0.00	
StdDev		0.0	0.08	0.27	0.06	
101 *Off*	4	0.1	-0.14	0.02	-0.05	
102 *Off*	4	0.1	-0.1	0.04	-0.05	
103 *Off*	4	0.1	-0.02	0.04	0.01	
104 *Off*	4	0.1	-0.07	0.03	-0.01	
105 *Off*	4	0.1	-0.05	0.03	-0.01	
108 *Off*	4	0.1	-0.04	0.04	-0.01	
110 *Off*	4	0.1	-0.01	0.08	0.03	
111 *Off*	4	0.1	-0.28	0.10	-0.05	
112 *Off*	4	0.1	-0.09	0.09	-0.04	
115 *Off*	4	0.1	-0.35	-0.02	-0.11	
118 *Off*	4	0.1	-0.13	-0.01	-0.06	
122 *Off*	12	0.3	-0.35	0.17	-0.08	
123 *Off*	12	0.3	-0.3	0.33	0.01	
124 *Off*	12	0.3	-0.51	0.27	-0.02	
N	80	14	14	14	14	
Min		0.1	-0.51	-0.02	-0.11	
Max		0.3	-0.01	0.33	0.03	
Median		0.1	-0.115	0.04	-0.03	
Mean		0.143	-0.1743	0.09	-0.03	
StdDev		0.085	0.155	0.10	0.04	
EL					0.1	
Reference						
					Effluent intake concentration	0.00

a. -- = no data; 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 D-20. Mound air monitoring data for 1992.[a]

	HTO incremental concentration (10^{-12} µCi/mL)						Pu-238 concentration (10^{-18} µCi/mL)						Pu-239, -240 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	Bauer 1993																	
	Effluent intake concentration					7.43	Effluent intake concentration					5.83	Effluent intake concentration					0.24

a. -- = no data; BEL = below environmental level; 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 D-21. Mound air monitoring data for 1993.[a]

	HTO incremental concentration (10^{-12} µCi/mL)					
Location	Samples	LDL	Min	Max	Mean	
211 *On*	50	19	BEL	205.40	6.76	
212 *On*	50	19	BEL	192.47	5.45	
213R *On*	52	19	BEL	183.54	4.43	
214R *On*	51	19	BEL	223.44	3.88	
215 *On*	52	19	BEL	179.96	1.20	
216 *On*	52	19	BEL	195.66	1.31	
217 *On*	51	19	BEL	186.20	BEL	
N	358	7	0	7	6	
Min		19	BEL	179.96	1.20	
Max		19	BEL	223.44	6.76	
Median		19	--	192.47	4.16	
Mean		19	--	195.24	3.84	
StdDev		0	--	15.05	2.23	
101 *Off*	51	19	BEL	188.92	3.38	
102 *Off*	51	19	BEL	202.45	4.40	
103 *Off*	50	19	BEL	226.90	1.19	
104 *Off*	51	19	BEL	201.15	BEL	
105 *Off*	49	19	BEL	217.19	BEL	
108 *Off*	51	19	BEL	252.41	BEL	
110 *Off*	51	19	BEL	210.32	BEL	
111 *Off*	51	19	BEL	264.65	BEL	
112 *Off*	50	19	BEL	199.57	BEL	
115 *Off*	51	19	BEL	218.53	BEL	
118 *Off*	49	19	BEL	203.49	1.29	
122 *Off*	51	19	BEL	227.59	1.15	
123 *Off*	52	19	BEL	545.60	4.82	
124 *Off*	50	19	BEL	176.27	2.00	
N	708	14	0	14	7	
Min		19	BEL	176.27	1.15	
Max		19	BEL	545.60	4.82	
Median		19	--	213.76	2.00	
Mean		19	--	238.22	2.60	
StdDev		0	--	91.51	1.58	
EL					12.2	
Reference	EG&G 1994					
	Effluent intake concentration					4.16

	Pu-238 incremental concentration (10^{-18} µCi/mL)					
Location	Samples	LDL	Min	Max	Mean	
211 *On*	12	0.2	2.16	13.11	6.04	
212 *On*	12	0.2	1.21	24.57	8.51	
213R *On*	12	0.2	10.86	86.49	41.45	
214R *On*	12	0.2	1.03	18.54	7.10	
215 *On*	12	0.2	1.41	6.60	3.41	
216 *On*	12	0.2	2.35	117.49	21.61	
217 *On*	12	0.2	0.58	12.93	2.78	
N	84	7	7	7	7	
Min		0.2	0.58	6.60	2.78	
Max		0.2	10.86	117.49	41.45	
Median		0.2	1.41	18.54	7.10	
Mean		0.2	2.80	39.96	12.99	
StdDev		0.0	3.61	43.66	14.04	
101 *Off*	4	0.06	0.65	24.08	7.01	
102 *Off*	4	0.06	1.51	7.63	3.76	
103 *Off*	4	0.06	1.66	4.56	3.22	
104 *Off*	4	0.06	0.56	6.63	2.19	
105 *Off*	4	0.06	0.48	1.76	1.19	
108 *Off*	4	0.06	BEL	0.06	BEL	
110 *Off*	4	0.06	BEL	0.04	BEL	
111 *Off*	4	0.06	0.02	0.48	0.15	
112 *Off*	4	0.06	0.06	0.31	0.18	
115 *Off*	4	0.06	BEL	0.58	0.11	
118 *Off*	4	0.06	0.63	3.28	1.95	
122 *Off*	12	0.2	0.29	2.53	1.07	
123 *Off*	12	0.2	2.00	12.13	5.90	
124 *Off*	12	0.2	0.62	27.55	6.52	
N	80	14	11	14	12	
Min		0.06	0.02	0.04	0.11	
Max		0.20	2.00	27.55	7.01	
Median		0.06	0.62	2.91	2.07	
Mean		0.09	0.77	6.54	2.77	
StdDev		0.06	0.66	8.90	2.52	
EL					0.07	
Reference						
	Effluent intake concentration					7.10

	Pu-239, -240 incremental concentration (10^{-18} µCi/mL)					
Location	Samples	LDL	Min	Max	Mean	
211 *On*	12	0.2	BEL	1.78	0.38	
212 *On*	12	0.2	BEL	1.82	0.58	
213R *On*	12	0.2	0.17	4.18	1.33	
214R *On*	12	0.2	BEL	1.12	0.39	
215 *On*	12	0.2	BEL	0.96	0.30	
216 *On*	12	0.2	0.08	6.60	1.15	
217 *On*	12	0.2	BEL	1.26	0.26	
N	84	7	2	7	7	
Min		0.2	0.08	0.96	0.26	
Max		0.2	0.17	6.60	1.33	
Median		0.2	0.13	1.78	0.39	
Mean		0.2	0.13	2.53	0.63	
StdDev		0.0	0.06	2.10	0.43	
101 *Off*	4	0.08	BEL	0.05	BEL	
102 *Off*	4	0.08	0.03	0.30	0.19	
103 *Off*	4	0.08	BEL	0.34	0.12	
104 *Off*	4	0.08	0.01	0.63	0.19	
105 *Off*	3	0.08	BEL	0.18	0.10	
108 *Off*	4	0.08	0.03	0.41	0.15	
110 *Off*	4	0.08	BEL	0.75	0.14	
111 *Off*	4	0.08	BEL	0.06	0.03	
112 *Off*	4	0.08	0.03	0.08	0.05	
115 *Off*	4	0.08	BEL	0.08	0.03	
118 *Off*	4	0.08	BEL	0.38	0.08	
122 *Off*	12	0.2	BEL	0.71	0.15	
123 *Off*	12	0.2	BEL	0.77	0.24	
124 *Off*	12	0.2	BEL	0.51	0.22	
N	79	14	4	14	13	
Min		0.08	0.01	0.05	0.03	
Max		0.20	0.03	0.77	0.24	
Median		0.08	0.03	0.36	0.14	
Mean		0.11	0.03	0.38	0.13	
StdDev		0.05	0.01	0.27	0.07	
EL					0.09	
Reference						
	Effluent intake concentration					0.39

a. -- = no data; BEL = below environmental level; 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 D-22. Mound air monitoring data for 1994.[a]

	HTO incremental concentration (10^{-12} µCi/mL)						Pu-238 incremental concentration (10^{-18} µCi/mL)						Pu-239, -240 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; 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.

ATTACHMENT D
MOUND ENVIRONMENTAL AIR-SAMPLING DATA FOR 1973 TO 2002

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

	HTO incremental concentration (10^{-12} µCi/mL)					
Location[b]	**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	52	26	BEL	25.08	3.35	
211T *On*	--	--	--	--	--	
212 *On*	51	23	BEL	20.27	2.70	
212T *On*	--	--	--	--	--	
213R *On*	50	23	BEL	21.36	2.11	
213RT *On*	--	--	--	--	--	
214R *On*	50	23	BEL	20.20	2.38	
214RT *On*	--	--	--	--	--	
215 *On*	52	23	BEL	20.85	0.83	
215T *On*	--	--	--	--	--	
216 *On*	52	23	BEL	18.38	0.43	
216T *On*	--	--	--	--	--	
217 *On*	49	23	BEL	15.28	0.42	
217T *On*	--	--	--	--	--	
N	356	7	0	7	7	
Min		23	BEL	15.28	0.42	
Max		26	BEL	25.08	3.35	
Median		23	--	20.27	2.11	
Mean		23.4	--	20.20	1.75	
StdDev		1.1	--	2.98	1.18	
101 *Off*	53	18	BEL	24.87	2.83	
102 *Off*	50	18	BEL	23.35	2.37	
103 *Off*	52	18	BEL	17.80	0.69	
104 *Off*	53	18	BEL	22.00	0.50	
105 *Off*	51	18	BEL	19.13	1.01	
108 *Off*	53	18	BEL	23.16	BEL	
110 *Off*	50	18	BEL	9.13	BEL	
111 *Off*	53	18	BEL	16.45	BEL	
112 *Off*	51	18	BEL	22.01	BEL	
115 *Off*	50	18	BEL	13.66	BEL	
118 *Off*	53	18	BEL	23.88	1.00	
122 *Off*	34	18	BEL	21.69	0.20	
123 *Off*	52	18	BEL	23.62	3.57	
124 *Off*	50	18	BEL	40.05	4.27	
N	705	14	0	14	9	
Min		18	BEL	9.13	0.20	
Max		18	BEL	40.05	4.27	
Median		18	--	22.01	1.01	
Mean		18	--	21.49	1.83	
StdDev		0	--	6.97	1.47	
EL				BEL	4.61	
Reference	EG&G 1996					
					Effluent intake concentration	2.11

	Pu-238 incremental concentration (10^{-18} µCi/mL)					
Location[b]	**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	12	0.86	2.49	35.96	9.88	
211T *On*	12	0.86	1.11	37.39	8.68	
212 *On*	12	0.86	0.90	11.42	4.95	
212T *On*	12	0.86	BEL	13.22	3.21	
213R *On*	12	0.86	17.04	2,430.5	326.87	
213RT *On*	12	0.86	14.36	1,881.1	264.60	
214R *On*	12	0.86	1.53	27.15	6.57	
214RT *On*	12	0.86	0.31	7.75	4.54	
215 *On*	12	0.86	BEL	49.38	5.40	
215T *On*	12	0.86	BEL	5.6	2.26	
216 *On*	12	0.86	BEL	69.95	15.33	
216T *On*	12	0.86	BEL	107.41	13.50	
217 *On*	12	0.86	BEL	7.59	1.95	
217T *On*	12	0.86	BEL	9.80	1.64	
N	168	14	7	14	14	
Min		0.86	0.31	5.60	1.64	
Max		0.86	17.04	2430.50	326.87	
Median		0.86	1.53	31.56	5.99	
Mean		0.86	5.39	335.30	47.81	
StdDev		0.00	7.12	779.29	105.82	
101 *Off*	4	0.07	0.16	0.74	0.40	
102 *Off*	4	0.07	1.55	4.07	2.28	
103 *Off*	4	0.07	0.61	5.31	2.48	
104 *Off*	4	0.07	0.05	0.73	0.45	
105 *Off*	4	0.07	0.06	11.36	3.37	
108 *Off*	4	0.07	BEL	0.20	0.03	
110 *Off*	4	0.07	BEL	0.16	0.04	
111 *Off*	4	0.07	BEL	0.11	0.03	
112 *Off*	4	0.07	BEL	2.19	0.72	
115 *Off*	4	0.07	0.05	0.35	0.20	
118 *Off*	4	0.07	0.12	3.20	1.51	
122 *Off*	9	0.86	BEL	6.79	1.26	
123 *Off*	12	0.86	0.35	6.77	2.82	
124 *Off*	12	0.86	0.46	20.46	6.19	
N	77	14	9	14	14	
Min		0.07	0.05	0.11	0.03	
Max		0.86	1.55	20.46	6.19	
Median		0.07	0.16	2.70	0.99	
Mean		0.24	0.38	4.46	1.56	
StdDev		0.34	0.48	5.70	1.75	
EL				BEL	0.04	
Reference						
					Effluent intake concentration	5.99

	Pu-239, -240 incremental concentration (10^{-18} µCi/mL)					
Location[b]	**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	12	0.6	BEL	0.75	0.16	
211T *On*	12	0.6	BEL	0.47	0.01	
212 *On*	12	0.6	BEL	1.08	0.03	
212T *On*	12	0.6	BEL	0.71	0.03	
213R *On*	12	0.6	BEL	7.15	0.97	
213RT *On*	12	0.6	BEL	6.86	1.58	
214R *On*	12	0.6	BEL	3.61	0.45	
214RT *On*	12	0.6	BEL	0.73	0.08	
215 *On*	12	0.6	BEL	1.04	0.04	
215T *On*	12	0.6	BEL	0.38	BEL	
216 *On*	12	0.6	BEL	2.77	0.37	
216T *On*	12	0.6	BEL	1.08	BEL	
217 *On*	12	0.6	BEL	0.80	BEL	
217T *On*	12	0.6	BEL	0.34	BEL	
N	168	14	0	14	10	
Min		0.6	BEL	0.34	0.01	
Max		0.6	BEL	7.15	1.58	
Median		0.6	--	0.92	0.12	
Mean		0.6	--	1.98	0.37	
StdDev		0.0	--	2.32	0.52	
101 *Off*	4	0.1	BEL	0.13	0.01	
102 *Off*	4	0.1	BEL	0.37	0.13	
103 *Off*	4	0.1	BEL	0.30	0.12	
104 *Off*	4	0.1	BEL	0.68	0.23	
105 *Off*	4	0.1	BEL	0.39	0.16	
108 *Off*	4	0.1	BEL	0.16	BEL	
110 *Off*	4	0.1	0.01	0.16	0.09	
111 *Off*	4	0.1	BEL	0.05	BEL	
112 *Off*	4	0.1	BEL	0.23	0.07	
115 *Off*	4	0.1	BEL	0.24	0.11	
118 *Off*	4	0.1	BEL	0.18	0.02	
122 *Off*	9	0.6	BEL	1.12	BEL	
123 *Off*	12	0.6	BEL	0.44	BEL	
124 *Off*	12	0.6	BEL	1.41	0.16	
N	77	14	1	14	10	
Min		0.1	0.01	0.05	0.01	
Max		0.6	0.01	1.41	0.23	
Median		0.1	--	0.27	0.12	
Mean		0.2	--	0.42	0.11	
StdDev		0.2	--	0.40	0.07	
EL				BEL	0.04	
Reference						
					Effluent intake concentration	0.12

a. -- = no data; BEL = below environmental level; 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 D-24. Mound air monitoring data for 1996.[a]

	HTO incremental concentration (10^{-12} µCi/mL)					Pu-238 incremental concentration (10^{-18} µCi/mL)					Pu-239, -240 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	35	BEL	32.51	9.43	12	0.5	2.34	13.28	5.42	12	0.4	BEL	0.52	BEL
211T *On*	--	--	--	--	--	12	0.5	1.50	12.68	4.27	12	0.4	BEL	0.62	BEL
212 *On*	51	30	BEL	114.80	9.12	12	0.5	1.37	20.01	5.76	12	0.4	BEL	1.00	0.001
212T *On*	--	--	--	--	--	12	0.5	0.78	10.42	4.05	12	0.4	BEL	0.12	BEL
213R *On*	50	30	BEL	50.07	9.16	12	0.5	33.35	216.55	89.12	12	0.4	BEL	1.46	0.18
213RT *On*	--	--	--	--	--	12	0.5	17.08	205.52	65.86	12	0.4	BEL	0.71	0.04
214R *On*	50	30	BEL	25.45	6.94	12	0.5	1.12	65.17	17.12	12	0.4	BEL	19.16	1.49
214RT *On*	--	--	--	--	--	12	0.5	1.81	95.57	20.59	12	0.4	BEL	3.90	0.35
215 *On*	52	30	BEL	20.26	5.55	12	0.5	1.06	124.83	27.64	12	0.4	BEL	0.29	0.01
215T *On*	--	--	--	--	--	12	0.5	1.25	236.86	51.59	12	0.4	BEL	1.46	0.18
216 *On*	52	30	BEL	27.29	5.77	12	0.5	1.04	13.70	5.03	12	0.4	BEL	1.18	0.08
216T *On*	--	--	--	--	--	12	0.5	1.18	13.99	6.12	12	0.4	BEL	0.21	BEL
217 *On*	49	30	BEL	23.62	4.89	12	0.5	0.18	4.51	1.43	12	0.4	BEL	0.38	BEL
217T *On*	--	--	--	--	--	12	0.5	0.34	6.19	1.69	12	0.4	BEL	1.35	0.01
N	356	7	0	7	7	168	14	14	14	14	168	14	0	14	9
Min		30	BEL	20.26	4.89		0.5	0.18	4.51	1.43		0.4	BEL	0.12	0.00
Max		35	BEL	114.80	9.43		0.5	33.35	236.86	89.12		0.4	BEL	19.16	1.49
Median		30	--	27.29	6.94		0.5	1.22	17.00	5.94		0.4	--	0.86	0.08
Mean		30.7	--	42.00	7.27		0.5	4.60	74.23	21.84		0.4	--	2.31	0.26
StdDev		1.9	--	33.56	1.94		0.0	9.31	86.97	27.61		0.0	--	4.94	0.48
101 *Off*	49	23	BEL	41.76	5.09	4	0.4	0.03	0.38	0.25	4	0.2	BEL	1.71	0.62
102 *Off*	52	23	BEL	129.01	9.45	4	0.4	0.64	18.58	5.86	4	0.2	BEL	1.48	0.47
103 *Off*	52	23	BEL	41.84	4.73	4	0.4	1.13	3.87	2.32	4	0.2	BEL	0.07	BEL
104 *Off*	52	23	BEL	23.05	4.44	4	0.4	0.33	2.79	1.22	4	0.2	BEL	0.28	0.01
105 *Off*	51	23	BEL	24.41	6.02	4	0.4	0.00	0.37	0.19	4	0.2	BEL	0.15	BEL
	51	23	BEL	17.42	1.75	4	0.4	BEL	0.07	BEL	4	0.2	BEL	0.60	0.07
	52	23	BEL	19.69	0.80	4	0.4	BEL	0.35	0.06	4	0.2	BEL	0.27	0.04
108 *Off*	52	23	BEL	22.61	0.99	4	0.4	BEL	0.24	0.12	4	0.2	BEL	BEL	BEL
110 *Off*	52	23	BEL	22.97	2.07	4	0.4	BEL	0.29	0.13	4	0.2	BEL	0.80	0.03
111 *Off*	52	23	BEL	16.73	1.62	4	0.4	BEL	0.06	BEL	4	0.2	BEL	0.56	0.13
112 *Off*	52	23	BEL	18.43	3.16	4	0.4	0.04	3.22	1.18	4	0.2	BEL	0.66	0.22
115 *Off*	51	23	BEL	23.22	3.81	12	0.5	0.09	3.70	1.07	12	0.4	BEL	BEL	BEL
118 *Off*	52	23	BEL	24.33	6.82	12	0.5	1.10	45.95	14.83	12	0.4	BEL	1.61	0.11
122 *Off*	50	23	BEL	33.85	5.69	12	0.5	0.89	24.40	6.45	12	0.4	BEL	1.52	BEL

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	HTO incremental concentration (10^{-12} µCi/mL)					
Location[b]	**Samples**	**LDL**	**Min**	**Max**	**Mean**	
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

	Pu-238 incremental concentration (10^{-18} µCi/mL)					
Location[b]	**Samples**	**LDL**	**Min**	**Max**	**Mean**	
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

	Pu-239, -240 incremental concentration (10^{-18} µCi/mL)					
Location[b]	**Samples**	**LDL**	**Min**	**Max**	**Mean**	
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; 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.

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

	HTO incremental concentration (10^{-12} µCi/mL)						Pu-238 incremental concentration (10^{-18} µCi/mL)						Pu-239, -240 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*	49	35	BEL	27.08	9.04		12	0.5	2.17	33.50	9.31		12	0.3	BEL	0.20	BEL	
212 *On*	53	31	BEL	80.13	11.80		12	0.5	1.25	5.19	3.02		12	0.3	BEL	BEL	BEL	
213 *On*	53	31	BEL	39.75	9.93		12	0.5	2.89	141.76	33.35		12	0.3	BEL	0.85	BEL	
214 *On*	53	31	BEL	35.32	7.19		12	0.5	5.85	56.08	31.89		12	0.3	BEL	0.10	BEL	
215 *On*	32	31	BEL	26.76	6.30		9	0.5	22.54	81.56	44.66		9	0.3	BEL	0.33	BEL	
215T *On*	--	--	--	--	--		9	0.5	41.38	98.76	57.70		8	0.3	BEL	0.25	BEL	
216 *On*	53	31	BEL	18.24	5.77		12	0.5	1.58	9.87	3.54		12	0.3	BEL	BEL	BEL	
217 *On*	49	31	BEL	18.92	1.97		12	0.5	0.12	1.93	0.80		12	0.3	BEL	0.31	BEL	
N	342	7	0	7	7		90	8	8	8	8		89	8	0	6	0	
Min		31	BEL	18.24	1.97			0.5	0.12	1.93	0.80			0.3	BEL	0.10	BEL	
Max		35	BEL	80.13	11.80			0.5	41.38	141.76	57.70			0.3	BEL	0.85	BEL	
Median		31	--	27.08	7.19			0.5	2.53	44.79	20.60			0.3	--	0.28	--	
Mean		31.6	--	35.17	7.43			0.5	9.7225	53.58	23.03			0.3	--	0.34	--	
StdDev		1.5	--	21.33	3.21			0.0	14.7	50.61	21.77			0.0	--	0.26	--	
101 *Off*	51	22	BEL	40.64	3.08		4	0.2	0.26	0.60	0.44		4	0.1	BEL	BEL	BEL	
102 *Off*	52	22	BEL	51.14	6.51		4	0.2	1.00	6.69	3.26		4	0.1	BEL	1.31	BEL	
103 *Off*	52	22	BEL	59.79	4.93		4	0.2	0.76	2.26	1.38		4	0.1	BEL	BEL	BEL	
104 *Off*	52	22	BEL	26.96	2.93		12	0.5	0.09	2.27	0.75		4	0.1	BEL	0.09	BEL	
105 *Off*	49	22	BEL	43.57	3.44		4	0.2	0.27	0.83	0.45		4	0.1	BEL	0.45	0.14	
111 *Off*	51	22	BEL	37.57	2.04		4	0.2	BEL	0.18	0.50		4	0.1	BEL	1.27	0.06	
112 *Off*	52	22	BEL	24.08	1.03		4	0.2	0.22	0.51	0.37		4	0.1	BEL	BEL	BEL	
115 *Off*	49	22	BEL	22.99	0.13		4	0.2	BEL	0.84	0.15		4	0.1	BEL	BEL	BEL	
118 *Off*	52	22	BEL	39.67	1.92		4	0.2	0.12	0.44	0.27		4	0.1	BEL	0.79	BEL	
122 *Off*	51	22	BEL	30.73	4.03		12	0.5	BEL	19.58	4.33		12	0.3	BEL	1.67	BEL	
123 *Off*	51	22	BEL	41.64	6.11		12	0.5	6.37	318.17	65.59		12	0.3	BEL	0.65	BEL	
124 *Off*	50	22	BEL	41.56	8.58		12	0.5	1.02	9.33	3.98		12	0.3	BEL	0.09	BEL	
CLN *Off*	52	22	BEL	27.25	2.02		12	0.5	0.66	44.34	14.26		12	0.3	BEL	0.58	BEL	
CLS *Off*	50	22	BEL	31.15	3.65		12	0.5	1.65	28.30	11.92		12	0.3	BEL	0.22	BEL	
N	714	14	0	14	14		104	14	11	14	14		96	14	0	10	2	
Min		22	BEL	22.99	0.13			0.2	0.09	0.18	0.15			0.1	BEL	0.09	0.06	
Max		22	BEL	59.79	8.58			0.5	6.37	318.17	65.59			0.3	BEL	1.67	0.14	
Median		22	--	38.62	3.26			0.2	0.66	2.27	1.07			0.1	--	0.62	0.10	
Mean		22	--	37.05	3.60			0.33	1.13	31.02	7.69			0.17	--	0.71	0.10	
StdDev		0	--	10.59	2.30			0.15	1.80	83.69	17.25			0.10	--	0.55	0.06	
EL					5.74						0.06						0.43	
Reference	BWXT 1998																	
					Effluent intake concentration	7.19					Effluent intake concentration	20.60					Effluent intake concentration	0.00

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	Th-228 incremental concentration (10^{-18} µCi/mL)						Th-230 incremental concentration (10^{-18} µCi/mL)						Th-232 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; 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 D-26. Mound air monitoring data for 1998.[a]

	HTO incremental concentration (10^{-12} µCi/mL)						Pu-238 incremental concentration (10^{-18} µCi/mL)						Pu-239, -240 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

ATTACHMENT D
MOUND ENVIRONMENTAL AIR-SAMPLING DATA FOR 1973 TO 2002

	Th-228 incremental concentration (10^{-18} µCi/mL)					
Location[b]	**Samples**	**LDL**	**Min**	**Max**	**Mean**	
213 *On*	12	0.6	BEL	3.20	BEL	
215T *On*	12	0.6	BEL	3.22	BEL	
216 *On*	12	0.6	BEL	1.22	BEL	
218 *On*	6	0.6	BEL	1.33	BEL	
N	42	4	0	4	0	
Min		0.6	BEL	1.22	BEL	
Max		0.6	BEL	3.22	BEL	
Median		0.6	--	2.27	--	
Mean		0.6	--	2.24	--	
StdDev		0.0	--	1.12	--	
124 *Off*	12	0.6	BEL	5.57	BEL	
N	12	1	0	1	0	
Min		0.6	BEL	5.57	BEL	
Max		0.6	BEL	5.57	BEL	
Median		--	--	--	--	
Mean		--	--	--	--	
StdDev		--	--	--	--	
EL					7.64	
	Effluent intake concentration					0.00

	Th-230 incremental concentration (10^{-18} µCi/mL)					
Location[b]	**Samples**	**LDL**	**Min**	**Max**	**Mean**	
213 *On*	12	0.9	BEL	3.29	BEL	
215T *On*	12	0.9	BEL	4.01	BEL	
216 *On*	12	0.9	BEL	6.43	BEL	
218 *On*	6	0.9	BEL	1.71	BEL	
N	42	4	0	4	0	
Min		0.9	BEL	1.71	BEL	
Max		0.9	BEL	6.43	BEL	
Median		0.9	--	3.65	--	
Mean		0.9	--	3.86	--	
StdDev		0.0	--	1.96	--	
124 *Off*	12	0.9	BEL	9.29	BEL	
N	12	1	0	1	0	
Min		0.9	BEL	9.29	BEL	
Max		0.9	BEL	9.29	BEL	
Median		--	--	--	--	
Mean		--	--	--	--	
StdDev		--	--	--	--	
EL					8.11	
	Effluent intake concentration					0.00

	Th-232 incremental concentration (10^{-18} µCi/mL)					
Location[b]	**Samples**	**LDL**	**Min**	**Max**	**Mean**	
213 *On*	12	0.6	BEL	6.50	0.40	
215T *On*	12	0.6	BEL	4.75	0.14	
216 *On*	12	0.6	BEL	2.65	0.18	
218 *On*	6	0.6	BEL	3.53	BEL	
N	42	4	0	4	3	
Min		0.6	BEL	2.65	0.14	
Max		0.6	BEL	6.50	0.40	
Median		0.6	--	4.14	0.18	
Mean		0.6	--	4.36	0.24	
StdDev		0.0	--	1.67	0.14	
124 *Off*	12	0.6	BEL	4.06	0.44	
N	12	1	0	1	1	
Min		0.6	BEL	4.06	0.44	
Max		0.6	BEL	4.06	0.44	
Median		--	--	--	--	
Mean		--	--	--	--	
StdDev		--	--	--	--	
EL					5.58	
	Effluent intake concentration					0.18

a. -- = no data; BEL = below environmental level; 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 D-27. Mound air monitoring data for 1999.[a]

	HTO incremental concentration (10^{-12} µCi/mL)						Pu-238 incremental concentration (10^{-18} µCi/mL)						Pu-239, -240 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

ATTACHMENT D
MOUND ENVIRONMENTAL AIR-SAMPLING DATA FOR 1973 TO 2002

	Th-228 incremental concentration (10^{-18} µCi/mL)						Th-230 incremental concentration (10^{-18} µCi/mL)						Th-232 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	14.78	5.55		12	1.1	BEL	21.88	5.79		12	0.5	BEL	13.25	4.62	
215T *On*	12	0.6	BEL	10.64	4.02		12	1.1	BEL	13.37	3.82		12	0.5	BEL	28.99	4.96	
216 *On*	12	0.6	BEL	18.52	5.18		12	1.1	BEL	23.17	5.00		12	0.5	BEL	17.40	4.22	
218 *On*	12	0.6	BEL	19.56	3.02		12	1.1	BEL	17.7	1.98		12	0.5	BEL	20.77	2.0	
N	48	4	0	4	4		48	4	0	4	4		48	4	0	4	4	
Min		0.6	BEL	10.64	3.02			1.1	BEL	13.37	1.98			0.5	BEL	13.25	2.00	
Max		0.6	BEL	19.56	5.55			1.1	BEL	23.17	5.79			0.5	BEL	28.99	4.96	
Median		0.6	--	16.65	4.60			1.1	--	19.79	4.41			0.5	--	19.09	4.42	
Mean		0.6	--	15.88	4.44			1.1	--	19.03	4.15			0.5	--	20.10	3.95	
StdDev		0.0	--	4.05	1.15			0.0	--	4.44	1.66			0.0	--	6.68	1.33	
124 *Off*	12	0.6	BEL	13.72	3.22		12	1.3	BEL	13.72	3.22		12	0.5	BEL	20.77	2.0	
N	12	1	0	1	1		12	1	0	1	1		12	1	0	1	1	
Min		0.6	BEL	13.72	3.22			1.3	BEL	13.72	3.22			0.5	BEL	20.77	2.00	
Max		0.6	BEL	13.72	3.22			1.3	BEL	13.72	3.22			0.5	BEL	20.77	2.00	
Median		--	--	--	--			--	--	--	--			--	--	--	--	
Mean		--	--	--	--			--	--	--	--			--	--	--	--	
StdDev		--	--	--	--			--	--	--	--			--	--	--	--	
EL					5.46						6.44						4.78	
	Effluent intake concentration					4.60	Effluent intake concentration					4.41	Effluent intake concentration					4.42

a. -- = no data; BEL = below environmental level; 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.

ATTACHMENT D
MOUND ENVIRONMENTAL AIR-SAMPLING DATA FOR 1973 TO 2002

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

	HTO incremental concentration (10^{-12} µCi/mL)						Pu-238 incremental concentration (10^{-18} µCi/mL)						Pu-239, -240 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

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	Th-228 incremental concentration (10^{-18} µCi/mL)						Th-230 incremental concentration (10^{-18} µCi/mL)						Th-232 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; 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.

ATTACHMENT D
MOUND ENVIRONMENTAL AIR-SAMPLING DATA FOR 1973 TO 2002

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

	HTO incremental concentration (10^{-12} µCi/mL)					
Location[b]	**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	48	26	BEL	26.01	5.06	
213 *On*	50	23	BEL	44.09	7.61	
214 *On*	51	23	BEL	24.72	4.60	
215 *On*	51	23	BEL	30.61	2.82	
215T *On*	--	--	--	--	--	
216 *On*	49	23	BEL	52.39	5.24	
218 *On*	49	23	BEL	48.81	2.98	
N	298	6	0	6	6	
Min		23	BEL	24.72	2.82	
Max		26	BEL	52.39	7.61	
Median		23	--	37.35	**4.83**	
Mean		23.5	--	37.77	4.72	
StdDev		1.2	--	12.13	1.75	
101 *Off*	51	15	BEL	37.24	3.99	
102 *Off*	49	15	BEL	64.72	6.09	
103 *Off*	51	15	BEL	63.13	4.76	
104 *Off*	51	15	BEL	19.57	1.33	
105 *Off*	50	15	BEL	20.50	0.28	
111 *Off*	34	15	BEL	5.56	BEL	
112 *Off*	51	15	BEL	27.65	0.83	
115 *Off*	51	15	BEL	12.72	BEL	
118 *Off*	50	15	BEL	34.08	0.17	
124 *Off*	48	15	BEL	76.74	7.28	
CLN *Off*	49	15	BEL	30.32	3.91	
212 *Off*	51	23	BEL	75.94	9.79	
217 *Off*	42	23	BEL	19.28	1.88	
N	628	13	0	13	11	
Min		15	BEL	5.56	0.17	
Max		23	BEL	76.74	9.79	
Median		15	--	30.32	3.91	
Mean		16.2	--	37.50	3.66	
StdDev		3.0	--	25.19	3.38	
EL					2.5	
Reference	BWXT 2002					
	Effluent intake concentration					4.83

	Pu-238 incremental concentration (10^{-18} µCi/mL)					
Location[b]	**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	12	0.6	1.46	20.16	5.51	
213 *On*	12	0.6	1.26	121.73	15.19	
214 *On*	12	0.6	0.72	5.69	2.90	
215 *On*	11	0.6	BRB	4.50	1.61	
215T *On*	12	0.6	0.24	5.74	1.62	
216 *On*	12	0.6	0.39	22.27	5.58	
218 *On*	12	0.6	0.96	7.01	4.01	
N	83	7	6	7	7	
Min		0.6	0.24	4.50	1.61	
Max		0.6	1.46	121.73	15.19	
Median		0.6	0.84	7.01	4.01	
Mean		0.6	0.84	26.73	5.20	
StdDev		0.0	0.48	42.53	4.70	
101 *Off*	4	0.1	BRB	0.20	0.09	
102 *Off*	4	0.1	0.25	0.40	0.32	
103 *Off*	4	0.1	0.46	5.55	1.91	
104 *Off*	12	0.6	BRB	1.44	0.25	
105 *Off*	4	0.1	0.02	0.12	0.06	
111 *Off*	4	0.1	BRB	0.29	0.09	
112 *Off*	4	0.1	BRB	0.08	BRB	
115 *Off*	4	0.1	BRB	0.04	0.01	
118 *Off*	4	0.1	BRB	0.30	0.14	
124 *Off*	12	0.6	0.22	2.45	1.32	
CLN *Off*	11	0.6	0.10	2.11	0.91	
212 *Off*	12	0.6	0.61	4.57	1.56	
217 *Off*	11	0.6	0.01	1.55	0.40	
N	90	13	7	13	12	
Min		0.1	0.01	0.04	0.01	
Max		0.6	0.61	5.55	1.91	
Median		0.1	0.22	0.40	0.29	
Mean		0.29	0.24	1.47	0.59	
StdDev		0.25	0.25	1.89	0.71	
EL					BRB	
Reference						
	Effluent intake concentration					4.01

	Pu-239, -240 incremental concentration (10^{-18} µCi/mL)					
Location[b]	**Samples**	**LDL**	**Min**	**Max**	**Mean**	
211 *On*	12	0.7	BEL	0.69	0.01	
213 *On*	12	0.7	BEL	1.62	BEL	
214 *On*	12	0.7	BEL	0.70	BEL	
215 *On*	11	0.7	BEL	1.85	0.2	
215T *On*	12	0.7	BEL	1.64	BEL	
216 *On*	12	0.7	BEL	0.51	0.03	
218 *On*	12	0.7	BEL	1.09	BEL	
N	83	7	0	7	3	
Min		0.7	BEL	0.51	0.01	
Max		0.7	BEL	1.85	0.2	
Median		0.7	--	1.09	0.03	
Mean		0.7	--	1.16	0.08	
StdDev		0.0	--	0.5	0.1	
101 *Off*	4	0.1	BEL	0.49	BEL	
102 *Off*	4	0.1	BEL	0.15	BEL	
103 *Off*	4	0.1	BEL	0.17	BEL	
104 *Off*	12	0.7	BEL	0.61	BEL	
105 *Off*	4	0.1	BEL	1.40	0.17	
111 *Off*	4	0.1	BEL	1.17	0.11	
112 *Off*	4	0.1	BEL	1.56	0.38	
115 *Off*	4	0.1	BEL	1.17	0.26	
118 *Off*	4	0.1	BEL	0.53	0.05	
124 *Off*	12	0.7	BEL	0.49	0.003	
CLN *Off*	11	0.7	BEL	0.90	0.11	
212 *Off*	12	0.7	BEL	0.56	BEL	
217 *Off*	11	0.7	BEL	1.09	0.04	
N	90	13	0	13	8	
Min		0.1	BEL	0.15	0.00	
Max		0.7	BEL	1.56	0.38	
Median		0.1	--	0.61	0.11	
Mean		0.33	--	0.79	0.14	
StdDev		0.30	--	0.44	0.13	
EL					0.4	
Reference						
	Effluent intake concentration					0.03

ATTACHMENT D
MOUND ENVIRONMENTAL AIR-SAMPLING DATA FOR 1973 TO 2002

	Th-228 incremental concentration (10^{-18} µCi/mL)						Th-230 incremental concentration (10^{-18} µCi/mL)						Th-232 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	0.8	BEL	20.97	4.01		12	1.5	BEL	20.99	3.91		12	0.4	BEL	14.31	2.82	
215T *On*	12	0.8	BEL	13.56	3.29		12	1.5	BEL	9.69	2.80		12	0.4	BEL	7.00	2.13	
216 *On*	12	0.8	BEL	12.48	4.30		12	1.5	BEL	9.74	3.28		12	0.4	BEL	8.15	2.37	
218 *On*	12	0.8	BEL	12.05	3.56		12	1.5	BEL	14.52	2.17		12	0.4	BEL	11.01	1.67	
N	48	4	0	4	4		48	4	0	4	4		48	4	0	4	4	
Min		0.8	BEL	12.05	3.29			1.5	BEL	9.69	2.17			0.4	BEL	7.00	1.67	
Max		0.8	BEL	20.97	4.30			1.5	BEL	20.99	3.91			0.4	BEL	14.31	2.82	
Median		0.8	--	13.02	3.79			1.5	--	12.13	3.04			0.4	--	9.58	2.25	
Mean		0.8	--	14.77	3.79			1.5	--	13.74	3.04			0.4	--	10.12	2.25	
StdDev		0.0	--	4.19	0.45			0.0	--	5.34	0.74			0.0	--	3.26	0.48	
124 *Off*	12	0.8	BEL	12.35	1.67		12	1.5	BEL	11.77	0.95		12	0.4	BEL	9.97	0.94	
N	12	1	0	1	1		12	1	0	1	1		12	1	0	1	1	
Min		0.8	BEL	12.35	1.67			1.5	BEL	11.77	0.95			0.4	BEL	9.97	0.94	
Max		0.8	BEL	12.35	1.67			1.5	BEL	11.77	0.95			0.4	BEL	9.97	0.94	
Median		--	--	--	--			--	--	--	--			--	--	--	--	
Mean		--	--	--	--			--	--	--	--			--	--	--	--	
StdDev		--	--	--	--			--	--	--	--			--	--	--	--	
EL					5.2						6.39						4.56	
	Effluent intake concentration					3.79	Effluent intake concentration					3.04	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 D-30. Mound air monitoring data for 2002.[a]

	HTO incremental concentration (10^{-12} µCi/mL)						Pu-238 incremental concentration (10^{-18} µCi/mL)						Pu-239, -240 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	CH2MHILL 2003																	
	Effluent intake concentration					3.50	Effluent intake concentration					3.76	Effluent intake concentration					0.19

ATTACHMENT D
MOUND ENVIRONMENTAL AIR-SAMPLING DATA FOR 1973 TO 2002

	Th-228 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

	Th-230 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

	Th-232 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

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.