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RECORD OF ISSUE/REVISIONS

ISSUE AUTHORIZATION DATE	EFFECTIVE DATE	REV. NO.	DESCRIPTION
12/30/2003	12/30/2003	00-A	New Technical Basis Document for the Fernald Environmental Management Project (FEMP) – Occupational Environmental Dose. Initiated by Samuel L.T. Chu.
03/25/2004	03/25/2004	00-B	Incorporates OCAS and reviewers' comments. Initiated by Samuel L.T. Chu.
04/06/2004	04/06/2004	00	First approved issue. Initiated by Samuel L.T. Chu.

ACRONYMS AND ABBREVIATIONS

AMS	air monitoring station
Ci	curie
EA	exposure area
FEMP	Fernald Environmental Management Project
FEMP	Feed Material Production Center
ft	foot
ft^2	square foot
g	gram
kg	kilogram
l	liter
m	meter
m^3	cubic meter
mg	milligram
mR	milliroentgen
mrad	millirad
mrem	millirem
MTU	metric ton of uranium
NLO	National Lead of Ohio, Inc.
pCi	picoCurie
s	second
TBD	technical basis document
TLD	thermoluminescent dosimeter
U.S.C.	United States Code
WL	working level, a unit of measurement for radon daughter exposure rate, 1 WL≈ 100 pCi/L of radon in 100%.
WLM	working level-month is the exposure of an individual to 1 WL for 170 hours (working Month).
yr	year
µCi	microCurie

4.0 OCCUPATIONAL ENVIRONMENTAL DOSE

This section provides the technical basis for estimation of historic radiological doses to workers from the U.S. Department of Energy Fernald Environmental Management Project (FEMP; previously known as the Feed Material Production Center, or FMPC) based on exposure to occupational environmental radiation sources.

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

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

For the National Institute for Occupational Safety and Health dose reconstruction program and this technical basis document (TBD), the following criteria are applicable:

- TBDs are being developed to support radiological dose reconstructions. Therefore, the only information included in the TBDs is that which may relate to site-specific occupational dose reconstruction.

- The information gathered for the TBDs takes into consideration that the Energy Employees Occupational Illness Compensation Program Act of 2000 (Public Law 106-398) requires the consideration of the type of cancer, past health-related activities, the risk of developing a radiation-related cancer from workplace exposure, and other relevant factors [42 U.S.C. 7384n(c)].

- The TBDs are intended to support dose reconstruction efforts that involve determining or assuming specific characteristics of the monitoring procedures, identifying events or processes that were unmonitored, identifying the types and quantities of radioactive materials involved, evaluating production processes and safety procedures employed, identifying the locations and activities of exposed persons, and identifying comparable exposure circumstances for which data is available to make assumptions regarding exposure of others.

- Occupational environmental dose refers to the dose received by a person who was or is occupationally employed at the FEMP while that person was on the site but outside a facility or building. The dose can be external or internal, depending upon the characteristics of the source of the radiation. The radiation can be direct, as from radioactive material fixed in place (e.g., process equipment), or from radioactive materials deposited on the ground or other objects outside buildings. The radiation can be from radioactive gases or from airborne radioactive contamination.

- Radiation exposure from offsite sources are not occupational exposures.

- Accidents were not considered when compiling the data for this Section of the FEMP TBD. Dose reconstructors will handle accidents as special cases. Decisions on how to handle accidents will be made on a case-by-case basis.

- The contribution of food chain vectors will not be considered in establishing dose values.
- Fallout will not be considered a contributing factor in dose reconstruction.

4.1 INTRODUCTION

The occupational environmental dose is the dose received by individuals working outside the production facilities and silos in the radioactive waste areas or in the administration areas inside or outside the fenced production areas. Records review showed that the personnel likely to receive occupational environmental dose include construction workers, contractors, security guards, environmental monitoring personnel, personnel involved with outdoor work duties, and administrative personnel. For these individuals, the primary radiation exposure pathways are inhalation of airborne radionuclides, exposure to direct radiation from emission plumes, exposure to radioactive materials in the process plants, and exposure to radioactive substances deposited on the ground or surfaces. The internal dose from the inhalation of radioactive materials can be determined from radionuclide air concentrations. The external dose from exposure to radioactive materials outside the body can be determined from historic data of external dosimetry monitoring.

This TBD of the FEMP Site Profile shows the derivation of radionuclide air concentrations and subsequent radionuclide intakes by an individual on the site and presents historic external dose area radiation monitoring data for the reconstruction of occupational environmental doses for unmonitored claimants.

4.2 SITE BACKGROUND AND HISTORY

The FEMP began operations in 1952 and was fully operational by the end of 1954. The primary function of the FEMP was to convert uranium ore concentrates and recycled materials to either uranium oxides or highly purified uranium ingots and billets for machining or extrusion into tubular forms of assorted standard isotopic assays. These products were for use as production reactor fuel cores and target fuel element fabrication. Small amounts of thorium also were processed.

Uranium metal deliveries peaked in 1960 at approximately 10,000 metric tons of uranium (MTU). Deliveries began to decline in 1964 to a low of approximately 1,230 MTU in 1975. During the 1970s consideration was given to closing the FEMP. The staffing level, which peaked at 2,891 in 1956, slowly declined from 662 in 1972 to 538 in 1979. Starting in 1981, production output increased to three times the 1979 level and staff increased from 538 to more than 1,000.

The production of uranium metal at the FEMP ended in July 1988, and site personnel began to concentrate on cleanup efforts. Current operations at the FEMP are limited to site remediation and restoration.

The production area facilities included nine separate plants, a pilot plant, ancillary buildings, and administrative buildings connected by a network of roadways. These facilities, along with concrete storage pads, gravel ground cover, railroad access, sanitary landfill, and metal scrap piles, were surrounded by security fencing (as are the remaining facilities). The Waste Storage Area outside the 136-acre fenced production area includes six low-level radioactive waste storage pits, two earthen-bermed concrete silos containing K-65 residues (high specific activity, low-level radium-bearing residues), one concrete silo containing metal oxides, and all affected adjoining areas. This area includes two fly-ash piles about 3,000 ft south-southwest of the waste storage area, as well as a burn pit between Pits 3 and 4. Production operations occurred in Plants 1 through 9 and the Pilot Plant. The FEMP site is currently undergoing remediation, and some of the plants and buildings that existed

while the site was in operation no longer exist. As of 2002, Plants 1, 4, 5, 6, 7, and 9 had been dismantled; other facilities are planned for or in various phases of dismantlement.

4.3 INTERNAL DOSES FROM ATMOSPHERIC RADIONUCLIDE CONCENTRATIONS

Radionuclide emissions from the operating years of FEMP were evaluated in *History of FMOS Radionuclide Discharges* (Boback et al. 1987) and *The Fernald Dosimetry Reconstruction Project, Tasks 2 and 3, Radionuclide Source Terms and Uncertainties* (RAC 1995). The values for uranium and thorium discharges from routine operations during the FEMP operating years (from 1951 through 1988) are from Dolan and Dolan (1988), the addendum to Boback et al. 1987. The values for releases of ^{222}Rn and its daughter products are from RAC 1995.

This section shows the derivation of radionuclide concentrations within the general plant areas for each of the production years for the unmonitored worker dose reconstruction effort using the plant emission data. For 1989 and after, emissions quantities from remediation and decommissioning activities are not readily available; however, there is information and data relevant to environmental dose in the Site Annual Environmental Reports. Therefore, this TBD reports occupational environmental dose information available in FEMP site environmental reports for this period (for example, WEMCO 1990 to 1992; FERMCO 1993 to 1996; Fluor 1997 to 2001).

4.3.1 Airborne Radioactive Materials Emissions (from 1951 to 1988)

During the course of FEMP production operations, 175,130 kg of uranium and 8,769 kg of thorium were released to the atmosphere from various emissions sources due to routine operations. Table 4-1 provides annual airborne uranium emissions due to FEMP site operations throughout the operating history (from 1951 through 1988) of the site from each production plant and processing facility. The values in Table 4-1 include:

- Monitored source emissions as reported in FEMP-2082
- Emissions from Plant 2/3 UO_3 gulping
- Emissions from the processes
- Building exhaust emissions due to normal operating conditions
- Emission approximations for laboratory hoods.

Tables 4-2a and 4-2b provide summaries of annual fugitive uranium and thorium emissions from wind erosion of the waste storage area. The estimated radon fluxes at the waste pits are also included.

Table 4-3 provides annual airborne thorium emissions due to thorium operations at Plants 8 and 9 and the Pilot Plant from 1951 through 1988. Thorium process emissions represent the best approximation possible given the lack of specific production information. At best this estimate is accurate within an order of magnitude; however, because of the conservative assumptions used for scrubber and dust collector efficiencies and the intake of material to the collection equipment, the actual thorium emissions should not exceed those in Table 4-3.

Appendix J of *Radionuclide Source Terms and Uncertainties* (RAC 1988) estimated the emissions of ^{222}Rn and radon daughters primarily from the K-65 Silos and from other stored K-65 materials. Figure 4-1 summarizes the ^{222}Rn emission quantity estimates. Table 4-4 lists the emissions of radon and its daughters from drummed K-65 materials at the Plant 1 pad for 1951 to 1953.

Table 4-1. FEMP uranium emissions summary by plant (kg).

Year	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Lab	Oil & graphite burner	Solid & liquid waste incineration	N.A.R.	Cooling towers	Year total
1951	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	123.0	0.0	0.0	0.0	0.0	2.9	125.9
1952	0.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0	493.0	0.0	0.0	0.0	3.0	2.9	504.9
1953	3.8	6.0	1,473.0	90.0	14.1	0.0	0.0	0.0	493.0	1.9	0.0	0.0	3.0	2.9	2,087.7
1954	46.2	281.4	5,891.0	4,119.1	34.3	4,261.0	418.1	0.0	271.0	1.9	0.0	15	3.0	2.9	15,345.0
1955	46.2	1,115.1	12,452.0	10,410.4	65.3	7,268.0	1,825.4	0.0	443.0	1.9	0.0	118	3.0	2.9	33,751.2
1956	43.4	1,981.4	5,148.1	3,501.5	42.2	1,743.0	2,758.6	0.0	32.0	1.9	0.0	118	3.0	2.9	15,376.0
1957	49.4	3,735.4	819.7	3,664.8	51.8	0.0	2,366.7	0.4	18.0	1.9	0.0	118	3.0	2.9	10,814.0
1958	407.4	3,526.5	668.4	715.5	177.3	0.0	2,525.7	681.0	27.0	1.9	0.0	118	3.0	2.9	8,854.6
1959	46.0	3,936.4	1,433.8	478.9	143.1	0.0	2,360.9	420.5	34.0	1.9	0.0	118	3.0	2.9	8,979.4
1960	20.0	4,240.9	219.0	203.4	288.5	0.0	2,903.1	222.8	718.0	1.9	0.0	118	3.0	2.9	8,941.5
1961	52.8	3,714.1	268.5	76.7	136.0	0.0	2,581.0	74.0	174.0	1.9	0.0	118	3.0	2.9	7,202.9
1962	14.0	2,141.1	708.8	356.5	76.6	0.0	2,923.0	142.5	174.0	1.9	20	118	3.0	2.9	6,682.3
1963	82.6	0.0	1,475.4	783.6	199.7	0.0	3,165.9	169.2	51.8	1.9	27	118	0.0	2.9	6,078.0
1964	18.0	0.0	549.4	330.8	50.9	0.0	3,917.2	266.8	13.0	1.9	27	118	0.0	2.9	5,295.9
1965	4.1	193.1	338.9	226.9	59.0	0.0	6,200.7	83.02	10.0	1.9	28.2	118	0.3	2.9	7,267.0
1966	12.2	514.9	230.9	77.1	23.7	0.0	1,253.6	52.72	18.1	1.9	34.0	118	0.3	2.9	2,340.3
1967	20.4	648.0	284.16	148.3	14.3	0.0	2,207.6	80.64	11.8	1.9	34.0	118	0.3	2.9	3,572.3
1968	0.5	1,121.6	271.1	88.4	39.0	0.0	3,983.8	121.9	3.6	1.9	34.0	118	0.3	2.9	5,787.0
1969	27.2	699.5	52.0	119.6	9.83	0.0	3,547.4	13.63	3.6	1.9	34.0	94	0.3	2.9	4,605.9
1970	4.5	357.3	31.7	53.3	5.84	0.0	1,235.2	14.15	0.0	1.9	34.0	71	0.3	2.9	1,812.1
1971	9.0	306.5	0.89	0.1	2.7	0.0	632.1	0.65	0.0	1.9	34.0	71	0.3	2.9	1,062.0
1972	28.4	1,361.8	9.8	33.1	1.61	0.0	5.04	24.6	0.0	1.9	34.0	71	0.3	2.9	1,574.5
1973	1.0	1,398.3	58.2	79.1	3.03	0.0	53.02	15.87	0.0	1.9	34.0	71	0.3	2.9	1,718.6
1974	1.4	2,449.6	25.2	40.1	1.69	0.0	11.0	38.8	0.0	1.9	34.0	71	0.3	2.9	2,677.9
1975	5.6	2,850.0	120.9	19.1	1.25	0.0	3.51	0.68	0.4	1.9	34.0	71	0.3	2.9	3,111.5
1976	2.7	3,345.5	26.9	13.8	4.17	0.0	7.22	3.37	0.0	2.4	34.0	71	0.4	2.9	3,514.4
1977	0.6	757.61	130.0	53.4	1.89	0.0	4.73	0.61	10.4	1.9	34.0	71	0.3	2.9	1,069.3
1978	1.8	0.0	13.30	29.2	1.92	0.0	0.04	72.6	2.2	1.9	34.0	71	0.0	2.9	230.8
1979	0.8	0.0	47.23	12.4	1.5	0.0	0.06	2.84	0.0	1.9	22.0	71	0.0	2.9	162.6
1980	13.4	2.7	135.4	89.6	1.64	0.0	16.14	0.54	3.3	1.9	7.0	0.7	0.0	2.9	275.2
1981	1.3	30.1	424.7	135.7	2.10	0.0	10.01	0.75	0.0	1.9	7.0	1.2	0.3	2.9	618.0
1982	2.1	52.4	23.68	122.0	3.91	0.0	118.33	6.23	0.0	1.9	7.0	1.8	0.3	2.9	342.6
1983	6.4	130.2	45.81	41.6	3.87	0.0	82.8	1.43	0.0	1.9	2.4	5.4	0.3	2.9	325.0
1984	12.1	574.5	43.93	84.1	5.05	0.0	46.19	171.4	2.8	1.9	6.4	10.4	0.3	2.9	962.0
1985		130.1	3.33	0.22	3.42	0.0	0.06	1.12		1.9			0.3	2.9	218.7[2]
1986		0.0	3.75	0.24	3.77	0.0	0.06	1.46		1.9			0.3	2.9	43.7[2]
1987		200.1	3.29	0.18	2.09	0.0	0.37	0.36		1.9			0.3	2.9	246.9[2]
1988		90.1	1.09	0.12	0.80	0.0	0.09	0.18		1.9			0.3	2.9	97.5
Total	985.3	41,892.21	33,433.26	26,198.86	1483.88	13,272	47,164.67	2686.75	3131	68.9	596	2490.5	39.4	110.2	173,675.16

Table 4-2a. Fugitive uranium and thorium emissions from wind erosion of Waste Pits 1, 2 and 3.

	Pit 1[a]			Pit 2[b]			Pit 3[c]		
Year	Exposed pit area (ft^2)	Uranium emission (kg/yr)	Thorium emission (kg/yr)	Exposed pit area (ft^2)	Uranium emission (kg/yr)	Thorium emission (kg/yr)	Exposed pit area (ft^2)	Uranium emission (kg/yr)	Thorium emission (kg/yr)
1953	4,293	0.15	--	--	--	--	--	--	--
1954	6,868	0.25	--	--	--	--	--	--	--
1955	38,633	1.4	--	--	--	--	--	--	--
1956	55,803	2.0	--	--	--	--	--	--	--
1957	60,095	2.16	--	17,781	46.4	0.014	--	--	--
1958	60,095	2.16	--	35,562	92.7	0.032	--	--	--
1959	60,095	2.16	--	35,562	92.7	0.032	0	0.0	0.0
1960	60,095	2.16	--	40,008	104.3	0.032	0	0.0	0.0
1961	51,510	1.85	--	44,453	115.9	0.036	0	0.0	0.0
1962	42,925	1.54	--	44,453	115.9	0.036	44,431	0.63	0.0
1963	17,170	0.62	--	44,453	115.9	0.036	44,431	0.63	0.0
1964	8,585	0.31	--	44,453	115.9	0.036	236,966	3.36	0.01
1965	8,585	0.31	--	22,227	57.95	0.018	266,587	3.78	0.014
1966	8,585	0.31	--	13,336	34.8	0.01	266,587	3.78	0.014
1967	8,585	0.31	--	0	0	0.0	0	0.0	0.0
1968	12,878	0.46	--	0	0	0.0	0	0.0	0.0
1969	68,680	2.5	--	--	--	--	103,673	1.47	0.005
1970	60,095	2.15	--	--	--	--	177,725	2.52	0.01
1971	51,510	1.85	--	--	--	--	177,725	2.52	0.01
1972	42,925	1.54	--	--	--	--	88,862	1.26	0.005
1973	34,340	1.23	--	--	--	--	88,862	1.26	0.005
1974	25,755	0.92	--	--	--	--	29,621	0.42	0.0
1975	17,170	0.62	--	--	--	--	236,966	3.35	0.01
1976	8,585	0.31	--	--	--	--	236,966	3.35	0.01
1977	--	--	--	--	--	--	236,966	3.35	0.01
1978	--	--	--	--	--	--	207,346	2.94	0.01
1979	--	--	--	--	--	--	177,725	2.52	0.01
1980	--	--	--	--	--	--	133,294	1.89	0.005
1981	--	--	--	--	--	--	103,673	1.47	0.005
1982	--	--	--	--	--	--	44,431	0.63	0.0
1983	--	--	--	--	--	--	0	0.0	0.0
1984	--	--	--	--	--	--	--	--	--
1985	--	--	--	--	--	--	--	--	--
1986	--	--	--	--	--	--	--	--	--
1987	--	--	--	--	--	--	--	--	--
1988	--	--	--	--	--	--	--	--	--
Total		29.2	--		892.45	0.282		41.13	0.133

[a] Radon Flux - average 9.1 $pCi/m^3/sec$ and maximum 75 $pCi/m^3/sec$

[b] Radon Flux - average 6.0 $pCi/m^3/sec$ and maximum 81.1 $pCi/m^3/sec$

[c] Radon Flux - average 2.6 $pCi/m^3/sec$ and maximum 48 $pCi/m^3/sec$

Table 4-2b. Fugitive uranium and thorium emissions from wind erosion of Waste Pits 4, 5 and 6.

	Pit 4[d]			Pit 5[d]			Pit 6[d]		
Year	Exposed pit area (ft^2)	Uranium emission (kg/yr)	Thorium emission (kg/yr)	Exposed pit area (ft^2)	Uranium emission (kg/yr)	Thorium emission (kg/yr)	Exposed pit area (ft^2)	Uranium emission (kg/yr)	Thorium emission (kg/yr)
1953	--	--	--	--	--	--	--	--	--
1954	--	--	--	--	--	--	--	--	--
1955	--	--	--	--	--	--	--	--	--
1956	--	--	--	--	--	--	--	--	--
1957	--	--	--	--	--	--	--	--	--
1958	--	--	--	--	--	--	--	--	--
1959	--	--	--	--	--	--	--	--	--
1960	9,583	1.9	0.38	--	--	--	--	--	--
1961	19,166	3.79	0.76	--	--	--	--	--	--
1962	38,333	7.58	1.53	--	--	--	--	--	--
1963	43,124	8.52	1.72	--	--	--	--	--	--
1964	47,916	9.47	1.91	--	--	--	--	--	--
1965	47,916	9.47	1.91	--	--	--	--	--	--
1966	52,708	10.42	2.1	--	--	--	--	--	--
1967	52,708	10.42	2.1	--	--	--	--	--	--
1968	57,499	11.36	2.3	0	0.0	0.0	--	--	--
1969	57,499	11.36	2.3	0	0.0	0.0	--	--	--
1970	57,499	11.36	2.3	0	0.0	0.0	--	--	--
1971	57,499	11.36	2.3	0	0.0	0.0	--	--	--
1972	62,291	12.3	2.49	0	0.0	0.0	--	--	--
1973	62,291	12.3	2.49	0	0.0	0.0	--	--	--
1974	62,291	12.3	2.49	17,860	0.28	0.1	--	--	--
1975	67,082	13.26	2.68	44,649	0.71	0.24	--	--	--
1976	71,874	14.2	2.87	142,877	2.27	0.76	--	--	--
1977	81,457	16.1	3.25	53,579	0.85	0.29	--	--	--
1978	91,040	18.0	3.64	53,579	0.85	0.29	--	--	--
1979	95,832	18.94	3.83	53,579	0.85	0.29	3,240	8.26	--
1980	95,832	18.94	3.83	53,579	0.85	0.29	4,860	12.4	--
1981	95,832	18.94	3.83	53,579	0.85	0.29	8,100	20.7	--
1982	95,832	18.94	3.83	53,579	0.85	0.29	8,100	20.7	--
1983	95,832	18.94	3.83	53,579	0.85	0.29	8,100	20.7	--
1984	95,832	18.94	3.83	53,579	0.85	0.29	8,100	20.7	--
1985	95,832	18.94	3.83	53,579	0.85	0.29	8,100	20.7	--
1986	95,832	18.94	3.83	53,579	0.85	0.29	8,100	20.7	--
1987	95,832	18.94	3.83	89,296	1.42	0.48	8,100	20.7	--
1988	95,832	18.94	3.83	119,124	1.9	0.64	8,100	20.7	--
Total		394.9	79.8		15.1	5.1		186	--

[d] Radon Flux – less than 0.1 $pCi/m^3/sec$

Since 1972, the FEMP has served as the thorium materials repository for DOE. The thorium metal and residues stored on site are primarily ^{232}Th. Since most of the material and residues have been stored for quite some time, there is a significant amount of ^{224}Rn present, which results in the generation of thoron gas (^{220}Rn). The average thoron activity concentration in outside air has been reported to be comparable to the environmental background concentration of the radon; therefore, it can be assumed that the FEMP thoron environmental concentrations vary with fluctuations in radon concentrations (Tomes 1997). The bulk of the thorium materials are stored in Buildings 64, 65, 67, 68, and 69. Since thoron has a half-life of 55.6 seconds, significant accumulation occurs only in areas in the proximity of the buildings where the thorium is stored. Therefore, for 1972 and subsequent years, an activity concentration equal to that of radon background concentration is assigned to the areas close to buildings where thorium was stored.

Table 4-3. Thorium emission estimates by year (kg)

Year	Plant 8	Plant 9	Pilot Plant	Yearly total
1953	0	0	0	0
1954	0	1028	0	1028
1955	0	1176	0	1176
1956	0	0	0	0
1957	0	0	0	0
1958	0	0	0	0
1959	0	0	0	0
1960	0	0	0	0
1961	0	0	0	0
1962	0	0	0	0
1963	0	0	0	0
1964	0	0	344	344
1965	0	0	344	344
1966	118	0	344	462
1967	0	0	344	344
1968	0	0	344	344
1969	1040	0	394	1434
1970	699	0	499	1198
1971	430	0	62	492

Year	Plant 8	Plant 9	Pilot Plant	Yearly total
1972	0	0	141	141
1973	0	0	50	50
1974	0	0	100	100
1975	0	0	3	3
1976	0	0	0	0
1977	0	0	408	408
1978	0	0	408	408
1979	0	0	408	408
1980	0	0	0	0
1981	0	0	0	0
1982	0	0	0	0
1983	0	0	0	0
1984	0	0	0	0
1985	0	0	0	0
1986	0	0	0	0
1987	0	0	0	0
1988	0	0	0	0
Total	2,204	2,287	4,193	8,684

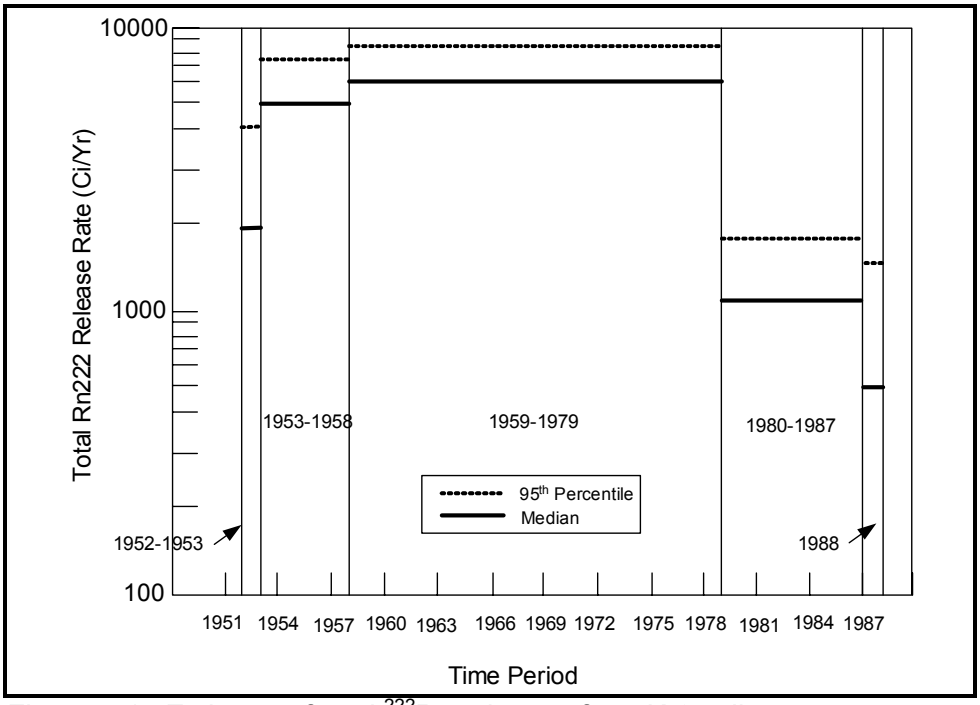

Figure 4-1. Estimate of total ^{222}Rn releases from K-65 silos.

Table 4-4. Summary of ^{222}Rn and ^{222}Rn daughter product releases (Ci) for drummed K-65 material stored on the Plant 1 Pad.

Years	Rn-222 release			Rn-222 daughters release[a]		
	5th	Median	95th	5th	Median	95th
1951[b]	2.6	35	170	0.24	6.2	45
1952	42	580	2,800	3.9	100	730
1953[c]	6.9	95	450	0.63	17	120

a. The quantities given for ^{222}Rn daughters are comprised of quantities of each short-lived daughter: ^{218}Po, ^{214}Pb, ^{214}Bi, and ^{214}Po.
b. Releases for 1951 are assumed to have occurred from October to December.
c. Releases for 1953 are assumed to have occurred from January to June.

4.3.2 Onsite Environmental Radioactive Material Air Concentrations and Intake for 1951 to 1988)

This section presents the derivation of the on-site radioactivity concentrations at various locations of the FEMP based on discharges from routine operations during the plant's operating years.

4.3.2.1 Exposure Site Locations

The airborne emissions data indicate that the quantity of normal releases at FEMP has varied significantly from facility to facility. It is assumed that the radioactive aerosol concentration varies significantly in various sections of the plant site. The dose received by the worker is highly dependent on the amount of time spent in specific work areas. For the purpose of providing supportive information for dose reconstruction, this TBD has divided the FEMP into smaller areas, designated as Exposure Areas (EAs), on a grid that provides a realistic estimated representation of the radiological conditions where the employees may have worked. Figure 4-2 shows the FEMP site plan depicting the grids. There are 11 EAs for which this TBD presents airborne radionuclide concentrations from routine operations. Table 4-5 lists the major facilities in each of EA-1 through EA-11.

4.3.2.2 Airborne Radionuclide Concentration Derivation

The radioactive aerosol concentrations at distances from a continuous source in each EA can be obtained by:

$$C_{EA} = \sum_i R_i \left(\frac{\chi}{Q}\right)_{di} f_i(RF) \tag{4-1}$$

where

C_{EA} = radionuclide concentration in EA (g/m^3)
R_i = radionuclide emission rate from source *i* (g/s) where *i* can be Plant 1, 2/3, 4, etc.
$(\chi/Q)_{di}$ = atmospheric dilution factor at distance *d* from source *i* (s/m^3)
f_i = fraction of time that the wind blew in the EA direction from source *i*
(RF) = respirable fraction of the source aerosol (<10 µm)

Airborne radionuclide concentrations for each of the EAs are the sum of the contributions of all the emission sources to the most probable occupied area within the EA.

Radionuclide Emission Rates (R_i)×(RF)
The average annualized emission rates are derived by dividing emission quantities in Tables 4-1, 4-2, 4-3 and Figure 4-1 by 3.154 × 10^7 s per average year. In 1951 and 1953, ^{222}Rn and radon daughters were released from stored drums of K-65 materials at the Plant 1 pad in three months in one case and six months in another (Table 4-4). However, their release rates were respectively annualized as if the total emission quantities were released over a one-year period. The radon daughter releases in Table 4-4 represent a equilibrium factor ranging from 1% to 27% for the years 1951 through 1953. For dose reconstruction purposes, the EPA default equilibrium factor of 70% for outdoor is used for the intake calculation. The 70% equilibrium factor is claimant favorable. Therefore, the radon daughter releases in Table 4-4 were not used in the Rn intake calculations.

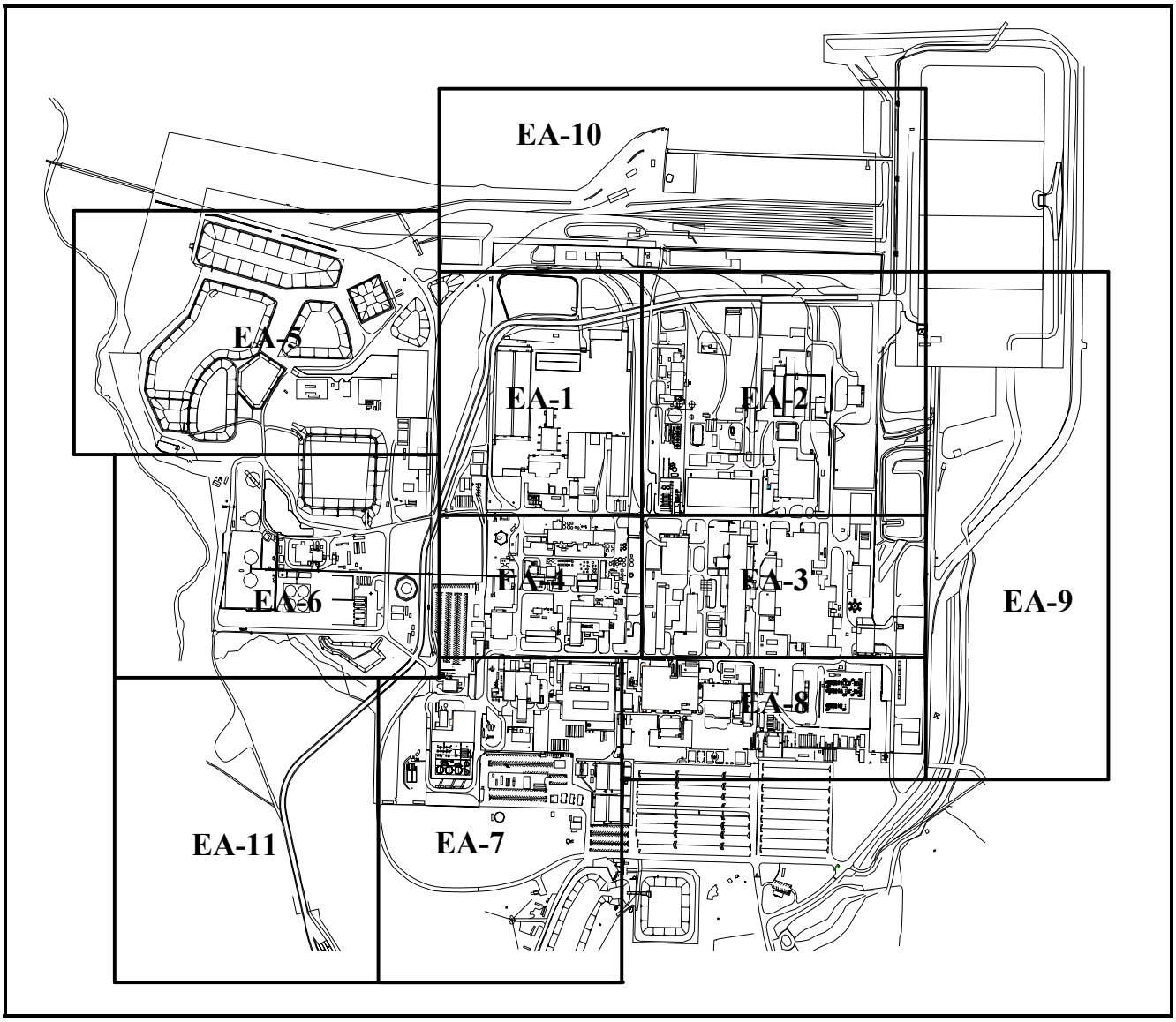

Figure 4-2. Exposure Areas.

Table 4-5. Facilities and buildings in each Exposure Area.

EA	Facilities and buildings
EA-1	Plants 1, Buildings 67 and 68
EA-2	Plant 9, Buildings 64 and 65
EA-3	Plants 4, 5, 6, and 7
EA-4	Plant 2/3 and Plant 8
EA-5	Waste Pit Area
EA-6	K-65 Silos
EA-7	Pilot Plant, Building 69, Laboratory Building Waste Water Treatment Facility, Storm Water Retention Basins, Administrative Area (Expanded into this EA in the 1990s)
EA-8	Administrative Area, Industrial Relations and Security Buildings
EA-9	Onsite Disposal Facility, Sewage Treatment Plant
EA-10	Railroad
EA-11	Waste Haul Road

For internal dose assessment, the particle sizes of interest are those below 10 µm. Particle sizes below 10 µm are considered respirable and sufficiently small to remain airborne during transport. Appendix E of the *Fernald Dosimetry Reconstruction Project* (RAC 1988) states that the size distribution of emissions released from various processes involving uranium compounds involve particle sizes below 10 µm in the 60th to 70th percentile, weighted more in the 60th percentile. The average particle size distribution from the stack is derived from Table E-1 of the RAC 1988 report and shows 7.8-µm particle size at the 55th percentile and 9.78 µm at the 65th percentile. Therefore, a value of 65% is used for (RF) and the emission rate is reduced 35% to account for respirable size portion of the release.

Atmospheric Dilution Factor (χ/Q)
The dilution factor (χ/Q) is calculable using the Pasquill-Gifford equation:

$$\frac{\chi(x,y)}{Q} = \frac{1}{\pi\sigma_y\sigma_z u} \exp\left[-\frac{1}{2}\left(\frac{y^2}{\sigma_y^2}+\frac{H^2}{\sigma_z^2}\right)\right] \tag{4-2}$$

where

$\chi(x, y)$	=	ground level concentration at point x, y (g/m^3)
x	=	downwind distance on plume center line (m)
y	=	cross-wind distance (m)
Q	=	emission rate (g/s)
σ_y, σ_z	=	horizontal and vertical standard deviations of contaminant concentration in the plume (m), Figures 4-3 and 4-4, respectively.
u	=	mean wind speed at level of plume center line (m/s)
H	=	effective chimney height (m)

For particulates, the (χ/Q) equation becomes:

$$\frac{\chi(x,y)}{Q} = \frac{1}{2\pi\sigma_y\sigma_z u} \exp\left[-\frac{1}{2}\left(\frac{y^2}{\sigma_y^2}+\frac{H^2}{\sigma_z^2}\right)\right] \tag{4-3}$$

Equation 4-2 yields the ground-level concentration of a gas that is continuously emitted from a point source and is based on total reflection of the gas by the ground. If the pollutant in the plume were retained on the ground, as in the case of particulates (Equation 4-3), then the ground-level concentration would be approximately one-half that in Equation 4-3.

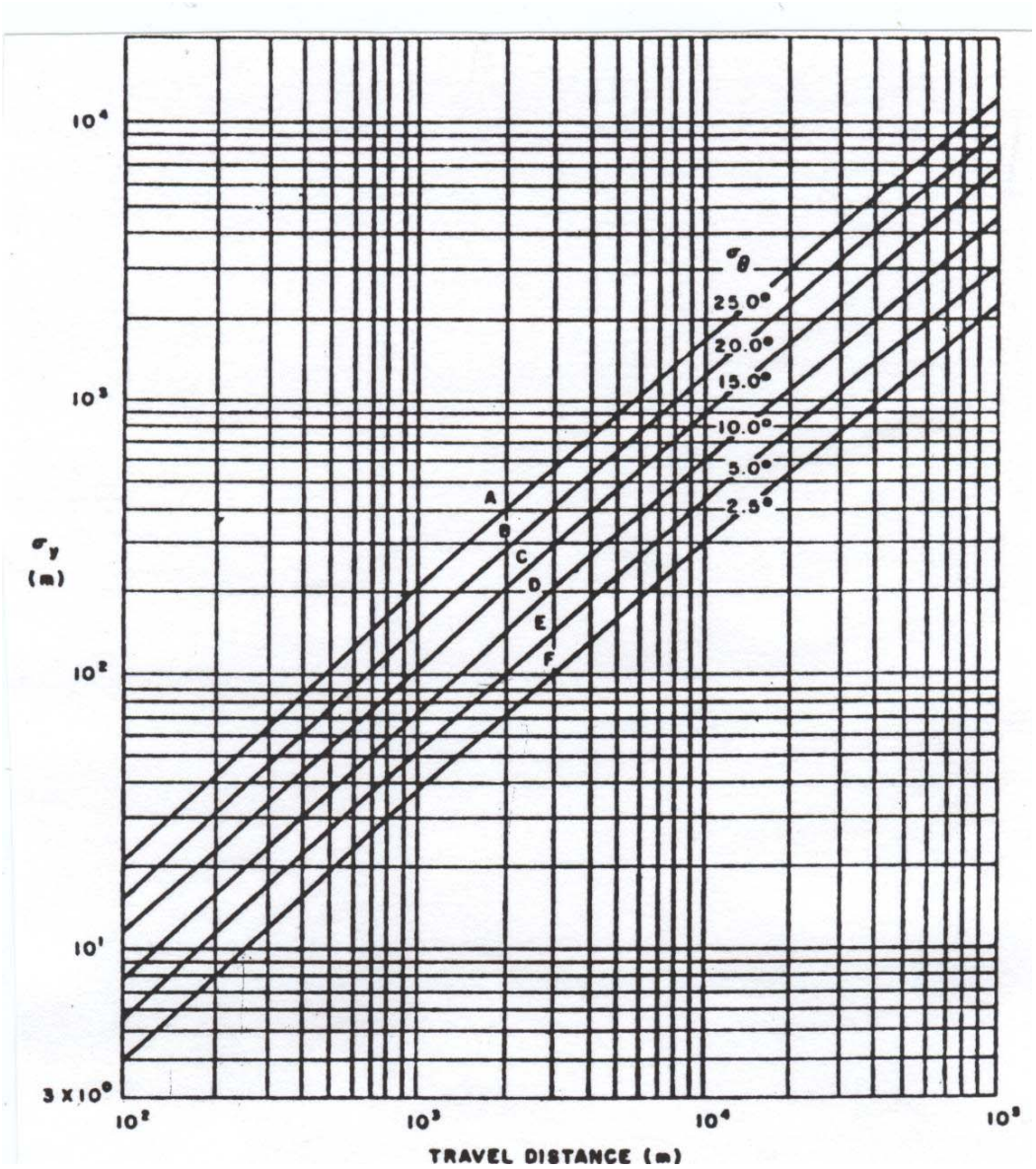

Figure 4-3. Horizontal diffusion, σ_y, versus downwind distance from a point source for Pasquill's stability categories.

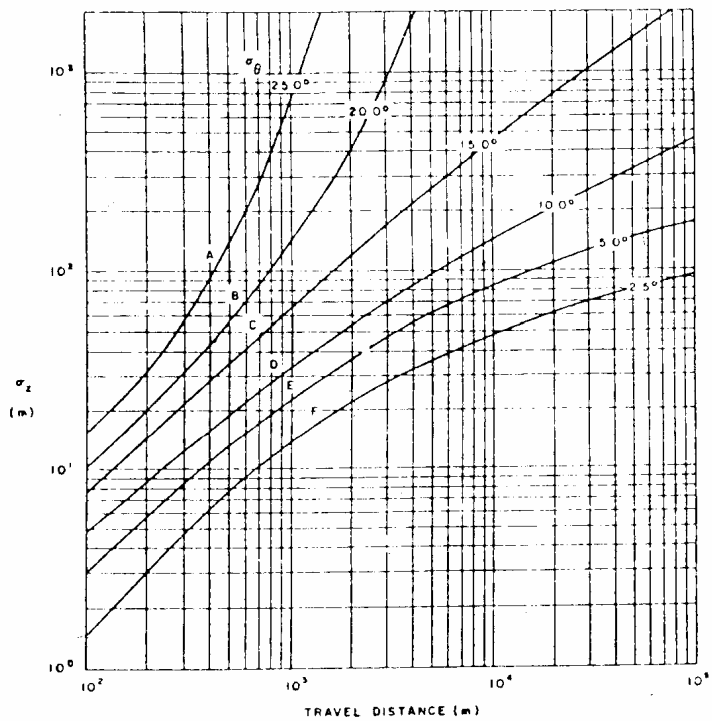

Figure 4-4. Horizontal diffusion, σ_z, versus downwind distance from a continuously emitting point source for Pasquill's stability categories.

Table 4-6 shows the χ/Q values with respect to the receptor distances downwind on the plume center line using a wind speed of 3.2 m/s, Pasquill stability class F, ground release, and elevated releases assuming an average stack height of 10 m (Parsons date unknown). Because U and Th emissions from the production plants were particulates released through the stacks, elevated release χ/Q is used for uranium and thorium releases. Ground release χ/Q is used for U and Th fugitive emissions from the waste pits. Rn-222 is treated as elevated gaseous release primarily from the head space of the K-65 Silos.

The maximum ground level concentration occurs at the downwind distance where the vertical standard deviation is:

$$\sigma_z = H/\sqrt{2} = 7.1 \qquad (4\text{-}4)$$

This corresponds to a distance of approximately 500 m downwind from the source for Pasquill Stability Class F.

Table 4-7 provides the EA receptor downwind distance estimation (m) from each of the contributing emission sources used for the radioactivity concentration calculations. The distances were estimated based on emission sources to the most likely occupied location in each of the EAs. Distances slightly higher (approaching the 500m maximum concentration distance) than those scaled from plot plan reproductions were assigned to ensure claimant favorable.

Table 4-6. χ/Q values versus distances from the emission source.

Distance (m)	(χ/Q) (s/m^3)[a]	
	Ground release	10-m release height
100	0.02	5.12×10^{-11}
150	8.29×10^{-3}	3.37×10^{-8}
200	4.14×10^{-3}	1.60×10^{-5}
250	2.48×10^{-3}	1.09×10^{-4}
300	1.69×10^{-3}	2.11×10^{-4}
350	1.21×10^{-3}	2.31×10^{-4}
400	8.85×10^{-4}	2.71×10^{-4}
450	7.68×10^{-4}	2.77×10^{-4}
500	6.98×10^{-4}	2.87×10^{-4}
550	5.92×10^{-4}	2.71×10^{-4}
600	4.61×10^{-4}	2.48×10^{-4}
650	4.19×10^{-4}	2.41×10^{-4}
700	3.51×10^{-4}	2.23×10^{-4}
750	2.84×10^{-4}	2.02×10^{-4}
1,000	1.75×10^{-4}	1.40×10^{-4}
2,000	6.46×10^{-5}	5.83×10^{-5}
5,000	1.63×10^{-5}	1.56×10^{-5}

[a] For U and Th particulate aerosol, 0.5 × the values in the table.

Table 4-7. Receptor downwind estimated distances from contributing emission sources (m).

EA	Contributing emission sources										
	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste pits	K-65 silos
1	150	250	300	500	600	350	500	500	350	500	400
2	500	500	400	300	500	500	600	250	500	1,000	1,000
3	500	500	200	150	250	250	500	350	450	1,000	1,000
4	300	150	250	500	500	250	150	500	200	600	450
5	300	400	600	2,000	2,000	600	500	2,000	600	150	300
6	500	400	550	2,000	2,000	550	400	2,000	500	300	250
7	500	400	450	400	500	400	300	550	300	700	500
8	500	450	300	300	300	250	450	500	300	1,000	1,000
9	2,000	2,000	500	450	300	500	2,000	500	2,000	2,000	2,000
10	400	500	500	600	650	550	550	450	600	500	1,000
11	2,000	2,000	5,000	2,000	2,000	700	700	2,000	700	700	450

Effects of Wind Direction (f_i)

Wind direction plays a key role in predicting the amount of aerosol that arrives at an EA. Figure 4-5 shows a wind rose at the 10-m level from 2000. The prevailing winds were from the west through south-southwest about 40% of the time.

Table 4-8 lists the fraction of the time that the wind blew toward the EAs from a contributing emission source, as determined using Figures 4-2 and 4-5.

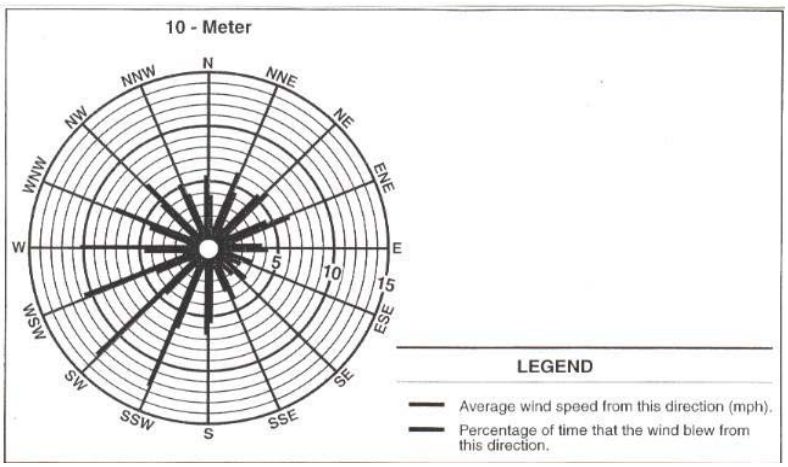

Figure 4-5. Wind rose for a 10-m height for 2000.

Table 4-8. Percentage of time that the wind blew in the direction of the Exposure Areas.

	Contributing emission sources (%)										
EA	**Plant 1**	**Plant 2/3**	**Plant 4**	**Plant 5**	**Plant 6**	**Plant 7**	**Plant 8**	**Plant 9**	**Pilot Plant**	**Waste pits**	**K-65 silos**
1	36	34	11	11	11	11	22	12	22	20	20
2	36	37	44	49	12	36	24	41	37	18	20
3	19	25	15	54	8	34	34	16	34	15	18
4	26	26	15	13	15	11	34	11	11	8	25
5	18	9	9	9	9	8	7	16	9	15	30
6	13	11	13	14	6	8	8	13	8	13	19
7	13	13	10	7	11	11	24	13	15	11	11
8	19	19	23	26	14	23	8	12	19	11	15
9	18	18	18	18	18	21	21	18	29	18	18
10	35	33	10	12	7	23	33	5	12	24	23
11	10	14	17	13	13	11	11	11	11	13	8

4.3.2.3 Radionuclide Concentrations and Intake from Routine Emissions

Table 4-9a lists estimates of the radionuclide concentrations and the amount of radionuclide intake for a claimant who spent a year within an EA for 1951 to 1988. The median radon releases values in Figure 4-1 and Table 4-4 were used for the estimates. Appendix 4A lists the detailed results. Table 4-9a also provides concentration values that include the background radon concentrations. The background radon concentrations used were the average background concentrations measured in 1989 to 2000 of 0.47 pCi/L. (Fluor, 2001). The background concentration measurements are shown in Appendix 4B. The intake calculation assumed that an individual would breathe in 2,400 m^3 of air in a year. The concentration and annual intake values for uranium and thorium in Table 4-9a are in milligrams per cubic meter and milligrams respectively. Table 4-9d lists the specific activities and isotopic content (or activity fraction of an isotope) for converting milligrams to Becquerel of individual isotopes. Radon (^{222}Rn) and thoron (^{220}Rn) concentration values are in pCi/L. The ^{222}Rn and ^{220}Rn intake levels are expressed in Working Level Months. For ^{222}Rn, 1 WL= 100pCi/L and the WLM is derived based on an individual continuously breathed air at the FEMP for 2,000 hrs for the year and an assumed environmental radon daughter product equilibrium factor of 70% (This ratio for ambient outside air is in accordance with widespread sampling conducted throughout the United States that is referenced in the NCRP report). For ^{220}Rn, 1 WL=7.47 pCi/L and the equilibrium factor have been documented to range between 0.02 to 0.1 at several locations (Tomes, 1997).

Therefore,

Rn-222 WLM = $\frac{0.7 \times 2000}{100 \times 170} \times Concentration \frac{pCi}{L}$ = 8.24×10^{-2} × (Rn concentration in pCi/L),

and

Rn-220 WLM = $\frac{0.1 \times 2000}{7.47 \times 170} \times Concentration \frac{pCi}{L}$ = 1.58×10^{-1} × (thoron concentration in pCi/L)

The average concentration of radon emissions from the waste pits (EA-5) typically was an order of magnitude lower than those from the K-65 silos. Therefore, the results for EA-5 do not include the radon emitted from the waste pits.

The following example demonstrates the use of Equation 4-1 to calculate the 1955 radionuclide (uranium and radon) concentrations and intake at an administrative building location (EA-8).

Step 1. Calculate the concentration of uranium in EA-8 from each of the emission sources (i.e., Pilot Plant, Plant 1, 2/3, etc.) using Equation 4-5:

$$C_{EA8i} = R_i\,(RF) \times \left(\frac{\chi}{Q}\right)_{di} \times f_i \qquad (4\text{-}5)$$

Where

C_{EA8i} = uranium concentration in EA-8 as a consequent of emission from source *i*, where *i* can be Plant 1, 2/3, 4, and etc.

R_i = uranium emission rate of source *i*. Table 4-1, 4-2a, and 4-2b values for U emission source *i* ÷ by number of seconds per year. For ^{222}Rn releases, Figure 4-1 was used.

$\left(\frac{\chi}{Q}\right)_{di}$ = atmospheric dilution factor at distance *d,* where *d* is the distance from EA-8 to emission source *i* using Table 4-6 values based on distance values in Table 4-7.

RF = respirable fraction of the uranium aerosol. 65% as discussed in Section 4.3.2.2.

f_i = fraction of time that the wind blew in EA-8 direction from emission source *i* using Table 4-8 percentages.

The following data presents the inputs and results of application of Eq. 4-5. The resulting C_{EA8i} appear in Appendix 4A, table for 1955 Row EA-8 and Columns 3 through 10 for U

release, and Column 15 in the unit of Ci/m^3 and Column 16 in the unit of pCi/ m^3 for radon release.

1955 *I*	g/sec *R×(RF)*	m *d*	sec/m^3 $(\chi/Q)_{di}$	% f_i	g/m^3 C_{EA8i}
Plant 1	3.38E-03[a]	500	1.44E-04	19	9.23E-08
Plant 2/3	2.29E-02	450	1.39E-04	19	6.04E-07
Plant 4	2.56E-01	300	1.06E-04	23	6.22E-06
Plant 5	2.14E-01	300	1.06E-04	26	5.90E-06
Plant 6	1.34E-03	300	1.06E-04	14	1.99E-08
Plant 7	1.50E-01	250	5.45E-05	23	1.88E-06
Plant 8	3.75E-02	450	1.39E-04	8	4.16E-07
Plant 9	0.0	500	1.44E-04	12	0.0
Pilot Plant	9.11E-03	300	1.06E-04	19	1.84E-07
Waste Pits	4.43E-05[b]	1,000	8.75E-05[b]	11	4.26E-10
Silos (Rn)	1.58E-04 Ci/sec[c]	1,000	1.40E-04[c]	15	3.32E-09[c]

Notes:
[a] Plant 1 release included the solid and liquid waste incineration and Oil & Graphite releases. (46.2kg + 118kg)
[b] *RF*=1.0 for Waste Pits releases and ground release diffusion factor was used.
[c] RF=1.0 and gaseous elevated release diffusion factor was used. The unit for radon release is Ci/m^3.

Step 2. Sum C_{EA8i} for all the radionuclide emission sources and obtain total radionuclide intake for the year by multiplying the concentration by 2,400 m^3:

$$C_{EA8} = \sum_i C_{EA*i} = 1.53\times10^{-5}\ g/m^3 \text{ or } 1.53\times10^{-2}\ mg/m^3 \text{ and}$$

U intake = (1.53×10^{-2} *mg/m*^{3})(2400 *m*^{3}) = 36.7 *mg*

The U concentration and intake results are in Appendix 4A, 1955 table, columns 13 and 14, respectively.

Step 3. Transfer the total U concentration and annual intake in EA-8 forward to Table 4-9a. Calculate the Rn intake in WLM by adding the average background concentration and using the conversion factor given in Table 4-9d as shown in the following:

Rn intake (WLM) = ((3.32×10^{-9} *Ci/m*^{3})(10^9 pCi/L per *Ci/m*^{3}) + (0.47 pCi/L))(8.24×10^{-2} WLM/(p*Ci/m*^{3})

= 0.312 WLM

The above radon WLM result for EA-8 are presented in column 10 of Table 4-9a for the year 1955.

4.3.3 Onsite Air Monitored Average Concentrations (1989 to 2002)

On-site average radionuclide concentrations for 1989 to 1996 were obtained from continuous, high-volume air monitoring stations (AMS) as part of the various sampling programs at FEMP to monitor

releases to the environment. The air monitoring results were reported in the annual site environmental reports for the years covered in this TBD section.

Figure 4-6 shows the AMS locations. On-site average radionuclide concentrations were derived from data in the Annual Site Environmental Reports from AMS 8 and AMS 9. Figures 4-7 and 4-8 provide the average uranium and thorium concentrations, respectively, at AMS 8 and AMS 9 by year. The radon concentrations is taken from the average monitoring results from six fence line AMS locations along Paddy's Run Road closest to the K-65 Silos.

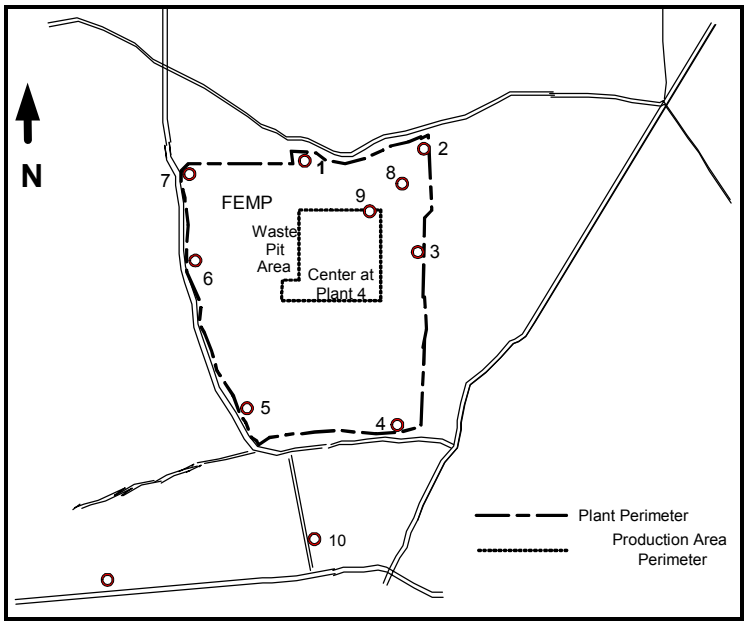

Figure 4-6. Air monitoring station locations.

In about 1997, in recognition that the primary source of air emissions at the FEMP had changed under full-scale remediation from point sources to fugitive emissions from diffuse sources, the FEMP Radiological Air Particulate Monitoring Program defined a new approach for demonstrating NESHAP Subpart H compliance. The approach utilizes radiological air particulate monitoring results rather than computer modeling to estimate the dose from airborne particulates. The onsite monitors were positioned to provide surveillance of the fugitive emissions generated by the remediation activities.

The annual environmental reports reported the maximum and minimum radionuclide concentrations obtained by these monitors. This TBD uses the maximum concentration values reported at the monitor locations as the technical basis for internal occupational environmental dose assessment.

Onsite Radionuclide Concentrations and Intakes (1989–1996)

The values in Figure 4-5 were used to estimate the radionuclide concentrations at each of the EAs. By using Equation 4-1, the radionuclide release rates were calculated using average radionuclide concentrations obtained from AMS 8 and AMS 9. AMS 8 and 9 are located approximately 750 m and 500 m from the center of the Production Area (Plant 4), downwind of the prevailing wind direction (40% of the time), respectively. The radionuclide release rates used to estimate EA concentration were the average of those release rates calculated for AMS 8 and AMS 9, using ground release (χ/Q)s . The source of release was assumed to be at the center of the Production Area (Plant 4). The EA concentrations and intakes were calculated using these input data. The average radon concentrations measured from the various AMS locations reported in the Environmental Reports are

directly used as the average EA radon concentrations in accordance with the following. These radon concentrations included the ambient concentration.

- Average AMS M, L, K and J values were applied to EA-1, EA-3, EA-4, and EA-8.
- Average AMS M and L values corrected for distance were applied to EA-6.
- Average AMS 6, O, and N values were applied to EA-5.
- AMS 9 value was applied to EA-2, EA-7, and EA-11.
- AMS 8 value was applied to EA-9 and EA-10.

Table 4-9b lists a summary of the results; Appendix 4A contains more detail.

Onsite Radionuclide Concentrations and Intakes (1997 to 2002)
The onsite radionuclide concentrates reported in the Integrated Site Environmental Reports (Fluor 1997, 1998, 1999, 2000, 2001) form the technical basis for the occupational environmental dose calculations. Table 4-9c lists the maximum concentration values from 1997 to 2002.

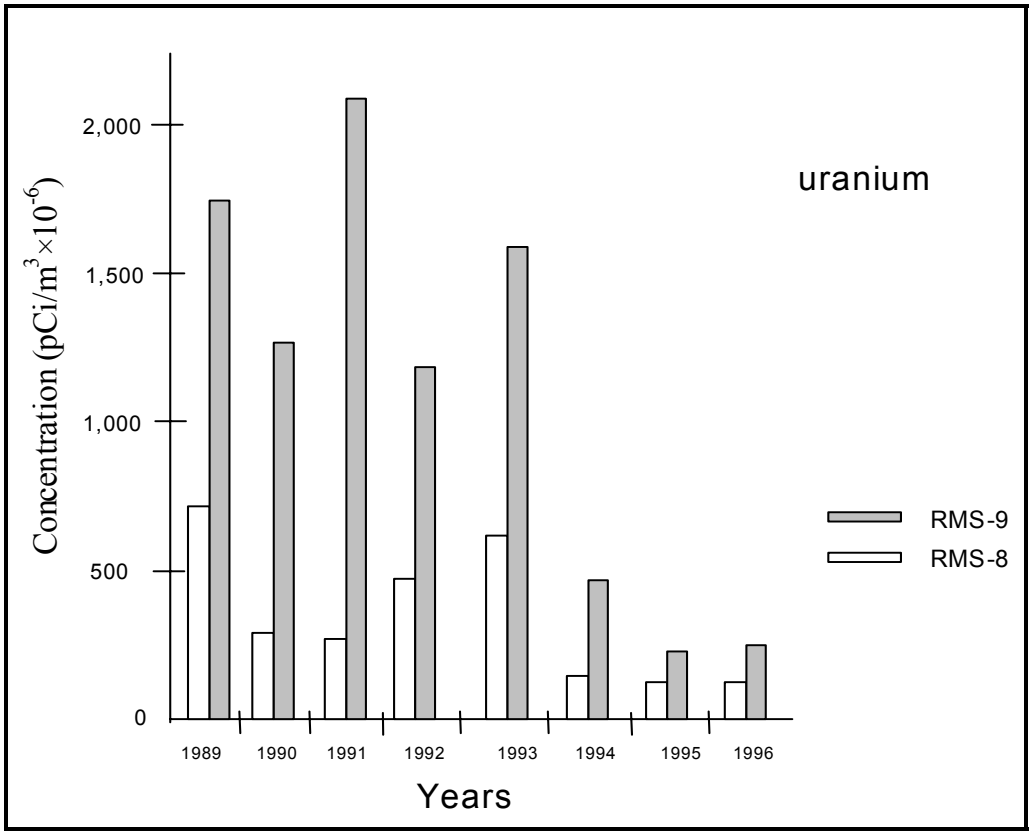

Figure 4-7. Average onsite uranium concentrations (1989 - 1996).

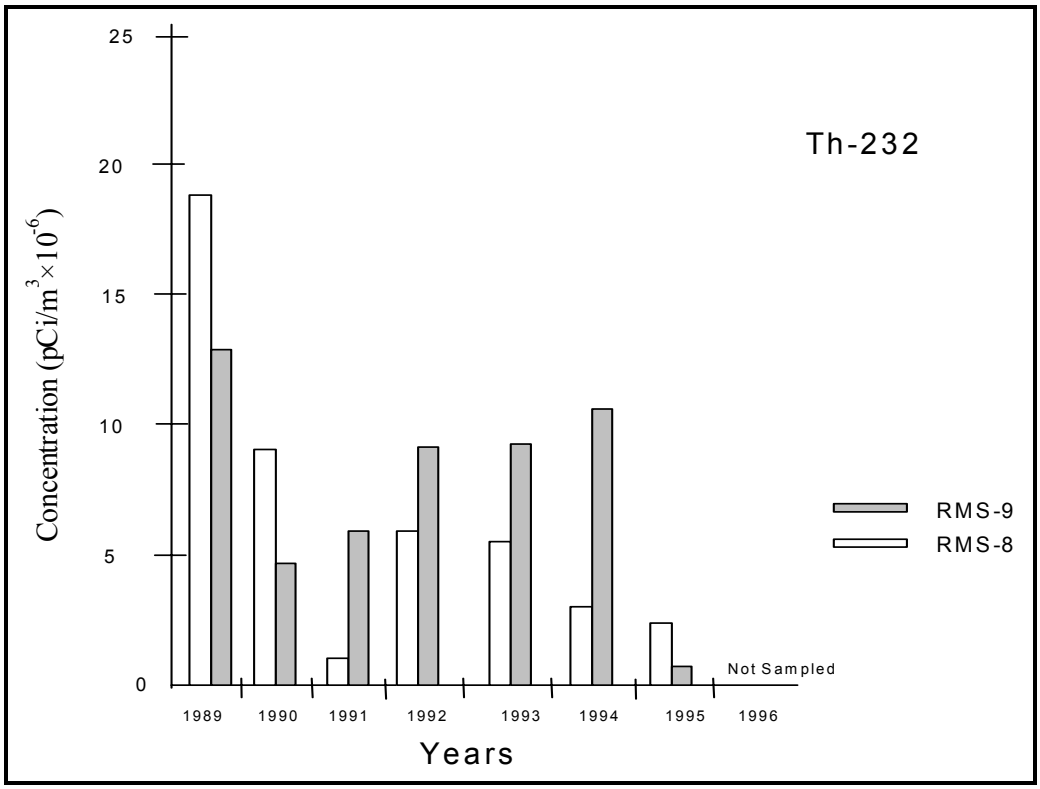

Figure 4-8. Average onsite thorium concentrations (1989 -1996).

4.3.4 Airborne Radionuclide Concentration and Intake Summary for Years 1951 through 2002 (Table 4-9)

Table 4-9a. Radionuclide concentration and intake summary for 1951 to 1988. (g to Bq Conversion factors are in Table 4-9d)

Radionuclide		EA-1	EA-2	EA-3	EA-4	EA-5	EA-6	EA-7	EA-8	EA-9	EA-10	EA-11
1951												
Uranium	Conc. (mg/m^3)	6.44E-05	1.35E-04	1.19E-04	2.23E-06	2.83E-05	2.91E-05	4.01E-05	5.08E-05	2.14E-05	3.77E-05	3.11E-05
	Intake (mg)	1.55E-01	3.23E-01	2.86E-01	5.35E-03	6.79E-02	6.98E-02	9.63E-02	1.22E-01	5.14E-02	9.05E-02	7.46E-02
Thorium	Conc. (mg/m^3)	0	0	0	0	0	0	0	0	0	0	0
	Intake (mg)	0	0	0	0	0	0	0	0	0	0	0
Rn-222	Conc. (pCi/L)	3.31E+00	2.79E-01	1.47E-01	4.88E-01	3.38E-01	1.01E-01	1.01E-01	1.47E-01	3.50E-02	3.44E-01	1.94E-02
	Conc.+ Backgrd	3.78E+00	7.49E-01	6.17E-01	9.58E-01	8.08E-01	5.71E-01	5.71E-01	6.17E-01	5.05E-01	8.14E-01	4.89E-01
	Intake (WLM)	3.11E-01	6.17E-02	5.08E-02	7.89E-02	6.66E-02	4.71E-02	4.71E-02	5.08E-02	4.16E-02	6.71E-02	4.03E-02
1952												
Uranium	Conc. (mg/m^3)	2.60E-04	5.42E-04	4.79E-04	1.16E-05	1.14E-04	1.17E-04	1.63E-04	2.05E-04	8.82E-05	1.52E-04	1.25E-04
	Intake (mg)	6.24E-01	1.30E+00	1.15E+00	2.78E-02	2.73E-01	2.80E-01	3.91E-01	4.93E-01	2.12E-01	3.65E-01	3.00E-01
Thorium	Conc. (mg/m^3)	0	0	0	0	0	0	0	0	0	0	0
	Intake (mg)	0	0	0	0	0	0	0	0	0	0	0
Rn-222	Conc. (pCi/L)	5.83E+01	6.40E+00	4.04E+00	1.25E+01	9.61E+00	2.98E+00	3.67E+00	3.77E+00	1.24E+00	7.74E+00	1.73E+00
	Conc.+ Backgrd	5.88E+01	6.87E+00	4.51E+00	1.30E+01	1.01E+01	3.45E+00	4.14E+00	4.24E+00	1.71E+00	8.21E+00	2.20E+00
	Intake (WLM)	4.84E+00	5.66E-01	3.72E-01	1.07E+00	8.31E-01	2.84E-01	3.41E-01	3.49E-01	1.41E-01	6.77E-01	1.81E-01
1953												
Uranium	Conc. (mg/m^3)	6.46E-04	2.46E-03	5.22E-04	3.00E-04	4.61E-04	6.63E-04	6.07E-04	1.00E-03	9.23E-04	6.26E-04	2.84E-04
	Intake (mg)	1.55E+00	5.91E+00	1.25E+00	7.20E-01	1.11E+00	1.59E+00	1.46E+00	2.40E+00	2.21E+00	1.50E+00	6.81E-01
Thorium	Conc. (mg/m^3)	0	0	0	0	0	0	0	0	0	0	0
	Intake (mg)	0	0	0	0	0	0	0	0	0	0	0
Rn-222	Conc. (pCi/L)	1.24E+01	2.53E+00	2.00E+00	5.71E+00	4.93E+00	1.59E+00	2.28E+00	1.73E+00	7.60E-01	2.97E+00	1.46E+00
	Conc.+ Backgrd	1.29E+01	3.00E+00	2.47E+00	6.18E+00	5.40E+00	2.06E+00	2.75E+00	2.20E+00	1.23E+00	3.44E+00	1.93E+00
	Intake (WLM)	1.06E+00	2.47E-01	2.04E-01	5.09E-01	4.45E-01	1.70E-01	2.27E-01	1.81E-01	1.01E-01	2.83E-01	1.59E-01
1954												
Uranium	Conc. (mg/m^3)	4.49E-03	1.72E-02	2.79E-03	3.25E-03	2.83E-03	3.73E-03	3.10E-03	6.88E-03	8.19E-03	6.59E-03	2.22E-03
	Intake (mg)	1.08E+01	4.13E+01	6.70E+00	7.79E+00	6.80E+00	8.95E+00	7.43E+00	1.65E+01	1.97E+01	1.58E+01	5.33E+00
Thorium	Conc. (mg/m^3)	3.65E-04	4.73E-04	3.92E-04	3.34E-04	9.88E-05	2.15E-05	3.73E-04	3.65E-04	5.47E-04	1.47E-04	6.79E-05
	Intake (mg)	8.76E-01	1.14E+00	9.40E-01	8.03E-01	2.37E-01	5.16E-02	8.96E-01	8.76E-01	1.31E+00	3.52E-01	1.63E-01
Rn-222	Conc. (pCi/L)	8.59E+00	4.44E+00	3.99E+00	1.10E+01	1.00E+01	3.28E+00	5.00E+00	3.33E+00	1.66E+00	5.10E+00	3.51E+00
	Conc.+ Backgrd	9.06E+00	4.91E+00	4.46E+00	1.15E+01	1.05E+01	3.75E+00	5.47E+00	3.80E+00	2.13E+00	5.57E+00	3.98E+00
	Intake (WLM)	7.47E-01	4.05E-01	3.68E-01	9.45E-01	8.63E-01	3.09E-01	4.51E-01	3.13E-01	1.76E-01	4.59E-01	3.28E-01
1955												
Uranium	Conc. (mg/m^3)	1.01E-02	3.72E-02	6.22E-03	7.13E-03	5.95E-03	7.95E-03	7.47E-03	1.53E-02	1.70E-02	1.46E-02	4.60E-03
	Intake (mg)	2.43E+01	8.92E+01	1.49E+01	1.71E+01	1.43E+01	1.91E+01	1.79E+01	3.67E+01	4.07E+01	3.51E+01	1.11E+01
Thorium	Conc. (mg/m^3)	4.17E-04	5.42E-04	4.48E-04	3.83E-04	1.13E-04	2.46E-05	4.27E-04	4.17E-04	6.26E-04	1.68E-04	7.77E-05
	Intake (mg)	1.00E+00	1.30E+00	1.07E+00	9.18E-01	2.71E-01	5.90E-02	1.02E+00	1.00E+00	1.50E+00	4.03E-01	1.87E-01
Rn-222	Conc. (pCi/L)	8.59E+00	4.44E+00	3.99E+00	1.10E+01	1.00E+01	3.28E+00	5.00E+00	3.33E+00	1.66E+00	5.10E+00	3.51E+00
	Conc.+ Backgrd	9.06E+00	4.91E+00	4.46E+00	1.15E+01	1.05E+01	3.75E+00	5.47E+00	3.80E+00	2.13E+00	5.57E+00	3.98E+00
	Intake (WLM)	7.47E-01	4.05E-01	3.68E-01	9.45E-01	8.63E-01	3.09E-01	4.51E-01	3.13E-01	1.76E-01	4.59E-01	3.28E-01

Table 4-9a (Cont'd). Radionuclide concentration and intake summary for 1951 to 1988. (g to Bq Conversion factors are in Table 4-9d)

Radionuclide		EA-1	EA-2	EA-3	EA-4	EA-5	EA-6	EA-7	EA-8	EA-9	EA-10	EA-11
1956												
Uranium	Conc. (mg/m^3)	5.41E-03	1.60E-02	5.07E-03	2.54E-03	2.96E-03	3.86E-03	4.85E-03	6.83E-03	6.22E-03	8.37E-03	2.13E-03
	Intake (mg)	1.30E+01	3.84E+01	1.22E+01	6.10E+00	7.09E+00	9.25E+00	1.16E+01	1.64E+01	1.49E+01	2.01E+01	5.10E+00
Thorium	Conc. (mg/m^3)	0	0	0	0	0	0	0	0	0	0	0
	Intake (mg)	0	0	0	0	0	0	0	0	0	0	0
Rn-222	Conc. (pCi/L)	8.59E+00	4.44E+00	3.99E+00	1.10E+01	1.00E+01	3.28E+00	5.00E+00	3.33E+00	1.66E+00	5.10E+00	3.51E+00
	Conc.+ Backgrd	9.06E+00	4.91E+00	4.46E+00	1.15E+01	1.05E+01	3.75E+00	5.47E+00	3.80E+00	2.13E+00	5.57E+00	3.98E+00
	Intake (WLM)	7.47E-01	4.05E-01	3.68E-01	9.45E-01	8.63E-01	3.09E-01	4.51E-01	3.13E-01	1.76E-01	4.59E-01	3.28E-01
1957												
Uranium	Conc. (mg/m^3)	4.49E-03	1.07E-02	5.14E-03	1.69E-03	2.85E-03	2.52E-03	4.04E-03	5.18E-03	3.07E-03	7.50E-03	1.34E-03
	Intake (mg)	1.08E+01	2.57E+01	1.23E+01	4.07E+00	6.83E+00	6.05E+00	9.71E+00	1.24E+01	7.37E+00	1.80E+01	3.21E+00
Thorium	Conc. (mg/m^3)	2.01E-08	4.54E-09	3.79E-09	5.32E-09	1.79E-07	3.17E-08	5.57E-09	2.78E-09	1.68E-09	2.42E-08	6.58E-09
	Intake (mg)	4.83E-05	1.09E-05	9.09E-06	1.28E-05	4.31E-04	7.61E-05	1.34E-05	6.66E-06	4.03E-06	5.80E-05	1.58E-05
Rn-222	Conc. (pCi/L)	8.59E+00	4.44E+00	3.99E+00	1.10E+01	1.00E+01	3.28E+00	5.00E+00	3.33E+00	1.66E+00	5.10E+00	3.51E+00
	Conc.+ Backgrd	9.06E+00	4.91E+00	4.46E+00	1.15E+01	1.05E+01	3.75E+00	5.47E+00	3.80E+00	2.13E+00	5.57E+00	3.98E+00
	Intake (WLM)	7.47E-01	4.05E-01	3.68E-01	9.45E-01	8.63E-01	3.09E-01	4.51E-01	3.13E-01	1.76E-01	4.59E-01	3.28E-01
1958												
Uranium	Conc. (mg/m^3)	3.90E-03	8.00E-03	5.64E-03	1.04E-03	3.76E-03	2.55E-03	3.91E-03	3.86E-03	1.93E-03	7.09E-03	1.23E-03
	Intake (mg)	9.36E+00	1.92E+01	1.35E+01	2.50E+00	9.02E+00	6.12E+00	9.40E+00	9.26E+00	4.64E+00	1.70E+01	2.94E+00
Thorium	Conc. (mg/m^3)	4.60E-08	1.04E-08	8.66E-09	1.22E-08	4.10E-07	7.24E-08	1.27E-08	6.35E-09	3.83E-09	5.52E-08	1.50E-08
	Intake (mg)	1.10E-04	2.49E-05	2.08E-05	2.92E-05	9.84E-04	1.74E-04	3.06E-05	1.52E-05	9.20E-06	1.33E-04	3.61E-05
Rn-222	Conc. (pCi/L)	8.59E+00	4.44E+00	3.99E+00	1.10E+01	1.00E+01	3.28E+00	5.00E+00	3.33E+00	1.66E+00	5.10E+00	3.51E+00
	Conc.+ Backgrd	9.06E+00	4.91E+00	4.46E+00	1.15E+01	1.05E+01	3.75E+00	5.47E+00	3.80E+00	2.13E+00	5.57E+00	3.98E+00
	Intake (WLM)	7.47E-01	4.05E-01	3.68E-01	9.45E-01	8.63E-01	3.09E-01	4.51E-01	3.13E-01	1.76E-01	4.59E-01	3.28E-01
1959												
Uranium	Conc. (mg/m^3)	3.96E-03	8.53E-03	5.49E-03	7.75E-04	3.82E-03	2.74E-03	3.88E-03	3.99E-03	2.05E-03	7.10E-03	1.24E-03
	Intake (mg)	9.49E+00	2.05E+01	1.32E+01	1.86E+00	9.18E+00	6.57E+00	9.31E+00	9.57E+00	4.93E+00	1.70E+01	2.97E+00
Thorium	Conc. (mg/m^3)	4.60E-08	1.04E-08	8.66E-09	1.22E-08	4.10E-07	7.24E-08	1.27E-08	6.35E-09	3.83E-09	5.52E-08	1.50E-08
	Intake (mg)	1.10E-04	2.49E-05	2.08E-05	2.92E-05	9.84E-04	1.74E-04	3.06E-05	1.52E-05	9.20E-06	1.33E-04	3.61E-05
Rn-222	Conc. (pCi/L)	1.03E+01	5.33E+00	4.79E+00	1.32E+01	1.20E+01	3.94E+00	6.01E+00	3.99E+00	2.00E+00	6.13E+00	4.22E+00
	Conc.+ Backgrd	1.08E+01	5.80E+00	5.26E+00	1.37E+01	1.25E+01	4.41E+00	6.48E+00	4.46E+00	2.47E+00	6.60E+00	4.69E+00
	Intake (WLM)	8.87E-01	4.78E-01	4.33E-01	1.13E+00	1.03E+00	3.63E-01	5.34E-01	3.68E-01	2.04E-01	5.44E-01	3.86E-01
1960												
Uranium	Conc. (mg/m^3)	4.40E-03	8.10E-03	6.81E-03	4.71E-04	4.12E-03	2.68E-03	4.16E-03	3.76E-03	1.44E-03	7.67E-03	1.43E-03
	Intake (mg)	3.61E+00	5.76E-01	4.94E-01	1.64E+00	5.83E+00	1.23E+01	1.20E+00	3.02E-01	1.82E-01	6.31E-01	8.75E-01
Thorium	Conc. (mg/m^3)	5.93E-07	1.34E-07	1.11E-07	1.57E-07	5.28E-06	9.33E-07	1.64E-07	8.17E-08	4.94E-08	7.11E-07	1.94E-07
	Intake (mg)	1.42E-03	3.21E-04	2.67E-04	3.76E-04	1.27E-02	2.24E-03	3.93E-04	1.96E-04	1.18E-04	1.71E-03	4.65E-04
Rn-222	Conc. (pCi/L)	1.03E+01	5.33E+00	4.79E+00	1.32E+01	1.20E+01	3.94E+00	6.01E+00	3.99E+00	2.00E+00	6.13E+00	4.22E+00
	Conc.+ Backgrd	1.08E+01	5.80E+00	5.26E+00	1.37E+01	1.25E+01	4.41E+00	6.48E+00	4.46E+00	2.47E+00	6.60E+00	4.69E+00
	Intake (WLM)	8.87E-01	4.78E-01	4.33E-01	1.13E+00	1.03E+00	3.63E-01	5.34E-01	3.68E-01	2.04E-01	5.44E-01	3.86E-01

Table 4-9a (Cont'd). Radionuclide concentration and intake summary for 1951 to 1988. (g to Bq Conversion factors are in Table 4-9d)

Radionuclide		EA-1	EA-2	EA-3	EA-4	EA-5	EA-6	EA-7	EA-8	EA-9	EA-10	EA-11
1961												
Uranium	Conc. (mg/m^3)	3.61E-03	6.57E-03	5.55E-03	3.31E-04	4.05E-03	2.36E-03	3.48E-03	3.05E-03	1.07E-03	6.68E-03	1.16E-03
	Intake (mg)	8.67E+00	1.58E+01	1.33E+01	7.93E-01	9.72E+00	5.67E+00	8.34E+00	7.33E+00	2.58E+00	1.60E+01	2.77E+00
Thorium	Conc. (mg/m^3)	1.61E-06	3.64E-07	3.03E-07	4.26E-07	1.44E-05	2.54E-06	4.46E-07	2.22E-07	1.34E-07	1.93E-06	5.27E-07
	Intake (mg)	3.87E-03	8.72E-04	7.27E-04	1.02E-03	3.44E-02	6.09E-03	1.07E-03	5.33E-04	3.22E-04	4.64E-03	1.26E-03
Rn-222	Conc. (pCi/L)	1.03E+01	5.33E+00	4.79E+00	1.32E+01	1.20E+01	3.94E+00	6.01E+00	3.99E+00	2.00E+00	6.13E+00	4.22E+00
	Conc.+ Backgrd	1.08E+01	5.80E+00	5.26E+00	1.37E+01	1.25E+01	4.41E+00	6.48E+00	4.46E+00	2.47E+00	6.60E+00	4.69E+00
	Intake (WLM)	8.87E-01	4.78E-01	4.33E-01	1.13E+00	1.03E+00	3.63E-01	5.34E-01	3.68E-01	2.04E-01	5.44E-01	3.86E-01
1962												
Uranium	Conc. (mg/m^3)	3.45E-03	5.89E-03	4.81E-03	5.00E-04	3.92E-03	2.15E-03	3.32E-03	2.65E-03	1.34E-03	5.67E-03	1.18E-03
	Intake (mg)	8.27E+00	1.41E+01	1.16E+01	1.20E+00	9.41E+00	5.16E+00	7.97E+00	6.37E+00	3.21E+00	1.36E+01	2.83E+00
Thorium	Conc. (mg/m^3)	2.26E-06	5.10E-07	4.25E-07	5.97E-07	2.01E-05	3.55E-06	6.25E-07	3.11E-07	1.88E-07	2.71E-06	7.38E-07
	Intake (mg)	5.42E-03	1.22E-03	1.02E-03	1.43E-03	4.83E-02	8.53E-03	1.50E-03	7.47E-04	4.51E-04	6.50E-03	1.77E-03
Rn-222	Conc. (pCi/L)	1.03E+01	5.33E+00	4.79E+00	1.32E+01	1.20E+01	3.94E+00	6.01E+00	3.99E+00	2.00E+00	6.13E+00	4.22E+00
	Conc.+ Backgrd	1.08E+01	5.80E+00	5.26E+00	1.37E+01	1.25E+01	4.41E+00	6.48E+00	4.46E+00	2.47E+00	6.60E+00	4.69E+00
	Intake (WLM)	8.87E-01	4.78E-01	4.33E-01	1.13E+00	1.03E+00	3.63E-01	5.34E-01	3.68E-01	2.04E-01	5.44E-01	3.86E-01
1963												
Uranium	Conc. (mg/m^3)	3.09E-03	5.10E-03	3.53E-03	8.97E-04	3.64E-03	1.87E-03	3.05E-03	2.21E-03	1.81E-03	4.23E-03	1.16E-03
	Intake (mg)	7.41E+00	1.22E+01	8.46E+00	2.15E+00	8.74E+00	4.48E+00	7.32E+00	5.31E+00	4.35E+00	1.01E+01	2.78E+00
Thorium	Conc. (mg/m^3)	2.53E-06	5.71E-07	4.76E-07	6.69E-07	2.26E-05	3.98E-06	7.00E-07	3.49E-07	2.11E-07	3.04E-06	8.28E-07
	Intake (mg)	6.08E-03	1.37E-03	1.14E-03	1.61E-03	5.41E-02	9.56E-03	1.68E-03	8.38E-04	5.06E-04	7.29E-03	1.99E-03
Rn-222	Conc. (pCi/L)	1.03E+01	5.33E+00	4.79E+00	1.32E+01	1.20E+01	3.94E+00	6.01E+00	3.99E+00	2.00E+00	6.13E+00	4.22E+00
	Conc.+ Backgrd	1.08E+01	5.80E+00	5.26E+00	1.37E+01	1.25E+01	4.41E+00	6.48E+00	4.46E+00	2.47E+00	6.60E+00	4.69E+00
	Intake (WLM)	8.87E-01	4.78E-01	4.33E-01	1.13E+00	1.03E+00	3.63E-01	5.34E-01	3.68E-01	2.04E-01	5.44E-01	3.86E-01
1964												
Uranium	Conc. (mg/m^3)	3.19E-03	3.83E-03	4.21E-03	4.99E-04	3.59E-03	1.64E-03	3.16E-03	1.60E-03	1.16E-03	4.43E-03	1.20E-03
	Intake (mg)	7.65E+00	9.18E+00	1.01E+01	1.20E+00	8.63E+00	3.94E+00	7.60E+00	3.85E+00	2.79E+00	1.06E+01	2.88E+00
Thorium	Conc. (mg/m^3)	1.83E-04	3.77E-04	3.34E-04	6.98E-06	1.04E-04	8.58E-05	1.13E-04	1.42E-04	6.02E-05	1.09E-04	8.79E-05
	Intake (mg)	4.39E-01	9.05E-01	8.02E-01	1.68E-02	2.50E-01	2.06E-01	2.71E-01	3.42E-01	1.44E-01	2.61E-01	2.11E-01
Rn-222	Conc. (pCi/L)	1.03E+01	5.33E+00	4.79E+00	1.32E+01	1.20E+01	3.94E+00	6.01E+00	3.99E+00	2.00E+00	6.13E+00	4.22E+00
	Conc.+ Backgrd	1.08E+01	5.80E+00	5.26E+00	1.37E+01	1.25E+01	4.41E+00	6.48E+00	4.46E+00	2.47E+00	6.60E+00	4.69E+00
	Intake (WLM)	8.87E-01	4.78E-01	4.33E-01	1.13E+00	1.03E+00	3.63E-01	5.34E-01	3.68E-01	2.04E-01	5.44E-01	3.86E-01
1965												
Uranium	Conc. (mg/m^3)	4.47E-03	4.94E-03	6.53E-03	3.25E-04	2.90E-03	1.90E-03	4.61E-03	1.98E-03	1.20E-03	6.43E-03	1.71E-03
	Intake (mg)	1.07E+01	1.19E+01	1.57E+01	7.80E-01	6.97E+00	4.57E+00	1.11E+01	4.74E+00	2.88E+00	1.54E+01	4.10E+00
Thorium	Conc. (mg/m^3)	1.83E-04	3.77E-04	3.34E-04	6.98E-06	1.04E-04	8.58E-05	1.13E-04	1.42E-04	6.02E-05	1.09E-04	8.79E-05
	Intake (mg)	4.39E-01	9.05E-01	8.02E-01	1.67E-02	2.50E-01	2.06E-01	2.71E-01	3.42E-01	1.44E-01	2.61E-01	2.11E-01
Rn-222	Conc. (pCi/L)	1.03E+01	5.33E+00	4.79E+00	1.32E+01	1.20E+01	3.94E+00	6.01E+00	3.99E+00	2.00E+00	6.13E+00	4.22E+00
	Conc.+ Backgrd	1.08E+01	5.80E+00	5.26E+00	1.37E+01	1.25E+01	4.41E+00	6.48E+00	4.46E+00	2.47E+00	6.60E+00	4.69E+00
	Intake (WLM)	8.87E-01	4.78E-01	4.33E-01	1.13E+00	1.03E+00	3.63E-01	5.34E-01	3.68E-01	2.04E-01	5.44E-01	3.86E-01

Table 4-9a (Cont'd). Radionuclide concentration and intake summary for 1951 to 1988. (g to Bq Conversion factors are in Table 4-9d)

Radionuclide		EA-1	EA-2	EA-3	EA-4	EA-5	EA-6	EA-7	EA-8	EA-9	EA-10	EA-11
1966												
Uranium	Conc. (mg/m^3)	1.24E-03	1.95E-03	1.77E-03	2.18E-04	1.49E-03	7.73E-04	1.25E-03	8.65E-04	4.44E-04	2.06E-03	4.45E-04
	Intake (mg)	2.97E+00	4.68E+00	4.26E+00	5.24E-01	3.58E+00	1.85E+00	3.01E+00	2.08E+00	1.06E+00	4.94E+00	1.07E+00
Thorium	Conc. (mg/m^3)	2.60E-04	4.49E-04	4.53E-04	7.06E-06	1.31E-04	1.13E-04	1.94E-04	1.69E-04	7.51E-05	2.18E-04	1.18E-04
	Intake (mg)	6.24E-01	1.08E+00	1.09E+00	1.69E-02	3.14E-01	2.70E-01	4.65E-01	4.07E-01	1.80E-01	5.23E-01	2.83E-01
Rn-222	Conc. (pCi/L)	1.03E+01	5.33E+00	4.79E+00	1.32E+01	1.20E+01	3.94E+00	6.01E+00	3.99E+00	2.00E+00	6.13E+00	4.22E+00
	Conc.+ Backgrd	1.08E+01	5.80E+00	5.26E+00	1.37E+01	1.25E+01	4.41E+00	6.48E+00	4.46E+00	2.47E+00	6.60E+00	4.69E+00
	Intake (WLM)	8.87E-01	4.78E-01	4.33E-01	1.13E+00	1.03E+00	3.63E-01	5.34E-01	3.68E-01	2.04E-01	5.44E-01	3.86E-01
1967												
Uranium	Conc. (mg/m^3)	1.86E-03	2.81E-03	2.82E-03	2.42E-04	9.83E-04	9.21E-04	1.97E-03	1.22E-03	6.47E-04	3.01E-03	6.81E-04
	Intake (mg)	4.47E+00	6.75E+00	6.76E+00	5.80E-01	2.36E+00	2.21E+00	4.72E+00	2.93E+00	1.55E+00	7.23E+00	1.63E+00
Thorium	Conc. (mg/m^3)	1.83E-04	3.77E-04	3.34E-04	7.04E-06	1.06E-04	8.61E-05	1.13E-04	1.43E-04	6.02E-05	1.09E-04	8.79E-05
	Intake (mg)	4.40E-01	9.05E-01	8.03E-01	1.69E-02	2.54E-01	2.07E-01	2.71E-01	3.42E-01	1.44E-01	2.62E-01	2.11E-01
Rn-222	Conc. (pCi/L)	1.03E+01	5.33E+00	4.79E+00	1.32E+01	1.20E+01	3.94E+00	6.01E+00	3.99E+00	2.00E+00	6.13E+00	4.22E+00
	Conc.+ Backgrd	1.08E+01	5.80E+00	5.26E+00	1.37E+01	1.25E+01	4.41E+00	6.48E+00	4.46E+00	2.47E+00	6.60E+00	4.69E+00
	Intake (WLM)	8.87E-01	4.78E-01	4.33E-01	1.13E+00	1.03E+00	3.63E-01	5.34E-01	3.68E-01	2.04E-01	5.44E-01	3.86E-01
1968												
Uranium	Conc. (mg/m^3)	3.20E-03	4.34E-03	4.93E-03	2.30E-04	1.48E-03	1.45E-03	3.35E-03	1.85E-03	9.13E-04	5.08E-03	1.17E-03
	Intake (mg)	7.67E+00	1.04E+01	1.18E+01	5.53E-01	3.55E+00	3.48E+00	8.05E+00	4.44E+00	2.19E+00	1.22E+01	2.80E+00
Thorium	Conc. (mg/m^3)	1.83E-04	3.77E-04	3.34E-04	7.11E-06	1.09E-04	8.66E-05	1.13E-04	1.43E-04	6.02E-05	1.09E-04	8.80E-05
	Intake (mg)	4.40E-01	9.05E-01	8.03E-01	1.71E-02	2.61E-01	2.08E-01	2.71E-01	3.42E-01	1.44E-01	2.63E-01	2.11E-01
Rn-222	Conc. (pCi/L)	1.03E+01	5.33E+00	4.79E+00	1.32E+01	1.20E+01	3.94E+00	6.01E+00	3.99E+00	2.00E+00	6.13E+00	4.22E+00
	Conc.+ Backgrd	1.08E+01	5.80E+00	5.26E+00	1.37E+01	1.25E+01	4.41E+00	6.48E+00	4.46E+00	2.47E+00	6.60E+00	4.69E+00
	Intake (WLM)	8.87E-01	4.78E-01	4.33E-01	1.13E+00	1.03E+00	3.63E-01	5.34E-01	3.68E-01	2.04E-01	5.44E-01	3.86E-01
1969												
Uranium	Conc. (mg/m^3)	2.67E-03	3.32E-03	4.15E-03	1.61E-04	1.29E-03	1.15E-03	2.80E-03	1.38E-03	6.44E-04	4.20E-03	9.93E-04
	Intake (mg)	6.41E+00	7.97E+00	9.97E+00	3.86E-01	3.11E+00	2.76E+00	6.72E+00	3.32E+00	1.54E+00	1.01E+01	2.38E+00
Thorium	Conc. (mg/m^3)	8.86E-04	1.07E-03	1.43E-03	8.15E-06	3.36E-04	3.31E-04	8.42E-04	4.01E-04	2.00E-04	1.08E-03	3.64E-04
	Intake (mg)	2.13E+00	2.57E+00	3.43E+00	1.96E-02	8.05E-01	7.94E-01	2.02E+00	9.62E-01	4.80E-01	2.60E+00	8.73E-01
Rn-222	Conc. (pCi/L)	1.03E+01	5.33E+00	4.79E+00	1.32E+01	1.20E+01	3.94E+00	6.01E+00	3.99E+00	2.00E+00	6.13E+00	4.22E+00
	Conc.+ Backgrd	1.08E+01	5.80E+00	5.26E+00	1.37E+01	1.25E+01	4.41E+00	6.48E+00	4.46E+00	2.47E+00	6.60E+00	4.69E+00
	Intake (WLM)	8.87E-01	4.78E-01	4.33E-01	1.13E+00	1.03E+00	3.63E-01	5.34E-01	3.68E-01	2.04E-01	5.44E-01	3.86E-01
1970												
Uranium	Conc. (mg/m^3)	1.01E-03	1.38E-03	1.56E-03	1.04E-04	7.16E-04	5.01E-04	1.05E-03	5.95E-04	2.63E-04	1.67E-03	3.69E-04
	Intake (mg)	2.42E+00	3.31E+00	3.75E+00	2.51E-01	1.72E+00	1.20E+00	2.53E+00	1.43E+00	6.32E-01	4.00E+00	8.86E-01
Thorium	Conc. (mg/m^3)	7.19E-04	9.75E-04	1.19E-03	1.00E-05	2.89E-04	2.79E-04	6.42E-04	3.66E-04	1.75E-04	8.01E-04	3.04E-04
	Intake (mg)	1.73E+00	2.34E+00	2.85E+00	2.40E-02	6.94E-01	6.71E-01	1.54E+00	8.79E-01	4.21E-01	1.92E+00	7.29E-01
Rn-222	Conc. (pCi/L)	1.03E+01	5.33E+00	4.79E+00	1.32E+01	1.20E+01	3.94E+00	6.01E+00	3.99E+00	2.00E+00	6.13E+00	4.22E+00
	Conc.+ Backgrd	1.08E+01	5.80E+00	5.26E+00	1.37E+01	1.25E+01	4.41E+00	6.48E+00	4.46E+00	2.47E+00	6.60E+00	4.69E+00
	Intake (WLM)	8.87E-01	4.78E-01	4.33E-01	1.13E+00	1.03E+00	3.63E-01	5.34E-01	3.68E-01	2.04E-01	5.44E-01	3.86E-01

Table 4-9a (Cont'd). Radionuclide concentration and intake summary for 1951 to 1988. (g to Bq Conversion factors are in Table 4-9d)

Radionuclide		EA-1	EA-2	EA-3	EA-4	EA-5	EA-6	EA-7	EA-8	EA-9	EA-10	EA-11
1971												
Uranium	Conc. (mg/m^3)	5.64E-04	8.55E-04	9.17E-04	7.53E-05	5.62E-04	3.34E-04	5.99E-04	3.81E-04	1.30E-04	1.04E-03	2.04E-04
	Intake (mg)	1.35E+00	2.05E+00	2.20E+00	1.81E-01	1.35E+00	8.02E-01	1.44E+00	9.14E-01	3.12E-01	2.49E+00	4.90E-01
Thorium	Conc. (mg/m^3)	3.16E-04	3.32E-04	4.93E-04	2.05E-06	1.33E-04	1.16E-04	3.16E-04	1.24E-04	6.53E-05	4.19E-04	1.25E-04
	Intake (mg)	7.57E-01	7.98E-01	1.18E+00	4.93E-03	3.19E-01	2.78E-01	7.58E-01	2.98E-01	1.57E-01	1.01E+00	3.01E-01
Rn-222	Conc. (pCi/L)	1.03E+01	5.33E+00	4.79E+00	1.32E+01	1.20E+01	3.94E+00	6.01E+00	3.99E+00	2.00E+00	6.13E+00	4.22E+00
	Conc.+ Backgrd	1.08E+01	5.80E+00	5.26E+00	1.37E+01	1.25E+01	4.41E+00	6.48E+00	4.46E+00	2.47E+00	6.60E+00	4.69E+00
	Intake (WLM)	8.87E-01	4.78E-01	4.33E-01	1.13E+00	1.03E+00	3.63E-01	5.34E-01	3.68E-01	2.04E-01	5.44E-01	3.86E-01
1972												
Uranium	Conc. (mg/m^3)	5.79E-04	1.70E-03	1.04E-03	1.07E-04	7.00E-04	5.32E-04	5.77E-04	8.52E-04	2.01E-04	1.52E-03	1.40E-04
	Intake (mg)	1.39E+00	4.08E+00	2.50E+00	2.58E-01	1.68E+00	1.28E+00	1.38E+00	2.04E+00	4.83E-01	3.65E+00	3.36E-01
Thorium	Conc. (mg/m^3)	7.74E-05	1.55E-04	1.38E-04	3.51E-06	6.45E-05	3.90E-05	4.70E-05	5.87E-05	2.49E-05	4.76E-05	3.68E-05
	Intake (mg)	1.86E-01	3.72E-01	3.30E-01	8.42E-03	1.55E-01	9.36E-02	1.13E-01	1.41E-01	5.97E-02	1.14E-01	8.84E-02
Rn-222	Conc. (pCi/L)	1.03E+01	5.33E+00	4.79E+00	1.32E+01	1.20E+01	3.94E+00	6.01E+00	3.99E+00	2.00E+00	6.13E+00	4.22E+00
	Conc.+ Backgrd	1.08E+01	5.80E+00	5.26E+00	1.37E+01	1.25E+01	4.41E+00	6.48E+00	4.46E+00	2.47E+00	6.60E+00	4.69E+00
	Intake (WLM)	8.87E-01	4.78E-01	4.33E-01	1.13E+00	1.03E+00	3.63E-01	5.34E-01	3.68E-01	2.04E-01	5.44E-01	3.86E-01
Rn-220	Conc. (pCi/L)	4.70E-01	4.70E-01	0.0	0.0	0.0	0.0	4.70E-01	0.0	0.0	0.0	0.0
	Intake (WLM)	7.43E-02	7.43E-02	0.0	0.0	0.0	0.0	7.43E-02	0.0	0.0	0.0	0.0
1973												
Uranium	Conc. (mg/m^3)	6.47E-04	1.85E-03	1.10E-03	1.15E-04	7.15E-04	5.63E-04	6.33E-04	9.15E-04	2.53E-04	1.60E-03	1.61E-04
	Intake (mg)	1.55E+00	4.43E+00	2.64E+00	2.77E-01	1.72E+00	1.35E+00	1.52E+00	2.20E+00	6.08E-01	3.84E+00	3.88E-01
Thorium	Conc. (mg/m^3)	2.98E-05	5.55E-05	4.92E-05	1.85E-06	4.34E-05	1.75E-05	1.73E-05	2.11E-05	9.01E-06	1.96E-05	1.38E-05
	Intake (mg)	7.14E-02	1.33E-01	1.18E-01	4.45E-03	1.04E-01	4.19E-02	4.15E-02	5.08E-02	2.16E-02	4.71E-02	3.31E-02
Rn-222	Conc. (pCi/L)	1.03E+01	5.33E+00	4.79E+00	1.32E+01	1.20E+01	3.94E+00	6.01E+00	3.99E+00	2.00E+00	6.13E+00	4.22E+00
	Conc.+ Backgrd	1.08E+01	5.80E+00	5.26E+00	1.37E+01	1.25E+01	4.41E+00	6.48E+00	4.46E+00	2.47E+00	6.60E+00	4.69E+00
	Intake (WLM)	8.87E-01	4.78E-01	4.33E-01	1.13E+00	1.03E+00	3.63E-01	5.34E-01	3.68E-01	2.04E-01	5.44E-01	3.86E-01
Rn-220	Conc. (pCi/L)	4.70E-01	4.70E-01	0.0	0.0	0.0	0.0	4.70E-01	0.0	0.0	0.0	0.0
	Intake (WLM)	7.43E-02	7.43E-02	0.0	0.0	0.0	0.0	7.43E-02	0.0	0.0	0.0	0.0
1974												
Uranium	Conc. (mg/m^3)	1.01E-03	2.90E-03	1.80E-03	1.02E-04	9.45E-04	8.60E-04	9.76E-04	1.44E-03	3.36E-04	2.57E-03	2.34E-04
	Intake (mg)	2.42E+00	6.96E+00	4.32E+00	2.44E-01	2.27E+00	2.06E+00	2.34E+00	3.47E+00	8.06E-01	6.16E+00	5.61E-01
Thorium	Conc. (mg/m^3)	5.61E-05	1.10E-04	9.77E-05	2.80E-06	5.62E-05	2.95E-05	3.36E-05	4.18E-05	1.77E-05	3.51E-05	2.65E-05
	Intake (mg)	1.35E-01	2.65E-01	2.35E-01	6.71E-03	1.35E-01	7.09E-02	8.07E-02	1.00E-01	4.26E-02	8.43E-02	6.36E-02
Rn-222	Conc. (pCi/L)	1.03E+01	5.33E+00	4.79E+00	1.32E+01	1.20E+01	3.94E+00	6.01E+00	3.99E+00	2.00E+00	6.13E+00	4.22E+00
	Conc.+ Backgrd	1.08E+01	5.80E+00	5.26E+00	1.37E+01	1.25E+01	4.41E+00	6.48E+00	4.46E+00	2.47E+00	6.60E+00	4.69E+00
	Intake (WLM)	8.87E-01	4.78E-01	4.33E-01	1.13E+00	1.03E+00	3.63E-01	5.34E-01	3.68E-01	2.04E-01	5.44E-01	3.86E-01
Rn-220	Conc. (pCi/L)	4.70E-01	4.70E-01	0.0	0.0	0.0	0.0	4.70E-01	0.0	0.0	0.0	0.0
	Intake (WLM)	7.43E-02	7.43E-02	0.0	0.0	0.0	0.0	7.43E-02	0.0	0.0	0.0	0.0

Table 4-9a (Cont'd). Radionuclide concentration and intake summary for 1951 to 1988. (g to Bq Conversion factors are in Table 4-9d)

1975												
Uranium	Conc. (mg/m^3)	1.17E-03	3.42E-03	2.06E-03	1.02E-04	1.14E-03	1.03E-03	1.13E-03	1.69E-03	3.99E-04	2.98E-03	2.74E-04
	Intake (mg)	2.80E+00	8.20E+00	4.95E+00	2.44E-01	2.74E+00	2.46E+00	2.71E+00	4.05E+00	9.58E-01	7.16E+00	6.58E-01
Thorium	Conc. (mg/m^3)	5.79E-06	4.23E-06	3.70E-06	1.17E-06	3.82E-05	7.34E-06	2.14E-06	1.82E-06	8.74E-07	5.98E-06	2.14E-06
	Intake (mg)	1.39E-02	1.02E-02	8.89E-03	2.80E-03	9.18E-02	1.76E-02	5.15E-03	4.37E-03	2.10E-03	1.43E-02	5.13E-03
Rn-222	Conc. (pCi/L)	1.03E+01	5.33E+00	4.79E+00	1.32E+01	1.20E+01	3.94E+00	6.01E+00	3.99E+00	2.00E+00	6.13E+00	4.22E+00
	Conc.+ Backgrd	1.08E+01	5.80E+00	5.26E+00	1.37E+01	1.25E+01	4.41E+00	6.48E+00	4.46E+00	2.47E+00	6.60E+00	4.69E+00
	Intake (WLM)	8.87E-01	4.78E-01	4.33E-01	1.13E+00	1.03E+00	3.63E-01	5.34E-01	3.68E-01	2.04E-01	5.44E-01	3.86E-01
Rn-220	Conc. (pCi/L)	4.70E-01	4.70E-01	0.0	0.0	0.0	0.0	4.70E-01	0.0	0.0	0.0	0.0
	Intake (WLM)	7.43E-02	7.43E-02	0.0	0.0	0.0	0.0	7.43E-02	0.0	0.0	0.0	0.0
1976												
Uranium	Conc. (mg/m^3)	1.34E-03	3.84E-03	2.41E-03	8.57E-05	1.29E-03	1.15E-03	1.29E-03	1.91E-03	4.03E-04	3.44E-03	3.09E-04
	Intake (mg)	3.22E+00	9.22E+00	5.79E+00	2.06E-01	3.09E+00	2.76E+00	3.09E+00	4.58E+00	9.67E-01	8.26E+00	7.41E-01
Thorium	Conc. (mg/m^3)	5.24E-06	1.18E-06	9.85E-07	1.38E-06	4.66E-05	8.24E-06	1.45E-06	7.22E-07	4.36E-07	6.28E-06	1.71E-06
	Intake (mg)	1.26E-02	2.84E-03	2.36E-03	3.32E-03	1.12E-01	1.98E-02	3.48E-03	1.73E-03	1.05E-03	1.51E-02	4.11E-03
Rn-222	Conc. (pCi/L)	1.03E+01	5.33E+00	4.79E+00	1.32E+01	1.20E+01	3.94E+00	6.01E+00	3.99E+00	2.00E+00	6.13E+00	4.22E+00
	Conc.+ Backgrd	1.08E+01	5.80E+00	5.26E+00	1.37E+01	1.25E+01	4.41E+00	6.48E+00	4.46E+00	2.47E+00	6.60E+00	4.69E+00
	Intake (WLM)	8.87E-01	4.78E-01	4.33E-01	1.13E+00	1.03E+00	3.63E-01	5.34E-01	3.68E-01	2.04E-01	5.44E-01	3.86E-01
Rn-220	Conc. (pCi/L)	4.70E-01	4.70E-01	0.0	0.0	0.0	0.0	4.70E-01	0.0	0.0	0.0	0.0
	Intake (WLM)	7.43E-02	7.43E-02	0.0	0.0	0.0	0.0	7.43E-02	0.0	0.0	0.0	0.0
1977												
Uranium	Conc. (mg/m^3)	3.92E-04	1.18E-03	6.12E-04	1.15E-04	6.68E-04	3.99E-04	3.83E-04	5.78E-04	1.97E-04	9.59E-04	1.06E-04
	Intake (mg)	9.41E-01	2.84E+00	1.47E+00	2.77E-01	1.60E+00	9.58E-01	9.19E-01	1.39E+00	4.73E-01	2.30E+00	2.55E-01
Thorium	Conc. (mg/m^3)	2.18E-04	4.48E-04	3.97E-04	8.67E-06	1.37E-04	1.04E-04	1.34E-04	1.69E-04	7.15E-05	1.31E-04	1.05E-04
	Intake (mg)	5.24E-01	1.07E+00	9.52E-01	2.08E-02	3.28E-01	2.50E-01	3.23E-01	4.06E-01	1.72E-01	3.14E-01	2.51E-01
Rn-222	Conc. (pCi/L)	1.03E+01	5.33E+00	4.79E+00	1.32E+01	1.20E+01	3.94E+00	6.01E+00	3.99E+00	2.00E+00	6.13E+00	4.22E+00
	Conc.+ Backgrd	1.08E+01	5.80E+00	5.26E+00	1.37E+01	1.25E+01	4.41E+00	6.48E+00	4.46E+00	2.47E+00	6.60E+00	4.69E+00
	Intake (WLM)	8.87E-01	4.78E-01	4.33E-01	1.13E+00	1.03E+00	3.63E-01	5.34E-01	3.68E-01	2.04E-01	5.44E-01	3.86E-01
Rn-220	Conc. (pCi/L)	4.70E-01	4.70E-01	0.0	0.0	0.0	0.0	4.70E-01	0.0	0.0	0.0	0.0
	Intake (WLM)	7.43E-02	7.43E-02	0.0	0.0	0.0	0.0	7.43E-02	0.0	0.0	0.0	0.0
1978												
Uranium	Conc. (mg/m^3)	8.84E-05	2.09E-04	9.61E-05	1.11E-04	4.84E-04	1.31E-04	9.16E-05	1.17E-04	7.74E-05	1.87E-04	3.13E-05
	Intake (mg)	2.12E-01	5.01E-01	2.31E-01	2.67E-01	1.16E+00	3.13E-01	2.20E-01	2.81E-01	1.86E-01	4.48E-01	7.52E-02
Thorium	Conc. (mg/m^3)	2.19E-04	4.48E-04	3.97E-04	8.90E-06	1.44E-04	1.05E-04	1.35E-04	1.69E-04	7.16E-05	1.32E-04	1.05E-04
	Intake (mg)	5.26E-01	1.07E+00	9.53E-01	2.14E-02	3.46E-01	2.53E-01	3.23E-01	4.06E-01	1.72E-01	3.17E-01	2.52E-01
Rn-222	Conc. (pCi/L)	1.03E+01	5.33E+00	4.79E+00	1.32E+01	1.20E+01	3.94E+00	6.01E+00	3.99E+00	2.00E+00	6.13E+00	4.22E+00
	Conc.+ Backgrd	1.08E+01	5.80E+00	5.26E+00	1.37E+01	1.25E+01	4.41E+00	6.48E+00	4.46E+00	2.47E+00	6.60E+00	4.69E+00
	Intake (WLM)	8.87E-01	4.78E-01	4.33E-01	1.13E+00	1.03E+00	3.63E-01	5.34E-01	3.68E-01	2.04E-01	5.44E-01	3.86E-01
Rn-220	Conc. (pCi/L)	4.70E-01	4.70E-01	0.0	0.0	0.0	0.0	4.70E-01	0.0	0.0	0.0	0.0
	Intake (WLM)	7.43E-02	7.43E-02	0.0	0.0	0.0	0.0	7.43E-02	0.0	0.0	0.0	0.0

Table 4-9a (Cont'd). Radionuclide concentration and intake summary for 1951 to 1988. (g to Bq Conversion factors are in Table 4-9d)

Radionuclide		EA-1	EA-2	EA-3	EA-4	EA-5	EA-6	EA-7	EA-8	EA-9	EA-10	EA-11
1979												
Uranium	Conc. (mg/m^3)	8.45E-05	1.88E-04	6.49E-05	8.52E-05	6.51E-04	1.61E-04	7.22E-05	9.41E-05	4.94E-05	1.91E-04	3.39E-05
	Intake (mg)	2.03E-01	4.52E-01	1.56E-01	2.05E-01	1.56E+00	3.86E-01	1.73E-01	2.26E-01	1.19E-01	4.59E-01	8.13E-02
Thorium	Conc. (mg/m^3)	2.20E-04	4.48E-04	3.97E-04	8.97E-06	1.47E-04	1.06E-04	1.35E-04	1.69E-04	7.16E-05	1.32E-04	1.05E-04
	Intake (mg)	5.27E-01	1.07E+00	9.53E-01	2.15E-02	3.52E-01	2.54E-01	3.23E-01	4.06E-01	1.72E-01	3.17E-01	2.52E-01
Rn-222	Conc. (pCi/L)	1.03E+01	5.33E+00	4.79E+00	1.32E+01	1.20E+01	3.94E+00	6.01E+00	3.99E+00	2.00E+00	6.13E+00	4.22E+00
	Conc.+ Backgrd	1.08E+01	5.80E+00	5.26E+00	1.37E+01	1.25E+01	4.41E+00	6.48E+00	4.46E+00	2.47E+00	6.60E+00	4.69E+00
	Intake (WLM)	8.87E-01	4.78E-01	4.33E-01	1.13E+00	1.03E+00	3.63E-01	5.34E-01	3.68E-01	2.04E-01	5.44E-01	3.86E-01
Rn-220	Conc. (pCi/L)	4.70E-01	4.70E-01	0.0	0.0	0.0	0.0	4.70E-01	0.0	0.0	0.0	0.0
	Intake (WLM)	7.43E-02	7.43E-02	0.0	0.0	0.0	0.0	7.43E-02	0.0	0.0	0.0	0.0
1980												
Uranium	Conc. (mg/m^3)	1.51E-04	3.21E-04	5.16E-05	9.13E-05	7.21E-04	1.90E-04	9.98E-05	1.49E-04	1.31E-04	2.00E-04	5.22E-05
	Intake (mg)	3.62E-01	7.70E-01	1.24E-01	2.19E-01	1.73E+00	4.55E-01	2.40E-01	3.58E-01	3.14E-01	4.79E-01	1.25E-01
Thorium	Conc. (mg/m^3)	2.37E-05	5.36E-06	4.46E-06	6.27E-06	2.11E-04	3.74E-05	6.56E-06	3.27E-06	1.98E-06	2.85E-05	7.76E-06
	Intake (mg)	5.70E-02	1.29E-02	1.07E-02	1.50E-02	5.07E-01	8.96E-02	1.58E-02	7.86E-03	4.74E-03	6.84E-02	1.86E-02
Rn-222	Conc. (pCi/L)	2.06E+00	1.07E+00	9.59E-01	2.63E+00	2.41E+00	7.88E-01	1.20E+00	7.99E-01	3.99E-01	1.23E+00	8.43E-01
	Conc.+ Backgrd	2.53E+00	1.54E+00	1.43E+00	3.10E+00	2.88E+00	1.26E+00	1.67E+00	1.27E+00	8.69E-01	1.70E+00	1.31E+00
	Intake (WLM)	2.08E-01	1.27E-01	1.18E-01	2.55E-01	2.37E-01	1.04E-01	1.38E-01	1.05E-01	7.16E-02	1.40E-01	1.08E-01
Rn-220	Conc. (pCi/L)	4.70E-01	4.70E-01	0.0	0.0	0.0	0.0	4.70E-01	0.0	0.0	0.0	0.0
	Intake (WLM)	7.43E-02	7.43E-02	0.0	0.0	0.0	0.0	7.43E-02	0.0	0.0	0.0	0.0
1981												
Uranium	Conc. (mg/m^3)	2.57E-04	7.38E-04	6.46E-05	1.55E-04	9.46E-04	3.27E-04	1.96E-04	3.27E-04	3.10E-04	3.27E-04	9.02E-05
	Intake (mg)	6.18E-01	1.77E+00	1.55E-01	3.72E-01	2.27E+00	7.85E-01	4.70E-01	7.84E-01	7.45E-01	7.85E-01	2.16E-01
Thorium	Conc. (mg/m^3)	5.94E-06	1.34E-06	1.12E-06	1.57E-06	5.29E-05	9.35E-06	1.64E-06	8.19E-07	4.95E-07	7.13E-06	1.94E-06
	Intake (mg)	1.43E-02	3.22E-03	2.68E-03	3.77E-03	1.27E-01	2.24E-02	3.94E-03	1.97E-03	1.19E-03	1.71E-02	4.66E-03
Rn-222	Conc. (pCi/L)	2.06E+00	1.07E+00	9.59E-01	2.63E+00	2.41E+00	7.88E-01	1.20E+00	7.99E-01	3.99E-01	1.23E+00	8.43E-01
	Conc.+ Backgrd	2.53E+00	1.54E+00	1.43E+00	3.10E+00	2.88E+00	1.26E+00	1.67E+00	1.27E+00	8.69E-01	1.70E+00	1.31E+00
	Intake (WLM)	2.08E-01	1.27E-01	1.18E-01	2.55E-01	2.37E-01	1.04E-01	1.38E-01	1.05E-01	7.16E-02	1.40E-01	1.08E-01
Rn-220	Conc. (pCi/L)	4.70E-01	4.70E-01	0.0	0.0	0.0	0.0	4.70E-01	0.0	0.0	0.0	0.0
	Intake (WLM)	7.43E-02	7.43E-02	0.0	0.0	0.0	0.0	7.43E-02	0.0	0.0	0.0	0.0
1982												
Uranium	Conc. (mg/m^3)	2.37E-04	3.25E-04	1.82E-04	8.49E-05	8.65E-04	2.09E-04	1.64E-04	1.58E-04	1.09E-04	3.26E-04	7.74E-05
	Intake (mg)	5.68E-01	7.81E-01	4.36E-01	2.04E-01	2.08E+00	5.03E-01	3.93E-01	3.80E-01	2.63E-01	7.82E-01	1.86E-01
Thorium	Conc. (mg/m^3)	5.93E-06	1.34E-06	1.11E-06	1.57E-06	5.28E-05	9.33E-06	1.64E-06	8.17E-07	4.94E-07	7.11E-06	1.94E-06
	Intake (mg)	1.42E-02	3.21E-03	2.67E-03	3.76E-03	1.27E-01	2.24E-02	3.93E-03	1.96E-03	1.18E-03	1.71E-02	4.65E-03
Rn-222	Conc. (pCi/L)	2.06E+00	1.07E+00	9.59E-01	2.63E+00	2.41E+00	7.88E-01	1.20E+00	7.99E-01	3.99E-01	1.23E+00	8.43E-01
	Conc.+ Backgrd	2.53E+00	1.54E+00	1.43E+00	3.10E+00	2.88E+00	1.26E+00	1.67E+00	1.27E+00	8.69E-01	1.70E+00	1.31E+00
	Intake (WLM)	2.08E-01	1.27E-01	1.18E-01	2.55E-01	2.37E-01	1.04E-01	1.38E-01	1.05E-01	7.16E-02	1.40E-01	1.08E-01
Rn-220	Conc. (pCi/L)	4.70E-01	4.70E-01	0.0	0.0	0.0	0.0	4.70E-01	0.0	0.0	0.0	0.0
	Intake (WLM)	7.43E-02	7.43E-02	0.0	0.0	0.0	0.0	7.43E-02	0.0	0.0	0.0	0.0

Table 4-9a (Cont'd). Radionuclide concentration and intake summary for 1951 to 1988. (g to Bq Conversion factors are in Table 4-9d)

Radionuclide		EA-1	EA-2	EA-3	EA-4	EA-5	EA-6	EA-7	EA-8	EA-9	EA-10	EA-11
1983												
Uranium	Conc. (mg/m^3)	2.19E-04	3.31E-04	2.01E-04	5.76E-05	8.67E-04	2.25E-04	1.57E-04	1.58E-04	8.16E-05	3.52E-04	7.04E-05
	Intake (mg)	5.26E-01	7.95E-01	4.82E-01	1.38E-01	2.08E+00	5.41E-01	3.77E-01	3.79E-01	1.96E-01	8.45E-01	1.69E-01
Thorium	Conc. (mg/m^3)	5.93E-06	1.34E-06	1.11E-06	1.57E-06	5.28E-05	9.33E-06	1.64E-06	8.17E-07	4.94E-07	7.11E-06	1.94E-06
	Intake (mg)	1.42E-02	3.21E-03	2.67E-03	3.76E-03	1.27E-01	2.24E-02	3.93E-03	1.96E-03	1.18E-03	1.71E-02	4.65E-03
Rn-222	Conc. (pCi/L)	2.06E+00	1.07E+00	9.59E-01	2.63E+00	2.41E+00	7.88E-01	1.20E+00	7.99E-01	3.99E-01	1.23E+00	8.43E-01
	Conc.+ Backgrd	2.53E+00	1.54E+00	1.43E+00	3.10E+00	2.88E+00	1.26E+00	1.67E+00	1.27E+00	8.69E-01	1.70E+00	1.31E+00
	Intake (WLM)	2.08E-01	1.27E-01	1.18E-01	2.55E-01	2.37E-01	1.04E-01	1.38E-01	1.05E-01	7.16E-02	1.40E-01	1.08E-01
Rn-220	Conc. (pCi/L)	4.70E-01	4.70E-01	0.0	0.0	0.0	0.0	4.70E-01	0.0	0.0	0.0	0.0
	Intake (WLM)	7.43E-02	7.43E-02	0.0	0.0	0.0	0.0	7.43E-02	0.0	0.0	0.0	0.0
1984												
Uranium	Conc. (mg/m^3)	4.41E-04	9.35E-04	5.49E-04	1.38E-04	9.95E-04	3.76E-04	3.70E-04	4.84E-04	2.39E-04	8.04E-04	1.15E-04
	Intake (mg)	1.06E+00	2.24E+00	1.32E+00	3.31E-01	2.39E+00	9.03E-01	8.88E-01	1.16E+00	5.73E-01	1.93E+00	2.75E-01
Thorium	Conc. (mg/m^3)	5.93E-06	1.34E-06	1.11E-06	1.57E-06	5.28E-05	9.33E-06	1.64E-06	8.17E-07	4.94E-07	7.11E-06	1.94E-06
	Intake (mg)	1.42E-02	3.21E-03	2.67E-03	3.76E-03	1.27E-01	2.24E-02	3.93E-03	1.96E-03	1.18E-03	1.71E-02	4.65E-03
Rn-222	Conc. (pCi/L)	2.06E+00	1.07E+00	9.59E-01	2.63E+00	2.41E+00	7.88E-01	1.20E+00	7.99E-01	3.99E-01	1.23E+00	8.43E-01
	Conc.+ Backgrd	2.53E+00	1.54E+00	1.43E+00	3.10E+00	2.88E+00	1.26E+00	1.67E+00	1.27E+00	8.69E-01	1.70E+00	1.31E+00
	Intake (WLM)	2.08E-01	1.27E-01	1.18E-01	2.55E-01	2.37E-01	1.04E-01	1.38E-01	1.05E-01	7.16E-02	1.40E-01	1.08E-01
Rn-220	Conc. (pCi/L)	4.70E-01	4.70E-01	0.0	0.0	0.0	0.0	4.70E-01	0.0	0.0	0.0	0.0
	Intake (WLM)	7.43E-02	7.43E-02	0.0	0.0	0.0	0.0	7.43E-02	0.0	0.0	0.0	0.0
1985												
Uranium	Conc. (mg/m^3)	1.42E-04	1.69E-04	1.09E-04	2.62E-05	8.32E-04	1.82E-04	7.46E-05	8.62E-05	2.54E-05	2.36E-04	4.09E-05
	Intake (mg)	3.40E-01	4.05E-01	2.61E-01	6.29E-02	2.00E+00	4.38E-01	1.79E-01	2.07E-01	6.09E-02	5.67E-01	9.83E-02
Thorium	Conc. (mg/m^3)	5.93E-06	1.34E-06	1.11E-06	1.57E-06	5.28E-05	9.33E-06	1.64E-06	8.17E-07	4.94E-07	7.11E-06	1.94E-06
	Intake (mg)	1.42E-02	3.21E-03	2.67E-03	3.76E-03	1.27E-01	2.24E-02	3.93E-03	1.96E-03	1.18E-03	1.71E-02	4.65E-03
Rn-222	Conc. (pCi/L)	2.06E+00	1.07E+00	9.59E-01	2.63E+00	2.41E+00	7.88E-01	1.20E+00	7.99E-01	3.99E-01	1.23E+00	8.43E-01
	Conc.+ Backgrd	2.53E+00	1.54E+00	1.43E+00	3.10E+00	2.88E+00	1.26E+00	1.67E+00	1.27E+00	8.69E-01	1.70E+00	1.31E+00
	Intake (WLM)	2.08E-01	1.27E-01	1.18E-01	2.55E-01	2.37E-01	1.04E-01	1.38E-01	1.05E-01	7.16E-02	1.40E-01	1.08E-01
Rn-220	Conc. (pCi/L)	4.70E-01	4.70E-01	0.0	0.0	0.0	0.0	4.70E-01	0.0	0.0	0.0	0.0
	Intake (WLM)	7.43E-02	7.43E-02	0.0	0.0	0.0	0.0	7.43E-02	0.0	0.0	0.0	0.0
1986												
Uranium	Conc. (mg/m^3)	9.22E-05	2.71E-05	1.79E-05	2.65E-05	7.99E-04	1.43E-04	2.77E-05	1.60E-05	1.18E-05	1.10E-04	3.01E-05
	Intake (mg)	2.21E-01	6.51E-02	4.30E-02	6.37E-02	1.92E+00	3.42E-01	6.65E-02	3.85E-02	2.84E-02	2.63E-01	7.22E-02
Thorium	Conc. (mg/m^3)	5.93E-06	1.34E-06	1.11E-06	1.57E-06	5.28E-05	9.33E-06	1.64E-06	8.17E-07	4.94E-07	7.11E-06	1.94E-06
	Intake (mg)	1.42E-02	3.21E-03	2.67E-03	3.76E-03	1.27E-01	2.24E-02	3.93E-03	1.96E-03	1.18E-03	1.71E-02	4.65E-03
Rn-222	Conc. (pCi/L)	2.06E+00	1.07E+00	9.59E-01	2.63E+00	2.41E+00	7.88E-01	1.20E+00	7.99E-01	3.99E-01	1.23E+00	8.43E-01
	Conc.+ Backgrd	2.53E+00	1.54E+00	1.43E+00	3.10E+00	2.88E+00	1.26E+00	1.67E+00	1.27E+00	8.69E-01	1.70E+00	1.31E+00
	Intake (WLM)	2.08E-01	1.27E-01	1.18E-01	2.55E-01	2.37E-01	1.04E-01	1.38E-01	1.05E-01	7.16E-02	1.40E-01	1.08E-01
Rn-220	Conc. (pCi/L)	4.70E-01	4.70E-01	0.0	0.0	0.0	0.0	4.70E-01	0.0	0.0	0.0	0.0
	Intake (WLM)	7.43E-02	7.43E-02	0.0	0.0	0.0	0.0	7.43E-02	0.0	0.0	0.0	0.0

Table 4-9a (Cont'd). Radionuclide concentration and intake summary for 1951 to 1988. (g to Bq Conversion factors are in Table 4-9d)

Radionuclide		EA-1	EA-2	EA-3	EA-4	EA-5	EA-6	EA-7	EA-8	EA-9	EA-10	EA-11
1987												
Uranium	Conc. (mg/m^3)	1.69E-04	2.45E-04	1.58E-04	2.57E-05	8.61E-04	2.06E-04	9.98E-05	1.24E-04	3.21E-05	3.06E-04	4.72E-05
	Intake (mg)	4.06E-01	5.88E-01	3.78E-01	6.17E-02	2.07E+00	4.94E-01	2.40E-01	2.97E-01	7.71E-02	7.35E-01	1.13E-01
Thorium	Conc. (mg/m^3)	6.20E-06	1.40E-06	1.17E-06	1.64E-06	5.52E-05	9.76E-06	1.71E-06	8.55E-07	5.16E-07	7.44E-06	2.03E-06
	Intake (mg)	1.49E-02	3.36E-03	2.80E-03	3.93E-03	1.33E-01	2.34E-02	4.12E-03	2.05E-03	1.24E-03	1.79E-02	4.86E-03
Rn-222	Conc. (pCi/L)	2.06E+00	1.07E+00	9.59E-01	2.63E+00	2.41E+00	7.88E-01	1.20E+00	7.99E-01	3.99E-01	1.23E+00	8.43E-01
	Conc.+ Backgrd	2.53E+00	1.54E+00	1.43E+00	3.10E+00	2.88E+00	1.26E+00	1.67E+00	1.27E+00	8.69E-01	1.70E+00	1.31E+00
	Intake (WLM)	2.08E-01	1.27E-01	1.18E-01	2.55E-01	2.37E-01	1.04E-01	1.38E-01	1.05E-01	7.16E-02	1.40E-01	1.08E-01
Rn-220	Conc. (pCi/L)	4.70E-01	4.70E-01	0.0	0.0	0.0	0.0	4.70E-01	0.0	0.0	0.0	0.0
	Intake (WLM)	7.43E-02	7.43E-02	0.0	0.0	0.0	0.0	7.43E-02	0.0	0.0	0.0	0.0
1988												
Uranium	Conc. (mg/m^3)	1.27E-04	1.21E-04	8.04E-05	2.49E-05	8.42E-04	1.73E-04	5.89E-05	6.25E-05	1.85E-05	1.99E-04	3.78E-05
	Intake (mg)	3.05E-01	2.91E-01	1.93E-01	5.99E-02	2.02E+00	4.15E-01	1.41E-01	1.50E-01	4.43E-02	4.77E-01	9.08E-02
Thorium	Conc. (mg/m^3)	6.43E-06	1.45E-06	1.21E-06	1.70E-06	5.73E-05	1.01E-05	1.78E-06	8.87E-07	5.36E-07	7.72E-06	2.10E-06
	Intake (mg)	1.54E-02	3.48E-03	2.90E-03	4.08E-03	1.37E-01	2.43E-02	4.27E-03	2.13E-03	1.29E-03	1.85E-02	5.04E-03
Rn-222	Conc. (pCi/L)	8.59E-01	4.44E-01	3.99E-01	1.10E+00	1.00E+00	3.28E-01	5.00E-01	3.33E-01	1.66E-01	5.10E-01	3.51E-01
	Conc.+ Backgrd	1.33E+00	9.14E-01	8.69E-01	1.57E+00	1.47E+00	7.98E-01	9.70E-01	8.03E-01	6.36E-01	9.80E-01	8.21E-01
	Intake (WLM)	1.10E-01	7.53E-02	7.16E-02	1.29E-01	1.21E-01	6.58E-02	7.99E-02	6.62E-02	5.24E-02	8.08E-02	6.77E-02
Rn-220	Conc. (pCi/L)	4.70E-01	4.70E-01	0.0	0.0	0.0	0.0	4.70E-01	0.0	0.0	0.0	0.0
	Intake (WLM)	7.43E-02	7.43E-02	0.0	0.0	0.0	0.0	7.43E-02	0.0	0.0	0.0	0.0

Table 4-9b. Radionuclide concentration (Bq/m^3, pCi/L for Rn) and intake (Bq, WLM for Rn) from 1989 to 1996. (Breakdown of transuranic components of recycled uranium is in Table 4-9d)

Radionuclide		EA-1	EA-2	EA-3	EA-4	EA-5	EA-6	EA-7	EA-8	EA-9	EA-10	EA-11
1989												
Uranium	Conc. (Bq/m^3)	5.33E-06	2.74E-05	5.51E-07	3.76E-06	5.13E-06	8.10E-06	6.37E-06	1.12E-05	1.19E-05	6.59E-06	2.28E-06
	Intake (Bq)	1.28E-02	6.58E-02	1.32E-03	9.02E-03	1.23E-02	1.94E-02	1.53E-02	2.68E-02	2.85E-02	1.58E-02	5.47E-03
Thorium	Conc. (Bq/m^3)	8.72E-08	4.48E-07	6.14E-08	6.14E-08	8.39E-08	1.32E-07	1.04E-07	1.82E-07	1.94E-07	1.08E-07	3.72E-08
	Intake (Bq)	2.09E-04	1.08E-03	1.47E-04	1.47E-04	2.01E-04	3.18E-04	2.50E-04	4.38E-04	4.66E-04	2.59E-04	8.94E-05
Rn-222	Conc. (pCi/L)	7.75E-01	8.00E-01	7.75E-01	7.75E-01	8.33E-01	9.50E+00	8.00E-01	7.75E-01	6.00E-01	6.00E-01	8.00E-01
	Intake (WLM)	6.39E-02	6.59E-02	6.39E-02	6.39E-02	6.87E-02	7.83E-01	6.59E-02	6.39E-02	4.94E-02	4.94E-02	6.59E-02
Rn-220	Conc. (pCi/L)	5.00E-01	5.00E-01	0.0	0.0	0.0	0.0	5.00E-01	0.0	0.0	0.0	0.0
	Intake (WLM)	7.90E-02	7.90E-02	0.0	0.0	0.0	0.0	7.90E-02	0.0	0.0	0.0	0.0
1990												
Uranium	Conc. (Bq/m^3)	2.87E-06	1.47E-05	2.96E-07	2.02E-06	2.76E-06	4.35E-06	3.42E-06	5.99E-06	6.38E-06	3.55E-06	1.22E-06
	Intake (Bq)	6.88E-03	3.54E-02	7.12E-04	4.85E-03	6.62E-03	1.04E-02	8.21E-03	1.44E-02	1.53E-02	8.51E-03	2.94E-03
Thorium	Conc. (Bq/m^3)	3.90E-08	2.00E-07	2.75E-08	2.75E-08	3.75E-08	5.92E-08	4.66E-08	8.16E-08	8.69E-08	4.83E-08	1.67E-08
	Intake (Bq)	9.37E-05	4.81E-04	6.60E-05	6.60E-05	9.01E-05	1.42E-04	1.12E-04	1.96E-04	2.08E-04	1.16E-04	4.00E-05
Rn-222	Conc. (pCi/L)	8.00E-01	6.00E-01	8.00E-01	8.00E-01	7.00E-01	7.72E+00	6.00E-01	8.00E-01	5.00E-01	5.00E-01	6.00E-01
	Intake (WLM)	6.59E-02	4.94E-02	6.59E-02	6.59E-02	5.77E-02	6.36E-01	4.94E-02	6.59E-02	4.12E-02	4.12E-02	4.94E-02
Rn-220	Conc. (pCi/L)	5.00E-01	5.00E-01	0.0	0.0	0.0	0.0	5.00E-01	0.0	0.0	0.0	0.0
	Intake (WLM)	7.90E-02	7.90E-02	0.0	0.0	0.0	0.0	7.90E-02	0.0	0.0	0.0	0.0

Table 4-9b (Cont'd). Radionuclide concentration (Bq/m^3, pCi/L for Rn) and intake (Bq, WLM for Rn) summary from 1989 to 1996. . (Breakdown of transuranic components of recycled uranium is in Table 4-9d)

Radionuclide		EA-1	EA-2	EA-3	EA-4	EA-5	EA-6	EA-7	EA-8	EA-9	EA-10	EA-11
1991												
Uranium	Conc. (Bq/m^3)	4.13E-06	2.12E-05	4.27E-07	2.91E-06	3.97E-06	6.27E-06	4.93E-06	8.64E-06	9.20E-06	5.11E-06	1.76E-06
	Intake (Bq)	9.92E-03	5.10E-02	1.03E-03	6.99E-03	9.54E-03	1.51E-02	1.18E-02	2.07E-02	2.21E-02	1.23E-02	4.24E-03
Thorium	Conc. (Bq/m^3)	1.30E-08	6.68E-08	9.16E-09	9.16E-09	1.25E-08	1.97E-08	1.55E-08	2.72E-08	2.90E-08	1.61E-08	5.55E-09
	Intake (Bq)	3.12E-05	1.60E-04	2.20E-05	2.20E-05	3.00E-05	4.74E-05	3.73E-05	6.53E-05	6.95E-05	3.86E-05	1.33E-05
Rn-222	Conc. (pCi/L)	8.00E-01	6.00E-01	8.00E-01	8.00E-01	9.67E-01	8.31E+00	6.00E-01	8.00E-01	6.00E-01	6.00E-01	6.00E-01
	Intake (WLM)	6.59E-02	4.94E-02	6.59E-02	6.59E-02	7.97E-02	6.85E-01	4.94E-02	6.59E-02	4.94E-02	4.94E-02	4.94E-02
Rn-220	Conc. (pCi/L)	5.80E-01	5.80E-01	0.0	0.0	0.0	0.0	5.80E-01	0.0	0.0	0.0	0.0
	Intake (WLM)	9.16E-02	9.16E-02	0.0	0.0	0.0	0.0	9.16E-02	0.0	0.0	0.0	0.0
1992												
Uranium	Conc. (Bq/m^3)	3.70E-06	1.90E-05	3.82E-07	2.61E-06	3.56E-06	5.61E-06	4.41E-06	7.73E-06	8.23E-06	4.57E-06	1.58E-06
	Intake (Bq)	8.88E-03	4.56E-02	9.18E-04	6.25E-03	8.54E-03	1.35E-02	1.06E-02	1.86E-02	1.98E-02	1.10E-02	3.79E-03
Thorium	Conc. (Bq/m^3)	3.65E-08	1.87E-07	2.57E-08	2.57E-08	3.51E-08	5.53E-08	4.35E-08	7.62E-08	8.11E-08	4.51E-08	1.56E-08
	Intake (Bq)	8.75E-05	4.50E-04	6.16E-05	6.16E-05	8.41E-05	1.33E-04	1.04E-04	1.83E-04	1.95E-04	1.08E-04	3.74E-05
Rn-222	Conc. (pCi/L)	6.25E-01	6.00E-01	6.25E-01	6.25E-01	4.33E-01	7.13E+00	6.00E-01	6.25E-01	5.00E-01	5.00E-01	6.00E-01
	Intake (WLM)	5.15E-02	4.94E-02	5.15E-02	5.15E-02	3.57E-02	5.87E-01	4.94E-02	5.15E-02	4.12E-02	4.12E-02	4.94E-02
Rn-220	Conc. (pCi/L)	4.00E-01	4.00E-01	0.0	0.0	0.0	0.0	4.00E-01	0.0	0.0	0.0	0.0
	Intake (WLM)	6.32E-02	6.32E-02	0.0	0.0	0.0	0.0	6.32E-02	0.0	0.0	0.0	0.0
1993												
Uranium	Conc. (Bq/m^3)	4.44E-06	2.28E-05	4.59E-07	3.13E-06	4.27E-06	6.74E-06	5.30E-06	9.29E-06	9.89E-06	5.49E-06	1.90E-06
	Intake (Bq)	1.07E-02	5.48E-02	1.10E-03	7.51E-03	1.03E-02	1.62E-02	1.27E-02	2.23E-02	2.37E-02	1.32E-02	4.55E-03
Thorium	Conc. (Bq/m^3)	3.50E-08	1.80E-07	2.46E-08	2.46E-08	3.36E-08	5.31E-08	4.17E-08	7.31E-08	7.78E-08	4.32E-08	1.49E-08
	Intake (Bq)	8.39E-05	4.31E-04	5.91E-05	5.91E-05	8.07E-05	1.27E-04	1.00E-04	1.75E-04	1.87E-04	1.04E-04	3.58E-05
Rn-222	Conc. (pCi/L)	7.75E-01	6.90E-01	7.75E-01	7.75E-01	7.77E-01	1.00E+01	6.90E-01	7.75E-01	3.70E-01	3.70E-01	6.90E-01
	Intake (WLM)	6.39E-02	5.69E-02	6.39E-02	6.39E-02	6.40E-02	8.27E-01	5.69E-02	6.39E-02	3.05E-02	3.05E-02	5.69E-02
Rn-220	Conc. (pCi/L)	9.50E-01	9.50E-01	0.0	0.0	0.0	0.0	9.50E-01	0.0	0.0	0.0	0.0
	Intake (WLM)	1.50E-01	1.50E-01	0.0	0.0	0.0	0.0	1.50E-01	0.0	0.0	0.0	0.0
1994												
Uranium	Conc. (Bq/m^3)	1.17E-06	6.00E-06	1.21E-07	8.23E-07	1.12E-06	1.77E-06	1.39E-06	2.44E-06	2.60E-06	1.44E-06	4.99E-07
	Intake (Bq)	2.80E-03	1.44E-02	2.90E-04	1.97E-03	2.70E-03	4.26E-03	3.35E-03	5.86E-03	6.24E-03	3.47E-03	1.20E-03
Thorium	Conc. (Bq/m^3)	2.67E-08	1.37E-07	1.88E-08	1.88E-08	2.57E-08	4.06E-08	3.19E-08	5.59E-08	5.95E-08	3.30E-08	1.14E-08
	Intake (Bq)	6.41E-05	3.30E-04	4.52E-05	4.52E-05	6.17E-05	9.74E-05	7.65E-05	1.34E-04	1.43E-04	7.93E-05	2.74E-05
Rn-222	Conc. (pCi/L)	7.00E-01	5.00E-01	7.00E-01	7.00E-01	8.50E-01	7.13E+00	5.00E-01	7.00E-01	5.00E-01	5.00E-01	5.00E-01
	Intake (WLM)	5.77E-02	4.12E-02	5.77E-02	5.77E-02	7.00E-02	5.87E-01	4.12E-02	5.77E-02	4.12E-02	4.12E-02	4.12E-02
Rn-220	Conc. (pCi/L)	1.00E+00	1.00E+00	0.0	0.0	0.0	0.0	1.00E+00	0.0	0.0	0.0	
	Intake (WLM)	1.58E-01	1.58E-01	0.0	0.0	0.0	0.0	1.58E-01	0.0	0.0	0.0	
1995												
Uranium	Conc. (Bq/m^3)	7.62E-07	3.91E-06	7.88E-08	5.37E-07	7.33E-07	1.16E-06	9.09E-07	1.59E-06	1.70E-06	9.42E-07	3.25E-07
	Intake (Bq)	1.83E-03	9.39E-03	1.89E-04	1.29E-03	1.76E-03	2.78E-03	2.18E-03	3.82E-03	4.07E-03	2.26E-03	7.81E-04
Thorium	Conc. (Bq/m^3)	1.03E-08	5.27E-08	7.23E-09	7.23E-09	9.87E-09	1.56E-08	1.23E-08	2.15E-08	2.28E-08	1.27E-08	4.38E-09
	Intake (Bq)	2.46E-05	1.27E-04	1.74E-05	1.74E-05	2.37E-05	3.74E-05	2.94E-05	5.15E-05	5.48E-05	3.05E-05	1.05E-05
Rn-222	Conc. (pCi/L)	9.00E-01	8.00E-01	9.00E-01	9.00E-01	7.00E-01	1.01E+01	8.00E-01	9.00E-01	7.00E-01	7.00E-01	8.00E-01
	Intake (WLM)	7.42E-02	6.59E-02	7.42E-02	7.42E-02	5.77E-02	8.32E-01	6.59E-02	7.42E-02	5.77E-02	5.77E-02	6.59E-02
Rn-220	Conc. (pCi/L)	8.00E-01	8.00E-01	0.0	0.0	0.0	0.0	8.00E-01	0.0	0.0	0.0	
	Intake (WLM)	1.26E-01	1.26E-01	0.0	0.0	0.0	0.0	1.26E-01	0.0	0.0	0.0	

Table 4-9b (Cont'd). Radionuclide concentration (Bq/m^3, pCi/L for Rn) and intake (Bq, WLM for Rn) summary from 1989 to 1996. . (Breakdown of transuranic components of recycled uranium is in Table 4-9d)

1996												
Uranium	Conc. (Bq/m^3)	7.70E-07	3.96E-06	7.96E-08	5.42E-07	7.40E-07	1.17E-06	9.19E-07	1.61E-06	1.71E-06	9.52E-07	3.29E-07
	Intake (Bq)	1.85E-03	9.49E-03	1.91E-04	1.30E-03	1.78E-03	2.80E-03	2.21E-03	3.86E-03	4.11E-03	2.28E-03	7.89E-04
Thorium	Conc. (Bq/m^3)	0	0	0	0	0	0	0	0	0	0	0
	Intake (Bq)	0	0	0	0	0	0	0	0	0	0	0
Rn-222	Conc. (pCi/L)	1.58E+00	1.80E+00	1.58E+00	1.58E+00	1.63E+00	2.02E+01	1.80E+00	1.58E+00	1.50E+00	1.50E+00	1.80E+00
	Intake (WLM)	1.30E-01	1.48E-01	1.30E-01	1.30E-01	1.35E-01	1.66E+00	1.48E-01	1.30E-01	1.24E-01	1.24E-01	1.48E-01
Rn-220	Conc. (pCi/L)	7.00E-01	7.00E-01	0.0	0.0	0.0	0.0	7.00E-01	0.0	0.0	0.0	
	Intake (WLM)	1.11E-01	1.11E-01	0.0	0.0	0.0	0.0	1.11E-01	0.0	0.0	0.0	

Table 4-9c. Radionuclide concentration (Bq/m^3, pCi/L for Rn) and intake (Bq, WLM for Rn) from 1997 to 2002. (Breakdown of transuranic components of recycled uranium is in Table 4-9d)

Radionuclide		**Onsite general locations (all EAs)**	**K-65 Exclusion fence (EA-6)**
1997			
Uranium	Conc. (Bq/m^3)	4.44E-05	
	Intake (Bq)	1.07E-01	
Thorium	Conc. (Bq/m^3)	0	
	Intake (Bq)	0	
Rn-222	Conc. (pCi/L)	1.0	3.5
	Exposure (WLM)	8.24E-02	0.29
Rn-220	Conc. (pCi/L)	5.45E-02	
	Exposure (WLM)	8.61E-03	
1998			
Uranium	Conc. (Bq/m^3)	2.81E-05	
	Intake (Bq)	6.74E-02	
Thorium	Conc. (Bq/m^3)	0	
	Intake (Bq)	0	
Rn-222	Conc. (pCi/L)	0.8	5.2
	Exposure (WLM)	0.066	0.43
Rn-220	Conc. (pCi/L)	8.18E-02	
	Exposure (WLM)	1.29E-02	
1999			
Uranium	Conc. (Bq/m^3)	4.07E-05	
	Intake (Bq)	9.77E-02	
Thorium-230	Conc. (Bq/m^3)	9.25E-07	
	Intake (Bq)	2.23E-03	
Rn-222	Conc. (pCi/L)	0.8	5.5
	Exposure (WLM)	0.066	0.45
Rn-220	Conc. (pCi/L)	8.18E-02	
	Exposure (WLM)	1.29E-02	

Table 4-9c. (Cont'd). Radionuclide concentration (Bq/m^3, pCi/L for Rn) and intake (Bq, WLM for Rn) from 1997 to 2002. (Breakdown of transuranic components of recycled uranium is in Table 4-9d)

Radionuclide		Onsite general locations (all EAs)	K-65 Exclusion fence (EA-6)
2000			
Uranium	Conc. (Bq/m^3)	3.66E-05	
	Intake (Bq)	8.80E-02	
Thorium-230	Conc. (Bq/m^3)	7.03E-06	
	Intake (Bq)	1.69E-02	
Rn-222	Conc. (pCi/L)	0.6	2.0
	Exposure (WLM)	0.049	0.16
Rn-220	Conc. (pCi/L)	5.45E-02	
	Exposure (WLM)	8.61E-03	
2001			
Uranium	Conc. (Bq/m^3)	3.66E-05	
	Intake (Bq)	8.80E-02	
Thorium	Conc. (Bq/m^3)	2.77E-05	
	Intake (Bq)	6.59E-02	
Rn-222	Conc. (pCi/L)	0.4	1.7
	Exposure (WLM)	0.033	0.14
Rn-220	Conc. (pCi/L)	5.45E-02	
	Exposure (WLM)	8.61E-03	
2002			
Uranium	Conc. (Bq/m^3)	7.03E-05	
	Intake (Bq)	1.69E-01	
Thorium-230	Conc. (Bq/m^3)	2.15E-05	
	Intake (Bq)	5.15E-02	
Rn-222	Conc. (pCi/L)	0.5	2.1
	Exposure (WLM)	0.041	0.17
Rn-220	Conc. (pCi/L)	5.45E-02	
	Exposure (WLM)	8.61E-03	

Table 4-9d. Conversion factors and isotopic content for values in Table 4-9a.

Specific Activities for Recycled Uranium:

Uranium Enrichmt	U+Cont. (Bq/mg)	U		Pu - 80ppb		Np – 300 ppb		Tc- 5000 ppb	
		Bq/mg	*f* act.	Bq/mg	*f* act.	Bq/mg	*f* act.	Bq/mg	*f* act.
Depleted	4.53E+01	1.38E+01	0.305	1.83E-01	0.004	7.77E-03	1.72E-04	3.13E+00	0.069
Natural	5.76E+01	2.61E+01	0.453	1.83E-01	0.003	7.77E-03	1.35E-04	3.13E+00	0.054
2% Enriched	9.14E+01	6.03E+01	0.66	1.83E-01	0.002	7.77E-03	8.50E-05	3.13E+00	0.034

2% Enriched recycled uranium that is claimant favorable would be used as the default value for mass to activities conversion.

Conversion Example:
From Table 4-9a and year 1955, an intake of 24.3 mg for an individual in Exposure Area 1 for a year.
From column 2, for 2% enrichment, 24.3 mg × 91.4 Bq/mg = 2.22E+03 Bq of recycled U.
Using the fractions in Column 4 for U, Column 6 for Pu, Column 8 for Np, and Column 10 for Tc, the individual would have inhaled:
1,466 Bq 2% enrich U, or 1,129 Bq U-234 (for further breakdown of U isotopes, see next table)
4.44 Bq Pu
0.189 Bq Np
75.5 Bq Tc

Specific Activities for Enriched Uranium:

Uranium Enrichment	Isotopes	Mass %	*f* activities
Depleted	U-234 U-235 U-238	05 0.25 99.75	0.083 0.014 0.903
Natural	U-234 U-235 U-238	0.0057 0.7204 99.273	0.504 0.023 0.473
2% Enrich	U-234 U-235 U-238	0.02 2.0 97.98	0.770 0.026 0.204

Specific Activities for Thorium:

Thorium-232 would be the default isotope. The degree of equilibrium is impossible to estimate, due to the variation in times since chemical separation of the feed stock. The specific activity value for ^{232}Th and daughters is 1.11E-07 Ci/gm or 4.11Bq/mg.

Working Level (WL) Conversion Factor for Rn daughters:

1 WL = 100 pCi/L for 100% Rn daughter equilibrium
1 WLM (100% equilibrium) = 1.70E+04 pCi/L-hr

$$\text{No. of } WLM = \frac{Equalibrium\ Factor \times Exposure\ Time}{1.0\ WLM_{100}} \times Rn\ Concentration\ , = \frac{0.7 \times 2000}{17000} \times Concentration\ \frac{pCi}{L}\ ,$$

WLM = 8.24E-02 × Rn-222 concentration in pCi/L for 70% equilibrium and 2,000 hrs exposure time.

Working Level (WL) Conversion Factor for thoron daughters:

1 WL = 7.47 pCi/L for 100% Rn-220 daughter equilibrium
1 WLM (100% equilibrium) = 7.47pCi/L × 170 hr = 1.27E+03 pCi/L-hr

$$\text{No. of } WLM = \frac{Equalibrium\ Faction \times Exposure\ Time}{1.0\ WLM_{100}} \times Thoron\ Concentration\ , = \frac{0.1 \times 2000}{1270} \times Concentration\ \frac{pCi}{L}\ ,$$

WLM = 1.57E-01 × Rn-220 concentration in pCi/L for 10% equilibrium and 2,000 hrs exposure time.

4.3.5 Site-Wide Average Intake Summary by Isotopes for Years 1951 through 2002 (Table 4-10)

The FEMP site-wide intakes (averaging over the EAs) of each uranium and each non-uranium radionuclide were developed, using the conversion factors in Table 4-9d. These annual site-wide intakes are listed in Table 4-10 by each radionuclide.

Table 4-10. Site-wide intakes of each uranium and each non-uranium radionuclides in Bq/yr and radon in WLM for 1951 through 2002.

Year	Tc-99[a] Bq/yr	Th-232 Bq/yr	U-234[a] Bq/yr	Np-237[a] Bq/yr	Pu-239[a] Bq/yr	Rn-222[b] WLM	Rn-220 WLM
1951	3.82E-01	0	5.66E+00	9.48E-04	2.23E-02	7.88E-02	--
1952	1.54E+00	0	2.28E+01	3.83E-03	9.01E-02	8.78E-01	--
1953	5.80E+00	0	8.60E+01	1.44E-02	3.39E-01	3.26E-01	--
1954	4.19E+01	2.86E+00	6.20E+02	1.04E-01	2.45E+00	4.88E-01	--
1955	9.12E+01	3.26E+00	1.35E+03	2.26E-01	5.33E+00	4.88E-01	--
1956	4.39E+01	0	6.50E+02	1.09E-01	2.56E+00	4.88E-01	--
1957	3.31E+01	2.56E-04	4.91E+02	8.22E-02	1.94E+00	4.88E-01	--
1958	2.93E+01	5.85E-04	4.34E+02	7.27E-02	1.71E+00	4.88E-01	--
1959	2.98E+01	5.85E-04	4.41E+02	7.39E-02	1.74E+00	5.78E-01	--
1960	7.86E+00	7.55E-03	1.02E+01	1.95E-02	4.60E-01	5.78E-01	--
1961	2.59E+01	2.05E-02	3.84E+02	6.43E-02	1.51E+00	5.78E-01	--
1962	2.38E+01	2.87E-02	3.53E+02	5.91E-02	1.39E+00	5.78E-01	--
1963	2.09E+01	3.22E-02	3.09E+02	5.18E-02	1.22E+00	5.78E-01	--
1964	1.95E+01	1.44E+00	2.89E+02	4.83E-02	1.14E+00	5.78E-01	--
1965	2.53E+01	1.44E+00	3.75E+02	6.28E-02	1.48E+00	5.78E-01	--
1966	8.54E+00	1.96E+00	1.27E+02	2.12E-02	4.99E-01	5.78E-01	--
1967	1.17E+01	1.44E+00	1.74E+02	2.91E-02	6.85E-01	5.78E-01	--
1968	1.91E+01	1.44E+00	2.83E+02	4.74E-02	1.12E+00	5.78E-01	--
1969	1.56E+01	6.23E+00	2.31E+02	3.86E-02	9.09E-01	5.78E-01	--
1970	6.30E+00	5.16E+00	9.33E+01	1.56E-02	3.68E-01	5.78E-01	--
1971	3.86E+00	2.19E+00	5.73E+01	9.59E-03	2.26E-01	5.78E-01	--
1972	5.43E+00	6.21E-01	8.05E+01	1.35E-02	3.17E-01	5.78E-01	2.03E-02
1973	5.84E+00	2.49E-01	8.66E+01	1.45E-02	3.41E-01	5.78E-01	2.03E-02
1974	8.99E+00	4.55E-01	1.33E+02	2.23E-02	5.26E-01	5.78E-01	2.03E-02
1975	1.05E+01	6.58E-02	1.56E+02	2.61E-02	6.14E-01	5.78E-01	2.03E-02
1976	1.19E+01	6.67E-02	1.77E+02	2.96E-02	6.97E-01	5.78E-01	2.03E-02
1977	3.82E+00	1.72E+00	5.66E+01	9.48E-03	2.23E-01	5.78E-01	2.03E-02
1978	1.11E+00	1.73E+00	1.64E+01	2.75E-03	6.48E-02	5.78E-01	2.03E-02
1979	1.14E+00	1.74E+00	1.70E+01	2.84E-03	6.69E-02	5.78E-01	2.03E-02
1980	1.47E+00	3.02E-01	2.18E+01	3.66E-03	8.61E-02	1.47E-01	2.03E-02
1981	2.55E+00	7.56E-02	3.78E+01	6.34E-03	1.49E-01	1.47E-01	2.03E-02
1982	1.87E+00	7.55E-02	2.77E+01	4.65E-03	1.09E-01	1.47E-01	2.03E-02
1983	1.86E+00	7.55E-02	2.75E+01	4.61E-03	1.09E-01	1.47E-01	2.03E-02
1984	3.72E+00	7.55E-02	5.51E+01	9.23E-03	2.17E-01	1.47E-01	2.03E-02
1985	1.31E+00	7.55E-02	1.95E+01	3.26E-03	7.68E-02	1.47E-01	2.03E-02
1986	8.89E-01	7.55E-02	1.32E+01	2.21E-03	5.20E-02	1.47E-01	2.03E-02

Table 4-10. (Cont'd) Site-wide intakes of each uranium and each non-uranium radionuclides in Bq/yr and radon in WLM for 1951 through 2002.

Year	Tc-99 Bq/yr	Th-232 Bq/yr	U-234 Bq/yr	Np-237 Bq/yr	Pu-239 Bq/yr	Rn-222 WLM	Rn-220 WLM
1987	1.55E+00	7.90E-02	2.30E+01	3.86E-03	9.08E-02	1.47E-01	2.03E-02
1988	1.19E+00	8.16E-02	1.77E+01	2.96E-03	6.97E-02	8.39E-02	2.03E-02
1989	6.57E-04	3.28E-04	9.81E-03	1.64E-06	3.86E-05	1.28E-01	2.15E-02
1990	3.53E-04	1.46E-04	5.27E-03	8.83E-07	2.08E-05	1.08E-01	2.15E-02
1991	5.09E-04	4.88E-05	7.61E-03	1.27E-06	2.99E-05	1.16E-01	2.50E-02
1992	4.56E-04	1.37E-04	6.81E-03	1.14E-06	2.68E-05	9.63E-02	1.72E-02
1993	5.47E-04	1.31E-04	8.18E-03	1.37E-06	3.22E-05	1.25E-01	4.09E-02
1994	1.44E-04	1.00E-04	2.15E-03	3.60E-07	8.46E-06	9.94E-02	4.31E-02
1995	9.38E-05	3.86E-05	1.40E-03	2.35E-07	5.52E-06	1.36E-01	3.44E-02
1996	9.48E-05	0	1.42E-03	2.37E-07	5.57E-06	2.73E-01	3.03E-02
1997	3.64E-03	0	5.44E-02	9.10E-06	2.14E-04	1.86E-01	8.61E-03
1998	2.29E-03	0	3.42E-02	5.73E-06	1.35E-04	2.48E-01	1.29E-02
1999	3.32E-03	2.23E-03	4.96E-02	8.30E-06	1.95E-04	2.58E-01	1.29E-02
2000	2.99E-03	1.69E-02	4.47E-02	7.48E-06	1.76E-04	1.05E-01	8.61E-03
2001	2.99E-03	6.59E-02	4.47E-02	7.48E-06	1.76E-04	8.70E-02	8.61E-03
2002	5.75E-03	5.15E-02	8.59E-02	1.44E-05	3.38E-04	2.90E-02	8.61E-03

[a] Based on 2% enriched recycled uranium
[b] Background included.

4.4 ON-SITE EXTERNAL DOSES FROM AMBIENT RADIATION

External environmental radiation dose at FEMP is the result of photon radiation (i.e., gamma and X-rays) emitted from radionuclides stored on the site. For unmonitored personnel who worked in the administration areas, the largest source of direct radiation at FEMP was the waste stored in the K-65 Silos and the radionuclides in the Production Plants and facilities. To a lesser extend, the radioactive waste pit area is another direct radiation source for unmonitored personnel who worked in this area.

4.4.1 K-65 and Production Plants External Dose Contribution

There were three significant external radiation sources at FEMP, but by far the largest source was the wastes stored in the K-65 Silos. The ambient dose rates at the FEMP started to increase to measurable levels starting in 1955 when the wastes from Niagara Falls, New York, were relocated to the K-65 Silos. This elevation in ambient dose was due to the radium content of these wastes. Direct radiation occurred not only from the radium but from the radon-thoron daughter products as well, which with time continued to increase within the structures. This condition prevailed until the structures became such a significant source of radiation that the site found it necessary to construct reinforcement beams and coat the exterior surfaces of the silos in an attempt both to strengthen the structures and to reduce the radiation. While these actions provided some benefit, the radon-thoron dose contribution continued to increase as the gaseous radionuclides emanated and accumulated in the voided space under the domes. The source strength increased to the point that in 1991 it became necessary to add a bentonite layer (Fluor 2001) to the surface of the stored material in an attempt to contain the radioactive gases. This was effective, as evidenced by an immediate reduction in direct radiation dose rates, due to the shielding afforded by the solid materials in the silos. An immediate dose rate reduction of approximately one order of magnitude occurred as a result of the bentonite layer. However, the bentonite has provided only a temporary reduction. Dose rates have slowly

increased again, and in 2002 monitoring showed an increase of about a factor of four in the external radiation.

The reference materials found and reviewed for external radiation information has yielded useful data back to 1975 (NLO 1975 to 1985, WEMCO 1990 to 1992, FERMCO 1993 to 1996, and Fluor 1997 to 2001). The data collection, consisting of thermoluminescent dosimeter (TLD) measurements, became possible with the advances in the development of the TLD as a useful dose measurement device. These technology developments made it possible to measure radiation doses over long periods, in the exposure environment, and without power. TLDs became a popular and accurate tool for measuring doses in the environment over extended periods.

Before 1975 the only data found (Klein 1963) consisted of contact radiation readings using a Juno survey meter for measurements of exposure rates in the vicinity of the North and South Tanks (i.e., the K-65 Silos). The dose rates ranged from 10 to 20 mR/hr and 10 to 30 mR/hr, respectively. Later data (Boback 1978) provided readings using TLDs from inside the South Tank that ranged from 590 mR/hr at the surface of the residue to 650 mR/hr at 10 ft and 470 mR/hr at 13 ft above the surface of the residue. These data are indicative of the magnitude of the primary sources of ambient radiation and are presented here only to provide the reconstructor with background information.

Starting in 1976, gamma radiation at the site boundary sampling stations was measured with TLDs which were changed and processed every three months. Table 4-11 is a summary table of dose rates measured at the monitoring stations for years 1976 through 1995. Figure 4-9 shows the locations of the monitoring stations.

Since 1996, the FEMP expanded its direct radiation monitoring system to continuously measure at 32 locations including a numbers of on-site monitoring locations. Figure 4-10 identifies the location of the TLD stations. Table 4-12 provides summary level information pertaining to direct radiation measurements for 1996 through 2002.

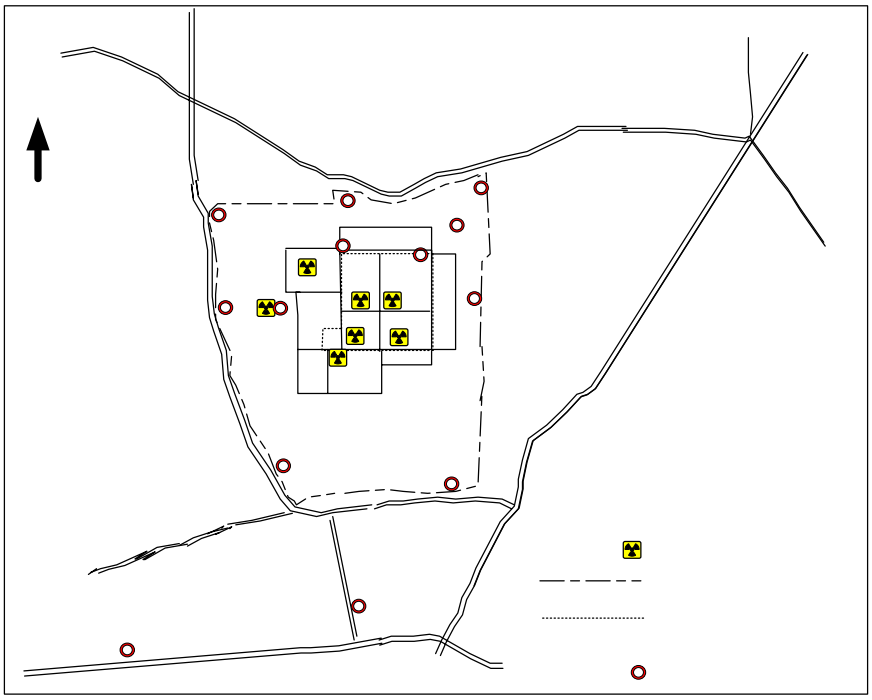

Figure 4-9. FEMP fence line TLD locations (1976 – 1995)

Table 4-11. Radiation dose rates at site boundary

	Maximum Measured Dose @ TLD Stations (mR/hr or mrem/hr)										
Year	**BS1**	**BS2**	**BS3**	**BS4**	**BS5**	**BS6**	**BS7**	**BS8**	**BS9**	**On-Site**	**Back-grd**
1976	0.010	0.012	0.012	0.011	0.012	0.015	NA	NA	NA	NA	0.010
1977	0.011	0.010	0.011	0.011	0.011	0.012	NA	NA	NA	NA	0.009
1978	0.010	0.011	0.011	0.010	0.011	0.013	NA	NA	NA	NA	0.009
1979	0.012	0.012	0.010	0.010	0.011	0.018	NA	NA	NA	NA	0.009
1980	0.012	0.014	0.014	0.013	0.012	0.023	NA	NA	NA	NA	0.011
1981	0.010	0.012	0.012	0.012	0.012	0.021	0.013	NA	NA	NA	0.009
1982	0.011	0.014	0.013	0.013	0.014	0.019	0.013	NA	NA	NA	0.010
1983	0.012	0.013	0.013	0.013	0.013	0.020	0.014	NA	NA	NA	0.010
1984	0.010	0.0113	0.0114	0.011	0.0115	0.0171	0.0123	NA	NA	NA	0.010
1985	0.0123	0.0129	0.0125	0.0122	0.0127	0.0191	0.0138	NA	NA	NA	0.0118
1986	0.0127	0.011	0.0111	0.0111	0.0116	0.015	0.0104	NA	NA	NA	0.009
1987	0.0096	0.0107	0.0103	0.0104	0.010	0.0157	0.0108	NA	NA	NA	0.0106
1988	0.0144	0.0164	0.0169	0.0155	0.015	0.0235	0.0158	0.0148	0.0186	NA	0.0151
1989	0.0135	0.0131	0.0161	0.0126	0.0127	0.0197	0.0132	0.0116	0.0175	NA	0.0128
1990	0.0079	0.0079	0.0076	0.0078	0.0073	0.013	0.0075	0.0074	0.010	NA	0.0075
1991	0.0081	0.0085	0.0077	0.0082	0.0077	0.013	0.008	0.0078	0.010	0.258	0.0069
1992	0.0080	0.0094	0.009	0.009	0.0091	0.0087	0.0083	0.0084	0.0115	0.0205	0.0082
1993	0.0089	0.0084	0.0077	0.0078	0.0077	0.0077	0.0075	0.0079	0.0107	0.0239	0.0068
1994[a]	0.0128	0.0082	0.0071	0.0074	0.0081	0.0079	0.0072	0.0079	0.0107	0.0239	0.0068
1995[a]	0.0157	0.0085	0.0075	0.0074	0.0079	0.0085	0.0077	0.0077	0.0108	0.0420	0.0074

NA – Not available
[a] Dose rate values in column 2 is from TLD station BS1A

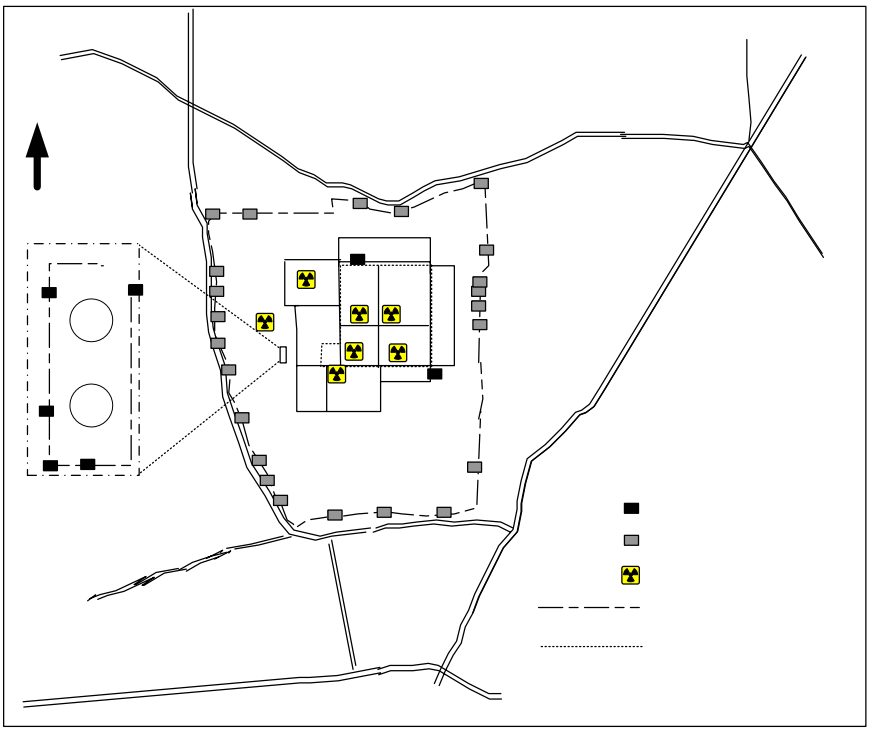

Figure 4-10. TLD monitoring locations (1996 – 2002).

Table 4-12. TLD measurement summary.

	TLD Monitoring Results (mrem/hr)						
	Fence line		Onsite		Offsite		
	Min.	Max.	Min. (Health & Safety Bldg)	Max. (K-65 Silos)	Min.	Max.	Back-grd Avg.
1996	0.008	0.0104	0.0069	0.0789	0.0069	0.0084	0.0088
1997	0.0082	0.0103	0.0070	0.101	0.0068	0.0085	0.0087
1998	0.0072	0.0096	0.0063	0.0093	NA	NA	0.0079
1999	0.0072	0.0093	0.0063	0.0103	NA	NA	0.0079
2000	0.0074	0.0097	0.0066	0.124	NA	NA	0.0079
2001	0.0079	0.0103	0.0066	0.137	NA	NA	0.0083
2002	0.0081	0.0111	0.0064	0.139	NA	NA	0.0087

The above measurement data were used to estimate the dose rate distribution to each of the Exposure Areas (EAs).

In 1985, EG&G, Inc. conducted an on-site and off-site aerial survey of the FEMP and surrounding areas for radiation due to gamma emission. The survey resulted in dose rate contour maps of the site for 1976 and 1985 that are shown in Figures 4-11 and 4-12, respectively. The aerial survey data were used to correlate the dose rates estimated for the EAs using the site TLD measurements. The aerial survey data particularly important because the 1976 data represent a low annual production rate of approximately 1,230 MTU while 1985 represent a modest annual production rate of about 3,700 MTU. The peak production rate of FEMP was 10,000 MTU in 1960.

Other relevant direct radiation exposure measurements are those called “background” measurements conducted using TLDs, starting in 1988 and extending through the first quarter of 2003, and covering up to 15 locations[1]. All the locations were not monitored throughout this period; some new ones were added and others deleted so that there were approximated 8 monitored sites at all times which provided adequate coverage for the site. The individual locations for each year were averaged since the data did not identify the specific locations and instead used general identifiers such as “men’s locker,” “Health and Safety Laboratory,” etc. Table 4-13 provides the average values in mrem/month. These on-site “background” dose rate measurements were compared with the EA dose rate estimates derived from on-site and fence line TLD measurement for the purpose of validating the EA dose rate estimates.

4.4.2 External Dose Contribution from Waste Pits

The Waste Pit Area is in EA-5. Figure 4-13 presents the beta gamma dose rate contours within the Waste Pit area. Table 4-14 lists the operational periods and the direct dose rate for each pit. Figure 4-14 depicts the radiation profile of the Waste Pit Area, taking into account the development of each pit (i.e., increasing dose rates as the pits were filled with wastes).

The beta and gamma radiation at the waste pits area is emitted from radionuclides buried in the ground. The gamma radiation is emitted at the ground level toward the atmosphere, and scattered from the atmosphere to reach receptor location at some distance from the waste pit area. This is known as the “skyshine” phenomena. Typically, radiation from “sky shine” is approximately 1% of the dose rate at the receptor location.

[1] From the ORAU O-Drive located on O:\DOE Site Images\FEMP\07-28-03-Data Capture\010001026 through 010001036.

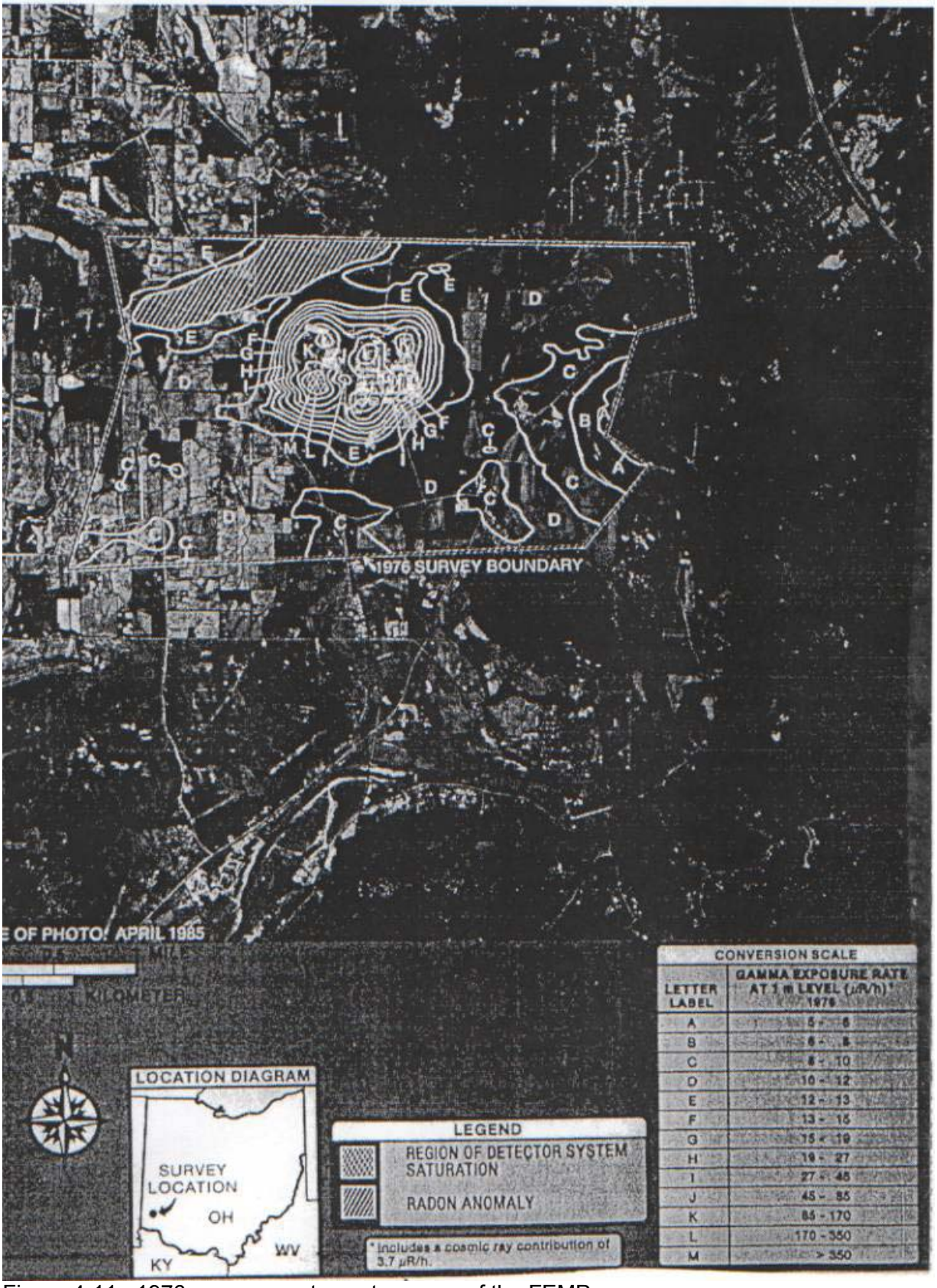

Figure 4-11. 1976 exposure rate contour map of the FEMP survey area

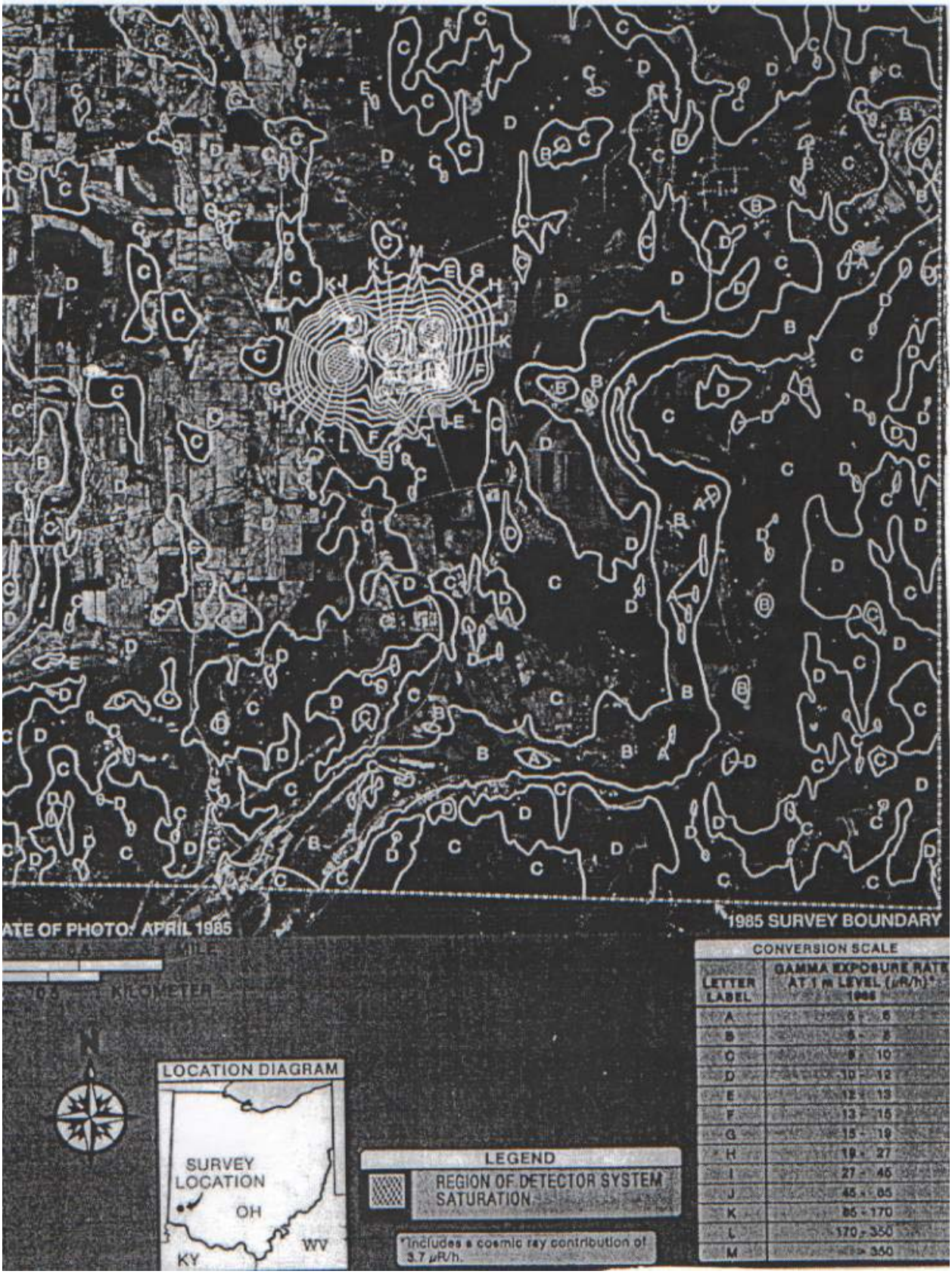

Figure 4-12. 1985 exposure rate contour map of the FEMP survey area.

Table 4-13. Average on-site "background" dose rates

Year	Average Dose rates (mrem/month)
1988	12.4
1989	11.33
1991	7.24
1992	7.79
1993	5.89
1994	5.64
1995	5.08
1996	5.01
1997	5.14
1998	4.98
1999	4.98
2000	5.15
2001	5.28
2002	5.41

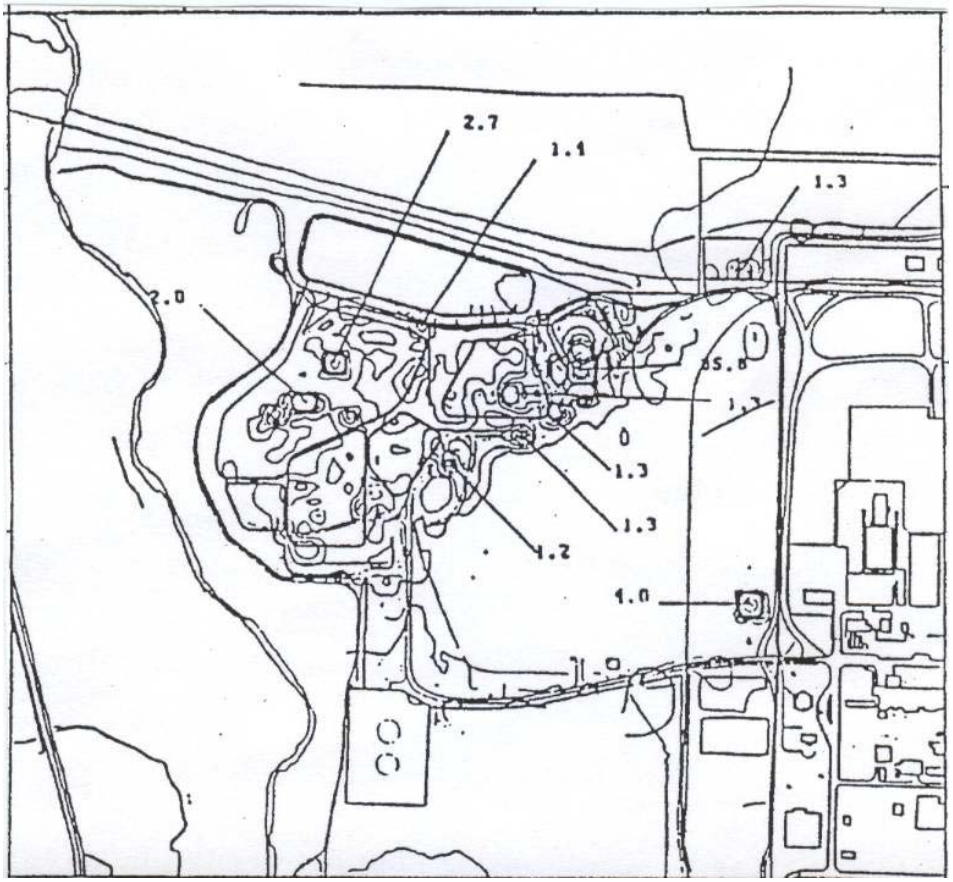

Figure 4-13. Beta gamma dose rate contours in the waste pit area.

Table 4-14. Waste pits dose rate data.

Waste pit	Operation period	Average ambient dose rate (mRad /hr)
1	1952-1959	1.0
2	1957-1964	1.2
3	1958-1977	2.0
4	1960-1986	16.0
5	1968-1987	1.0
6	1979-1985	1.3
Clearwell	1960s and 1970s	1.0
Burn pit	1957-1984	1.3

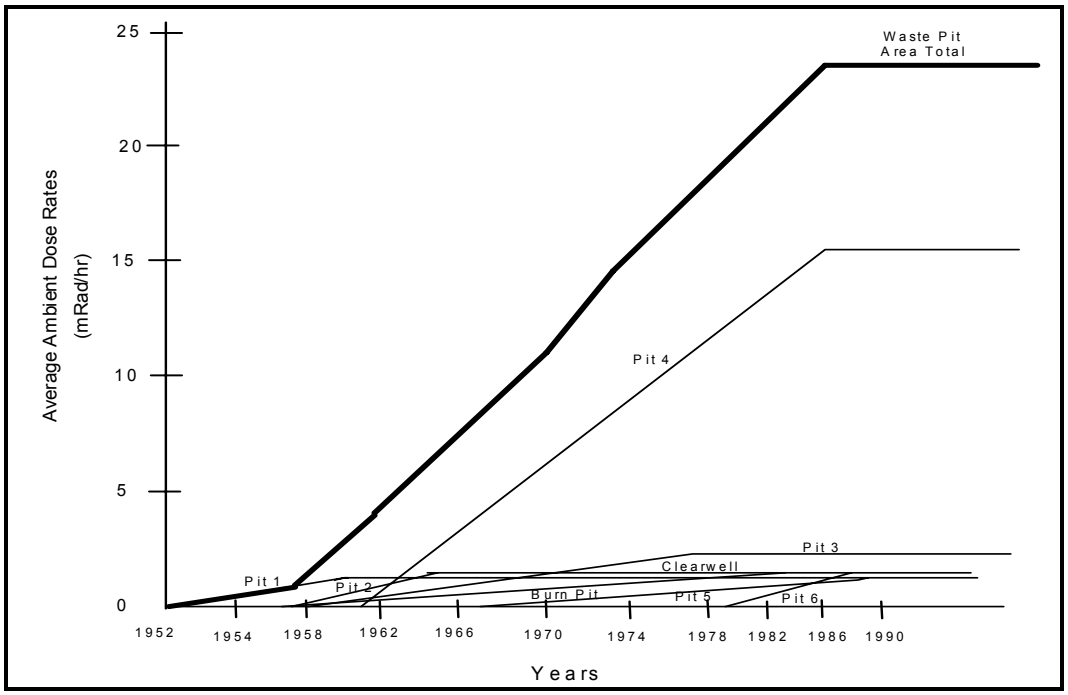

Figure 4-14. Waste pits dose rate profiles.

4.4.3 On-site Ambient Dose rate Estimate

The dose rate at each EA is estimated by summing the dose rates coming from the major direct dose contributors (i.e., K-65 silos, production facilities and the waste pits) and the background radiation and can be represented by Equation 4-5 below:

$$D_i = \left(BSs - D_{bkg}\right) \times \left(\frac{d_{BSs}}{d_{EAsi}}\right)^2 + Average\left[\left(BSj - D_{bkg}\right) \times \left(\frac{d_{BSj}}{d_{EAji}}\right)^2\right] + 0.01\left[D_{pit} \times \left(\frac{d_k}{d_{EAki}}\right)^2\right] + D_{bkg} \qquad (4\text{-}5)$$

Where

D_i = Estimated dose rate at EA*i.*
D_{bkg} = Background dose rate.

BSs = Measured dose rate at TLD stations closest to the K-65 silos.
d_{bss} = Distance from TLD stations to the K-65 silos.
d_{EAsi} = Distance from Silos to EA*i*.
BSj = Measured dose rate at fence line TLD stations. *j* is the combination of BS1, 2, 3, 4, 5, 7 and 9 correlated to the aerial survey results. Starting in 1996, the onsite TLD station BS32 (Health and Safety Building) was used.
d_{bsj} = Distance from TLD stations to production plants.
d_{EAji} = Distance from production plants to EA*i*.
D_{pit} = Average dose rate at the waste pit area.
d_k = Distance from center of waste pit area to edge of waste pit area.
d_{EAki} = Distance from waste pit area to EA*i*.

Measured dose rate values in Tables 4-11, 4-12 and Figure 4-14 were used for Equation 4-5. Table 4-17 summarizes the Equation 4-5 results. The Equation 4-5 results were also correlated to the direct dose rate contour maps (Figures 4-11 and 4-12) resulting from the aerial survey conducted by EG&G, Inc. in 1976 and 1985. The correlations have resulted in closely matched dose rate in each EA as shown in Table 4-15.

Table 4-15. Comparison of the estimated dose rates in EAs and the aerial survey results.

Exposure Areas	Estimated Dose Rates Compared to Aerial Surveys (mrem/hr)			
	1976		1985	
	Eq 4-5	Aerial Survey	Eq 4-5	Aerial Survey
EA-1	0.203	0.170-0.350 (L)	0.304	>0.350 (M)
EA-2	0.143	0.085-0.170 (K)	0.213	>0.350 (M)
EA-3	0.142	0.045-0.085 (J)	0.212	0.170-0.350 (L)
EA-4	0.201	0.085-0.170 (K)	0.302	0.170-0.350 (L)
EA-5	0.0843	0.065-0.128 (K,J)	0.0491	0.065-0.128 (K,J)
EA-6	0.456	>0.350 (M)	0.663	>0.350 (M)
EA-7	0.0167	0.015-0.019 (G)	0.0218	0.019-0.027 (H)
EA-8	0.0226	0.019-0.027 (H)	0.0309	0.027-0.045 (I)
EA-9	0.0181	0.015-0.019 (G)	0.0240	0.019-0.027 (H)
EA-10	0.0167	0.019-0.027 (H)	0.0219	0.027-0.045 (I)
EA-11	0.0149	0.019-0.027 (H)	0.0191	0.015-0.019 (G)

Starting in 1988, Equation 4-5 results were also compared with the measured onsite “background” dose rate in Table 4-13. For this comparison, the onsite “background” TLDs were assumed to be located inside buildings. One-half of the background dose rate was added to the values in Table 4-13 in order to correct for the building shielding. Background radiation from building penetrating cosmic ray accounts for half of the background dose rate. The Equation 4-5 results for comparison are dose rate values averaging over all EAs but excluding EA-6 that contains the K-65 silos. Because EA-6 has the highest dose rate, excluding its dose rate from the site-wide averaging ensures a truer equivalent comparison. Table 4-16 presents the results of the comparison.

Table 4-16. Site-wide average dose rates comparison.

Years	Eq. 4-5 (mrem/hour)	"Background" TLD Measurement (mrem/hour)
1988	0.052	0.024
1989	0.060	0.022
1991	0.038	0.013
1992	0.040	0.015
1993	0.044	0.015
1994	0.044	0.011
1995	0.040	0.011
1996	0.015	0.013
1997	0.015	0.014
1998	0.013	0.018
1999	0.013	0.018
2000	0.014	0.010
2001	0.015	0.014
2002	0.014	0.018

Although the Equation 4-5 results show moderately higher dose rates during production years and slightly elevated dose rates for some of the subsequent post-production years, the dose rates are in the same order of magnitude values. Higher dose rates are expected during production years 1988 and 1989. The comparison illustrates that the extrapolated dose rate values are reasonably valid.

Since no usable direct radiation measurements were identified in the available reference materials for the time period prior to 1976, the ambient dose rates in the plant site for those years were estimated by proportioning the metal production rate of the plant. Figure 4-15 overlays the projected site-wide average dose rate on the FEMP metal production rate profile.

In the 1980s, the plant processing systems were at about 75% capacity with an annual production rate of about 3,700 MTU of metal products. The plant process systems were at 100% capacity in the years back to the 1970s, 1960s and part of the 1950s. The on-site ambient direct radiation dose rates for those years were estimated by the ratio of the annual plant production rates, therefore a factor of 1.35 increase of the highest average ambient dose rates in the 80s. Using the same methodology resulted in the following ambient dose rate projections:

1951 to 1953 0.015 mrem/hr,
1954 and1955 1.8 mrem/hr, and
1956 to 1970 0.3 mrem/hr

Table 4-17 summarizes the on site ambient dose rates (mrem/hour) by EAs and the years. Site-wide average ambient dose rate also listed in Table 4-17. EA-6 which includes the K-65 Silos was purposefully excluded from the site average since that area has the highest dose rate and infrequently occupied.

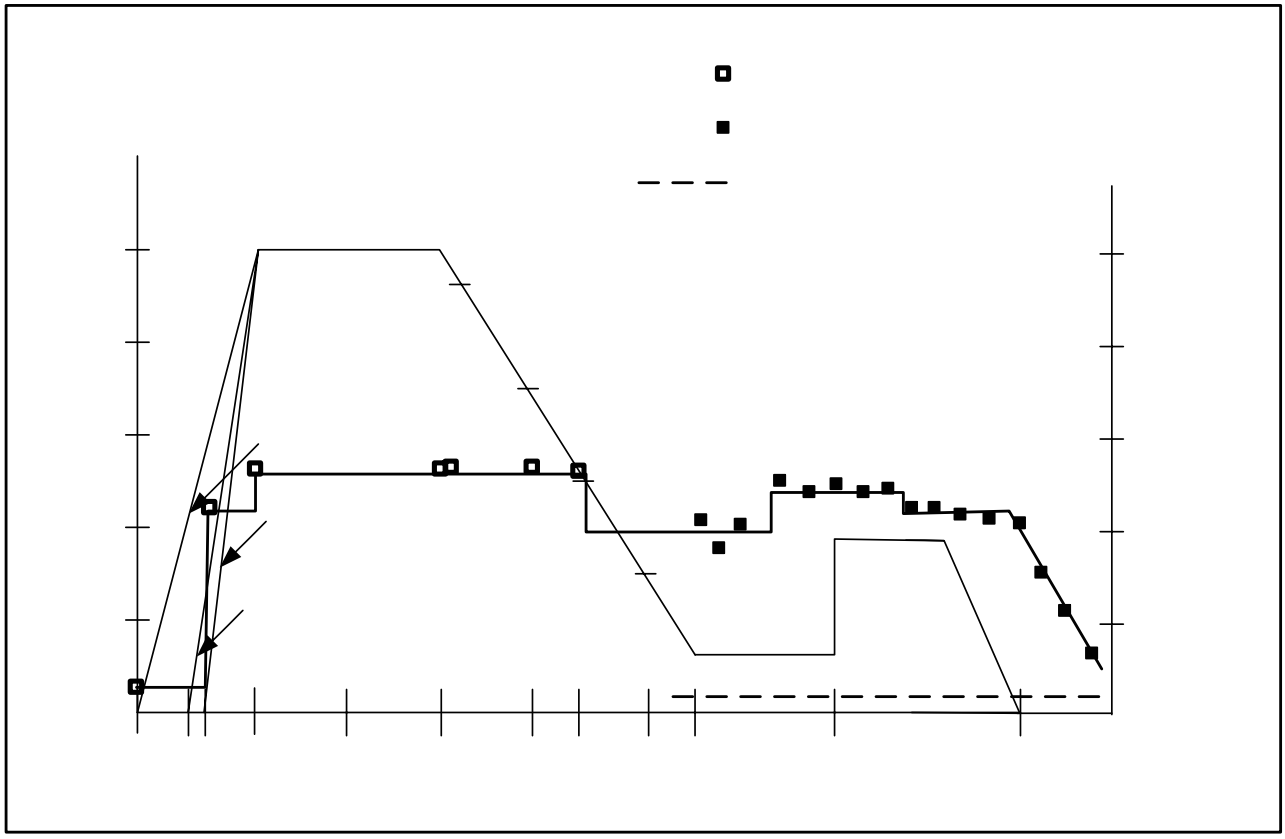

Figure 4-15. Projected site-wide direct radiation dose rates based on metal production rate.

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10,000 MTU
@ 100% sy
capacit

10,000

Metric Ton Uranium

8,000

6,000

Pilot Plant

4.4.4 On-site External Ambient Dose rate (Table 4-17)

Table 4-17. External occupational environmental dose rates summary (mrem/hr).

Dose contributors	EA-1	EA-2	EA-3	EA-4	EA-5	EA-6	EA-7	EA-8	EA-9	EA-10	EA-11
1951-1953											
Totals(net above bkgd)	8.06E-03	5.60E-03	5.51E-03	7.99E-03	2.30E-03	2.39E-02	2.90E-04	5.31E-04	3.39E-04	2.79E-04	2.25E-04
EA totals	2.38E-02	1.67E-02	1.65E-02	2.36E-02	7.21E-03	6.95E-02	1.42E-03	2.11E-03	1.56E-03	1.38E-03	1.23E-03
FEMP Site Average	9.55E-03										
1954-1955											
Totals(net above bkgd)	2.74E-01	1.90E-01	1.87E-01	2.72E-01	7.82E-02	8.12E-01	9.86E-03	1.81E-02	1.15E-02	9.48E-03	7.66E-03
EA totals	2.86E-01	2.01E-01	1.98E-01	2.83E-01	8.65E-02	8.34E-01	1.70E-02	2.53E-02	1.87E-02	1.66E-02	1.47E-02
FEMP Site Average	1.15E-01										
1956-1970											
Totals(net above bkgd)	4.67E-01	3.25E-01	3.20E-01	4.63E-01	1.33E-01	1.38E+00	1.68E-02	3.08E-02	1.97E-02	1.62E-02	1.31E-02
EA totals	4.76E-01	3.35E-01	3.29E-01	4.72E-01	1.44E-01	1.39E+00	2.83E-02	4.22E-02	3.11E-02	2.77E-02	2.46E-02
FEMP Site Average	1.91E-01										
1971-1975											
Totals(net above bkgd)	1.93E-01	1.33E-01	1.32E-01	1.91E-01	7.43E-02	4.46E-01	6.67E-03	1.26E-02	8.06E-03	6.68E-03	4.92E-03
EA totals	2.03E-01	1.43E-01	1.42E-01	2.01E-01	8.43E-02	4.56E-01	1.67E-02	2.26E-02	1.81E-02	1.67E-02	1.49E-02
FEMP Site Average	8.62E-02										
1976											
Waste pit area	8.59E-04	2.81E-04	2.15E-04	3.82E-04	1.37E-02	1.53E-03	1.70E-04	1.70E-04	1.27E-04	2.81E-04	1.70E-04
K-65 silos	2.81E-03	1.25E-03	7.03E-04	1.80E-03	7.20E-03	4.39E-01	1.25E-03	6.23E-04	3.72E-04	3.72E-04	1.80E-03
Production Plants	1.89E-01	1.31E-01	1.31E-01	1.89E-01	5.33E-02	5.25E-03	5.25E-03	1.18E-02	7.56E-03	6.03E-03	2.95E-03
Totals(net above bkgd)	1.93E-01	1.33E-01	1.32E-01	1.91E-01	7.43E-02	4.46E-01	6.67E-03	1.26E-02	8.06E-03	6.68E-03	4.92E-03
EA totals	2.03E-01	1.43E-01	1.42E-01	2.01E-01	8.43E-02	4.56E-01	1.67E-02	2.26E-02	1.81E-02	1.67E-02	1.49E-02
FEMP Site Average	8.62E-02										
1977											
Waste pit area	8.95E-04	2.92E-04	2.24E-04	3.98E-04	1.43E-02	1.59E-03	1.77E-04	1.77E-04	1.32E-04	2.92E-04	1.77E-04
K-65 silos	1.69E-03	7.50E-04	4.22E-04	1.08E-03	4.32E-03	2.64E-01	7.50E-04	3.74E-04	2.23E-04	2.23E-04	1.08E-03
Production Plants	1.41E-01	9.79E-02	9.79E-02	1.41E-01	5.20E-02	3.92E-03	3.92E-03	8.81E-03	5.64E-03	4.50E-03	2.20E-03
Totals(net above bkgd)	1.44E-01	9.90E-02	9.86E-02	1.42E-01	7.06E-02	2.69E-01	4.84E-03	9.36E-03	6.00E-03	5.01E-03	3.46E-03
EA totals	1.53E-01	1.08E-01	1.08E-01	1.51E-01	7.96E-02	2.78E-01	1.38E-02	1.84E-02	1.50E-02	1.40E-02	1.25E-02
FEMP Site Average	6.73E-02										
1978											
Waste pit area	9.31E-04	3.04E-04	2.33E-04	4.14E-04	1.49E-02	1.66E-03	1.84E-04	1.84E-04	1.38E-04	3.04E-04	1.84E-04
K-65 silos	2.25E-03	1.00E-03	5.63E-04	1.44E-03	5.76E-03	3.52E-01	1.00E-03	4.98E-04	2.98E-04	2.98E-04	1.44E-03
Production Plants	1.89E-01	1.31E-01	1.31E-01	1.89E-01	5.33E-02	5.25E-03	5.25E-03	1.18E-02	7.56E-03	6.03E-03	2.95E-03
Totals(net above bkgd)	1.92E-01	1.33E-01	1.32E-01	1.91E-01	7.40E-02	3.58E-01	6.43E-03	1.25E-02	8.00E-03	6.63E-03	4.58E-03
EA totals	2.01E-01	1.42E-01	1.41E-01	2.00E-01	8.30E-02	3.67E-01	1.54E-02	2.15E-02	1.70E-02	1.56E-02	1.36E-02
FEMP Site Average	8.50E-02										

Table 4-17. (Cont'd) External occupational environmental dose rates summary (mrem/hr).

Dose contributors	EA-1	EA-2	EA-3	EA-4	EA-5	EA-6	EA-7	EA-8	EA-9	EA-10	EA-11
1979											
Waste pit area	9.73E-04	3.18E-04	2.43E-04	4.32E-04	1.56E-02	1.73E-03	1.92E-04	1.92E-04	1.44E-04	3.18E-04	1.92E-04
K-65 silos	5.06E-03	2.25E-03	1.27E-03	3.24E-03	1.30E-02	7.91E-01	2.25E-03	1.12E-03	6.69E-04	6.69E-04	3.24E-03
Production Plants	2.27E-01	1.57E-01	1.57E-01	2.27E-01	5.44E-02	6.29E-03	6.29E-03	1.42E-02	9.06E-03	7.22E-03	3.54E-03
Totals(net above bkgd)	2.33E-01	1.60E-01	1.59E-01	2.30E-01	8.29E-02	7.99E-01	8.74E-03	1.55E-02	9.88E-03	8.21E-03	6.97E-03
EA totals	2.42E-01	1.69E-01	1.68E-01	2.39E-01	9.19E-02	8.08E-01	1.77E-02	2.45E-02	1.89E-02	1.72E-02	1.60E-02
FEMP Site Average	1.00E-01										
1980											
Waste pit area	1.02E-03	3.34E-04	2.56E-04	4.55E-04	1.64E-02	1.82E-03	2.02E-04	2.02E-04	1.52E-04	3.34E-04	2.02E-04
K-65 silos	6.75E-03	3.00E-03	1.69E-03	4.32E-03	1.73E-02	1.05E+00	3.00E-03	1.49E-03	8.93E-04	8.93E-04	4.32E-03
Production Plants	2.11E-01	1.47E-01	1.47E-01	2.11E-01	2.99E-02	5.87E-03	5.87E-03	1.32E-02	8.46E-03	6.74E-03	3.30E-03
Totals(net above bkgd)	2.19E-01	1.50E-01	1.49E-01	2.16E-01	6.36E-02	1.06E+00	9.07E-03	1.49E-02	9.50E-03	7.97E-03	7.83E-03
EA totals	2.30E-01	1.61E-01	1.60E-01	2.27E-01	7.46E-02	1.07E+00	2.01E-02	2.59E-02	2.05E-02	1.90E-02	1.88E-02
FEMP Site Average	9.57E-02										
1981											
Waste pit area	1.07E-03	3.50E-04	2.68E-04	4.76E-04	1.71E-02	1.90E-03	2.11E-04	2.11E-04	1.58E-04	3.50E-04	2.11E-04
K-65 silos	6.75E-03	3.00E-03	1.69E-03	4.32E-03	1.73E-02	1.05E+00	3.00E-03	1.49E-03	8.93E-04	8.93E-04	4.32E-03
Production Plants	3.53E-01	2.47E-01	2.45E-01	3.53E-01	6.86E-02	9.82E-03	9.82E-03	2.21E-02	1.41E-02	1.13E-02	5.52E-03
Totals(net above bkgd)	3.61E-01	2.51E-01	2.47E-01	3.58E-01	1.03E-01	1.07E+00	1.30E-02	2.38E-02	1.52E-02	1.25E-02	1.01E-02
EA totals	3.70E-01	2.60E-01	2.56E-01	3.67E-01	1.12E-01	1.08E+00	2.20E-02	3.28E-02	2.42E-02	2.15E-02	1.91E-02
FEMP Site Average	1.48E-01										
1982											
Waste pit area	1.12E-03	3.65E-04	2.79E-04	4.97E-04	1.79E-02	1.99E-03	2.21E-04	2.21E-04	1.65E-04	3.65E-04	2.21E-04
K-65 silos	5.06E-03	2.25E-03	1.27E-03	3.24E-03	1.30E-02	7.91E-01	2.25E-03	1.12E-03	6.69E-04	6.69E-04	3.24E-03
Production Plants	3.61E-01	2.52E-01	2.51E-01	3.61E-01	6.88E-02	1.00E-02	1.00E-02	2.26E-02	1.44E-02	1.15E-02	5.64E-03
Totals(net above bkgd)	3.67E-01	2.55E-01	2.52E-01	3.65E-01	9.97E-02	8.03E-01	1.25E-02	2.39E-02	1.53E-02	1.25E-02	9.10E-03
EA totals	3.77E-01	2.65E-01	2.62E-01	3.75E-01	1.10E-01	8.13E-01	2.25E-02	3.39E-02	2.53E-02	2.25E-02	1.91E-02
FEMP Site Average	1.51E-01										
1983											
Waste pit area	1.16E-03	3.80E-04	2.91E-04	5.17E-04	1.86E-02	2.07E-03	2.30E-04	2.30E-04	1.72E-04	3.80E-04	2.30E-04
K-65 silos	5.63E-03	2.50E-03	1.41E-03	3.60E-03	1.44E-02	8.79E-01	2.50E-03	1.25E-03	7.44E-04	7.44E-04	3.60E-03
Production Plants	3.66E-01	2.58E-01	2.54E-01	3.66E-01	6.90E-02	1.02E-02	1.02E-02	2.29E-02	1.47E-02	1.17E-02	5.72E-03
Totals(net above bkgd)	3.73E-01	2.61E-01	2.56E-01	3.70E-01	1.02E-01	8.91E-01	1.29E-02	2.44E-02	1.56E-02	1.28E-02	9.55E-03
EA totals	3.83E-01	2.71E-01	2.66E-01	3.80E-01	1.12E-01	9.01E-01	2.29E-02	3.44E-02	2.56E-02	2.28E-02	1.96E-02
FEMP Site Average	1.54E-01										
1984											
Waste pit area	1.14E-03	3.73E-04	2.86E-04	5.08E-04	1.83E-02	2.03E-03	2.26E-04	2.26E-04	1.69E-04	3.73E-04	2.26E-04
K-65 silos	3.99E-03	1.78E-03	9.98E-04	2.56E-03	1.02E-02	6.24E-01	1.78E-03	8.84E-04	5.28E-04	5.28E-04	2.56E-03
Production Plants	2.75E-01	1.91E-01	1.91E-01	2.75E-01	7.65E-03	7.65E-03	7.65E-03	1.72E-02	1.10E-02	8.78E-03	4.30E-03
Totals(net above bkgd)	2.81E-01	1.93E-01	1.93E-01	2.79E-01	3.62E-02	6.34E-01	9.65E-03	1.83E-02	1.17E-02	9.69E-03	7.09E-03
EA totals	2.91E-01	2.03E-01	2.03E-01	2.89E-01	4.62E-02	6.44E-01	1.97E-02	2.83E-02	2.17E-02	1.97E-02	1.71E-02
FEMP Site Average	1.14E-01										

Table 4-17. (Cont'd) External occupational environmental dose rates summary (mrem/hr).

Dose contributors	EA-1	EA-2	EA-3	EA-4	EA-5	EA-6	EA-7	EA-8	EA-9	EA-10	EA-11
1985											
Waste pit area	1.18E-03	3.84E-04	2.94E-04	5.23E-04	1.88E-02	2.09E-03	2.33E-04	2.33E-04	1.74E-04	3.84E-04	2.33E-04
K-65 silos	4.11E-03	1.83E-03	1.03E-03	2.63E-03	1.05E-02	6.42E-01	1.83E-03	9.09E-04	5.43E-04	5.43E-04	2.63E-03
Production Plants	2.87E-01	1.99E-01	1.99E-01	2.87E-01	7.96E-03	7.96E-03	7.96E-03	1.79E-02	1.15E-02	9.14E-03	4.48E-03
Totals(net above bkgd)	2.92E-01	2.01E-01	2.00E-01	2.90E-01	3.73E-02	6.52E-01	1.00E-02	1.91E-02	1.22E-02	1.01E-02	7.34E-03
EA totals	3.04E-01	2.13E-01	2.12E-01	3.02E-01	4.91E-02	6.63E-01	2.18E-02	3.09E-02	2.40E-02	2.19E-02	1.91E-02
FEMP Site Average	1.20E-01										
1986											
Waste pit area	1.18E-03	3.85E-04	2.95E-04	5.24E-04	1.89E-02	2.10E-03	2.33E-04	2.33E-04	1.74E-04	3.85E-04	2.33E-04
K-65 silos	3.38E-03	1.50E-03	8.44E-04	2.16E-03	8.64E-03	5.27E-01	1.50E-03	7.47E-04	4.46E-04	4.46E-04	2.16E-03
Production Plants	2.80E-01	1.94E-01	1.94E-01	2.80E-01	7.78E-03	7.78E-03	7.78E-03	1.75E-02	1.12E-02	8.93E-03	4.38E-03
Totals(net above bkgd)	2.85E-01	1.96E-01	1.96E-01	2.83E-01	3.53E-02	5.37E-01	9.51E-03	1.85E-02	1.18E-02	9.76E-03	6.77E-03
EA totals	2.94E-01	2.05E-01	2.05E-01	2.92E-01	4.43E-02	5.46E-01	1.85E-02	2.75E-02	2.08E-02	1.88E-02	1.58E-02
FEMP Site Average	1.14E-01										
1987											
Waste pit area	1.18E-03	3.85E-04	2.95E-04	5.24E-04	1.89E-02	2.10E-03	2.33E-04	2.33E-04	1.74E-04	3.85E-04	2.33E-04
K-65 silos	2.87E-03	1.28E-03	7.17E-04	1.84E-03	7.34E-03	4.48E-01	1.28E-03	6.35E-04	3.79E-04	3.79E-04	1.84E-03
Production Plants	4.15E-02	2.88E-02	2.88E-02	4.15E-02	1.15E-03	1.15E-03	1.15E-03	2.59E-03	1.66E-03	1.32E-03	6.48E-04
Totals(net above bkgd)	4.55E-02	3.05E-02	2.98E-02	4.38E-02	2.74E-02	4.51E-01	2.66E-03	3.46E-03	2.21E-03	2.09E-03	2.72E-03
EA totals	5.61E-02	4.11E-02	4.04E-02	5.44E-02	3.80E-02	4.62E-01	1.33E-02	1.41E-02	1.28E-02	1.27E-02	1.33E-02
FEMP Site Average	2.96E-02										
1988											
Waste pit area	1.18E-03	3.85E-04	2.95E-04	5.24E-04	1.89E-02	2.10E-03	2.33E-04	2.33E-04	1.74E-04	3.85E-04	2.33E-04
K-65 silos	4.73E-03	2.10E-03	1.18E-03	3.02E-03	1.21E-02	7.38E-01	2.10E-03	1.05E-03	6.25E-04	6.25E-04	3.02E-03
Production Plants	8.75E-02	6.08E-02	6.08E-02	8.75E-02	2.43E-03	2.43E-03	2.43E-03	5.47E-03	3.50E-03	2.79E-03	1.37E-03
Totals(net above bkgd)	9.34E-02	6.32E-02	6.22E-02	9.10E-02	3.34E-02	7.43E-01	4.76E-03	6.75E-03	4.30E-03	3.80E-03	4.62E-03
EA totals	1.09E-01	7.83E-02	7.73E-02	1.06E-01	4.85E-02	7.58E-01	1.99E-02	2.18E-02	1.94E-02	1.89E-02	1.97E-02
FEMP Site Average	5.19E-02										
1989											
Waste pit area	1.18E-03	3.85E-04	2.95E-04	5.24E-04	1.89E-02	2.10E-03	2.33E-04	2.33E-04	1.74E-04	3.85E-04	2.33E-04
K-65 silos	3.88E-03	1.73E-03	9.70E-04	2.48E-03	9.94E-03	6.06E-01	1.73E-03	8.60E-04	5.13E-04	5.13E-04	2.48E-03
Production Plants	1.18E-01	8.16E-02	8.16E-02	1.18E-01	3.26E-03	3.26E-03	3.26E-03	7.34E-03	4.70E-03	3.75E-03	1.84E-03
Totals(net above bkgd)	1.23E-01	8.37E-02	8.29E-02	1.21E-01	3.21E-02	6.12E-01	5.22E-03	8.44E-03	5.39E-03	4.65E-03	4.55E-03
EA totals	1.35E-01	9.65E-02	9.57E-02	1.33E-01	4.49E-02	6.25E-01	1.80E-02	2.12E-02	1.82E-02	1.74E-02	1.74E-02
FEMP Site Average	5.97E-02										
1990											
Waste pit area	1.18E-03	3.85E-04	2.95E-04	5.24E-04	1.89E-02	2.10E-03	2.33E-04	2.33E-04	1.74E-04	3.85E-04	2.33E-04
K-65 silos	3.09E-03	1.38E-03	7.73E-04	1.98E-03	7.92E-03	4.83E-01	1.38E-03	6.85E-04	4.09E-04	4.09E-04	1.98E-03
Production Plants	6.25E-02	4.34E-02	4.34E-02	6.25E-02	1.74E-03	1.74E-03	1.74E-03	3.91E-03	2.50E-03	1.99E-03	9.77E-04
Totals(net above bkgd)	6.68E-02	4.52E-02	4.45E-02	6.50E-02	2.85E-02	4.87E-01	3.34E-03	4.82E-03	3.08E-03	2.79E-03	3.19E-03
EA totals	7.43E-02	5.27E-02	5.20E-02	7.25E-02	3.60E-02	4.95E-01	1.08E-02	1.23E-02	1.06E-02	1.03E-02	1.07E-02
FEMP Site Average	3.42E-02										

Table 4-17. (Cont'd) External occupational environmental dose rates summary (mrem/hr).

Dose contributors	EA-1	EA-2	EA-3	EA-4	EA-5	EA-6	EA-7	EA-8	EA-9	EA-10	EA-11
1991											
Waste pit area	1.18E-03	3.85E-04	2.95E-04	5.24E-04	1.89E-02	2.10E-03	2.33E-04	2.33E-04	1.74E-04	3.85E-04	2.33E-04
K-65 silos	1.61E-03	7.14E-04	4.02E-04	1.03E-03	4.11E-03	2.51E-01	7.14E-04	3.56E-04	2.13E-04	2.13E-04	1.03E-03
Production Plants	7.75E-02	5.38E-02	5.38E-02	7.75E-02	2.15E-03	2.15E-03	2.15E-03	4.84E-03	3.10E-03	2.47E-03	1.21E-03
Totals(net above bkgd)	8.03E-02	5.49E-02	5.45E-02	7.91E-02	2.51E-02	2.55E-01	3.10E-03	5.43E-03	3.49E-03	3.07E-03	2.47E-03
EA totals	8.72E-02	6.18E-02	6.14E-02	8.60E-02	3.20E-02	2.62E-01	1.00E-02	1.23E-02	1.04E-02	9.97E-03	9.37E-03
FEMP Site Average	3.80E-02										
1992											
Waste pit area	1.18E-03	3.85E-04	2.95E-04	5.24E-04	1.89E-02	2.10E-03	2.33E-04	2.33E-04	1.74E-04	3.85E-04	2.33E-04
K-65 silos	7.87E-05	3.50E-05	1.97E-05	5.04E-05	2.02E-04	1.23E-02	3.50E-05	1.74E-05	1.04E-05	1.04E-05	5.04E-05
Production Plants	8.25E-02	5.73E-02	5.73E-02	8.25E-02	2.29E-03	2.29E-03	2.29E-03	5.16E-03	3.30E-03	2.63E-03	1.29E-03
Totals(net above bkgd)	8.38E-02	5.77E-02	5.76E-02	8.31E-02	2.14E-02	1.67E-02	2.56E-03	5.41E-03	3.48E-03	3.03E-03	1.57E-03
EA totals	9.20E-02	6.59E-02	6.58E-02	9.13E-02	2.96E-02	2.49E-02	1.08E-02	1.36E-02	1.17E-02	1.12E-02	9.77E-03
FEMP Site Average	4.02E-02										
1993											
Waste pit area	1.18E-03	3.85E-04	2.95E-04	5.24E-04	1.89E-02	2.10E-03	2.33E-04	2.33E-04	1.74E-04	3.85E-04	2.33E-04
K-65 silos	1.09E-04	4.86E-05	2.74E-05	7.00E-05	2.80E-04	1.71E-02	4.86E-05	2.42E-05	1.45E-05	1.45E-05	7.00E-05
Production Plants	9.75E-02	6.77E-02	6.77E-02	9.75E-02	2.71E-03	2.71E-03	2.71E-03	6.09E-03	3.90E-03	3.11E-03	1.52E-03
Totals(net above bkgd)	9.88E-02	6.81E-02	6.80E-02	9.81E-02	2.19E-02	2.19E-02	2.99E-03	6.35E-03	4.09E-03	3.51E-03	1.83E-03
EA totals	1.06E-01	7.49E-02	7.48E-02	1.05E-01	2.87E-02	2.87E-02	9.79E-03	1.32E-02	1.09E-02	1.03E-02	8.63E-03
FEMP Site Average	4.42E-02										
1994											
Waste pit area	1.18E-03	3.85E-04	2.95E-04	5.24E-04	1.89E-02	2.10E-03	2.33E-04	2.33E-04	1.74E-04	3.85E-04	2.33E-04
K-65 silos	1.09E-04	4.86E-05	2.74E-05	7.00E-05	2.80E-04	1.71E-02	4.86E-05	2.42E-05	1.45E-05	1.45E-05	7.00E-05
Production Plants	9.75E-02	6.77E-02	6.77E-02	9.75E-02	2.71E-03	2.71E-03	2.71E-03	6.09E-03	3.90E-03	3.11E-03	1.52E-03
Totals(net above bkgd)	9.88E-02	6.81E-02	6.80E-02	9.81E-02	2.19E-02	2.19E-02	2.99E-03	6.35E-03	4.09E-03	3.51E-03	1.83E-03
EA totals	1.06E-01	7.49E-02	7.48E-02	1.05E-01	2.87E-02	2.87E-02	9.79E-03	1.32E-02	1.09E-02	1.03E-02	8.63E-03
FEMP Site Average	4.42E-02										
1995											
Waste pit area	1.18E-03	3.85E-04	2.95E-04	5.24E-04	1.89E-02	2.10E-03	2.33E-04	2.33E-04	1.74E-04	3.85E-04	2.33E-04
K-65 silos	2.21E-04	9.84E-05	5.54E-05	1.42E-04	5.67E-04	3.46E-02	9.84E-05	4.90E-05	2.93E-05	2.93E-05	1.42E-04
Production Plants	8.50E-02	5.90E-02	5.90E-02	8.50E-02	2.36E-03	2.36E-03	2.36E-03	5.31E-03	3.40E-03	2.71E-03	1.33E-03
Totals(net above bkgd)	8.64E-02	5.95E-02	5.94E-02	8.57E-02	2.18E-02	3.91E-02	2.69E-03	5.59E-03	3.60E-03	3.12E-03	1.70E-03
EA totals	9.38E-02	6.69E-02	6.68E-02	9.31E-02	2.92E-02	4.65E-02	1.01E-02	1.30E-02	1.10E-02	1.05E-02	9.10E-03
FEMP Site Average	4.04E-02										
1996											
Waste pit area	1.13E-03	3.69E-04	2.82E-04	5.02E-04	1.81E-02	2.01E-03	2.23E-04	2.23E-04	1.67E-04	3.69E-04	2.23E-04
K-65 silos	4.49E-04	1.99E-04	1.12E-04	2.87E-04	1.15E-03	7.01E-02	1.99E-04	9.94E-05	5.93E-05	5.93E-05	2.87E-04
Production Plants	1.00E-02	6.94E-03	6.94E-03	1.00E-02	2.78E-04	2.78E-04	2.78E-04	6.25E-04	4.00E-04	3.19E-04	1.56E-04
Totals(net above bkgd)	1.16E-02	7.51E-03	7.34E-03	1.08E-02	1.95E-02	7.24E-02	7.00E-04	9.47E-04	6.26E-04	7.47E-04	6.67E-04
EA totals	2.04E-02	1.63E-02	1.61E-02	1.96E-02	2.83E-02	8.12E-02	9.50E-03	9.75E-03	9.43E-03	9.55E-03	9.47E-03
FEMP Site Average	1.48E-02										

Table 4-17. (Cont'd) External occupational environmental dose rates summary (mrem/hr).

Dose contributors	EA-1	EA-2	EA-3	EA-4	EA-5	EA-6	EA-7	EA-8	EA-9	EA-10	EA-11
1997											
Waste pit area	1.13E-03	3.69E-04	2.82E-04	5.02E-04	1.81E-02	2.01E-03	2.23E-04	2.23E-04	1.67E-04	3.69E-04	2.23E-04
K-65 silos	5.91E-04	2.63E-04	1.48E-04	3.78E-04	1.51E-03	9.23E-02	2.63E-04	1.31E-04	7.81E-05	7.81E-05	3.78E-04
Production Plants	1.06E-02	7.36E-03	7.36E-03	1.06E-02	2.94E-04	2.94E-04	2.94E-04	6.63E-04	4.24E-04	3.38E-04	1.66E-04
Totals(net above bkgd)	1.23E-02	7.99E-03	7.79E-03	1.15E-02	1.99E-02	9.46E-02	7.80E-04	1.02E-03	6.69E-04	7.85E-04	7.67E-04
EA totals	2.10E-02	1.67E-02	1.65E-02	2.02E-02	2.86E-02	1.03E-01	9.48E-03	9.72E-03	9.37E-03	9.48E-03	9.47E-03
FEMP Site Average	1.51E-02										
1998											
Waste pit area	1.13E-03	3.69E-04	2.82E-04	5.02E-04	1.81E-02	2.01E-03	2.23E-04	2.23E-04	1.67E-04	3.69E-04	2.23E-04
K-65 silos	8.96E-06	3.98E-06	2.24E-06	5.73E-06	2.29E-05	1.40E-03	3.98E-06	1.98E-06	1.18E-06	1.18E-06	5.73E-06
Production Plants	9.40E-03	6.53E-03	6.53E-03	9.40E-03	2.61E-04	2.61E-04	2.61E-04	5.88E-04	3.76E-04	3.00E-04	1.47E-04
Totals(net above bkgd)	1.05E-02	6.90E-03	6.81E-03	9.91E-03	1.84E-02	3.67E-03	4.88E-04	8.13E-04	5.44E-04	6.70E-04	3.76E-04
EA totals	1.84E-02	1.48E-02	1.47E-02	1.78E-02	2.63E-02	1.16E-02	8.39E-03	8.71E-03	8.44E-03	8.57E-03	8.28E-03
FEMP Site Average	1.34E-02										
1999											
Waste pit area	1.13E-03	3.69E-04	2.82E-04	5.02E-04	1.81E-02	2.01E-03	2.23E-04	2.23E-04	1.67E-04	3.69E-04	2.23E-04
K-65 silos	1.54E-05	6.83E-06	3.84E-06	9.83E-06	3.93E-05	2.40E-03	6.83E-06	3.40E-06	2.03E-06	2.03E-06	9.83E-06
Production Plants	9.40E-03	6.53E-03	6.53E-03	9.40E-03	2.61E-04	2.61E-04	2.61E-04	5.88E-04	3.76E-04	3.00E-04	1.47E-04
Totals(net above bkgd)	1.05E-02	6.90E-03	6.81E-03	9.91E-03	1.84E-02	4.67E-03	4.91E-04	8.14E-04	5.45E-04	6.71E-04	3.80E-04
EA totals	1.84E-02	1.48E-02	1.47E-02	1.78E-02	2.63E-02	1.26E-02	8.39E-03	8.71E-03	8.45E-03	8.57E-03	8.28E-03
FEMP Site Average	1.34E-02										
2000											
Waste pit area	1.13E-03	3.69E-04	2.82E-04	5.02E-04	1.81E-02	2.01E-03	2.23E-04	2.23E-04	1.67E-04	3.69E-04	2.23E-04
K-65 silos	7.43E-04	3.30E-04	1.86E-04	4.76E-04	1.90E-03	1.16E-01	3.30E-04	1.65E-04	9.83E-05	9.83E-05	4.76E-04
Production Plants	1.06E-02	7.36E-03	7.36E-03	1.06E-02	2.94E-04	2.94E-04	2.94E-04	6.63E-04	4.24E-04	3.38E-04	1.66E-04
Totals(net above bkgd)	1.25E-02	8.06E-03	7.83E-03	1.16E-02	2.03E-02	1.18E-01	8.48E-04	1.05E-03	6.89E-04	8.05E-04	8.64E-04
EA totals	2.04E-02	1.60E-02	1.57E-02	1.95E-02	2.82E-02	1.26E-01	8.75E-03	8.95E-03	8.59E-03	8.71E-03	8.76E-03
FEMP Site Average	1.44E-02										
2001											
Waste pit area	1.13E-03	3.69E-04	2.82E-04	5.02E-04	1.81E-02	2.01E-03	2.23E-04	2.23E-04	1.67E-04	3.69E-04	2.23E-04
K-65 silos	8.24E-04	3.66E-04	2.06E-04	5.27E-04	2.11E-03	1.29E-01	3.66E-04	1.82E-04	1.09E-04	1.09E-04	5.27E-04
Production Plants	9.80E-03	6.81E-03	6.81E-03	9.80E-03	2.72E-04	2.72E-04	2.72E-04	6.13E-04	3.92E-04	3.13E-04	1.53E-04
Totals(net above bkgd)	1.18E-02	7.54E-03	7.29E-03	1.08E-02	2.05E-02	1.31E-01	8.61E-04	1.02E-03	6.68E-04	7.90E-04	9.03E-04
EA totals	2.01E-02	1.58E-02	1.56E-02	1.91E-02	2.88E-02	1.39E-01	9.16E-03	9.32E-03	8.97E-03	9.09E-03	9.20E-03
FEMP Site Average	1.45E-02										
2002											
Waste pit area	1.13E-03	3.69E-04	2.82E-04	5.02E-04	1.81E-02	2.01E-03	2.23E-04	2.23E-04	1.67E-04	3.69E-04	2.23E-04
K-65 silos	8.34E-04	3.71E-04	2.08E-04	5.34E-04	2.13E-03	1.30E-01	3.71E-04	1.85E-04	1.10E-04	1.10E-04	5.34E-04
Production Plants	8.20E-03	5.69E-03	5.69E-03	8.20E-03	2.28E-04	2.28E-04	2.28E-04	5.13E-04	3.28E-04	2.61E-04	1.28E-04
Totals(net above bkgd)	1.02E-02	6.43E-03	6.19E-03	9.24E-03	2.04E-02	1.33E-01	8.22E-04	9.20E-04	6.05E-04	7.41E-04	8.85E-04
EA totals	1.89E-02	1.51E-02	1.49E-02	1.79E-02	2.91E-02	1.41E-01	9.52E-03	9.62E-03	9.31E-03	9.44E-03	9.58E-03
FEMP Site Average	1.43E-02										

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GLOSSARY

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

dosimeter
A device used to measure the quantity of radiation received. A holder with radiation-absorbing elements (filters) and an insert with radiation-sensitive elements packaged to provide a record of absorbed dose or dose equivalent received by an individual. (see thermoluminescent dosimeter.)

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

dosimetry system
A system used to assess dose equivalent from external radiation to the whole body, skin, and/or extremities. This includes the fabrication, assignment, and processing of the dosimeters as well as interpretation and documentation of the results.

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

gamma rays
Electromagnetic radiation (photons) originating in atomic nuclei and accompanying many nuclear reactions (e.g., fission, radioactive decay, and neutron capture).

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

radiation
Alpha, beta, neutron, and photon radiation.

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

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

thermoluminescence
Property of a material that causes it to emit light as a result of being excited by heat.

thermoluminescent dosimeter (TLD)
A holder containing solid chips of material that when heated will release the stored energy as light. The measurement of this light provides a measurement of absorbed dose.

Appendix 4A. FEMP radionuclide concentration and intake results by exposure area and year.

1951		Concentration contribution from emission sources (g/m^3)										Total conc. (g/m^3)	Total intake (mg)	Rn-222 silos	Rn-222 intake (Ci)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	0	0	0	0	0	0	0	0	6.44E-08	0	6.44E-08	1.55E-01	0	0
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-2	Uranium	0	0	0	0	0	0	0	0	1.35E-07	0	1.35E-07	3.23E-01	0	0
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-3	Uranium	0	0	0	0	0	0	0	0	1.19E-07	0	1.19E-07	2.86E-01	0	0
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-4	Uranium	0	0	0	0	0	0	0	0	2.23E-09	0	2.23E-09	5.35E-03	0	0
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-5	Uranium	0	0	0	0	0	0	0	0	2.83E-08	0	2.83E-08	6.79E-02	0	0
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-6	Uranium	0	0	0	0	0	0	0	0	2.91E-08	0	2.91E-08	6.98E-02	0	0
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-7	Uranium	0	0	0	0	0	0	0	0	4.01E-08	0	4.01E-08	9.63E-02	0	0
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-8	Uranium	0	0	0	0	0	0	0	0	5.08E-08	0	5.08E-08	1.22E-01	0	0
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-9	Uranium	0	0	0	0	0	0	0	0	2.14E-08	0	2.14E-08	5.14E-02	0	0
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-10	Uranium	0	0	0	0	0	0	0	0	3.77E-08	0	3.77E-08	9.05E-02	0	0
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-11	Uranium	0	0	0	0	0	0	0	0	3.11E-08	0	3.11E-08	7.46E-02	0	0
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0

1951/Rn		Concentration contribution from emission sources (Ci/m^3)										Total conc. (Ci/m^3)	Conc. in (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit		
EA-1	Rn-222	1.61E-08	0	0	0	0	0	0	0	0	0	3.31E-09	3.31E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0
EA-2	Rn-222	1.35E-09	0	0	0	0	0	0	0	0	0	2.79E-10	2.79E-01
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0
EA-3	Rn-222	7.15E-10	0	0	0	0	0	0	0	0	0	1.47E-10	1.47E-01
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0
EA-4	Rn-222	2.37E-09	0	0	0	0	0	0	0	0	0	4.88E-10	4.88E-01
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0
EA-5	Rn-222	1.64E-09	0	0	0	0	0	0	0	0	0	3.38E-10	3.38E-01
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0
EA-6	Rn-222	4.89E-10	0	0	0	0	0	0	0	0	0	1.01E-10	1.01E-01
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0
EA-7	Rn-222	4.89E-10	0	0	0	0	0	0	0	0	0	1.01E-10	1.01E-01
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0
EA-8	Rn-222	7.15E-10	0	0	0	0	0	0	0	0	0	1.47E-10	1.47E-01
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0
EA-9	Rn-222	1.70E-10	0	0	0	0	0	0	0	0	0	3.50E-11	3.50E-02
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0
EA-10	Rn-222	1.67E-09	0	0	0	0	0	0	0	0	0	3.44E-10	3.44E-01
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0
EA-11	Rn-222	9.43E-11	0	0	0	0	0	0	0	0	0	1.94E-11	1.94E-02
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0

Appendix 4A (Cont'd). FEMP radionuclide concentration and intake results by exposure area and year.

1952		Concentration contribution from emission sources (g/m^3)										Total conc. (g/m^3)	Total intake (mg)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	0	0	0	0	1.69E-09	0	0	0	2.58E-07	0	2.60E-07	6.24E-01	3.44E-09	3.44E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-2	Uranium	0	0	0	0	2.13E-09	0	0	0	5.39E-07	0	5.42E-07	1.30E+00	1.78E-09	1.78E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-3	Uranium	0	0	0	0	5.39E-10	0	0	0	4.78E-07	0	4.79E-07	1.15E+00	1.60E-09	1.60E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-4	Uranium	0	0	0	0	2.66E-09	0	0	0	8.94E-09	0	1.16E-08	2.78E-02	4.39E-09	4.39E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-5	Uranium	0	0	0	0	3.24E-10	0	0	0	1.13E-07	0	1.14E-07	2.73E-01	4.01E-09	4.01E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-6	Uranium	0	0	0	0	2.16E-10	0	0	0	1.17E-07	0	1.17E-07	2.80E-01	1.31E-09	1.31E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-7	Uranium	0	0	0	0	1.95E-09	0	0	0	1.61E-07	0	1.63E-07	3.91E-01	2.00E-09	2.00E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-8	Uranium	0	0	0	0	1.83E-09	0	0	0	2.04E-07	0	2.05E-07	4.93E-01	1.33E-09	1.33E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-9	Uranium	0	0	0	0	2.35E-09	0	0	0	8.59E-08	0	8.82E-08	2.12E-01	6.65E-10	6.65E-01
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-10	Uranium	0	0	0	0	1.04E-09	0	0	0	1.51E-07	0	1.52E-07	3.65E-01	2.04E-09	2.04E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-11	Uranium	0	0	0	0	4.69E-10	0	0	0	1.25E-07	0	1.25E-07	3.00E-01	1.41E-09	1.41E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0

1952/Rn		Concentration contribution from emission sources (Ci/m^3)										Total conc. (Ci/m^3)	Conc. in (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit		
EA-1	Rn-222	2.65E-07	0	0	0	0	0	0	0	0	0	5.49E-08	5.49E+01
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0
EA-2	Rn-222	2.23E-08	0	0	0	0	0	0	0	0	0	4.62E-09	4.62E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0
EA-3	Rn-222	1.18E-08	0	0	0	0	0	0	0	0	0	2.44E-09	2.44E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0
EA-4	Rn-222	3.90E-08	0	0	0	0	0	0	0	0	0	8.08E-09	8.08E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0
EA-5	Rn-222	2.70E-08	0	0	0	0	0	0	0	0	0	5.59E-09	5.59E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0
EA-6	Rn-222	8.06E-09	0	0	0	0	0	0	0	0	0	1.67E-09	1.67E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0
EA-7	Rn-222	8.06E-09	0	0	0	0	0	0	0	0	0	1.67E-09	1.67E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0
EA-8	Rn-222	1.18E-08	0	0	0	0	0	0	0	0	0	2.44E-09	2.44E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0
EA-9	Rn-222	2.80E-09	0	0	0	0	0	0	0	0	0	5.79E-10	5.79E-01
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0
EA-10	Rn-222	2.75E-08	0	0	0	0	0	0	0	0	0	5.70E-09	5.70E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0
EA-11	Rn-222	1.55E-09	0	0	0	0	0	0	0	0	0	3.22E-10	3.22E-01
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0

Appendix 4A (Cont'd). FEMP radionuclide concentration and intake results by exposure area and year.

1953		Concentration contribution from emission sources (g/m^3)										Total conc. (g/m^3)	Total intake (mg)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	7.22E-16	2.29E-09	3.52E-07	2.93E-08	3.96E-09	0	0	0	2.58E-07	0	6.46E-07	1.55E+00	3.44E-09	3.44E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-2	Uranium	4.05E-09	6.57E-09	1.81E-06	9.59E-08	5.00E-09	0	0	0	5.39E-07	0	2.46E-06	5.91E+00	1.78E-09	1.78E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-3	Uranium	2.02E-09	4.19E-09	3.64E-08	1.69E-11	1.27E-09	0	0	0	4.78E-07	0	5.22E-07	1.25E+00	1.60E-09	1.60E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-4	Uranium	2.15E-09	5.42E-13	2.48E-07	3.46E-08	6.25E-09	0	0	0	8.94E-09	0	3.00E-07	7.20E-01	4.39E-09	4.39E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-5	Uranium	1.49E-09	1.51E-09	3.39E-07	4.87E-09	7.62E-10	0	0	0	1.13E-07	0	4.61E-07	1.11E+00	4.01E-09	4.01E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-6	Uranium	1.46E-09	1.84E-09	5.35E-07	7.57E-09	5.08E-10	0	0	0	1.17E-07	0	6.63E-07	1.59E+00	1.31E-09	1.31E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-7	Uranium	1.46E-09	2.18E-09	4.20E-07	1.76E-08	4.59E-09	0	0	0	1.61E-07	0	6.07E-07	1.46E+00	2.00E-09	2.00E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-8	Uranium	2.14E-09	3.25E-09	7.37E-07	5.09E-08	4.29E-09	0	0	0	2.04E-07	0	1.00E-06	2.40E+00	1.33E-09	1.33E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-9	Uranium	4.11E-10	6.49E-10	7.84E-07	4.62E-08	5.52E-09	0	0	0	8.59E-08	0	9.23E-07	2.21E+00	6.65E-10	6.65E-01
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-10	Uranium	3.71E-09	5.86E-09	4.36E-07	2.76E-08	2.45E-09	0	0	0	1.51E-07	0	6.26E-07	1.50E+00	2.04E-09	2.04E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0
EA-11	Uranium	2.28E-10	5.05E-10	1.50E-07	7.03E-09	1.10E-09	0	0	0	1.25E-07	0	2.84E-07	6.81E-01	1.41E-09	1.41E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0

1953/Rn		Concentration contribution from emission sources (Ci/m^3)										Total conc. (Ci/m^3)	Conc. in (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit		
EA-1	Rn-222	4.26E-08	0	0	0	0	0	0	0	0	0	8.99E-09	8.99E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0
EA-2	Rn-222	3.59E-09	0	0	0	0	0	0	0	0	0	7.57E-10	7.57E-01
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0
EA-3	Rn-222	1.89E-09	0	0	0	0	0	0	0	0	0	3.99E-10	3.99E-01
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0
EA-4	Rn-222	6.27E-09	0	0	0	0	0	0	0	0	0	1.32E-09	1.32E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0
EA-5	Rn-222	4.34E-09	0	0	0	0	0	0	0	0	0	9.16E-10	9.16E-01
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0
EA-6	Rn-222	1.29E-09	0	0	0	0	0	0	0	0	0	2.73E-10	2.73E-01
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0
EA-7	Rn-222	1.29E-09	0	0	0	0	0	0	0	0	0	2.73E-10	2.73E-01
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0
EA-8	Rn-222	1.89E-09	0	0	0	0	0	0	0	0	0	3.99E-10	3.99E-01
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0
EA-9	Rn-222	4.49E-10	0	0	0	0	0	0	0	0	0	9.49E-11	9.49E-02
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0
EA-10	Rn-222	4.42E-09	0	0	0	0	0	0	0	0	0	9.33E-10	9.33E-01
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0
EA-11	Rn-222	2.50E-10	0	0	0	0	0	0	0	0	0	5.27E-11	5.27E-02
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0

Appendix 4A (Cont'd). FEMP radionuclide concentration and intake results by exposure area and year.

1954		Concentration contribution from emission sources (g/m^3)										Total conc. (g/m^3)	Total intake (mg)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	1.16E-14	1.07E-07	1.41E-06	1.34E-06	9.64E-09	1.12E-06	2.72E-07	9.62E-08	1.42E-07	5.53E-10	4.49E-06	1.08E+01	8.59E-09	8.59E+00
	Thorium	0	0	0	0	0	0	0	3.65E-07	0	0	3.65E-07	8.76E-01	0	0
EA-2	Uranium	6.52E-08	3.08E-07	7.24E-06	4.39E-06	1.22E-08	4.54E-06	2.56E-07	1.25E-07	2.97E-07	1.25E-10	1.72E-05	4.13E+01	4.44E-09	4.44E+00
	Thorium	0	0	0	0	0	0	0	4.73E-07	0	0	4.73E-07	1.14E+00	0	0
EA-3	Uranium	3.25E-08	1.96E-07	1.46E-07	7.72E-10	3.08E-09	1.63E-06	4.20E-07	1.03E-07	2.63E-07	1.04E-10	2.79E-06	6.70E+00	3.99E-09	3.99E+00
	Thorium	0	0	0	0	0	0	0	3.92E-07	0	0	3.92E-07	9.40E-01	0	0
EA-4	Uranium	3.46E-08	2.54E-11	9.92E-07	1.58E-06	1.52E-08	5.26E-07	4.94E-11	8.82E-08	4.91E-09	1.46E-10	3.25E-06	7.79E+00	1.10E-08	1.10E+01
	Thorium	0	0	0	0	0	0	0	3.34E-07	0	0	3.34E-07	8.03E-01	0	0
EA-5	Uranium	2.40E-08	7.07E-08	1.35E-06	2.23E-07	1.85E-09	9.80E-07	8.65E-08	2.60E-08	6.23E-08	4.93E-09	2.83E-06	6.80E+00	1.00E-08	1.00E+01
	Thorium	0	0	0	0	0	0	0	9.88E-08	0	0	9.88E-08	2.37E-01	0	0
EA-6	Uranium	2.35E-08	8.64E-08	2.14E-06	3.46E-07	1.24E-09	9.52E-07	9.34E-08	2.12E-08	6.41E-08	8.71E-10	3.73E-06	8.95E+00	3.28E-09	3.28E+00
	Thorium	0	0	0	0	0	0	0	2.15E-08	0	0	2.15E-08	5.16E-02	0	0
EA-7	Uranium	2.35E-08	1.02E-07	1.68E-06	8.05E-07	1.12E-08	0	2.86E-07	9.84E-08	8.84E-08	1.53E-10	3.10E-06	7.43E+00	5.00E-09	5.00E+00
	Thorium	0	0	0	0	0	0	0	3.73E-07	0	0	3.73E-07	8.96E-01	0	0
EA-8	Uranium	3.44E-08	1.53E-07	2.95E-06	2.33E-06	1.04E-08	1.10E-06	9.54E-08	9.62E-08	1.12E-07	7.63E-11	6.88E-06	1.65E+01	3.33E-09	3.33E+00
	Thorium	0	0	0	0	0	0	0	3.65E-07	0	0	3.65E-07	8.76E-01	0	0
EA-9	Uranium	6.62E-09	3.04E-08	3.14E-06	2.12E-06	1.34E-08	2.65E-06	5.27E-08	1.44E-07	4.72E-08	4.61E-11	8.19E-06	1.97E+01	1.66E-09	1.66E+00
	Thorium	0	0	0	0	0	0	0	5.47E-07	0	0	5.47E-07	1.31E+00	0	0
EA-10	Uranium	5.98E-08	2.75E-07	1.74E-06	1.26E-06	5.96E-09	2.74E-06	3.85E-07	3.87E-08	8.31E-08	6.64E-10	6.59E-06	1.58E+01	5.10E-09	5.10E+00
	Thorium	0	0	0	0	0	0	0	1.47E-07	0	0	1.47E-07	3.52E-01	0	0
EA-11	Uranium	3.68E-09	2.37E-08	6.02E-07	3.22E-07	2.68E-09	1.08E-06	1.06E-07	1.79E-08	6.85E-08	1.81E-10	2.22E-06	5.33E+00	3.51E-09	3.51E+00
	Thorium	0	0	0	0	0	0	0	6.79E-08	0	0	6.79E-08	1.63E-01	0	0

1955		Concentration contribution from emission sources (g/m^3)										Total conc. (g/m^3)	Total intake (mg)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	3.12E-14	4.26E-07	2.98E-06	3.39E-06	1.84E-08	1.90E-06	1.19E-06	0	2.32E-07	3.10E-09	1.01E-05	2.43E+01	8.59E-09	8.59E+00
	Thorium	0	0	0	0	0	0	0	4.17E-07	0	0	4.17E-07	1.00E+00	0	0
EA-2	Uranium	1.75E-07	1.22E-06	1.53E-05	1.11E-05	2.32E-08	7.74E-06	1.12E-06	0	4.85E-07	6.99E-10	3.72E-05	8.92E+01	4.44E-09	4.44E+00
	Thorium	0	0	0	0	0	0	0	5.42E-07	0	0	5.42E-07	1.30E+00	0	0
EA-3	Uranium	8.71E-08	7.78E-07	3.08E-07	1.95E-09	5.87E-09	2.78E-06	1.84E-06	0	4.30E-07	5.83E-10	6.22E-06	1.49E+01	3.99E-09	3.99E+00
	Thorium	0	0	0	0	0	0	0	4.48E-07	0	0	4.48E-07	1.07E+00	0	0
EA-4	Uranium	9.28E-08	1.01E-10	2.10E-06	4.00E-06	2.90E-08	8.98E-07	2.16E-10	0	8.03E-09	8.19E-10	7.13E-06	1.71E+01	1.10E-08	1.10E+01
	Thorium	0	0	0	0	0	0	0	3.83E-07	0	0	3.83E-07	9.18E-01	0	0
EA-5	Uranium	6.43E-08	2.80E-07	2.86E-06	5.63E-07	3.53E-09	1.67E-06	3.78E-07	0	1.02E-07	2.76E-08	5.95E-06	1.43E+01	1.00E-08	1.00E+01
	Thorium	0	0	0	0	0	0	0	1.13E-07	0	0	1.13E-07	2.71E-01	0	0
EA-6	Uranium	6.31E-08	3.43E-07	4.52E-06	8.76E-07	2.35E-09	1.62E-06	4.08E-07	0	1.05E-07	4.88E-09	7.95E-06	1.91E+01	3.28E-09	3.28E+00
	Thorium	0	0	0	0	0	0	0	2.46E-08	0	0	2.46E-08	5.90E-02	0	0
EA-7	Uranium	6.31E-08	4.05E-07	3.55E-06	2.03E-06	2.12E-08	0	1.25E-06	0	1.44E-07	8.57E-10	7.47E-06	1.79E+01	5.00E-09	5.00E+00
	Thorium	0	0	0	0	0	0	0	4.27E-07	0	0	4.27E-07	1.02E+00	0	0
EA-8	Uranium	9.23E-08	6.05E-07	6.23E-06	5.88E-06	1.99E-08	1.88E-06	4.17E-07	0	1.83E-07	4.27E-10	1.53E-05	3.67E+01	3.33E-09	3.33E+00
	Thorium	0	0	0	0	0	0	0	4.17E-07	0	0	4.17E-07	1.00E+00	0	0
EA-9	Uranium	1.78E-08	1.21E-07	6.63E-06	5.35E-06	2.56E-08	4.51E-06	2.30E-07	0	7.72E-08	2.58E-10	1.70E-05	4.07E+01	1.66E-09	1.66E+00
	Thorium	0	0	0	0	0	0	0	6.26E-07	0	0	6.26E-07	1.50E+00	0	0
EA-10	Uranium	1.60E-07	1.09E-06	3.68E-06	3.19E-06	1.14E-08	4.67E-06	1.68E-06	0	1.36E-07	3.72E-09	1.46E-05	3.51E+01	5.10E-09	5.10E+00
	Thorium	0	0	0	0	0	0	0	1.68E-07	0	0	1.68E-07	4.03E-01	0	0
EA-11	Uranium	9.86E-09	9.38E-08	1.27E-06	8.13E-07	5.10E-09	1.84E-06	4.61E-07	0	1.12E-07	1.01E-09	4.60E-06	1.11E+01	3.51E-09	3.51E+00
	Thorium	0	0	0	0	0	0	0	7.77E-08	0	0	7.77E-08	1.87E-01	0	0

Appendix 4A (Cont'd). FEMP radionuclide concentration and intake results by exposure area and year.

1956		Concentration contribution from emission sources (g/m^3)										Total conc. (g/m^3)	Total intake (mg)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	3.07E-14	7.57E-07	1.23E-06	1.14E-06	1.19E-08	4.56E-07	1.79E-06	0	1.68E-08	4.43E-09	5.41E-06	1.30E+01	8.59E-09	8.59E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-2	Uranium	1.72E-07	2.17E-06	6.33E-06	3.73E-06	1.50E-08	1.86E-06	1.69E-06	0	3.50E-08	9.99E-10	1.60E-05	3.84E+01	4.44E-09	4.44E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-3	Uranium	8.56E-08	1.38E-06	1.27E-07	6.57E-10	3.79E-09	6.66E-07	2.77E-06	0	3.11E-08	8.32E-10	5.07E-06	1.22E+01	3.99E-09	3.99E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-4	Uranium	9.12E-08	1.79E-10	8.67E-07	1.35E-06	1.87E-08	2.15E-07	3.26E-10	0	5.80E-10	1.17E-09	2.54E-06	6.10E+00	1.10E-08	1.10E+01
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-5	Uranium	6.32E-08	4.98E-07	1.18E-06	1.89E-07	2.28E-09	4.01E-07	5.71E-07	0	7.36E-09	3.94E-08	2.96E-06	7.09E+00	1.00E-08	1.00E+01
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-6	Uranium	6.21E-08	6.09E-07	1.87E-06	2.94E-07	1.52E-09	3.89E-07	6.16E-07	0	7.57E-09	6.97E-09	3.86E-06	9.25E+00	3.28E-09	3.28E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-7	Uranium	6.21E-08	7.19E-07	1.47E-06	6.84E-07	1.37E-08	0	1.89E-06	0	1.04E-08	1.22E-09	4.85E-06	1.16E+01	5.00E-09	5.00E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-8	Uranium	9.07E-08	1.07E-06	2.57E-06	1.98E-06	1.28E-08	4.50E-07	6.30E-07	0	1.32E-08	6.10E-10	6.83E-06	1.64E+01	3.33E-09	3.33E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-9	Uranium	1.75E-08	2.14E-07	2.74E-06	1.80E-06	1.65E-08	1.08E-06	3.48E-07	0	5.57E-09	3.69E-10	6.22E-06	1.49E+01	1.66E-09	1.66E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-10	Uranium	1.58E-07	1.93E-06	1.52E-06	1.07E-06	7.34E-09	1.12E-06	2.54E-06	0	9.81E-09	5.31E-09	8.37E-06	2.01E+01	5.10E-09	5.10E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-11	Uranium	9.70E-09	1.67E-07	5.26E-07	2.73E-07	3.30E-09	4.41E-07	6.97E-07	0	8.09E-09	1.45E-09	2.13E-06	5.10E+00	3.51E-09	3.51E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0

1957		Concentration contribution from emission sources (g/m^3)										Total conc. (g/m^3)	Total intake (mg)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	3.18E-14	1.43E-06	1.96E-07	1.19E-06	1.46E-08	0	1.54E-06	1.42E-10	9.43E-09	1.08E-07	4.49E-06	1.08E+01	8.59E-09	8.59E+00
	Thorium	0	0	0	0	0	0	0	0	0	2.01E-11	2.01E-11	4.83E-05	0	0
EA-2	Uranium	1.78E-07	4.09E-06	1.01E-06	3.90E-06	1.84E-08	0	1.45E-06	1.84E-10	1.97E-08	2.43E-08	1.07E-05	2.57E+01	4.44E-09	4.44E+00
	Thorium	0	0	0	0	0	0	0	0	0	4.54E-12	4.54E-12	1.09E-05	0	0
EA-3	Uranium	8.88E-08	2.61E-06	2.03E-08	6.87E-10	4.65E-09	0	2.38E-06	1.52E-10	1.75E-08	2.02E-08	5.14E-06	1.23E+01	3.99E-09	3.99E+00
	Thorium	0	0	0	0	0	0	0	0	0	3.79E-12	3.79E-12	9.09E-06	0	0
EA-4	Uranium	9.46E-08	3.37E-10	1.38E-07	1.41E-06	2.30E-08	0	2.79E-10	1.30E-10	3.26E-10	2.84E-08	1.69E-06	4.07E+00	1.10E-08	1.10E+01
	Thorium	0	0	0	0	0	0	0	0	0	5.32E-12	5.32E-12	1.28E-05	0	0
EA-5	Uranium	6.55E-08	9.39E-07	1.89E-07	1.98E-07	2.80E-09	0	4.90E-07	3.84E-11	4.14E-09	9.58E-07	2.85E-06	6.83E+00	1.00E-08	1.00E+01
	Thorium	0	0	0	0	0	0	0	0	0	1.79E-10	1.79E-10	4.31E-04	0	0
EA-6	Uranium	6.44E-08	1.15E-06	2.98E-07	3.08E-07	1.87E-09	0	5.29E-07	3.12E-11	4.26E-09	1.69E-07	2.52E-06	6.05E+00	3.28E-09	3.28E+00
	Thorium	0	0	0	0	0	0	0	0	0	3.17E-11	3.17E-11	7.61E-05	0	0
EA-7	Uranium	6.44E-08	1.36E-06	2.34E-07	7.16E-07	1.69E-08	0	1.62E-06	1.45E-10	5.87E-09	2.97E-08	4.04E-06	9.71E+00	5.00E-09	5.00E+00
	Thorium	0	0	0	0	0	0	0	0	0	5.57E-12	5.57E-12	1.34E-05	0	0
EA-8	Uranium	9.41E-08	2.03E-06	4.10E-07	2.07E-06	1.58E-08	0	5.40E-07	1.42E-10	7.44E-09	1.48E-08	5.18E-06	1.24E+01	3.33E-09	3.33E+00
	Thorium	0	0	0	0	0	0	0	0	0	2.78E-12	2.78E-12	6.66E-06	0	0
EA-9	Uranium	1.81E-08	4.04E-07	4.36E-07	1.88E-06	2.03E-08	0	2.99E-07	2.13E-10	3.14E-09	8.96E-09	3.07E-06	7.37E+00	1.66E-09	1.66E+00
	Thorium	0	0	0	0	0	0	0	0	0	1.68E-12	1.68E-12	4.03E-06	0	0
EA-10	Uranium	1.64E-07	3.65E-06	2.42E-07	1.12E-06	9.00E-09	0	2.18E-06	5.71E-11	5.52E-09	1.29E-07	7.50E-06	1.80E+01	5.10E-09	5.10E+00
	Thorium	0	0	0	0	0	0	0	0	0	2.42E-11	2.42E-11	5.80E-05	0	0
EA-11	Uranium	1.01E-08	3.14E-07	8.37E-08	2.86E-07	4.05E-09	0	5.98E-07	2.64E-11	4.55E-09	3.52E-08	1.34E-06	3.21E+00	3.51E-09	3.51E+00
	Thorium	0	0	0	0	0	0	0	0	0	6.58E-12	6.58E-12	1.58E-05	0	0

Appendix 4A (Cont'd). FEMP radionuclide concentration and intake results by exposure area and year.

1958		Concentration contribution from emission sources (g/m^3)										Total conc. (g/m^3)	Total intake (mg)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	9.98E-14	1.35E-06	1.60E-07	2.33E-07	4.98E-08	0	1.64E-06	2.42E-07	1.41E-08	2.10E-07	3.90E-06	9.36E+00	8.59E-09	8.59E+00
	Thorium	0	0	0	0	0	0	0	0	0	4.60E-11	4.60E-11	1.10E-04	0	0
EA-2	Uranium	5.59E-07	3.86E-06	8.21E-07	7.62E-07	6.29E-08	0	1.55E-06	3.14E-07	2.95E-08	4.74E-08	8.00E-06	1.92E+01	4.44E-09	4.44E+00
	Thorium	0	0	0	0	0	0	0	0	0	1.04E-11	1.04E-11	2.49E-05	0	0
EA-3	Uranium	2.79E-07	2.46E-06	1.65E-08	1.34E-10	1.59E-08	0	2.54E-06	2.59E-07	2.62E-08	3.95E-08	5.64E-06	1.35E+01	3.99E-09	3.99E+00
	Thorium	0	0	0	0	0	0	0	0	0	8.66E-12	8.66E-12	2.08E-05	0	0
EA-4	Uranium	2.97E-07	3.18E-10	1.13E-07	2.75E-07	7.87E-08	0	2.98E-10	2.22E-07	4.90E-10	5.55E-08	1.04E-06	2.50E+00	1.10E-08	1.10E+01
	Thorium	0	0	0	0	0	0	0	0	0	1.22E-11	1.22E-11	2.92E-05	0	0
EA-5	Uranium	2.06E-07	8.86E-07	1.54E-07	3.87E-08	9.59E-09	0	5.23E-07	6.55E-08	6.21E-09	1.87E-06	3.76E-06	9.02E+00	1.00E-08	1.00E+01
	Thorium	0	0	0	0	0	0	0	0	0	4.10E-10	4.10E-10	9.84E-04	0	0
EA-6	Uranium	2.02E-07	1.08E-06	2.43E-07	6.02E-08	6.39E-09	0	5.64E-07	5.32E-08	6.39E-09	3.31E-07	2.55E-06	6.12E+00	3.28E-09	3.28E+00
	Thorium	0	0	0	0	0	0	0	0	0	7.24E-11	7.24E-11	1.74E-04	0	0
EA-7	Uranium	2.02E-07	1.28E-06	1.91E-07	1.40E-07	5.77E-08	0	1.73E-06	2.47E-07	8.81E-09	5.81E-08	3.91E-06	9.40E+00	5.00E-09	5.00E+00
	Thorium	0	0	0	0	0	0	0	0	0	1.27E-11	1.27E-11	3.06E-05	0	0
EA-8	Uranium	2.95E-07	1.91E-06	3.34E-07	4.04E-07	5.40E-08	0	5.77E-07	2.42E-07	1.12E-08	2.90E-08	3.86E-06	9.26E+00	3.33E-09	3.33E+00
	Thorium	0	0	0	0	0	0	0	0	0	6.35E-12	6.35E-12	1.52E-05	0	0
EA-9	Uranium	5.68E-08	3.81E-07	3.56E-07	3.68E-07	6.94E-08	0	3.19E-07	3.63E-07	4.70E-09	1.75E-08	1.93E-06	4.64E+00	1.66E-09	1.66E+00
	Thorium	0	0	0	0	0	0	0	0	0	3.83E-12	3.83E-12	9.20E-06	0	0
EA-10	Uranium	5.14E-07	3.44E-06	1.98E-07	2.19E-07	3.08E-08	0	2.33E-06	9.72E-08	8.28E-09	2.52E-07	7.09E-06	1.70E+01	5.10E-09	5.10E+00
	Thorium	0	0	0	0	0	0	0	0	0	5.52E-11	5.52E-11	1.33E-04	0	0
EA-11	Uranium	3.16E-08	2.97E-07	6.83E-08	5.59E-08	1.38E-08	0	6.38E-07	4.50E-08	6.82E-09	6.86E-08	1.23E-06	2.94E+00	3.51E-09	3.51E+00
	Thorium	0	0	0	0	0	0	0	0	0	1.50E-11	1.50E-11	3.61E-05	0	0

1959		Concentration contribution from emission sources (g/m^3)										Total conc. (g/m^3)	Total intake (mg)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	3.11E-14	1.50E-06	3.43E-07	1.56E-07	4.02E-08	0	1.54E-06	1.49E-07	1.78E-08	2.10E-07	3.96E-06	9.49E+00	1.03E-08	1.03E+01
	Thorium	0	0	0	0	0	0	0	0	0	4.60E-11	4.60E-11	1.10E-04	0	0
EA-2	Uranium	1.75E-07	4.31E-06	1.76E-06	5.10E-07	5.08E-08	0	1.45E-06	1.94E-07	3.72E-08	4.74E-08	8.53E-06	2.05E+01	5.33E-09	5.33E+00
	Thorium	0	0	0	0	0	0	0	0	0	1.04E-11	1.04E-11	2.49E-05	0	0
EA-3	Uranium	8.70E-08	2.75E-06	3.55E-08	8.98E-11	1.29E-08	0	2.37E-06	1.60E-07	3.30E-08	3.95E-08	5.49E-06	1.32E+01	4.79E-09	4.79E+00
	Thorium	0	0	0	0	0	0	0	0	0	8.66E-12	8.66E-12	2.08E-05	0	0
EA-4	Uranium	9.27E-08	3.55E-10	2.42E-07	1.84E-07	6.35E-08	0	2.79E-10	1.37E-07	6.17E-10	5.55E-08	7.75E-07	1.86E+00	1.32E-08	1.32E+01
	Thorium	0	0	0	0	0	0	0	0	0	1.22E-11	1.22E-11	2.92E-05	0	0
EA-5	Uranium	6.42E-08	9.89E-07	3.30E-07	2.59E-08	7.74E-09	0	4.89E-07	4.04E-08	7.82E-09	1.87E-06	3.82E-06	9.18E+00	1.20E-08	1.20E+01
	Thorium	0	0	0	0	0	0	0	0	0	4.10E-10	4.10E-10	9.84E-04	0	0
EA-6	Uranium	6.31E-08	1.21E-06	5.21E-07	4.03E-08	5.16E-09	0	5.27E-07	3.28E-08	8.04E-09	3.31E-07	2.74E-06	6.57E+00	3.94E-09	3.94E+00
	Thorium	0	0	0	0	0	0	0	0	0	7.24E-11	7.24E-11	1.74E-04	0	0
EA-7	Uranium	6.31E-08	1.43E-06	4.09E-07	9.36E-08	4.66E-08	0	1.62E-06	1.53E-07	1.11E-08	5.81E-08	3.88E-06	9.31E+00	6.01E-09	6.01E+00
	Thorium	0	0	0	0	0	0	0	0	0	1.27E-11	1.27E-11	3.06E-05	0	0
EA-8	Uranium	9.22E-08	2.13E-06	7.17E-07	2.71E-07	4.36E-08	0	5.39E-07	1.49E-07	1.40E-08	2.90E-08	3.99E-06	9.57E+00	3.99E-09	3.99E+00
	Thorium	0	0	0	0	0	0	0	0	0	6.35E-12	6.35E-12	1.52E-05	0	0
EA-9	Uranium	1.77E-08	4.26E-07	7.63E-07	2.46E-07	5.60E-08	0	2.98E-07	2.24E-07	5.92E-09	1.75E-08	2.05E-06	4.93E+00	2.00E-09	2.00E+00
	Thorium	0	0	0	0	0	0	0	0	0	3.83E-12	3.83E-12	9.20E-06	0	0
EA-10	Uranium	1.60E-07	3.84E-06	4.24E-07	1.47E-07	2.49E-08	0	2.18E-06	6.00E-08	1.04E-08	2.52E-07	7.10E-06	1.70E+01	6.13E-09	6.13E+00
	Thorium	0	0	0	0	0	0	0	0	0	5.52E-11	5.52E-11	1.33E-04	0	0
EA-11	Uranium	9.85E-09	3.31E-07	1.46E-07	3.74E-08	1.12E-08	0	5.97E-07	2.78E-08	8.59E-09	6.86E-08	1.24E-06	2.97E+00	4.22E-09	4.22E+00
	Thorium	0	0	0	0	0	0	0	0	0	1.50E-11	1.50E-11	3.61E-05	0	0

Appendix 4A (Cont'd). FEMP radionuclide concentration and intake results by exposure area and year.

1960		Concentration contribution from emission sources (g/m^3)										Total conc. (g/m^3)	Total intake (mg)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	2.62E-14	1.62E-06	5.24E-08	6.62E-08	8.11E-08	0	1.89E-06	7.91E-08	3.76E-07	2.40E-07	4.40E-06	1.06E+01	1.03E-08	1.03E+01
	Thorium	0	0	0	0	0	0	0	0	0	5.93E-10	5.93E-10	1.42E-03	0	0
EA-2	Uranium	1.47E-07	4.64E-06	2.69E-07	2.17E-07	1.02E-07	0	1.78E-06	1.03E-07	7.86E-07	5.41E-08	8.10E-06	1.94E+01	5.33E-09	5.33E+00
	Thorium	0	0	0	0	0	0	0	0	0	1.34E-10	1.34E-10	3.21E-04	0	0
EA-3	Uranium	7.32E-08	2.96E-06	5.42E-09	3.81E-11	2.59E-08	0	2.92E-06	8.49E-08	6.97E-07	4.51E-08	6.81E-06	1.63E+01	4.79E-09	4.79E+00
	Thorium	0	0	0	0	0	0	0	0	0	1.11E-10	1.11E-10	2.67E-04	0	0
EA-4	Uranium	7.80E-08	3.83E-10	3.69E-08	7.82E-08	1.28E-07	0	3.43E-10	7.25E-08	1.30E-08	6.34E-08	4.71E-07	1.13E+00	1.32E-08	1.32E+01
	Thorium	0	0	0	0	0	0	0	0	0	1.57E-10	1.57E-10	3.76E-04	0	0
EA-5	Uranium	5.40E-08	1.07E-06	5.04E-08	1.10E-08	1.56E-08	0	6.01E-07	2.14E-08	1.65E-07	2.14E-06	4.12E-06	9.89E+00	1.20E-08	1.20E+01
	Thorium	0	0	0	0	0	0	0	0	0	5.28E-09	5.28E-09	1.27E-02	0	0
EA-6	Uranium	5.31E-08	1.30E-06	7.95E-08	1.71E-08	1.04E-08	0	6.49E-07	1.74E-08	1.70E-07	3.78E-07	2.68E-06	6.42E+00	3.94E-09	3.94E+00
	Thorium	0	0	0	0	0	0	0	0	0	9.33E-10	9.33E-10	2.24E-03	0	0
EA-7	Uranium	5.31E-08	1.54E-06	6.25E-08	3.98E-08	9.39E-08	0	1.99E-06	8.09E-08	2.34E-07	6.63E-08	4.16E-06	9.98E+00	6.01E-09	6.01E+00
	Thorium	0	0	0	0	0	0	0	0	0	1.64E-10	1.64E-10	3.93E-04	0	0
EA-8	Uranium	7.75E-08	2.30E-06	1.10E-07	1.15E-07	8.78E-08	0	6.63E-07	7.91E-08	2.97E-07	3.31E-08	3.76E-06	9.03E+00	3.99E-09	3.99E+00
	Thorium	0	0	0	0	0	0	0	0	0	8.17E-11	8.17E-11	1.96E-04	0	0
EA-9	Uranium	1.49E-08	4.59E-07	1.17E-07	1.05E-07	1.13E-07	0	3.66E-07	1.19E-07	1.25E-07	2.00E-08	1.44E-06	3.45E+00	2.00E-09	2.00E+00
	Thorium	0	0	0	0	0	0	0	0	0	4.94E-11	4.94E-11	1.18E-04	0	0
EA-10	Uranium	1.35E-07	4.14E-06	6.48E-08	6.24E-08	5.02E-08	0	2.68E-06	3.18E-08	2.20E-07	2.88E-07	7.67E-06	1.84E+01	6.13E-09	6.13E+00
	Thorium	0	0	0	0	0	0	0	0	0	7.11E-10	7.11E-10	1.71E-03	0	0
EA-11	Uranium	8.29E-09	3.57E-07	2.24E-08	1.59E-08	2.25E-08	0	7.34E-07	1.47E-08	1.81E-07	7.84E-08	1.43E-06	3.44E+00	4.22E-09	4.22E+00
	Thorium	0	0	0	0	0	0	0	0	0	1.94E-10	1.94E-10	4.65E-04	0	0

1961		Concentration contribution from emission sources (g/m^3)										Total conc. (g/m^3)	Total intake (mg)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	3.24E-14	1.42E-06	6.42E-08	2.50E-08	3.82E-08	0	1.68E-06	2.63E-08	9.11E-08	2.69E-07	3.61E-06	8.67E+00	1.03E-08	1.03E+01
	Thorium	0	0	0	0	0	0	0	0	0	1.61E-09	1.61E-09	3.87E-03	0	0
EA-2	Uranium	1.82E-07	4.06E-06	3.30E-07	8.17E-08	4.83E-08	0	1.58E-06	3.41E-08	1.90E-07	6.07E-08	6.57E-06	1.58E+01	5.33E-09	5.33E+00
	Thorium	0	0	0	0	0	0	0	0	0	3.64E-10	3.64E-10	8.72E-04	0	0
EA-3	Uranium	9.06E-08	2.59E-06	6.64E-09	1.44E-11	1.22E-08	0	2.60E-06	2.82E-08	1.69E-07	5.06E-08	5.55E-06	1.33E+01	4.79E-09	4.79E+00
	Thorium	0	0	0	0	0	0	0	0	0	3.03E-10	3.03E-10	7.27E-04	0	0
EA-4	Uranium	9.66E-08	3.35E-10	4.52E-08	2.95E-08	6.03E-08	0	3.05E-10	2.41E-08	3.16E-09	7.11E-08	3.31E-07	7.93E-01	1.32E-08	1.32E+01
	Thorium	0	0	0	0	0	0	0	0	0	4.26E-10	4.26E-10	1.02E-03	0	0
EA-5	Uranium	6.68E-08	9.33E-07	6.18E-08	4.15E-09	7.35E-09	0	5.34E-07	7.11E-09	4.00E-08	2.40E-06	4.05E-06	9.72E+00	1.20E-08	1.20E+01
	Thorium	0	0	0	0	0	0	0	0	0	1.44E-08	1.44E-08	3.44E-02	0	0
EA-6	Uranium	6.57E-08	1.14E-06	9.75E-08	6.45E-09	4.90E-09	0	5.77E-07	5.78E-09	4.12E-08	4.23E-07	2.36E-06	5.67E+00	3.94E-09	3.94E+00
	Thorium	0	0	0	0	0	0	0	0	0	2.54E-09	2.54E-09	6.09E-03	0	0
EA-7	Uranium	6.57E-08	1.35E-06	7.66E-08	1.50E-08	4.42E-08	0	1.77E-06	2.69E-08	5.67E-08	7.44E-08	3.48E-06	8.34E+00	6.01E-09	6.01E+00
	Thorium	0	0	0	0	0	0	0	0	0	4.46E-10	4.46E-10	1.07E-03	0	0
EA-8	Uranium	9.60E-08	2.01E-06	1.34E-07	4.34E-08	4.14E-08	0	5.89E-07	2.63E-08	7.19E-08	3.71E-08	3.05E-06	7.33E+00	3.99E-09	3.99E+00
	Thorium	0	0	0	0	0	0	0	0	0	2.22E-10	2.22E-10	5.33E-04	0	0
EA-9	Uranium	1.85E-08	4.02E-07	1.43E-07	3.94E-08	5.32E-08	0	3.26E-07	3.94E-08	3.03E-08	2.24E-08	1.07E-06	2.58E+00	2.00E-09	2.00E+00
	Thorium	0	0	0	0	0	0	0	0	0	1.34E-10	1.34E-10	3.22E-04	0	0
EA-10	Uranium	1.67E-07	3.62E-06	7.94E-08	2.35E-08	2.36E-08	0	2.38E-06	1.06E-08	5.34E-08	3.23E-07	6.68E-06	1.60E+01	6.13E-09	6.13E+00
	Thorium	0	0	0	0	0	0	0	0	0	1.93E-09	1.93E-09	4.64E-03	0	0
EA-11	Uranium	1.03E-08	3.12E-07	2.74E-08	5.99E-09	1.06E-08	0	6.52E-07	4.89E-09	4.40E-08	8.79E-08	1.16E-06	2.77E+00	4.22E-09	4.22E+00
	Thorium	0	0	0	0	0	0	0	0	0	5.27E-10	5.27E-10	1.26E-03	0	0

Appendix 4A (Cont'd). FEMP radionuclide concentration and intake results by exposure area and year.

1962		Concentration contribution from emission sources (g/m^3)										Total conc. (g/m^3)	Total intake (mg)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	2.89E-14	8.18E-07	1.70E-07	1.16E-07	2.15E-08	0	1.90E-06	5.06E-08	9.11E-08	2.78E-07	3.45E-06	8.27E+00	1.03E-08	1.03E+01
	Thorium	0	0	0	0	0	0	0	0	0	2.26E-09	2.26E-09	5.42E-03	0	0
EA-2	Uranium	1.62E-07	2.34E-06	8.71E-07	3.80E-07	2.72E-08	0	1.79E-06	6.56E-08	1.90E-07	6.28E-08	5.89E-06	1.41E+01	5.33E-09	5.33E+00
	Thorium	0	0	0	0	0	0	0	0	0	5.10E-10	5.10E-10	1.22E-03	0	0
EA-3	Uranium	8.06E-08	1.49E-06	1.75E-08	6.69E-11	6.88E-09	0	2.94E-06	5.43E-08	1.69E-07	5.23E-08	4.81E-06	1.16E+01	4.79E-09	4.79E+00
	Thorium	0	0	0	0	0	0	0	0	0	4.25E-10	4.25E-10	1.02E-03	0	0
EA-4	Uranium	8.59E-08	1.93E-10	1.19E-07	1.37E-07	3.40E-08	0	3.45E-10	4.64E-08	3.16E-09	7.35E-08	5.00E-07	1.20E+00	1.32E-08	1.32E+01
	Thorium	0	0	0	0	0	0	0	0	0	5.97E-10	5.97E-10	1.43E-03	0	0
EA-5	Uranium	5.95E-08	5.38E-07	1.63E-07	1.93E-08	4.14E-09	0	6.05E-07	1.37E-08	4.00E-08	2.48E-06	3.92E-06	9.41E+00	1.20E-08	1.20E+01
	Thorium	0	0	0	0	0	0	0	0	0	2.01E-08	2.01E-08	4.83E-02	0	0
EA-6	Uranium	5.84E-08	6.58E-07	2.57E-07	3.00E-08	2.76E-09	0	6.53E-07	1.11E-08	4.12E-08	4.38E-07	2.15E-06	5.16E+00	3.94E-09	3.94E+00
	Thorium	0	0	0	0	0	0	0	0	0	3.55E-09	3.55E-09	8.53E-03	0	0
EA-7	Uranium	5.84E-08	7.77E-07	2.02E-07	6.97E-08	2.49E-08	0	2.00E-06	5.17E-08	5.67E-08	7.69E-08	3.32E-06	7.97E+00	6.01E-09	6.01E+00
	Thorium	0	0	0	0	0	0	0	0	0	6.25E-10	6.25E-10	1.50E-03	0	0
EA-8	Uranium	8.54E-08	1.16E-06	3.54E-07	2.02E-07	2.33E-08	0	6.67E-07	5.06E-08	7.19E-08	3.84E-08	2.65E-06	6.37E+00	3.99E-09	3.99E+00
	Thorium	0	0	0	0	0	0	0	0	0	3.11E-10	3.11E-10	7.47E-04	0	0
EA-9	Uranium	1.64E-08	2.32E-07	3.77E-07	1.83E-07	3.00E-08	0	3.69E-07	7.59E-08	3.03E-08	2.32E-08	1.34E-06	3.21E+00	2.00E-09	2.00E+00
	Thorium	0	0	0	0	0	0	0	0	0	1.88E-10	1.88E-10	4.51E-04	0	0
EA-10	Uranium	1.49E-07	2.09E-06	2.10E-07	1.09E-07	1.33E-08	0	2.69E-06	2.03E-08	5.34E-08	3.34E-07	5.67E-06	1.36E+01	6.13E-09	6.13E+00
	Thorium	0	0	0	0	0	0	0	0	0	2.71E-09	2.71E-09	6.50E-03	0	0
EA-11	Uranium	9.13E-09	1.80E-07	7.24E-08	2.78E-08	5.98E-09	0	7.39E-07	9.42E-09	4.40E-08	9.09E-08	1.18E-06	2.83E+00	4.22E-09	4.22E+00
	Thorium	0	0	0	0	0	0	0	0	0	7.38E-10	7.38E-10	1.77E-03	0	0

1963		Concentration contribution from emission sources (g/m^3)										Total conc. (g/m^3)	Total intake (mg)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	4.32E-14	0	3.53E-07	2.55E-07	5.61E-08	0	2.06E-06	6.00E-08	2.71E-08	2.78E-07	3.09E-06	7.41E+00	1.03E-08	1.03E+01
	Thorium	0	0	0	0	0	0	0	0	0	2.53E-09	2.53E-09	6.08E-03	0	0
EA-2	Uranium	2.42E-07	0	1.81E-06	8.35E-07	7.09E-08	0	1.94E-06	7.79E-08	5.67E-08	6.28E-08	5.10E-06	1.22E+01	5.33E-09	5.33E+00
	Thorium	0	0	0	0	0	0	0	0	0	5.71E-10	5.71E-10	1.37E-03	0	0
EA-3	Uranium	1.21E-07	0	3.65E-08	1.47E-10	1.79E-08	0	3.18E-06	6.44E-08	5.03E-08	5.23E-08	3.53E-06	8.46E+00	4.79E-09	4.79E+00
	Thorium	0	0	0	0	0	0	0	0	0	4.76E-10	4.76E-10	1.14E-03	0	0
EA-4	Uranium	1.29E-07	0	2.49E-07	3.01E-07	8.86E-08	0	3.74E-10	5.50E-08	9.39E-10	7.35E-08	8.97E-07	2.15E+00	1.32E-08	1.32E+01
	Thorium	0	0	0	0	0	0	0	0	0	6.69E-10	6.69E-10	1.61E-03	0	0
EA-5	Uranium	8.91E-08	0	3.39E-07	4.24E-08	1.08E-08	0	6.55E-07	1.63E-08	1.19E-08	2.48E-06	3.64E-06	8.74E+00	1.20E-08	1.20E+01
	Thorium	0	0	0	0	0	0	0	0	0	2.26E-08	2.26E-08	5.41E-02	0	0
EA-6	Uranium	8.75E-08	0	5.36E-07	6.59E-08	7.20E-09	0	7.07E-07	1.32E-08	1.23E-08	4.38E-07	1.87E-06	4.48E+00	3.94E-09	3.94E+00
	Thorium	0	0	0	0	0	0	0	0	0	3.98E-09	3.98E-09	9.56E-03	0	0
EA-7	Uranium	8.75E-08	0	4.21E-07	1.53E-07	6.50E-08	0	2.17E-06	6.14E-08	1.69E-08	7.69E-08	3.05E-06	7.32E+00	6.01E-09	6.01E+00
	Thorium	0	0	0	0	0	0	0	0	0	7.00E-10	7.00E-10	1.68E-03	0	0
EA-8	Uranium	1.28E-07	0	7.38E-07	4.43E-07	6.08E-08	0	7.23E-07	6.00E-08	2.14E-08	3.84E-08	2.21E-06	5.31E+00	3.99E-09	3.99E+00
	Thorium	0	0	0	0	0	0	0	0	0	3.49E-10	3.49E-10	8.38E-04	0	0
EA-9	Uranium	2.46E-08	0	7.85E-07	4.03E-07	7.82E-08	0	3.99E-07	9.01E-08	9.02E-09	2.32E-08	1.81E-06	4.35E+00	2.00E-09	2.00E+00
	Thorium	0	0	0	0	0	0	0	0	0	2.11E-10	2.11E-10	5.06E-04	0	0
EA-10	Uranium	2.22E-07	0	4.36E-07	2.40E-07	3.47E-08	0	2.92E-06	2.41E-08	1.59E-08	3.34E-07	4.23E-06	1.01E+01	6.13E-09	6.13E+00
	Thorium	0	0	0	0	0	0	0	0	0	3.04E-09	3.04E-09	7.29E-03	0	0
EA-11	Uranium	1.37E-08	0	1.51E-07	6.12E-08	1.56E-08	0	8.00E-07	1.12E-08	1.31E-08	9.09E-08	1.16E-06	2.78E+00	4.22E-09	4.22E+00
	Thorium	0	0	0	0	0	0	0	0	0	8.28E-10	8.28E-10	1.99E-03	0	0

Appendix 4A (Cont'd). FEMP radionuclide concentration and intake results by exposure area and year.

1964		Concentration contribution from emission sources (g/m^3)										Total conc. (g/m^3)	Total intake (mg)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	3.13E-14	0	1.31E-07	1.08E-07	1.43E-08	0	2.55E-06	9.47E-08	6.81E-09	2.85E-07	3.19E-06	7.65E+00	1.03E-08	1.03E+01
	Thorium	0	0	0	0	0	0	0	0	1.80E-07	2.82E-09	1.83E-07	4.39E-01	0	0
EA-2	Uranium	1.76E-07	0	6.75E-07	3.52E-07	1.81E-08	0	2.40E-06	1.23E-07	1.42E-08	6.44E-08	3.83E-06	9.18E+00	5.33E-09	5.33E+00
	Thorium	0	0	0	0	0	0	0	0	3.76E-07	6.36E-10	3.77E-07	9.05E-01	0	0
EA-3	Uranium	8.75E-08	0	1.36E-08	6.20E-11	4.57E-09	0	3.94E-06	1.02E-07	1.26E-08	5.37E-08	4.21E-06	1.01E+01	4.79E-09	4.79E+00
	Thorium	0	0	0	0	0	0	0	0	3.34E-07	5.30E-10	3.34E-07	8.02E-01	0	0
EA-4	Uranium	9.33E-08	0	9.26E-08	1.27E-07	2.26E-08	0	4.62E-10	8.68E-08	2.36E-10	7.54E-08	4.99E-07	1.20E+00	1.32E-08	1.32E+01
	Thorium	0	0	0	0	0	0	0	0	6.24E-09	7.45E-10	6.98E-09	1.68E-02	0	0
EA-5	Uranium	6.46E-08	0	1.26E-07	1.79E-08	2.75E-09	0	8.11E-07	2.56E-08	2.99E-09	2.54E-06	3.59E-06	8.63E+00	1.20E-08	1.20E+01
	Thorium	0	0	0	0	0	0	0	0	7.91E-08	2.51E-08	1.04E-07	2.50E-01	0	0
EA-6	Uranium	6.34E-08	0	1.99E-07	2.78E-08	1.83E-09	0	8.75E-07	2.08E-08	3.08E-09	4.49E-07	1.64E-06	3.94E+00	3.94E-09	3.94E+00
	Thorium	0	0	0	0	0	0	0	0	8.14E-08	4.44E-09	8.58E-08	2.06E-01	0	0
EA-7	Uranium	6.34E-08	0	1.57E-07	6.47E-08	1.66E-08	0	2.68E-06	9.69E-08	4.24E-09	7.90E-08	3.16E-06	7.60E+00	6.01E-09	6.01E+00
	Thorium	0	0	0	0	0	0	0	0	1.12E-07	7.80E-10	1.13E-07	2.71E-01	0	0
EA-8	Uranium	9.27E-08	0	2.75E-07	1.87E-07	1.55E-08	0	8.94E-07	9.47E-08	5.37E-09	3.94E-08	1.60E-06	3.85E+00	3.99E-09	3.99E+00
	Thorium	0	0	0	0	0	0	0	0	1.42E-07	3.89E-10	1.42E-07	3.42E-01	0	0
EA-9	Uranium	1.78E-08	0	2.92E-07	1.70E-07	1.99E-08	0	4.94E-07	1.42E-07	2.26E-09	2.38E-08	1.16E-06	2.79E+00	2.00E-09	2.00E+00
	Thorium	0	0	0	0	0	0	0	0	5.99E-08	2.35E-10	6.02E-08	1.44E-01	0	0
EA-10	Uranium	1.61E-07	0	1.62E-07	1.01E-07	8.85E-09	0	3.61E-06	3.81E-08	3.99E-09	3.43E-07	4.43E-06	1.06E+01	6.13E-09	6.13E+00
	Thorium	0	0	0	0	0	0	0	0	1.05E-07	3.38E-09	1.09E-07	2.61E-01	0	0
EA-11	Uranium	9.91E-09	0	5.61E-08	2.58E-08	3.98E-09	0	9.90E-07	1.76E-08	3.29E-09	9.33E-08	1.20E-06	2.88E+00	4.22E-09	4.22E+00
	Thorium	0	0	0	0	0	0	0	0	8.70E-08	9.22E-10	8.79E-08	2.11E-01	0	0

1965		Concentration contribution from emission sources (g/m^3)										Total conc. (g/m^3)	Total intake (mg)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	2.85E-14	7.37E-08	8.11E-08	7.38E-08	1.66E-08	0	4.03E-06	2.95E-08	5.24E-09	1.58E-07	4.47E-06	1.07E+01	1.03E-08	1.03E+01
	Thorium	0	0	0	0	0	0	0	0	1.80E-07	2.79E-09	1.83E-07	4.39E-01	0	0
EA-2	Uranium	1.60E-07	2.11E-07	4.16E-07	2.42E-07	2.09E-08	0	3.80E-06	3.82E-08	1.09E-08	3.57E-08	4.94E-06	1.19E+01	5.33E-09	5.33E+00
	Thorium	0	0	0	0	0	0	0	0	3.76E-07	6.30E-10	3.77E-07	9.05E-01	0	0
EA-3	Uranium	7.97E-08	1.35E-07	8.38E-09	4.25E-11	5.30E-09	0	6.23E-06	3.16E-08	9.70E-09	2.98E-08	6.53E-06	1.57E+01	4.79E-09	4.79E+00
	Thorium	0	0	0	0	0	0	0	0	3.34E-07	5.25E-10	3.34E-07	8.02E-01	0	0
EA-4	Uranium	8.50E-08	1.74E-11	5.71E-08	8.72E-08	2.62E-08	0	7.32E-10	2.70E-08	1.81E-10	4.18E-08	3.25E-07	7.80E-01	1.32E-08	1.32E+01
	Thorium	0	0	0	0	0	0	0	0	6.24E-09	7.37E-10	6.98E-09	1.67E-02	0	0
EA-5	Uranium	5.88E-08	4.85E-08	7.79E-08	1.23E-08	3.19E-09	0	1.28E-06	7.98E-09	2.30E-09	1.41E-06	2.90E-06	6.97E+00	1.20E-08	1.20E+01
	Thorium	0	0	0	0	0	0	0	0	7.91E-08	2.49E-08	1.04E-07	2.50E-01	0	0
EA-6	Uranium	5.78E-08	5.93E-08	1.23E-07	1.91E-08	2.13E-09	0	1.39E-06	6.48E-09	2.37E-09	2.49E-07	1.90E-06	4.57E+00	3.94E-09	3.94E+00
	Thorium	0	0	0	0	0	0	0	0	8.14E-08	4.39E-09	8.58E-08	2.06E-01	0	0
EA-7	Uranium	5.78E-08	7.01E-08	9.67E-08	4.44E-08	1.92E-08	0	4.25E-06	3.01E-08	3.26E-09	4.38E-08	4.61E-06	1.11E+01	6.01E-09	6.01E+00
	Thorium	0	0	0	0	0	0	0	0	1.12E-07	7.72E-10	1.13E-07	2.71E-01	0	0
EA-8	Uranium	8.45E-08	1.05E-07	1.69E-07	1.28E-07	1.80E-08	0	1.42E-06	2.95E-08	4.13E-09	2.18E-08	1.98E-06	4.74E+00	3.99E-09	3.99E+00
	Thorium	0	0	0	0	0	0	0	0	1.42E-07	3.85E-10	1.42E-07	3.42E-01	0	0
EA-9	Uranium	1.63E-08	2.09E-08	1.80E-07	1.17E-07	2.31E-08	0	7.82E-07	4.42E-08	1.74E-09	1.32E-08	1.20E-06	2.88E+00	2.00E-09	2.00E+00
	Thorium	0	0	0	0	0	0	0	0	5.99E-08	2.32E-10	6.02E-08	1.44E-01	0	0
EA-10	Uranium	1.47E-07	1.88E-07	1.00E-07	6.96E-08	1.03E-08	0	5.71E-06	1.18E-08	3.07E-09	1.90E-07	6.43E-06	1.54E+01	6.13E-09	6.13E+00
	Thorium	0	0	0	0	0	0	0	0	1.05E-07	3.35E-09	1.09E-07	2.61E-01	0	0
EA-11	Uranium	9.03E-09	1.62E-08	3.46E-08	1.77E-08	4.61E-09	0	1.57E-06	5.49E-09	2.53E-09	5.17E-08	1.71E-06	4.10E+00	4.22E-09	4.22E+00
	Thorium	0	0	0	0	0	0	0	0	8.70E-08	9.12E-10	8.79E-08	2.11E-01	0	0

Appendix 4A (Cont'd). FEMP radionuclide concentration and intake results by exposure area and year.

1966		Concentration contribution from emission sources (g/m^3)										Total conc. (g/m^3)	Total intake (mg)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	3.12E-14	1.97E-07	5.52E-08	2.51E-08	6.66E-09	0	8.16E-07	1.87E-08	9.48E-09	1.09E-07	1.24E-06	2.97E+00	1.03E-08	1.03E+01
	Thorium	0	0	0	0	0	0	7.68E-08	0	1.80E-07	3.05E-09	2.60E-07	6.24E-01	0	0
EA-2	Uranium	1.75E-07	5.63E-07	2.84E-07	8.21E-08	8.41E-09	0	7.69E-07	2.43E-08	1.98E-08	2.46E-08	1.95E-06	4.68E+00	5.33E-09	5.33E+00
	Thorium	0	0	0	0	0	0	7.24E-08	0	3.76E-07	6.88E-10	4.49E-07	1.08E+00	0	0
EA-3	Uranium	8.71E-08	3.59E-07	5.71E-09	1.45E-11	2.13E-09	0	1.26E-06	2.01E-08	1.76E-08	2.05E-08	1.77E-06	4.26E+00	4.79E-09	4.79E+00
	Thorium	0	0	0	0	0	0	1.19E-07	0	3.34E-07	5.73E-10	4.53E-07	1.09E+00	0	0
EA-4	Uranium	9.28E-08	4.65E-11	3.89E-08	2.96E-08	1.05E-08	0	1.48E-10	1.72E-08	3.28E-10	2.88E-08	2.18E-07	5.24E-01	1.32E-08	1.32E+01
	Thorium	0	0	0	0	0	0	1.39E-11	0	6.24E-09	8.06E-10	7.06E-09	1.69E-02	0	0
EA-5	Uranium	6.43E-08	1.29E-07	5.31E-08	4.17E-09	1.28E-09	0	2.60E-07	5.07E-09	4.16E-09	9.72E-07	1.49E-06	3.58E+00	1.20E-08	1.20E+01
	Thorium	0	0	0	0	0	0	2.44E-08	0	7.91E-08	2.72E-08	1.31E-07	3.14E-01	0	0
EA-6	Uranium	6.31E-08	1.58E-07	8.38E-08	6.48E-09	8.54E-10	0	2.80E-07	4.12E-09	4.28E-09	1.72E-07	7.73E-07	1.85E+00	3.94E-09	3.94E+00
	Thorium	0	0	0	0	0	0	2.64E-08	0	8.14E-08	4.80E-09	1.13E-07	2.70E-01	0	0
EA-7	Uranium	6.31E-08	1.87E-07	6.59E-08	1.51E-08	7.71E-09	0	8.59E-07	1.91E-08	5.90E-09	3.02E-08	1.25E-06	3.01E+00	6.01E-09	6.01E+00
	Thorium	0	0	0	0	0	0	8.08E-08	0	1.12E-07	8.43E-10	1.94E-07	4.65E-01	0	0
EA-8	Uranium	9.23E-08	2.79E-07	1.15E-07	4.36E-08	7.21E-09	0	2.86E-07	1.87E-08	7.48E-09	1.50E-08	8.65E-07	2.08E+00	3.99E-09	3.99E+00
	Thorium	0	0	0	0	0	0	2.69E-08	0	1.42E-07	4.21E-10	1.69E-07	4.07E-01	0	0
EA-9	Uranium	1.78E-08	5.57E-08	1.23E-07	3.96E-08	9.28E-09	0	1.58E-07	2.81E-08	3.15E-09	9.09E-09	4.44E-07	1.06E+00	2.00E-09	2.00E+00
	Thorium	0	0	0	0	0	0	1.49E-08	0	5.99E-08	2.54E-10	7.51E-08	1.80E-01	0	0
EA-10	Uranium	1.60E-07	5.03E-07	6.83E-08	2.36E-08	4.12E-09	0	1.16E-06	7.52E-09	5.55E-09	1.31E-07	2.06E-06	4.94E+00	6.13E-09	6.13E+00
	Thorium	0	0	0	0	0	0	1.09E-07	0	1.05E-07	3.66E-09	2.18E-07	5.23E-01	0	0
EA-11	Uranium	9.86E-09	4.33E-08	2.36E-08	6.02E-09	1.85E-09	0	3.17E-07	3.48E-09	4.58E-09	3.57E-08	4.45E-07	1.07E+00	4.22E-09	4.22E+00
	Thorium	0	0	0	0	0	0	2.98E-08	0	8.70E-08	9.97E-10	1.18E-07	2.83E-01	0	0

1967		Concentration contribution from emission sources (g/m^3)										Total conc. (g/m^3)	Total intake (mg)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	3.27E-14	2.47E-07	6.80E-08	4.82E-08	4.02E-09	0	1.44E-06	2.86E-08	6.18E-09	2.37E-08	1.86E-06	4.47E+00	1.03E-08	1.03E+01
	Thorium	0	0	0	0	0	0	0	0	1.80E-07	3.02E-09	1.83E-07	4.40E-01	0	0
EA-2	Uranium	1.84E-07	7.09E-07	3.49E-07	1.58E-07	5.07E-09	0	1.35E-06	3.71E-08	1.29E-08	5.34E-09	2.81E-06	6.75E+00	5.33E-09	5.33E+00
	Thorium	0	0	0	0	0	0	0	0	3.76E-07	6.82E-10	3.77E-07	9.05E-01	0	0
EA-3	Uranium	9.15E-08	4.52E-07	7.03E-09	2.78E-11	1.28E-09	0	2.22E-06	3.07E-08	1.15E-08	4.45E-09	2.82E-06	6.76E+00	4.79E-09	4.79E+00
	Thorium	0	0	0	0	0	0	0	0	3.34E-07	5.68E-10	3.34E-07	8.03E-01	0	0
EA-4	Uranium	9.75E-08	5.85E-11	4.79E-08	5.70E-08	6.34E-09	0	2.61E-10	2.62E-08	2.14E-10	6.26E-09	2.42E-07	5.80E-01	1.32E-08	1.32E+01
	Thorium	0	0	0	0	0	0	0	0	6.24E-09	7.98E-10	7.04E-09	1.69E-02	0	0
EA-5	Uranium	6.75E-08	1.63E-07	6.54E-08	8.02E-09	7.73E-10	0	4.57E-07	7.75E-09	2.71E-09	2.11E-07	9.83E-07	2.36E+00	1.20E-08	1.20E+01
	Thorium	0	0	0	0	0	0	0	0	7.91E-08	2.69E-08	1.06E-07	2.54E-01	0	0
EA-6	Uranium	6.63E-08	1.99E-07	1.03E-07	1.25E-08	5.15E-10	0	4.93E-07	6.30E-09	2.79E-09	3.73E-08	9.21E-07	2.21E+00	3.94E-09	3.94E+00
	Thorium	0	0	0	0	0	0	0	0	8.14E-08	4.75E-09	8.61E-08	2.07E-01	0	0
EA-7	Uranium	6.63E-08	2.35E-07	8.11E-08	2.90E-08	4.65E-09	0	1.51E-06	2.93E-08	3.85E-09	6.55E-09	1.97E-06	4.72E+00	6.01E-09	6.01E+00
	Thorium	0	0	0	0	0	0	0	0	1.12E-07	8.35E-10	1.13E-07	2.71E-01	0	0
EA-8	Uranium	9.69E-08	3.51E-07	1.42E-07	8.38E-08	4.35E-09	0	5.04E-07	2.86E-08	4.87E-09	3.27E-09	1.22E-06	2.93E+00	3.99E-09	3.99E+00
	Thorium	0	0	0	0	0	0	0	0	1.42E-07	4.17E-10	1.43E-07	3.42E-01	0	0
EA-9	Uranium	1.86E-08	7.01E-08	1.51E-07	7.62E-08	5.60E-09	0	2.79E-07	4.29E-08	2.06E-09	1.97E-09	6.47E-07	1.55E+00	2.00E-09	2.00E+00
	Thorium	0	0	0	0	0	0	0	0	5.99E-08	2.52E-10	6.02E-08	1.44E-01	0	0
EA-10	Uranium	1.68E-07	6.32E-07	8.40E-08	4.55E-08	2.49E-09	0	2.03E-06	1.15E-08	3.62E-09	2.84E-08	3.01E-06	7.23E+00	6.13E-09	6.13E+00
	Thorium	0	0	0	0	0	0	0	0	1.05E-07	3.62E-09	1.09E-07	2.62E-01	0	0
EA-11	Uranium	1.04E-08	5.45E-08	2.90E-08	1.16E-08	1.12E-09	0	5.58E-07	5.33E-09	2.98E-09	7.74E-09	6.81E-07	1.63E+00	4.22E-09	4.22E+00
	Thorium	0	0	0	0	0	0	0	0	8.70E-08	9.87E-10	8.79E-08	2.11E-01	0	0

Appendix 4A (Cont'd). FEMP radionuclide concentration and intake results by exposure area and year.

1968		Concentration contribution from emission sources (g/m^3)										Total conc. (g/m^3)	Total intake (mg)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	2.90E-14	4.28E-07	6.48E-08	2.88E-08	1.10E-08	0	2.59E-06	4.33E-08	1.89E-09	2.62E-08	3.20E-06	7.67E+00	1.03E-08	1.03E+01
	Thorium	0	0	0	0	0	0	0	0	1.80E-07	3.31E-09	1.83E-07	4.40E-01	0	0
EA-2	Uranium	1.62E-07	1.23E-06	3.33E-07	9.42E-08	1.38E-08	0	2.44E-06	5.61E-08	3.94E-09	5.90E-09	4.34E-06	1.04E+01	5.33E-09	5.33E+00
	Thorium	0	0	0	0	0	0	0	0	3.76E-07	7.47E-10	3.77E-07	9.05E-01	0	0
EA-3	Uranium	8.09E-08	7.83E-07	6.70E-09	1.66E-11	3.50E-09	0	4.01E-06	4.64E-08	3.49E-09	4.92E-09	4.93E-06	1.18E+01	4.79E-09	4.79E+00
	Thorium	0	0	0	0	0	0	0	0	3.34E-07	6.22E-10	3.34E-07	8.03E-01	0	0
EA-4	Uranium	8.62E-08	1.01E-10	4.57E-08	3.40E-08	1.73E-08	0	4.70E-10	3.97E-08	6.53E-11	6.91E-09	2.30E-07	5.53E-01	1.32E-08	1.32E+01
	Thorium	0	0	0	0	0	0	0	0	6.24E-09	8.74E-10	7.11E-09	1.71E-02	0	0
EA-5	Uranium	5.97E-08	2.82E-07	6.24E-08	4.78E-09	2.11E-09	0	8.25E-07	1.17E-08	8.28E-10	2.33E-07	1.48E-06	3.55E+00	1.20E-08	1.20E+01
	Thorium	0	0	0	0	0	0	0	0	7.91E-08	2.95E-08	1.09E-07	2.61E-01	0	0
EA-6	Uranium	5.86E-08	3.45E-07	9.84E-08	7.43E-09	1.41E-09	0	8.90E-07	9.52E-09	8.52E-10	4.12E-08	1.45E-06	3.48E+00	3.94E-09	3.94E+00
	Thorium	0	0	0	0	0	0	0	0	8.14E-08	5.21E-09	8.66E-08	2.08E-01	0	0
EA-7	Uranium	5.86E-08	4.07E-07	7.74E-08	1.73E-08	1.27E-08	0	2.73E-06	4.43E-08	1.17E-09	7.23E-09	3.35E-06	8.05E+00	6.01E-09	6.01E+00
	Thorium	0	0	0	0	0	0	0	0	1.12E-07	9.15E-10	1.13E-07	2.71E-01	0	0
EA-8	Uranium	8.57E-08	6.08E-07	1.36E-07	5.00E-08	1.19E-08	0	9.10E-07	4.33E-08	1.49E-09	3.61E-09	1.85E-06	4.44E+00	3.99E-09	3.99E+00
	Thorium	0	0	0	0	0	0	0	0	1.42E-07	4.56E-10	1.43E-07	3.42E-01	0	0
EA-9	Uranium	1.65E-08	1.21E-07	1.44E-07	4.54E-08	1.53E-08	0	5.03E-07	6.49E-08	6.27E-10	2.18E-09	9.13E-07	2.19E+00	2.00E-09	2.00E+00
	Thorium	0	0	0	0	0	0	0	0	5.99E-08	2.76E-10	6.02E-08	1.44E-01	0	0
EA-10	Uranium	1.49E-07	1.09E-06	8.02E-08	2.71E-08	6.78E-09	0	3.67E-06	1.74E-08	1.10E-09	3.14E-08	5.08E-06	1.22E+01	6.13E-09	6.13E+00
	Thorium	0	0	0	0	0	0	0	0	1.05E-07	3.97E-09	1.09E-07	2.63E-01	0	0
EA-11	Uranium	9.16E-09	9.43E-08	2.77E-08	6.90E-09	3.05E-09	0	1.01E-06	8.06E-09	9.10E-10	8.55E-09	1.17E-06	2.80E+00	4.22E-09	4.22E+00
	Thorium	0	0	0	0	0	0	0	0	8.70E-08	1.08E-09	8.80E-08	2.11E-01	0	0

1969		Concentration contribution from emission sources (g/m^3)										Total conc. (g/m^3)	Total intake (mg)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	2.95E-14	2.67E-07	1.24E-08	3.89E-08	2.76E-09	0	2.31E-06	4.84E-09	1.89E-09	3.39E-08	2.67E-06	6.41E+00	1.03E-08	1.03E+01
	Thorium	0	0	0	0	0	0	6.77E-07	0	2.06E-07	3.32E-09	8.86E-07	2.13E+00	0	0
EA-2	Uranium	1.65E-07	7.65E-07	6.39E-08	1.27E-07	3.49E-09	0	2.18E-06	6.28E-09	3.94E-09	7.66E-09	3.32E-06	7.97E+00	5.33E-09	5.33E+00
	Thorium	0	0	0	0	0	0	6.38E-07	0	4.31E-07	7.50E-10	1.07E-06	2.57E+00	0	0
EA-3	Uranium	8.23E-08	4.88E-07	1.29E-09	2.24E-11	8.83E-10	0	3.57E-06	5.19E-09	3.49E-09	6.38E-09	4.15E-06	9.97E+00	4.79E-09	4.79E+00
	Thorium	0	0	0	0	0	0	1.05E-06	0	3.82E-07	6.25E-10	1.43E-06	3.43E+00	0	0
EA-4	Uranium	8.77E-08	6.32E-11	8.76E-09	4.60E-08	4.36E-09	0	4.19E-10	4.43E-09	6.53E-11	8.96E-09	1.61E-07	3.86E-01	1.32E-08	1.32E+01
	Thorium	0	0	0	0	0	0	1.23E-10	0	7.15E-09	8.78E-10	8.15E-09	1.96E-02	0	0
EA-5	Uranium	6.07E-08	1.76E-07	1.20E-08	6.47E-09	5.31E-10	0	7.34E-07	1.31E-09	8.28E-10	3.02E-07	1.29E-06	3.11E+00	1.20E-08	1.20E+01
	Thorium	0	0	0	0	0	0	2.15E-07	0	9.06E-08	2.96E-08	3.36E-07	8.05E-01	0	0
EA-6	Uranium	5.97E-08	2.15E-07	1.89E-08	1.01E-08	3.54E-10	0	7.92E-07	1.06E-09	8.52E-10	5.34E-08	1.15E-06	2.76E+00	3.94E-09	3.94E+00
	Thorium	0	0	0	0	0	0	2.32E-07	0	9.32E-08	5.23E-09	3.31E-07	7.94E-01	0	0
EA-7	Uranium	5.97E-08	2.54E-07	1.48E-08	2.34E-08	3.20E-09	0	2.43E-06	4.95E-09	1.17E-09	9.38E-09	2.80E-06	6.72E+00	6.01E-09	6.01E+00
	Thorium	0	0	0	0	0	0	7.12E-07	0	1.28E-07	9.19E-10	8.42E-07	2.02E+00	0	0
EA-8	Uranium	8.72E-08	3.79E-07	2.60E-08	6.76E-08	2.99E-09	0	8.10E-07	4.84E-09	1.49E-09	4.68E-09	1.38E-06	3.32E+00	3.99E-09	3.99E+00
	Thorium	0	0	0	0	0	0	2.37E-07	0	1.63E-07	4.58E-10	4.01E-07	9.62E-01	0	0
EA-9	Uranium	1.68E-08	7.56E-08	2.77E-08	6.14E-08	3.85E-09	0	4.48E-07	7.26E-09	6.27E-10	2.83E-09	6.44E-07	1.54E+00	2.00E-09	2.00E+00
	Thorium	0	0	0	0	0	0	1.31E-07	0	6.86E-08	2.77E-10	2.00E-07	4.80E-01	0	0
EA-10	Uranium	1.52E-07	6.83E-07	1.54E-08	3.67E-08	1.71E-09	0	3.27E-06	1.95E-09	1.10E-09	4.07E-08	4.20E-06	1.01E+01	6.13E-09	6.13E+00
	Thorium	0	0	0	0	0	0	9.58E-07	0	1.21E-07	3.99E-09	1.08E-06	2.60E+00	0	0
EA-11	Uranium	9.32E-09	5.88E-08	5.31E-09	9.34E-09	7.68E-10	0	8.97E-07	9.01E-10	9.10E-10	1.11E-08	9.93E-07	2.38E+00	4.22E-09	4.22E+00
	Thorium	0	0	0	0	0	0	2.63E-07	0	9.96E-08	1.09E-09	3.64E-07	8.73E-01	0	0

Appendix 4A (Cont'd). FEMP radionuclide concentration and intake results by exposure area and year.

1970		Concentration contribution from emission sources (g/m^3)										Total conc. (g/m^3)	Total intake (mg)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	2.08E-14	1.36E-07	7.58E-09	1.73E-08	1.64E-09	0	8.04E-07	5.02E-09	0	3.55E-08	1.01E-06	2.42E+00	1.03E-08	1.03E+01
	Thorium	0	0	0	0	0	0	4.55E-07	0	2.61E-07	3.32E-09	7.19E-07	1.73E+00	0	0
EA-2	Uranium	1.17E-07	3.91E-07	3.89E-08	5.68E-08	2.07E-09	0	7.58E-07	6.52E-09	0	8.00E-09	1.38E-06	3.31E+00	5.33E-09	5.33E+00
	Thorium	0	0	0	0	0	0	4.29E-07	0	5.46E-07	7.50E-10	9.75E-07	2.34E+00	0	0
EA-3	Uranium	5.81E-08	2.49E-07	7.84E-10	9.99E-12	5.25E-10	0	1.24E-06	5.39E-09	0	6.67E-09	1.56E-06	3.75E+00	4.79E-09	4.79E+00
	Thorium	0	0	0	0	0	0	7.03E-07	0	4.84E-07	6.25E-10	1.19E-06	2.85E+00	0	0
EA-4	Uranium	6.19E-08	3.23E-11	5.34E-09	2.05E-08	2.59E-09	0	1.46E-10	4.60E-09	0	9.37E-09	1.04E-07	2.51E-01	1.32E-08	1.32E+01
	Thorium	0	0	0	0	0	0	8.25E-11	0	9.05E-09	8.78E-10	1.00E-08	2.40E-02	0	0
EA-5	Uranium	4.29E-08	8.98E-08	7.29E-09	2.88E-09	3.16E-10	0	2.56E-07	1.36E-09	0	3.16E-07	7.16E-07	1.72E+00	1.20E-08	1.20E+01
	Thorium	0	0	0	0	0	0	1.45E-07	0	1.15E-07	2.96E-08	2.89E-07	6.94E-01	0	0
EA-6	Uranium	4.21E-08	1.10E-07	1.15E-08	4.48E-09	2.11E-10	0	2.76E-07	1.11E-09	0	5.58E-08	5.01E-07	1.20E+00	3.94E-09	3.94E+00
	Thorium	0	0	0	0	0	0	1.56E-07	0	1.18E-07	5.23E-09	2.79E-07	6.71E-01	0	0
EA-7	Uranium	4.21E-08	1.30E-07	9.05E-09	1.04E-08	1.90E-09	0	8.46E-07	5.14E-09	0	9.81E-09	1.05E-06	2.53E+00	6.01E-09	6.01E+00
	Thorium	0	0	0	0	0	0	4.79E-07	0	1.63E-07	9.19E-10	6.42E-07	1.54E+00	0	0
EA-8	Uranium	6.15E-08	1.94E-07	1.59E-08	3.01E-08	1.78E-09	0	2.82E-07	5.02E-09	0	4.89E-09	5.95E-07	1.43E+00	3.99E-09	3.99E+00
	Thorium	0	0	0	0	0	0	1.60E-07	0	2.06E-07	4.58E-10	3.66E-07	8.79E-01	0	0
EA-9	Uranium	1.18E-08	3.86E-08	1.69E-08	2.74E-08	2.29E-09	0	1.56E-07	7.53E-09	0	2.95E-09	2.63E-07	6.32E-01	2.00E-09	2.00E+00
	Thorium	0	0	0	0	0	0	8.82E-08	0	8.69E-08	2.77E-10	1.75E-07	4.21E-01	0	0
EA-10	Uranium	1.07E-07	3.49E-07	9.37E-09	1.63E-08	1.02E-09	0	1.14E-06	2.02E-09	0	4.26E-08	1.67E-06	4.00E+00	6.13E-09	6.13E+00
	Thorium	0	0	0	0	0	0	6.44E-07	0	1.53E-07	3.99E-09	8.01E-07	1.92E+00	0	0
EA-11	Uranium	6.58E-09	3.01E-08	3.24E-09	4.16E-09	4.56E-10	0	3.12E-07	9.35E-10	0	1.16E-08	3.69E-07	8.86E-01	4.22E-09	4.22E+00
	Thorium	0	0	0	0	0	0	1.77E-07	0	1.26E-07	1.09E-09	3.04E-07	7.29E-01	0	0

1971		Concentration contribution from emission sources (g/m^3)										Total conc. (g/m^3)	Total intake (mg)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	2.17E-14	1.17E-07	2.13E-10	3.25E-11	7.59E-10	0	4.11E-07	2.31E-10	0	3.47E-08	5.64E-07	1.35E+00	1.03E-08	1.03E+01
	Thorium	0	0	0	0	0	0	2.80E-07	0	3.25E-08	3.32E-09	3.16E-07	7.57E-01	0	0
EA-2	Uranium	1.21E-07	3.35E-07	1.09E-09	1.07E-10	9.58E-10	0	3.88E-07	2.99E-10	0	7.84E-09	8.55E-07	2.05E+00	5.33E-09	5.33E+00
	Thorium	0	0	0	0	0	0	2.64E-07	0	6.78E-08	7.50E-10	3.32E-07	7.98E-01	0	0
EA-3	Uranium	6.05E-08	2.14E-07	2.20E-11	1.88E-14	2.43E-10	0	6.36E-07	2.48E-10	0	6.53E-09	9.17E-07	2.20E+00	4.79E-09	4.79E+00
	Thorium	0	0	0	0	0	0	4.32E-07	0	6.02E-08	6.25E-10	4.93E-07	1.18E+00	0	0
EA-4	Uranium	6.44E-08	2.77E-11	1.50E-10	3.84E-11	1.20E-09	0	7.46E-11	2.11E-10	0	9.18E-09	7.53E-08	1.81E-01	1.32E-08	1.32E+01
	Thorium	0	0	0	0	0	0	5.08E-11	0	1.12E-09	8.78E-10	2.05E-09	4.93E-03	0	0
EA-5	Uranium	4.46E-08	7.70E-08	2.05E-10	5.41E-12	1.46E-10	0	1.31E-07	6.25E-11	0	3.09E-07	5.62E-07	1.35E+00	1.20E-08	1.20E+01
	Thorium	0	0	0	0	0	0	8.90E-08	0	1.43E-08	2.96E-08	1.33E-07	3.19E-01	0	0
EA-6	Uranium	4.38E-08	9.41E-08	3.23E-10	8.41E-12	9.73E-11	0	1.41E-07	5.08E-11	0	5.47E-08	3.34E-07	8.02E-01	3.94E-09	3.94E+00
	Thorium	0	0	0	0	0	0	9.61E-08	0	1.47E-08	5.23E-09	1.16E-07	2.78E-01	0	0
EA-7	Uranium	4.38E-08	1.11E-07	2.54E-10	1.95E-11	8.78E-10	0	4.33E-07	2.36E-10	0	9.61E-09	5.99E-07	1.44E+00	6.01E-09	6.01E+00
	Thorium	0	0	0	0	0	0	2.95E-07	0	2.02E-08	9.19E-10	3.16E-07	7.58E-01	0	0
EA-8	Uranium	6.41E-08	1.66E-07	4.45E-10	5.65E-11	8.22E-10	0	1.44E-07	2.31E-10	0	4.79E-09	3.81E-07	9.14E-01	3.99E-09	3.99E+00
	Thorium	0	0	0	0	0	0	9.82E-08	0	2.56E-08	4.58E-10	1.24E-07	2.98E-01	0	0
EA-9	Uranium	1.23E-08	3.31E-08	4.74E-10	5.14E-11	1.06E-09	0	7.97E-08	3.46E-10	0	2.89E-09	1.30E-07	3.12E-01	2.00E-09	2.00E+00
	Thorium	0	0	0	0	0	0	5.42E-08	0	1.08E-08	2.77E-10	6.53E-08	1.57E-01	0	0
EA-10	Uranium	1.11E-07	2.99E-07	2.63E-10	3.07E-11	4.69E-10	0	5.82E-07	9.28E-11	0	4.17E-08	1.04E-06	2.49E+00	6.13E-09	6.13E+00
	Thorium	0	0	0	0	0	0	3.96E-07	0	1.90E-08	3.99E-09	4.19E-07	1.01E+00	0	0
EA-11	Uranium	6.85E-09	2.58E-08	9.09E-11	7.81E-12	2.11E-10	0	1.60E-07	4.30E-11	0	1.14E-08	2.04E-07	4.90E-01	4.22E-09	4.22E+00
	Thorium	0	0	0	0	0	0	1.09E-07	0	1.57E-08	1.09E-09	1.25E-07	3.01E-01	0	0

Appendix 4A (Cont'd). FEMP radionuclide concentration and intake results by exposure area and year.

1972		Concentration contribution from emission sources (g/m^3)										Total conc. (g/m^3)	Total intake (mg)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	2.53E-14	5.20E-07	2.34E-09	1.08E-08	4.53E-10	0	3.28E-09	8.73E-09	0	3.34E-08	5.79E-07	1.39E+00	1.03E-08	1.03E+01
	Thorium	0	0	0	0	0	0	0	0	7.38E-08	3.60E-09	7.74E-08	1.86E-01	0	0
EA-2	Uranium	1.42E-07	1.49E-06	1.20E-08	3.53E-08	5.71E-10	0	3.09E-09	1.13E-08	0	7.54E-09	1.70E-06	4.08E+00	5.33E-09	5.33E+00
	Thorium	0	0	0	0	0	0	0	0	1.54E-07	8.11E-10	1.55E-07	3.72E-01	0	0
EA-3	Uranium	7.08E-08	9.51E-07	2.42E-10	6.21E-12	1.45E-10	0	5.07E-09	9.37E-09	0	6.28E-09	1.04E-06	2.50E+00	4.79E-09	4.79E+00
	Thorium	0	0	0	0	0	0	0	0	1.37E-07	6.76E-10	1.38E-07	3.30E-01	0	0
EA-4	Uranium	7.54E-08	1.23E-10	1.65E-09	1.27E-08	7.14E-10	0	5.95E-13	8.00E-09	0	8.83E-09	1.07E-07	2.58E-01	1.32E-08	1.32E+01
	Thorium	0	0	0	0	0	0	0	0	2.56E-09	9.50E-10	3.51E-09	8.42E-03	0	0
EA-5	Uranium	5.22E-08	3.42E-07	2.25E-09	1.79E-09	8.70E-11	0	1.04E-09	2.36E-09	0	2.98E-07	7.00E-07	1.68E+00	1.20E-08	1.20E+01
	Thorium	0	0	0	0	0	0	0	0	3.24E-08	3.20E-08	6.45E-08	1.55E-01	0	0
EA-6	Uranium	5.13E-08	4.18E-07	3.56E-09	2.78E-09	5.80E-11	0	1.13E-09	1.92E-09	0	5.26E-08	5.32E-07	1.28E+00	3.94E-09	3.94E+00
	Thorium	0	0	0	0	0	0	0	0	3.34E-08	5.66E-09	3.90E-08	9.36E-02	0	0
EA-7	Uranium	5.13E-08	4.94E-07	2.80E-09	6.47E-09	5.24E-10	0	3.45E-09	8.93E-09	0	9.24E-09	5.77E-07	1.38E+00	6.01E-09	6.01E+00
	Thorium	0	0	0	0	0	0	0	0	4.60E-08	9.95E-10	4.70E-08	1.13E-01	0	0
EA-8	Uranium	7.50E-08	7.39E-07	4.90E-09	1.87E-08	4.90E-10	0	1.15E-09	8.73E-09	0	4.61E-09	8.52E-07	2.04E+00	3.99E-09	3.99E+00
	Thorium	0	0	0	0	0	0	0	0	5.82E-08	4.96E-10	5.87E-08	1.41E-01	0	0
EA-9	Uranium	1.44E-08	1.47E-07	5.22E-09	1.70E-08	6.30E-10	0	6.36E-10	1.31E-08	0	2.78E-09	2.01E-07	4.83E-01	2.00E-09	2.00E+00
	Thorium	0	0	0	0	0	0	0	0	2.46E-08	3.00E-10	2.49E-08	5.97E-02	0	0
EA-10	Uranium	1.30E-07	1.33E-06	2.90E-09	1.02E-08	2.80E-10	0	4.64E-09	3.51E-09	0	4.01E-08	1.52E-06	3.65E+00	6.13E-09	6.13E+00
	Thorium	0	0	0	0	0	0	0	0	4.32E-08	4.32E-09	4.76E-08	1.14E-01	0	0
EA-11	Uranium	8.01E-09	1.15E-07	1.00E-09	2.59E-09	1.26E-10	0	1.27E-09	1.63E-09	0	1.09E-08	1.40E-07	3.36E-01	4.22E-09	4.22E+00
	Thorium	0	0	0	0	0	0	0	0	3.56E-08	1.18E-09	3.68E-08	8.84E-02	0	0

1973		Concentration contribution from emission sources (g/m^3)										Total conc. (g/m^3)	Total intake (mg)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	2.01E-14	5.34E-07	1.39E-08	2.57E-08	8.52E-10	0	3.45E-08	5.63E-09	0	3.28E-08	6.47E-07	1.55E+00	1.03E-08	1.03E+01
	Thorium	0	0	0	0	0	0	0	0	2.62E-08	3.58E-09	2.98E-08	7.14E-02	0	0
EA-2	Uranium	1.13E-07	1.53E-06	7.15E-08	8.43E-08	1.08E-09	0	3.25E-08	7.31E-09	0	7.39E-09	1.85E-06	4.43E+00	5.33E-09	5.33E+00
	Thorium	0	0	0	0	0	0	0	0	5.47E-08	8.08E-10	5.55E-08	1.33E-01	0	0
EA-3	Uranium	5.62E-08	9.76E-07	1.44E-09	1.48E-11	2.72E-10	0	5.33E-08	6.04E-09	0	6.16E-09	1.10E-06	2.64E+00	4.79E-09	4.79E+00
	Thorium	0	0	0	0	0	0	0	0	4.85E-08	6.74E-10	4.92E-08	1.18E-01	0	0
EA-4	Uranium	5.99E-08	1.26E-10	9.81E-09	3.04E-08	1.34E-09	0	6.26E-12	5.16E-09	0	8.65E-09	1.15E-07	2.77E-01	1.32E-08	1.32E+01
	Thorium	0	0	0	0	0	0	0	0	9.07E-10	9.46E-10	1.85E-09	4.45E-03	0	0
EA-5	Uranium	4.15E-08	3.51E-07	1.34E-08	4.28E-09	1.64E-10	0	1.10E-08	1.53E-09	0	2.92E-07	7.15E-07	1.72E+00	1.20E-08	1.20E+01
	Thorium	0	0	0	0	0	0	0	0	1.15E-08	3.19E-08	4.34E-08	1.04E-01	0	0
EA-6	Uranium	4.08E-08	4.30E-07	2.11E-08	6.65E-09	1.09E-10	0	1.18E-08	1.24E-09	0	5.15E-08	5.63E-07	1.35E+00	3.94E-09	3.94E+00
	Thorium	0	0	0	0	0	0	0	0	1.18E-08	5.64E-09	1.75E-08	4.19E-02	0	0
EA-7	Uranium	4.08E-08	5.08E-07	1.66E-08	1.55E-08	9.86E-10	0	3.63E-08	5.76E-09	0	9.06E-09	6.33E-07	1.52E+00	6.01E-09	6.01E+00
	Thorium	0	0	0	0	0	0	0	0	1.63E-08	9.91E-10	1.73E-08	4.15E-02	0	0
EA-8	Uranium	5.96E-08	7.58E-07	2.91E-08	4.47E-08	9.22E-10	0	1.21E-08	5.63E-09	0	4.52E-09	9.15E-07	2.20E+00	3.99E-09	3.99E+00
	Thorium	0	0	0	0	0	0	0	0	2.07E-08	4.94E-10	2.11E-08	5.08E-02	0	0
EA-9	Uranium	1.15E-08	1.51E-07	3.10E-08	4.06E-08	1.19E-09	0	6.69E-09	8.45E-09	0	2.73E-09	2.53E-07	6.08E-01	2.00E-09	2.00E+00
	Thorium	0	0	0	0	0	0	0	0	8.71E-09	2.98E-10	9.01E-09	2.16E-02	0	0
EA-10	Uranium	1.04E-07	1.36E-06	1.72E-08	2.43E-08	5.27E-10	0	4.89E-08	2.26E-09	0	3.93E-08	1.60E-06	3.84E+00	6.13E-09	6.13E+00
	Thorium	0	0	0	0	0	0	0	0	1.53E-08	4.30E-09	1.96E-08	4.71E-02	0	0
EA-11	Uranium	6.37E-09	1.18E-07	5.94E-09	6.18E-09	2.37E-10	0	1.34E-08	1.05E-09	0	1.07E-08	1.61E-07	3.88E-01	4.22E-09	4.22E+00
	Thorium	0	0	0	0	0	0	0	0	1.26E-08	1.17E-09	1.38E-08	3.31E-02	0	0

Appendix 4A (Cont'd). FEMP radionuclide concentration and intake results by exposure area and year.

1974		Concentration contribution from emission sources (g/m^3)										Total conc. (g/m^3)	Total intake (mg)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	2.02E-14	9.35E-07	6.03E-09	1.30E-08	4.75E-10	0	7.16E-09	1.38E-08	0	3.08E-08	1.01E-06	2.42E+00	1.03E-08	1.03E+01
	Thorium	0	0	0	0	0	0	0	0	5.24E-08	3.73E-09	5.61E-08	1.35E-01	0	0
EA-2	Uranium	1.13E-07	2.68E-06	3.10E-08	4.27E-08	6.00E-10	0	6.75E-09	1.79E-08	0	6.94E-09	2.90E-06	6.96E+00	5.33E-09	5.33E+00
	Thorium	0	0	0	0	0	0	0	0	1.09E-07	8.41E-10	1.10E-07	2.65E-01	0	0
EA-3	Uranium	5.65E-08	1.71E-06	6.23E-10	7.52E-12	1.52E-10	0	1.11E-08	1.48E-08	0	5.78E-09	1.80E-06	4.32E+00	4.79E-09	4.79E+00
	Thorium	0	0	0	0	0	0	0	0	9.70E-08	7.01E-10	9.77E-08	2.35E-01	0	0
EA-4	Uranium	6.01E-08	2.21E-10	4.25E-09	1.54E-08	7.50E-10	0	1.30E-12	1.26E-08	0	8.13E-09	1.02E-07	2.44E-01	1.32E-08	1.32E+01
	Thorium	0	0	0	0	0	0	0	0	1.81E-09	9.84E-10	2.80E-09	6.71E-03	0	0
EA-5	Uranium	4.16E-08	6.16E-07	5.80E-09	2.17E-09	9.14E-11	0	2.28E-09	3.73E-09	0	2.74E-07	9.45E-07	2.27E+00	1.20E-08	1.20E+01
	Thorium	0	0	0	0	0	0	0	0	2.30E-08	3.32E-08	5.62E-08	1.35E-01	0	0
EA-6	Uranium	4.09E-08	7.52E-07	9.15E-09	3.37E-09	6.09E-11	0	2.46E-09	3.03E-09	0	4.84E-08	8.60E-07	2.06E+00	3.94E-09	3.94E+00
	Thorium	0	0	0	0	0	0	0	0	2.37E-08	5.86E-09	2.95E-08	7.09E-02	0	0
EA-7	Uranium	4.09E-08	8.89E-07	7.19E-09	7.84E-09	5.50E-10	0	7.54E-09	1.41E-08	0	8.51E-09	9.76E-07	2.34E+00	6.01E-09	6.01E+00
	Thorium	0	0	0	0	0	0	0	0	3.26E-08	1.03E-09	3.36E-08	8.07E-02	0	0
EA-8	Uranium	5.98E-08	1.33E-06	1.26E-08	2.27E-08	5.14E-10	0	2.51E-09	1.38E-08	0	4.24E-09	1.44E-06	3.47E+00	3.99E-09	3.99E+00
	Thorium	0	0	0	0	0	0	0	0	4.13E-08	5.14E-10	4.18E-08	1.00E-01	0	0
EA-9	Uranium	1.15E-08	2.65E-07	1.34E-08	2.06E-08	6.61E-10	0	1.39E-09	2.07E-08	0	2.56E-09	3.36E-07	8.06E-01	2.00E-09	2.00E+00
	Thorium	0	0	0	0	0	0	0	0	1.74E-08	3.10E-10	1.77E-08	4.26E-02	0	0
EA-10	Uranium	1.04E-07	2.39E-06	7.45E-09	1.23E-08	2.94E-10	0	1.01E-08	5.54E-09	0	3.69E-08	2.57E-06	6.16E+00	6.13E-09	6.13E+00
	Thorium	0	0	0	0	0	0	0	0	3.07E-08	4.47E-09	3.51E-08	8.43E-02	0	0
EA-11	Uranium	6.39E-09	2.06E-07	2.57E-09	3.13E-09	1.32E-10	0	2.78E-09	2.56E-09	0	1.01E-08	2.34E-07	5.61E-01	4.22E-09	4.22E+00
	Thorium	0	0	0	0	0	0	0	0	2.53E-08	1.22E-09	2.65E-08	6.36E-02	0	0

1975		Concentration contribution from emission sources (g/m^3)										Total conc. (g/m^3)	Total intake (mg)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	2.10E-14	1.09E-06	2.89E-08	6.21E-09	3.51E-10	0	2.28E-09	2.41E-10	2.09E-10	3.96E-08	1.17E-06	2.80E+00	1.03E-08	1.03E+01
	Thorium	0	0	0	0	0	0	0	0	1.57E-09	4.21E-09	5.79E-09	1.39E-02	0	0
EA-2	Uranium	1.18E-07	3.12E-06	1.49E-07	2.03E-08	4.44E-10	0	2.15E-09	3.13E-10	4.38E-10	8.94E-09	3.42E-06	8.20E+00	5.33E-09	5.33E+00
	Thorium	0	0	0	0	0	0	0	0	3.28E-09	9.51E-10	4.23E-09	1.02E-02	0	0
EA-3	Uranium	5.87E-08	1.99E-06	2.99E-09	3.58E-12	1.12E-10	0	3.53E-09	2.59E-10	3.88E-10	7.45E-09	2.06E-06	4.95E+00	4.79E-09	4.79E+00
	Thorium	0	0	0	0	0	0	0	0	2.91E-09	7.93E-10	3.70E-09	8.89E-03	0	0
EA-4	Uranium	6.25E-08	2.57E-10	2.04E-08	7.34E-09	5.55E-10	0	4.14E-13	2.21E-10	7.25E-12	1.05E-08	1.02E-07	2.44E-01	1.32E-08	1.32E+01
	Thorium	0	0	0	0	0	0	0	0	5.44E-11	1.11E-09	1.17E-09	2.80E-03	0	0
EA-5	Uranium	4.33E-08	7.16E-07	2.78E-08	1.03E-09	6.76E-11	0	7.27E-10	6.54E-11	9.20E-11	3.53E-07	1.14E-06	2.74E+00	1.20E-08	1.20E+01
	Thorium	0	0	0	0	0	0	0	0	6.90E-10	3.75E-08	3.82E-08	9.18E-02	0	0
EA-6	Uranium	4.25E-08	8.75E-07	4.39E-08	1.61E-09	4.51E-11	0	7.84E-10	5.31E-11	9.46E-11	6.23E-08	1.03E-06	2.46E+00	3.94E-09	3.94E+00
	Thorium	0	0	0	0	0	0	0	0	7.10E-10	6.63E-09	7.34E-09	1.76E-02	0	0
EA-7	Uranium	4.25E-08	1.03E-06	3.45E-08	3.73E-09	4.07E-10	0	2.40E-09	2.47E-10	1.30E-10	1.10E-08	1.13E-06	2.71E+00	6.01E-09	6.01E+00
	Thorium	0	0	0	0	0	0	0	0	9.78E-10	1.17E-09	2.14E-09	5.15E-03	0	0
EA-8	Uranium	6.21E-08	1.55E-06	6.05E-08	1.08E-08	3.80E-10	0	8.01E-10	2.41E-10	1.65E-10	5.46E-09	1.69E-06	4.05E+00	3.99E-09	3.99E+00
	Thorium	0	0	0	0	0	0	0	0	1.24E-09	5.81E-10	1.82E-09	4.37E-03	0	0
EA-9	Uranium	1.20E-08	3.08E-07	6.44E-08	9.81E-09	4.89E-10	0	4.43E-10	3.62E-10	6.97E-11	3.30E-09	3.99E-07	9.58E-01	2.00E-09	2.00E+00
	Thorium	0	0	0	0	0	0	0	0	5.23E-10	3.51E-10	8.74E-10	2.10E-03	0	0
EA-10	Uranium	1.08E-07	2.78E-06	3.58E-08	5.86E-09	2.17E-10	0	3.23E-09	9.70E-11	1.23E-10	4.75E-08	2.98E-06	7.16E+00	6.13E-09	6.13E+00
	Thorium	0	0	0	0	0	0	0	0	9.20E-10	5.06E-09	5.98E-09	1.43E-02	0	0
EA-11	Uranium	6.64E-09	2.40E-07	1.23E-08	1.49E-09	9.76E-11	0	8.87E-10	4.49E-11	1.01E-10	1.29E-08	2.74E-07	6.58E-01	4.22E-09	4.22E+00
	Thorium	0	0	0	0	0	0	0	0	7.58E-10	1.38E-09	2.14E-09	5.13E-03	0	0

Appendix 4A (Cont'd). FEMP radionuclide concentration and intake results by exposure area and year.

1976		Concentration contribution from emission sources (g/m^3)										Total conc. (g/m^3)	Total intake (mg)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	2.05E-14	1.28E-06	6.43E-09	4.49E-09	1.17E-09	0	4.70E-09	1.20E-09	0	4.45E-08	1.34E-06	3.22E+00	1.03E-08	1.03E+01
	Thorium	0	0	0	0	0	0	0	0	0	5.24E-09	5.24E-09	1.26E-02	0	0
EA-2	Uranium	1.15E-07	3.66E-06	3.31E-08	1.47E-08	1.48E-09	0	4.43E-09	1.55E-09	0	1.00E-08	3.84E-06	9.22E+00	5.33E-09	5.33E+00
	Thorium	0	0	0	0	0	0	0	0	0	1.18E-09	1.18E-09	2.84E-03	0	0
EA-3	Uranium	5.71E-08	2.34E-06	6.65E-10	2.59E-12	3.75E-10	0	7.26E-09	1.28E-09	0	8.36E-09	2.41E-06	5.79E+00	4.79E-09	4.79E+00
	Thorium	0	0	0	0	0	0	0	0	0	9.85E-10	9.85E-10	2.36E-03	0	0
EA-4	Uranium	6.09E-08	3.02E-10	4.53E-09	5.31E-09	1.85E-09	0	8.52E-13	1.10E-09	0	1.18E-08	8.57E-08	2.06E-01	1.32E-08	1.32E+01
	Thorium	0	0	0	0	0	0	0	0	0	1.38E-09	1.38E-09	3.32E-03	0	0
EA-5	Uranium	4.21E-08	8.41E-07	6.19E-09	7.46E-10	2.25E-10	0	1.49E-09	3.24E-10	0	3.96E-07	1.29E-06	3.09E+00	1.20E-08	1.20E+01
	Thorium	0	0	0	0	0	0	0	0	0	4.66E-08	4.66E-08	1.12E-01	0	0
EA-6	Uranium	4.14E-08	1.03E-06	9.77E-09	1.16E-09	1.50E-10	0	1.61E-09	2.63E-10	0	7.00E-08	1.15E-06	2.76E+00	3.94E-09	3.94E+00
	Thorium	0	0	0	0	0	0	0	0	0	8.24E-09	8.24E-09	1.98E-02	0	0
EA-7	Uranium	4.14E-08	1.21E-06	7.68E-09	2.70E-09	1.36E-09	0	4.95E-09	1.22E-09	0	1.23E-08	1.29E-06	3.09E+00	6.01E-09	6.01E+00
	Thorium	0	0	0	0	0	0	0	0	0	1.45E-09	1.45E-09	3.48E-03	0	0
EA-8	Uranium	6.05E-08	1.81E-06	1.35E-08	7.80E-09	1.27E-09	0	1.65E-09	1.20E-09	0	6.13E-09	1.91E-06	4.58E+00	3.99E-09	3.99E+00
	Thorium	0	0	0	0	0	0	0	0	0	7.22E-10	7.22E-10	1.73E-03	0	0
EA-9	Uranium	1.16E-08	3.62E-07	1.43E-08	7.09E-09	1.63E-09	0	9.11E-10	1.79E-09	0	3.71E-09	4.03E-07	9.67E-01	2.00E-09	2.00E+00
	Thorium	0	0	0	0	0	0	0	0	0	4.36E-10	4.36E-10	1.05E-03	0	0
EA-10	Uranium	1.05E-07	3.26E-06	7.96E-09	4.23E-09	7.25E-10	0	6.65E-09	4.81E-10	0	5.34E-08	3.44E-06	8.26E+00	6.13E-09	6.13E+00
	Thorium	0	0	0	0	0	0	0	0	0	6.28E-09	6.28E-09	1.51E-02	0	0
EA-11	Uranium	6.47E-09	2.81E-07	2.75E-09	1.08E-09	3.26E-10	0	1.82E-09	2.23E-10	0	1.45E-08	3.09E-07	7.41E-01	4.22E-09	4.22E+00
	Thorium	0	0	0	0	0	0	0	0	0	1.71E-09	1.71E-09	4.11E-03	0	0

1977		Concentration contribution from emission sources (g/m^3)										Total conc. (g/m^3)	Total intake (mg)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	2.01E-14	2.89E-07	3.11E-08	1.74E-08	5.31E-10	0	3.08E-09	2.16E-10	5.45E-09	4.49E-08	3.92E-07	9.41E-01	1.03E-08	1.03E+01
	Thorium	0	0	0	0	0	0	0	0	2.14E-07	4.82E-09	2.18E-07	5.24E-01	0	0
EA-2	Uranium	1.12E-07	8.29E-07	1.60E-07	5.69E-08	6.71E-10	0	2.90E-09	2.81E-10	1.14E-08	1.01E-08	1.18E-06	2.84E+00	5.33E-09	5.33E+00
	Thorium	0	0	0	0	0	0	0	0	4.46E-07	1.09E-09	4.48E-07	1.07E+00	0	0
EA-3	Uranium	5.60E-08	5.29E-07	3.21E-09	1.00E-11	1.70E-10	0	4.76E-09	2.32E-10	1.01E-08	8.45E-09	6.12E-07	1.47E+00	4.79E-09	4.79E+00
	Thorium	0	0	0	0	0	0	0	0	3.96E-07	9.06E-10	3.97E-07	9.52E-01	0	0
EA-4	Uranium	5.97E-08	6.84E-11	2.19E-08	2.05E-08	8.38E-10	0	5.58E-13	1.98E-10	1.89E-10	1.19E-08	1.15E-07	2.77E-01	1.32E-08	1.32E+01
	Thorium	0	0	0	0	0	0	0	0	7.40E-09	1.27E-09	8.67E-09	2.08E-02	0	0
EA-5	Uranium	4.13E-08	1.90E-07	2.99E-08	2.89E-09	1.02E-10	0	9.79E-10	5.86E-11	2.39E-09	4.00E-07	6.68E-07	1.60E+00	1.20E-08	1.20E+01
	Thorium	0	0	0	0	0	0	0	0	9.38E-08	4.29E-08	1.37E-07	3.28E-01	0	0
EA-6	Uranium	4.06E-08	2.33E-07	4.72E-08	4.49E-09	6.81E-11	0	1.06E-09	4.76E-11	2.46E-09	7.07E-08	3.99E-07	9.58E-01	3.94E-09	3.94E+00
	Thorium	0	0	0	0	0	0	0	0	9.65E-08	7.58E-09	1.04E-07	2.50E-01	0	0
EA-7	Uranium	4.06E-08	2.75E-07	3.71E-08	1.04E-08	6.15E-10	0	3.24E-09	2.21E-10	3.39E-09	1.24E-08	3.83E-07	9.19E-01	6.01E-09	6.01E+00
	Thorium	0	0	0	0	0	0	0	0	1.33E-07	1.33E-09	1.34E-07	3.23E-01	0	0
EA-8	Uranium	5.93E-08	4.11E-07	6.50E-08	3.02E-08	5.75E-10	0	1.08E-09	2.16E-10	4.30E-09	6.19E-09	5.78E-07	1.39E+00	3.99E-09	3.99E+00
	Thorium	0	0	0	0	0	0	0	0	1.69E-07	6.65E-10	1.69E-07	4.06E-01	0	0
EA-9	Uranium	1.14E-08	8.19E-08	6.92E-08	2.74E-08	7.40E-10	0	5.97E-10	3.25E-10	1.81E-09	3.74E-09	1.97E-07	4.73E-01	2.00E-09	2.00E+00
	Thorium	0	0	0	0	0	0	0	0	7.11E-08	4.01E-10	7.15E-08	1.72E-01	0	0
EA-10	Uranium	1.03E-07	7.39E-07	3.84E-08	1.64E-08	3.29E-10	0	4.36E-09	8.71E-11	3.19E-09	5.39E-08	9.59E-07	2.30E+00	6.13E-09	6.13E+00
	Thorium	0	0	0	0	0	0	0	0	1.25E-07	5.78E-09	1.31E-07	3.14E-01	0	0
EA-11	Uranium	6.34E-09	6.37E-08	1.33E-08	4.17E-09	1.48E-10	0	1.20E-09	4.03E-11	2.63E-09	1.47E-08	1.06E-07	2.55E-01	4.22E-09	4.22E+00
	Thorium	0	0	0	0	0	0	0	0	1.03E-07	1.58E-09	1.05E-07	2.51E-01	0	0

Appendix 4A (Cont'd). FEMP radionuclide concentration and intake results by exposure area and year.

1978		Concentration contribution from emission sources (g/m^3)										Total conc. (g/m^3)	Total intake (mg)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	2.03E-14	0	3.18E-09	9.50E-09	5.40E-10	0	2.60E-11	2.58E-08	1.15E-09	4.82E-08	8.84E-08	2.12E-01	1.03E-08	1.03E+01
	Thorium	0	0	0	0	0	0	0	0	2.14E-07	5.67E-09	2.19E-07	5.26E-01	0	0
EA-2	Uranium	1.14E-07	0	1.63E-08	3.11E-08	6.81E-10	0	2.45E-11	3.34E-08	2.41E-09	1.09E-08	2.09E-07	5.01E-01	5.33E-09	5.33E+00
	Thorium	0	0	0	0	0	0	0	0	4.46E-07	1.28E-09	4.48E-07	1.07E+00	0	0
EA-3	Uranium	5.67E-08	0	3.29E-10	5.48E-12	1.73E-10	0	4.02E-11	2.76E-08	2.14E-09	9.07E-09	9.61E-08	2.31E-01	4.79E-09	4.79E+00
	Thorium	0	0	0	0	0	0	0	0	3.96E-07	1.07E-09	3.97E-07	9.53E-01	0	0
EA-4	Uranium	6.04E-08	0	2.24E-09	1.12E-08	8.52E-10	0	4.72E-15	2.36E-08	3.99E-11	1.27E-08	1.11E-07	2.67E-01	1.32E-08	1.32E+01
	Thorium	0	0	0	0	0	0	0	0	7.40E-09	1.50E-09	8.90E-09	2.14E-02	0	0
EA-5	Uranium	4.18E-08	0	3.06E-09	1.58E-09	1.04E-10	0	8.28E-12	6.98E-09	5.06E-10	4.30E-07	4.84E-07	1.16E+00	1.20E-08	1.20E+01
	Thorium	0	0	0	0	0	0	0	0	9.38E-08	5.05E-08	1.44E-07	3.46E-01	0	0
EA-6	Uranium	4.11E-08	0	4.83E-09	2.46E-09	6.92E-11	0	8.94E-12	5.67E-09	5.20E-10	7.59E-08	1.31E-07	3.13E-01	3.94E-09	3.94E+00
	Thorium	0	0	0	0	0	0	0	0	9.65E-08	8.92E-09	1.05E-07	2.53E-01	0	0
EA-7	Uranium	4.11E-08	0	3.80E-09	5.71E-09	6.25E-10	0	2.74E-11	2.64E-08	7.17E-10	1.33E-08	9.16E-08	2.20E-01	6.01E-09	6.01E+00
	Thorium	0	0	0	0	0	0	0	0	1.33E-07	1.57E-09	1.35E-07	3.23E-01	0	0
EA-8	Uranium	6.00E-08	0	6.65E-09	1.65E-08	5.84E-10	0	9.13E-12	2.58E-08	9.09E-10	6.65E-09	1.17E-07	2.81E-01	3.99E-09	3.99E+00
	Thorium	0	0	0	0	0	0	0	0	1.69E-07	7.82E-10	1.69E-07	4.06E-01	0	0
EA-9	Uranium	1.15E-08	0	7.08E-09	1.50E-08	7.51E-10	0	5.05E-12	3.86E-08	3.83E-10	4.02E-09	7.74E-08	1.86E-01	2.00E-09	2.00E+00
	Thorium	0	0	0	0	0	0	0	0	7.11E-08	4.72E-10	7.16E-08	1.72E-01	0	0
EA-10	Uranium	1.04E-07	0	3.93E-09	8.95E-09	3.34E-10	0	3.69E-11	1.04E-08	6.75E-10	5.79E-08	1.87E-07	4.48E-01	6.13E-09	6.13E+00
	Thorium	0	0	0	0	0	0	0	0	1.25E-07	6.80E-09	1.32E-07	3.17E-01	0	0
EA-11	Uranium	6.42E-09	0	1.36E-09	2.28E-09	1.50E-10	0	1.01E-11	4.80E-09	5.56E-10	1.58E-08	3.13E-08	7.52E-02	4.22E-09	4.22E+00
	Thorium	0	0	0	0	0	0	0	0	1.03E-07	1.85E-09	1.05E-07	2.52E-01	0	0

1979		Concentration contribution from emission sources (g/m^3)										Total conc. (g/m^3)	Total intake (mg)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	1.78E-14	0	1.13E-08	4.03E-09	4.22E-10	0	3.90E-11	1.01E-09	0	6.77E-08	8.45E-08	2.03E-01	1.03E-08	1.03E+01
	Thorium	0	0	0	0	0	0	0	0	2.14E-07	5.94E-09	2.20E-07	5.27E-01	0	0
EA-2	Uranium	9.99E-08	0	5.80E-08	1.32E-08	5.32E-10	0	3.68E-11	1.31E-09	0	1.53E-08	1.88E-07	4.52E-01	5.33E-09	5.33E+00
	Thorium	0	0	0	0	0	0	0	0	4.46E-07	1.34E-09	4.48E-07	1.07E+00	0	0
EA-3	Uranium	4.98E-08	0	1.17E-09	2.33E-12	1.35E-10	0	6.03E-11	1.08E-09	0	1.27E-08	6.49E-08	1.56E-01	4.79E-09	4.79E+00
	Thorium	0	0	0	0	0	0	0	0	3.96E-07	1.12E-09	3.97E-07	9.53E-01	0	0
EA-4	Uranium	5.30E-08	0	7.96E-09	4.77E-09	6.65E-10	0	7.08E-15	9.24E-10	0	1.79E-08	8.52E-08	2.05E-01	1.32E-08	1.32E+01
	Thorium	0	0	0	0	0	0	0	0	7.40E-09	1.57E-09	8.97E-09	2.15E-02	0	0
EA-5	Uranium	3.67E-08	0	1.09E-08	6.70E-10	8.11E-11	0	1.24E-11	2.73E-10	0	6.03E-07	6.51E-07	1.56E+00	1.20E-08	1.20E+01
	Thorium	0	0	0	0	0	0	0	0	9.38E-08	5.29E-08	1.47E-07	3.52E-01	0	0
EA-6	Uranium	3.61E-08	0	1.71E-08	1.04E-09	5.41E-11	0	1.34E-11	2.22E-10	0	1.06E-07	1.61E-07	3.86E-01	3.94E-09	3.94E+00
	Thorium	0	0	0	0	0	0	0	0	9.65E-08	9.35E-09	1.06E-07	2.54E-01	0	0
EA-7	Uranium	3.61E-08	0	1.35E-08	2.42E-09	4.88E-10	0	4.11E-11	1.03E-09	0	1.87E-08	7.22E-08	1.73E-01	6.01E-09	6.01E+00
	Thorium	0	0	0	0	0	0	0	0	1.33E-07	1.64E-09	1.35E-07	3.23E-01	0	0
EA-8	Uranium	5.27E-08	0	2.36E-08	7.01E-09	4.57E-10	0	1.37E-11	1.01E-09	0	9.33E-09	9.41E-08	2.26E-01	3.99E-09	3.99E+00
	Thorium	0	0	0	0	0	0	0	0	1.69E-07	8.19E-10	1.69E-07	4.06E-01	0	0
EA-9	Uranium	1.01E-08	0	2.51E-08	6.37E-09	5.87E-10	0	7.57E-12	1.51E-09	0	5.64E-09	4.94E-08	1.19E-01	2.00E-09	2.00E+00
	Thorium	0	0	0	0	0	0	0	0	7.11E-08	4.95E-10	7.16E-08	1.72E-01	0	0
EA-10	Uranium	9.17E-08	0	1.40E-08	3.80E-09	2.61E-10	0	5.53E-11	4.05E-10	0	8.12E-08	1.91E-07	4.59E-01	6.13E-09	6.13E+00
	Thorium	0	0	0	0	0	0	0	0	1.25E-07	7.13E-09	1.32E-07	3.17E-01	0	0
EA-11	Uranium	5.63E-09	0	4.82E-09	9.68E-10	1.17E-10	0	1.52E-11	1.88E-10	0	2.21E-08	3.39E-08	8.13E-02	4.22E-09	4.22E+00
	Thorium	0	0	0	0	0	0	0	0	1.03E-07	1.94E-09	1.05E-07	2.52E-01	0	0

Appendix 4A (Cont'd). FEMP radionuclide concentration and intake results by exposure area and year.

1980		Concentration contribution from emission sources (g/m^3)										Total conc. (g/m^3)	Total intake (mg)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	4.43E-15	1.03E-09	3.24E-08	2.91E-08	4.61E-10	0	1.05E-08	1.92E-10	1.73E-09	7.53E-08	1.51E-07	3.62E-01	2.06E-09	2.06E+00
	Thorium	0	0	0	0	0	0	0	0	0	2.37E-08	2.37E-08	5.70E-02	0	0
EA-2	Uranium	2.48E-08	2.95E-09	1.66E-07	9.55E-08	5.82E-10	0	9.90E-09	2.49E-10	3.61E-09	1.70E-08	3.21E-07	7.70E-01	1.07E-09	1.07E+00
	Thorium	0	0	0	0	0	0	0	0	0	5.36E-09	5.36E-09	1.29E-02	0	0
EA-3	Uranium	1.24E-08	1.88E-09	3.35E-09	1.68E-11	1.47E-10	0	1.62E-08	2.06E-10	3.20E-09	1.42E-08	5.16E-08	1.24E-01	9.59E-10	9.59E-01
	Thorium	0	0	0	0	0	0	0	0	0	4.46E-09	4.46E-09	1.07E-02	0	0
EA-4	Uranium	1.32E-08	2.44E-13	2.28E-08	3.44E-08	7.28E-10	0	1.91E-12	1.76E-10	5.98E-11	1.99E-08	9.13E-08	2.19E-01	2.63E-09	2.63E+00
	Thorium	0	0	0	0	0	0	0	0	0	6.27E-09	6.27E-09	1.50E-02	0	0
EA-5	Uranium	9.12E-09	6.79E-10	3.11E-08	4.84E-09	8.87E-11	0	3.34E-09	5.19E-11	7.59E-10	6.71E-07	7.21E-07	1.73E+00	2.41E-09	2.41E+00
	Thorium	0	0	0	0	0	0	0	0	0	2.11E-07	2.11E-07	5.07E-01	0	0
EA-6	Uranium	8.96E-09	8.29E-10	4.92E-08	7.54E-09	5.91E-11	0	3.61E-09	4.22E-11	7.81E-10	1.19E-07	1.90E-07	4.55E-01	7.88E-10	7.88E-01
	Thorium	0	0	0	0	0	0	0	0	0	3.74E-08	3.74E-08	8.96E-02	0	0
EA-7	Uranium	8.96E-09	9.80E-10	3.86E-08	1.75E-08	5.34E-10	0	1.11E-08	1.96E-10	1.08E-09	2.08E-08	9.98E-08	2.40E-01	1.20E-09	1.20E+00
	Thorium	0	0	0	0	0	0	0	0	0	6.56E-09	6.56E-09	1.58E-02	0	0
EA-8	Uranium	1.31E-08	1.46E-09	6.77E-08	5.07E-08	4.99E-10	0	3.69E-09	1.92E-10	1.36E-09	1.04E-08	1.49E-07	3.58E-01	7.99E-10	7.99E-01
	Thorium	0	0	0	0	0	0	0	0	0	3.27E-09	3.27E-09	7.86E-03	0	0
EA-9	Uranium	2.52E-09	2.92E-10	7.21E-08	4.60E-08	6.42E-10	0	2.04E-09	2.87E-10	5.75E-10	6.27E-09	1.31E-07	3.14E-01	3.99E-10	3.99E-01
	Thorium	0	0	0	0	0	0	0	0	0	1.98E-09	1.98E-09	4.74E-03	0	0
EA-10	Uranium	2.28E-08	2.64E-09	4.00E-08	2.75E-08	2.85E-10	0	1.49E-08	7.71E-11	1.01E-09	9.04E-08	2.00E-07	4.79E-01	1.23E-09	1.23E+00
	Thorium	0	0	0	0	0	0	0	0	0	2.85E-08	2.85E-08	6.84E-02	0	0
EA-11	Uranium	1.40E-09	2.27E-10	1.38E-08	7.00E-09	1.28E-10	0	4.08E-09	3.57E-11	8.34E-10	2.46E-08	5.22E-08	1.25E-01	8.43E-10	8.43E-01
	Thorium	0	0	0	0	0	0	0	0	0	7.76E-09	7.76E-09	1.86E-02	0	0

1981		Concentration contribution from emission sources (g/m^3)										Total conc. (g/m^3)	Total intake (mg)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	1.80E-15	1.15E-08	1.02E-07	4.41E-08	5.90E-10	0	6.51E-09	2.66E-10	0	9.29E-08	2.57E-07	6.18E-01	2.06E-09	2.06E+00
	Thorium	0	0	0	0	0	0	0	0	0	5.94E-09	5.94E-09	1.43E-02	0	0
EA-2	Uranium	1.01E-08	3.29E-08	5.22E-07	1.45E-07	7.45E-10	0	6.14E-09	3.45E-10	0	2.10E-08	7.38E-07	1.77E+00	1.07E-09	1.07E+00
	Thorium	0	0	0	0	0	0	0	0	0	1.34E-09	1.34E-09	3.22E-03	0	0
EA-3	Uranium	5.04E-09	2.10E-08	1.05E-08	2.54E-11	1.89E-10	0	1.01E-08	2.86E-10	0	1.75E-08	6.46E-08	1.55E-01	9.59E-10	9.59E-01
	Thorium	0	0	0	0	0	0	0	0	0	1.12E-09	1.12E-09	2.68E-03	0	0
EA-4	Uranium	5.37E-09	2.72E-12	7.16E-08	5.22E-08	9.32E-10	0	1.18E-12	2.44E-10	0	2.45E-08	1.55E-07	3.72E-01	2.63E-09	2.63E+00
	Thorium	0	0	0	0	0	0	0	0	0	1.57E-09	1.57E-09	3.77E-03	0	0
EA-5	Uranium	3.72E-09	7.56E-09	9.77E-08	7.34E-09	1.14E-10	0	2.07E-09	7.21E-11	0	8.27E-07	9.46E-07	2.27E+00	2.41E-09	2.41E+00
	Thorium	0	0	0	0	0	0	0	0	0	5.29E-08	5.29E-08	1.27E-01	0	0
EA-6	Uranium	3.65E-09	9.25E-09	1.54E-07	1.14E-08	7.57E-11	0	2.24E-09	5.86E-11	0	1.46E-07	3.27E-07	7.85E-01	7.88E-10	7.88E-01
	Thorium	0	0	0	0	0	0	0	0	0	9.35E-09	9.35E-09	2.24E-02	0	0
EA-7	Uranium	3.65E-09	1.09E-08	1.21E-07	2.65E-08	6.83E-10	0	6.86E-09	2.72E-10	0	2.57E-08	1.96E-07	4.70E-01	1.20E-09	1.20E+00
	Thorium	0	0	0	0	0	0	0	0	0	1.64E-09	1.64E-09	3.94E-03	0	0
EA-8	Uranium	5.34E-09	1.63E-08	2.12E-07	7.67E-08	6.39E-10	0	2.29E-09	2.66E-10	0	1.28E-08	3.27E-07	7.84E-01	7.99E-10	7.99E-01
	Thorium	0	0	0	0	0	0	0	0	0	8.19E-10	8.19E-10	1.97E-03	0	0
EA-9	Uranium	1.03E-09	3.25E-09	2.26E-07	6.97E-08	8.22E-10	0	1.26E-09	3.99E-10	0	7.73E-09	3.10E-07	7.45E-01	3.99E-10	3.99E-01
	Thorium	0	0	0	0	0	0	0	0	0	4.95E-10	4.95E-10	1.19E-03	0	0
EA-10	Uranium	9.29E-09	2.94E-08	1.26E-07	4.16E-08	3.65E-10	0	9.22E-09	1.07E-10	0	1.11E-07	3.27E-07	7.85E-01	1.23E-09	1.23E+00
	Thorium	0	0	0	0	0	0	0	0	0	7.13E-09	7.13E-09	1.71E-02	0	0
EA-11	Uranium	5.71E-10	2.53E-09	4.34E-08	1.06E-08	1.64E-10	0	2.53E-09	4.96E-11	0	3.04E-08	9.02E-08	2.16E-01	8.43E-10	8.43E-01
	Thorium	0	0	0	0	0	0	0	0	0	1.94E-09	1.94E-09	4.66E-03	0	0

Appendix 4A (Cont'd). FEMP radionuclide concentration and intake results by exposure area and year.

1982		Concentration contribution from emission sources (g/m^3)										Total conc. (g/m^3)	Total intake (mg)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	2.07E-15	2.00E-08	5.66E-09	3.97E-08	1.10E-09	0	7.70E-08	2.21E-09	0	9.10E-08	2.37E-07	5.68E-01	2.06E-09	2.06E+00
	Thorium	0	0	0	0	0	0	0	0	0	5.93E-09	5.93E-09	1.42E-02	0	0
EA-2	Uranium	1.16E-08	5.73E-08	2.91E-08	1.30E-07	1.39E-09	0	7.26E-08	2.87E-09	0	2.05E-08	3.25E-07	7.81E-01	1.07E-09	1.07E+00
	Thorium	0	0	0	0	0	0	0	0	0	1.34E-09	1.34E-09	3.21E-03	0	0
EA-3	Uranium	5.78E-09	3.66E-08	5.86E-10	2.29E-11	3.51E-10	0	1.19E-07	2.37E-09	0	1.71E-08	1.82E-07	4.36E-01	9.59E-10	9.59E-01
	Thorium	0	0	0	0	0	0	0	0	0	1.11E-09	1.11E-09	2.67E-03	0	0
EA-4	Uranium	6.16E-09	4.73E-12	3.99E-09	4.69E-08	1.73E-09	0	1.40E-11	2.03E-09	0	2.40E-08	8.49E-08	2.04E-01	2.63E-09	2.63E+00
	Thorium	0	0	0	0	0	0	0	0	0	1.57E-09	1.57E-09	3.76E-03	0	0
EA-5	Uranium	4.27E-09	1.32E-08	5.45E-09	6.60E-09	2.11E-10	0	2.45E-08	5.99E-10	0	8.11E-07	8.65E-07	2.08E+00	2.41E-09	2.41E+00
	Thorium	0	0	0	0	0	0	0	0	0	5.28E-08	5.28E-08	1.27E-01	0	0
EA-6	Uranium	4.19E-09	1.61E-08	8.60E-09	1.03E-08	1.41E-10	0	2.64E-08	4.87E-10	0	1.43E-07	2.09E-07	5.03E-01	7.88E-10	7.88E-01
	Thorium	0	0	0	0	0	0	0	0	0	9.33E-09	9.33E-09	2.24E-02	0	0
EA-7	Uranium	4.19E-09	1.90E-08	6.76E-09	2.38E-08	1.27E-09	0	8.11E-08	2.26E-09	0	2.52E-08	1.64E-07	3.93E-01	1.20E-09	1.20E+00
	Thorium	0	0	0	0	0	0	0	0	0	1.64E-09	1.64E-09	3.93E-03	0	0
EA-8	Uranium	6.12E-09	2.84E-08	1.18E-08	6.90E-08	1.19E-09	0	2.70E-08	2.21E-09	0	1.25E-08	1.58E-07	3.80E-01	7.99E-10	7.99E-01
	Thorium	0	0	0	0	0	0	0	0	0	8.17E-10	8.17E-10	1.96E-03	0	0
EA-9	Uranium	1.18E-09	5.67E-09	1.26E-08	6.27E-08	1.53E-09	0	1.49E-08	3.32E-09	0	7.58E-09	1.09E-07	2.63E-01	3.99E-10	3.99E-01
	Thorium	0	0	0	0	0	0	0	0	0	4.94E-10	4.94E-10	1.18E-03	0	0
EA-10	Uranium	1.07E-08	5.11E-08	7.00E-09	3.74E-08	6.80E-10	0	1.09E-07	8.89E-10	0	1.09E-07	3.26E-07	7.82E-01	1.23E-09	1.23E+00
	Thorium	0	0	0	0	0	0	0	0	0	7.11E-09	7.11E-09	1.71E-02	0	0
EA-11	Uranium	6.55E-10	4.41E-09	2.42E-09	9.53E-09	3.05E-10	0	2.99E-08	4.12E-10	0	2.97E-08	7.74E-08	1.86E-01	8.43E-10	8.43E-01
	Thorium	0	0	0	0	0	0	0	0	0	1.94E-09	1.94E-09	4.65E-03	0	0

1983		Concentration contribution from emission sources (g/m^3)										Total conc. (g/m^3)	Total intake (mg)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	2.70E-15	4.98E-08	1.10E-08	1.35E-08	1.09E-09	0	5.39E-08	5.07E-10	0	8.96E-08	2.19E-07	5.26E-01	2.06E-09	2.06E+00
	Thorium	0	0	0	0	0	0	0	0	0	5.93E-09	5.93E-09	1.42E-02	0	0
EA-2	Uranium	1.51E-08	1.43E-07	5.63E-08	4.43E-08	1.37E-09	0	5.08E-08	6.59E-10	0	2.02E-08	3.31E-07	7.95E-01	1.07E-09	1.07E+00
	Thorium	0	0	0	0	0	0	0	0	0	1.34E-09	1.34E-09	3.21E-03	0	0
EA-3	Uranium	7.53E-09	9.10E-08	1.13E-09	7.80E-12	3.48E-10	0	8.33E-08	5.45E-10	0	1.68E-08	2.01E-07	4.82E-01	9.59E-10	9.59E-01
	Thorium	0	0	0	0	0	0	0	0	0	1.11E-09	1.11E-09	2.67E-03	0	0
EA-4	Uranium	8.03E-09	1.18E-11	7.72E-09	1.60E-08	1.72E-09	0	9.78E-12	4.65E-10	0	2.37E-08	5.76E-08	1.38E-01	2.63E-09	2.63E+00
	Thorium	0	0	0	0	0	0	0	0	0	1.57E-09	1.57E-09	3.76E-03	0	0
EA-5	Uranium	5.56E-09	3.27E-08	1.05E-08	2.25E-09	2.09E-10	0	1.71E-08	1.37E-10	0	7.98E-07	8.67E-07	2.08E+00	2.41E-09	2.41E+00
	Thorium	0	0	0	0	0	0	0	0	0	5.28E-08	5.28E-08	1.27E-01	0	0
EA-6	Uranium	5.46E-09	4.00E-08	1.66E-08	3.50E-09	1.39E-10	0	1.85E-08	1.12E-10	0	1.41E-07	2.25E-07	5.41E-01	7.88E-10	7.88E-01
	Thorium	0	0	0	0	0	0	0	0	0	9.33E-09	9.33E-09	2.24E-02	0	0
EA-7	Uranium	5.46E-09	4.73E-08	1.31E-08	8.13E-09	1.26E-09	0	5.67E-08	5.19E-10	0	2.48E-08	1.57E-07	3.77E-01	1.20E-09	1.20E+00
	Thorium	0	0	0	0	0	0	0	0	0	1.64E-09	1.64E-09	3.93E-03	0	0
EA-8	Uranium	7.98E-09	7.07E-08	2.29E-08	2.35E-08	1.18E-09	0	1.89E-08	5.07E-10	0	1.24E-08	1.58E-07	3.79E-01	7.99E-10	7.99E-01
	Thorium	0	0	0	0	0	0	0	0	0	8.17E-10	8.17E-10	1.96E-03	0	0
EA-9	Uranium	1.54E-09	1.41E-08	2.44E-08	2.14E-08	1.51E-09	0	1.04E-08	7.61E-10	0	7.46E-09	8.16E-08	1.96E-01	3.99E-10	3.99E-01
	Thorium	0	0	0	0	0	0	0	0	0	4.94E-10	4.94E-10	1.18E-03	0	0
EA-10	Uranium	1.39E-08	1.27E-07	1.35E-08	1.28E-08	6.73E-10	0	7.63E-08	2.04E-10	0	1.08E-07	3.52E-07	8.45E-01	1.23E-09	1.23E+00
	Thorium	0	0	0	0	0	0	0	0	0	7.11E-09	7.11E-09	1.71E-02	0	0
EA-11	Uranium	8.53E-10	1.10E-08	4.68E-09	3.25E-09	3.02E-10	0	2.09E-08	9.45E-11	0	2.93E-08	7.04E-08	1.69E-01	8.43E-10	8.43E-01
	Thorium	0	0	0	0	0	0	0	0	0	1.94E-09	1.94E-09	4.65E-03	0	0

Appendix 4A (Cont'd). FEMP radionuclide concentration and intake results by exposure area and year.

1984		Concentration contribution from emission sources (g/m^3)										Total conc. (g/m^3)	Total intake (mg)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	5.49E-15	2.19E-07	1.05E-08	2.74E-08	1.42E-09	0	3.01E-08	6.08E-08	1.47E-09	8.96E-08	4.41E-07	1.06E+00	2.06E-09	2.06E+00
	Thorium	0	0	0	0	0	0	0	0	0	5.93E-09	5.93E-09	1.42E-02	0	0
EA-2	Uranium	3.08E-08	6.29E-07	5.40E-08	8.96E-08	1.79E-09	0	2.83E-08	7.89E-08	3.06E-09	2.02E-08	9.35E-07	2.24E+00	1.07E-09	1.07E+00
	Thorium	0	0	0	0	0	0	0	0	0	1.34E-09	1.34E-09	3.21E-03	0	0
EA-3	Uranium	1.53E-08	4.01E-07	1.09E-09	1.58E-11	4.54E-10	0	4.64E-08	6.53E-08	2.72E-09	1.68E-08	5.49E-07	1.32E+00	9.59E-10	9.59E-01
	Thorium	0	0	0	0	0	0	0	0	0	1.11E-09	1.11E-09	2.67E-03	0	0
EA-4	Uranium	1.63E-08	5.19E-11	7.40E-09	3.23E-08	2.24E-09	0	5.45E-12	5.58E-08	5.08E-11	2.37E-08	1.38E-07	3.31E-01	2.63E-09	2.63E+00
	Thorium	0	0	0	0	0	0	0	0	0	1.57E-09	1.57E-09	3.76E-03	0	0
EA-5	Uranium	1.13E-08	1.44E-07	1.01E-08	4.55E-09	2.73E-10	0	9.56E-09	1.65E-08	6.44E-10	7.98E-07	9.95E-07	2.39E+00	2.41E-09	2.41E+00
	Thorium	0	0	0	0	0	0	0	0	0	5.28E-08	5.28E-08	1.27E-01	0	0
EA-6	Uranium	1.11E-08	1.76E-07	1.59E-08	7.07E-09	1.82E-10	0	1.03E-08	1.34E-08	6.62E-10	1.41E-07	3.76E-07	9.03E-01	7.88E-10	7.88E-01
	Thorium	0	0	0	0	0	0	0	0	0	9.33E-09	9.33E-09	2.24E-02	0	0
EA-7	Uranium	1.11E-08	2.09E-07	1.25E-08	1.64E-08	1.64E-09	0	3.16E-08	6.22E-08	9.13E-10	2.48E-08	3.70E-07	8.88E-01	1.20E-09	1.20E+00
	Thorium	0	0	0	0	0	0	0	0	0	1.64E-09	1.64E-09	3.93E-03	0	0
EA-8	Uranium	1.62E-08	3.12E-07	2.20E-08	4.75E-08	1.54E-09	0	1.05E-08	6.08E-08	1.16E-09	1.24E-08	4.84E-07	1.16E+00	7.99E-10	7.99E-01
	Thorium	0	0	0	0	0	0	0	0	0	8.17E-10	8.17E-10	1.96E-03	0	0
EA-9	Uranium	3.13E-09	6.21E-08	2.34E-08	4.32E-08	1.98E-09	0	5.83E-09	9.12E-08	4.88E-10	7.46E-09	2.39E-07	5.73E-01	3.99E-10	3.99E-01
	Thorium	0	0	0	0	0	0	0	0	0	4.94E-10	4.94E-10	1.18E-03	0	0
EA-10	Uranium	2.82E-08	5.61E-07	1.30E-08	2.58E-08	8.78E-10	0	4.26E-08	2.45E-08	8.59E-10	1.08E-07	8.04E-07	1.93E+00	1.23E-09	1.23E+00
	Thorium	0	0	0	0	0	0	0	0	0	7.11E-09	7.11E-09	1.71E-02	0	0
EA-11	Uranium	1.74E-09	4.83E-08	4.49E-09	6.57E-09	3.94E-10	0	1.17E-08	1.13E-08	7.08E-10	2.93E-08	1.15E-07	2.75E-01	8.43E-10	8.43E-01
	Thorium	0	0	0	0	0	0	0	0	0	1.94E-09	1.94E-09	4.65E-03	0	0

1985		Concentration contribution from emission sources (g/m^3)										Total conc. (g/m^3)	Total intake (mg)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	0	4.97E-08	7.96E-10	7.16E-11	9.61E-10	0	3.90E-11	3.97E-10	0	8.96E-08	1.42E-07	3.40E-01	2.06E-09	2.06E+00
	Thorium	0	0	0	0	0	0	0	0	0	5.93E-09	5.93E-09	1.42E-02	0	0
EA-2	Uranium	0	1.42E-07	4.09E-09	2.34E-10	1.21E-09	0	3.68E-11	5.16E-10	0	2.02E-08	1.69E-07	4.05E-01	1.07E-09	1.07E+00
	Thorium	0	0	0	0	0	0	0	0	0	1.34E-09	1.34E-09	3.21E-03	0	0
EA-3	Uranium	0	9.08E-08	8.24E-11	4.13E-14	3.07E-10	0	6.03E-11	4.27E-10	0	1.68E-08	1.09E-07	2.61E-01	9.59E-10	9.59E-01
	Thorium	0	0	0	0	0	0	0	0	0	1.11E-09	1.11E-09	2.67E-03	0	0
EA-4	Uranium	0	1.17E-11	5.61E-10	8.46E-11	1.52E-09	0	7.08E-15	3.64E-10	0	2.37E-08	2.62E-08	6.29E-02	2.63E-09	2.63E+00
	Thorium	0	0	0	0	0	0	0	0	0	1.57E-09	1.57E-09	3.76E-03	0	0
EA-5	Uranium	0	3.27E-08	7.66E-10	1.19E-11	1.85E-10	0	1.24E-11	1.08E-10	0	7.98E-07	8.32E-07	2.00E+00	2.41E-09	2.41E+00
	Thorium	0	0	0	0	0	0	0	0	0	5.28E-08	5.28E-08	1.27E-01	0	0
EA-6	Uranium	0	4.00E-08	1.21E-09	1.85E-11	1.23E-10	0	1.34E-11	8.75E-11	0	1.41E-07	1.82E-07	4.38E-01	7.88E-10	7.88E-01
	Thorium	0	0	0	0	0	0	0	0	0	9.33E-09	9.33E-09	2.24E-02	0	0
EA-7	Uranium	0	4.72E-08	9.50E-10	4.30E-11	1.11E-09	0	4.11E-11	4.07E-10	0	2.48E-08	7.46E-08	1.79E-01	1.20E-09	1.20E+00
	Thorium	0	0	0	0	0	0	0	0	0	1.64E-09	1.64E-09	3.93E-03	0	0
EA-8	Uranium	0	7.06E-08	1.67E-09	1.24E-10	1.04E-09	0	1.37E-11	3.97E-10	0	1.24E-08	8.62E-08	2.07E-01	7.99E-10	7.99E-01
	Thorium	0	0	0	0	0	0	0	0	0	8.17E-10	8.17E-10	1.96E-03	0	0
EA-9	Uranium	0	1.41E-08	1.77E-09	1.13E-10	1.34E-09	0	7.57E-12	5.96E-10	0	7.46E-09	2.54E-08	6.09E-02	3.99E-10	3.99E-01
	Thorium	0	0	0	0	0	0	0	0	0	4.94E-10	4.94E-10	1.18E-03	0	0
EA-10	Uranium	0	1.27E-07	9.85E-10	6.75E-11	5.95E-10	0	5.53E-11	1.60E-10	0	1.08E-07	2.36E-07	5.67E-01	1.23E-09	1.23E+00
	Thorium	0	0	0	0	0	0	0	0	0	7.11E-09	7.11E-09	1.71E-02	0	0
EA-11	Uranium	0	1.09E-08	3.40E-10	1.72E-11	2.67E-10	0	1.52E-11	7.40E-11	0	2.93E-08	4.09E-08	9.83E-02	8.43E-10	8.43E-01
	Thorium	0	0	0	0	0	0	0	0	0	1.94E-09	1.94E-09	4.65E-03	0	0

Appendix 4A (Cont'd). FEMP radionuclide concentration and intake results by exposure area and year.

1986		Concentration contribution from emission sources (g/m^3)										Total conc. (g/m^3)	Total intake (mg)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	0	0	8.97E-10	7.81E-11	1.06E-09	0	3.90E-11	5.18E-10	0	8.96E-08	9.22E-08	2.21E-01	2.06E-09	2.06E+00
	Thorium	0	0	0	0	0	0	0	0	0	5.93E-09	5.93E-09	1.42E-02	0	0
EA-2	Uranium	0	0	4.61E-09	2.56E-10	1.34E-09	0	3.68E-11	6.72E-10	0	2.02E-08	2.71E-08	6.51E-02	1.07E-09	1.07E+00
	Thorium	0	0	0	0	0	0	0	0	0	1.34E-09	1.34E-09	3.21E-03	0	0
EA-3	Uranium	0	0	9.27E-11	4.50E-14	3.39E-10	0	6.03E-11	5.56E-10	0	1.68E-08	1.79E-08	4.30E-02	9.59E-10	9.59E-01
	Thorium	0	0	0	0	0	0	0	0	0	1.11E-09	1.11E-09	2.67E-03	0	0
EA-4	Uranium	0	0	6.32E-10	9.23E-11	1.67E-09	0	7.08E-15	4.75E-10	0	2.37E-08	2.65E-08	6.37E-02	2.63E-09	2.63E+00
	Thorium	0	0	0	0	0	0	0	0	0	1.57E-09	1.57E-09	3.76E-03	0	0
EA-5	Uranium	0	0	8.62E-10	1.30E-11	2.04E-10	0	1.24E-11	1.40E-10	0	7.98E-07	7.99E-07	1.92E+00	2.41E-09	2.41E+00
	Thorium	0	0	0	0	0	0	0	0	0	5.28E-08	5.28E-08	1.27E-01	0	0
EA-6	Uranium	0	0	1.36E-09	2.02E-11	1.36E-10	0	1.34E-11	1.14E-10	0	1.41E-07	1.43E-07	3.42E-01	7.88E-10	7.88E-01
	Thorium	0	0	0	0	0	0	0	0	0	9.33E-09	9.33E-09	2.24E-02	0	0
EA-7	Uranium	0	0	1.07E-09	4.69E-11	1.23E-09	0	4.11E-11	5.30E-10	0	2.48E-08	2.77E-08	6.65E-02	1.20E-09	1.20E+00
	Thorium	0	0	0	0	0	0	0	0	0	1.64E-09	1.64E-09	3.93E-03	0	0
EA-8	Uranium	0	0	1.88E-09	1.36E-10	1.15E-09	0	1.37E-11	5.18E-10	0	1.24E-08	1.60E-08	3.85E-02	7.99E-10	7.99E-01
	Thorium	0	0	0	0	0	0	0	0	0	8.17E-10	8.17E-10	1.96E-03	0	0
EA-9	Uranium	0	0	2.00E-09	1.23E-10	1.48E-09	0	7.57E-12	7.77E-10	0	7.46E-09	1.18E-08	2.84E-02	3.99E-10	3.99E-01
	Thorium	0	0	0	0	0	0	0	0	0	4.94E-10	4.94E-10	1.18E-03	0	0
EA-10	Uranium	0	0	1.11E-09	7.36E-11	6.55E-10	0	5.53E-11	2.08E-10	0	1.08E-07	1.10E-07	2.63E-01	1.23E-09	1.23E+00
	Thorium	0	0	0	0	0	0	0	0	0	7.11E-09	7.11E-09	1.71E-02	0	0
EA-11	Uranium	0	0	3.83E-10	1.87E-11	2.94E-10	0	1.52E-11	9.65E-11	0	2.93E-08	3.01E-08	7.22E-02	8.43E-10	8.43E-01
	Thorium	0	0	0	0	0	0	0	0	0	1.94E-09	1.94E-09	4.65E-03	0	0

1987		Concentration contribution from emission sources (g/m^3)										Total conc. (g/m^3)	Total intake (mg)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	0	0	7.64E-08	7.87E-10	5.86E-11	5.88E-10	0	2.41E-10	1.28E-10	0	9.09E-08	1.69E-07	2.06E-09	2.06E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	6.20E-09	6.20E-09	0	0
EA-2	Uranium	0	0	2.19E-07	4.04E-09	1.92E-10	7.42E-10	0	2.27E-10	1.66E-10	0	2.05E-08	2.45E-07	1.07E-09	1.07E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	1.40E-09	1.40E-09	0	0
EA-3	Uranium	0	0	1.40E-07	8.14E-11	3.38E-14	1.88E-10	0	3.72E-10	1.37E-10	0	1.71E-08	1.58E-07	9.59E-10	9.59E-01
	Thorium	0	0	0	0	0	0	0	0	0	0	1.17E-09	1.17E-09	0	0
EA-4	Uranium	0	0	1.81E-11	5.54E-10	6.92E-11	9.27E-10	0	4.37E-14	1.17E-10	0	2.40E-08	2.57E-08	2.63E-09	2.63E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	1.64E-09	1.64E-09	0	0
EA-5	Uranium	0	0	5.03E-08	7.57E-10	9.73E-12	1.13E-10	0	7.66E-11	3.46E-11	0	8.09E-07	8.61E-07	2.41E-09	2.41E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	5.52E-08	5.52E-08	0	0
EA-6	Uranium	0	0	6.15E-08	1.19E-09	1.51E-11	7.53E-11	0	8.27E-11	2.81E-11	0	1.43E-07	2.06E-07	7.88E-10	7.88E-01
	Thorium	0	0	0	0	0	0	0	0	0	0	9.76E-09	9.76E-09	0	0
EA-7	Uranium	0	0	7.26E-08	9.39E-10	3.52E-11	6.80E-10	0	2.53E-10	1.31E-10	0	2.51E-08	9.98E-08	1.20E-09	1.20E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	1.71E-09	1.71E-09	0	0
EA-8	Uranium	0	0	1.09E-07	1.65E-09	1.02E-10	6.36E-10	0	8.45E-11	1.28E-10	0	1.25E-08	1.24E-07	7.99E-10	7.99E-01
	Thorium	0	0	0	0	0	0	0	0	0	0	8.55E-10	8.55E-10	0	0
EA-9	Uranium	0	0	2.16E-08	1.75E-09	9.25E-11	8.18E-10	0	4.67E-11	1.92E-10	0	7.57E-09	3.21E-08	3.99E-10	3.99E-01
	Thorium	0	0	0	0	0	0	0	0	0	0	5.16E-10	5.16E-10	0	0
EA-10	Uranium	0	0	1.95E-07	9.73E-10	5.52E-11	3.63E-10	0	3.41E-10	5.14E-11	0	1.09E-07	3.06E-07	1.23E-09	1.23E+00
	Thorium	0	0	0	0	0	0	0	0	0	0	7.44E-09	7.44E-09	0	0
EA-11	Uranium	0	0	1.68E-08	3.36E-10	1.41E-11	1.63E-10	0	9.35E-11	2.38E-11	0	2.97E-08	4.72E-08	8.43E-10	8.43E-01
	Thorium	0	0	0	0	0	0	0	0	0	0	2.03E-09	2.03E-09	0	0

Appendix 4A (Cont'd). FEMP radionuclide concentration and intake results by exposure area and year.

1988		Concentration contribution from emission sources (g/m^3)										Total conc. (g/m^3)	Total intake (mg)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	0	3.44E-08	2.61E-10	3.90E-11	2.25E-10	0	5.86E-11	6.39E-11	0	9.19E-08	1.27E-07	3.05E-01	8.59E-10	8.59E-01
	Thorium	0	0	0	0	0	0	0	0	0	6.43E-09	6.43E-09	1.54E-02	0	0
EA-2	Uranium	0	9.86E-08	1.34E-09	1.28E-10	2.84E-10	0	5.52E-11	8.29E-11	0	2.07E-08	1.21E-07	2.91E-01	4.44E-10	4.44E-01
	Thorium	0	0	0	0	0	0	0	0	0	1.45E-09	1.45E-09	3.48E-03	0	0
EA-3	Uranium	0	6.29E-08	2.70E-11	2.25E-14	7.19E-11	0	9.05E-11	6.86E-11	0	1.73E-08	8.04E-08	1.93E-01	3.99E-10	3.99E-01
	Thorium	0	0	0	0	0	0	0	0	0	1.21E-09	1.21E-09	2.90E-03	0	0
EA-4	Uranium	0	8.13E-12	1.84E-10	4.61E-11	3.55E-10	0	1.06E-14	5.86E-11	0	2.43E-08	2.49E-08	5.99E-02	1.10E-09	1.10E+00
	Thorium	0	0	0	0	0	0	0	0	0	1.70E-09	1.70E-09	4.08E-03	0	0
EA-5	Uranium	0	2.26E-08	2.51E-10	6.49E-12	4.33E-11	0	1.86E-11	1.73E-11	0	8.19E-07	8.42E-07	2.02E+00	1.00E-09	1.00E+00
	Thorium	0	0	0	0	0	0	0	0	0	5.73E-08	5.73E-08	1.37E-01	0	0
EA-6	Uranium	0	2.77E-08	3.96E-10	1.01E-11	2.88E-11	0	2.01E-11	1.41E-11	0	1.45E-07	1.73E-07	4.15E-01	3.28E-10	3.28E-01
	Thorium	0	0	0	0	0	0	0	0	0	1.01E-08	1.01E-08	2.43E-02	0	0
EA-7	Uranium	0	3.27E-08	3.11E-10	2.35E-11	2.60E-10	0	6.17E-11	6.53E-11	0	2.54E-08	5.89E-08	1.41E-01	5.00E-10	5.00E-01
	Thorium	0	0	0	0	0	0	0	0	0	1.78E-09	1.78E-09	4.27E-03	0	0
EA-8	Uranium	0	4.89E-08	5.45E-10	6.78E-11	2.44E-10	0	2.06E-11	6.39E-11	0	1.27E-08	6.25E-08	1.50E-01	3.33E-10	3.33E-01
	Thorium	0	0	0	0	0	0	0	0	0	8.87E-10	8.87E-10	2.13E-03	0	0
EA-9	Uranium	0	9.74E-09	5.80E-10	6.17E-11	3.13E-10	0	1.14E-11	9.58E-11	0	7.66E-09	1.85E-08	4.43E-02	1.66E-10	1.66E-01
	Thorium	0	0	0	0	0	0	0	0	0	5.36E-10	5.36E-10	1.29E-03	0	0
EA-10	Uranium	0	8.79E-08	3.22E-10	3.68E-11	1.39E-10	0	8.29E-11	2.57E-11	0	1.10E-07	1.99E-07	4.77E-01	5.10E-10	5.10E-01
	Thorium	0	0	0	0	0	0	0	0	0	7.72E-09	7.72E-09	1.85E-02	0	0
EA-11	Uranium	0	7.58E-09	1.11E-10	9.37E-12	6.25E-11	0	2.27E-11	1.19E-11	0	3.00E-08	3.78E-08	9.08E-02	3.51E-10	3.51E-01
	Thorium	0	0	0	0	0	0	0	0	0	2.10E-09	2.10E-09	5.04E-03	0	0

1989		Concentration contribution from emission sources (Ci/m^3)										Total conc. (Ci/m^3)	Total intake (mCi)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	0	0	1.44E-16	0	0	0	0	0	0	0	1.44E-16	3.46E-10	0	0
	Thorium	0	0	2.36E-18	0	0	0	0	0	0	0	2.36E-18	5.66E-12	0	0
EA-2	Uranium	0	0	7.41E-16	0	0	0	0	0	0	0	7.41E-16	1.78E-09	0	0
	Thorium	0	0	1.21E-17	0	0	0	0	0	0	0	1.21E-17	2.91E-11	0	0
EA-3	Uranium	0	0	1.49E-17	0	0	0	0	0	0	0	1.49E-17	3.58E-11	0	0
	Thorium	0	0	1.66E-18	0	0	0	0	0	0	0	1.66E-18	3.98E-12	0	0
EA-4	Uranium	0	0	1.02E-16	0	0	0	0	0	0	0	1.02E-16	2.44E-10	0	0
	Thorium	0	0	1.66E-18	0	0	0	0	0	0	0	1.66E-18	3.98E-12	0	0
EA-5	Uranium	0	0	1.39E-16	0	0	0	0	0	0	0	1.39E-16	3.33E-10	0	0
	Thorium	0	0	2.27E-18	0	0	0	0	0	0	0	2.27E-18	5.44E-12	0	0
EA-6	Uranium	0	0	2.19E-16	0	0	0	0	0	0	0	2.19E-16	5.25E-10	0	0
	Thorium	0	0	3.58E-18	0	0	0	0	0	0	0	3.58E-18	8.59E-12	0	0
EA-7	Uranium	0	0	1.72E-16	0	0	0	0	0	0	0	1.72E-16	4.13E-10	0	0
	Thorium	0	0	2.81E-18	0	0	0	0	0	0	0	2.81E-18	6.75E-12	0	0
EA-8	Uranium	0	0	3.01E-16	0	0	0	0	0	0	0	3.01E-16	7.23E-10	0	0
	Thorium	0	0	4.93E-18	0	0	0	0	0	0	0	4.93E-18	1.18E-11	0	0
EA-9	Uranium	0	0	3.21E-16	0	0	0	0	0	0	0	3.21E-16	7.70E-10	0	0
	Thorium	0	0	5.25E-18	0	0	0	0	0	0	0	5.25E-18	1.26E-11	0	0
EA-10	Uranium	0	0	1.78E-16	0	0	0	0	0	0	0	1.78E-16	4.28E-10	0	0
	Thorium	0	0	2.91E-18	0	0	0	0	0	0	0	2.91E-18	6.99E-12	0	0
EA-11	Uranium	0	0	6.16E-17	0	0	0	0	0	0	0	6.16E-17	1.48E-10	0	0
	Thorium	0	0	1.01E-18	0	0	0	0	0	0	0	1.01E-18	2.42E-12	0	0

Appendix 4A (Cont'd). FEMP radionuclide concentration and intake results by exposure area and year.

1990		Concentration contribution from emission sources (Ci/m^3)										Total conc. (Ci/m^3)	Total intake (mCi)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	0	0	7.75E-17	0	0	0	0	0	0	0	7.75E-17	1.86E-10	0	0
	Thorium	0	0	1.05E-18	0	0	0	0	0	0	0	1.05E-18	2.53E-12	0	0
EA-2	Uranium	0	0	3.98E-16	0	0	0	0	0	0	0	3.98E-16	9.55E-10	0	0
	Thorium	0	0	5.42E-18	0	0	0	0	0	0	0	5.42E-18	1.30E-11	0	0
EA-3	Uranium	0	0	8.01E-18	0	0	0	0	0	0	0	8.01E-18	1.92E-11	0	0
	Thorium	0	0	7.43E-19	0	0	0	0	0	0	0	7.43E-19	1.78E-12	0	0
EA-4	Uranium	0	0	5.46E-17	0	0	0	0	0	0	0	5.46E-17	1.31E-10	0	0
	Thorium	0	0	7.43E-19	0	0	0	0	0	0	0	7.43E-19	1.78E-12	0	0
EA-5	Uranium	0	0	7.45E-17	0	0	0	0	0	0	0	7.45E-17	1.79E-10	0	0
	Thorium	0	0	1.01E-18	0	0	0	0	0	0	0	1.01E-18	2.43E-12	0	0
EA-6	Uranium	0	0	1.18E-16	0	0	0	0	0	0	0	1.18E-16	2.82E-10	0	0
	Thorium	0	0	1.60E-18	0	0	0	0	0	0	0	1.60E-18	3.84E-12	0	0
EA-7	Uranium	0	0	9.25E-17	0	0	0	0	0	0	0	9.25E-17	2.22E-10	0	0
	Thorium	0	0	1.26E-18	0	0	0	0	0	0	0	1.26E-18	3.02E-12	0	0
EA-8	Uranium	0	0	1.62E-16	0	0	0	0	0	0	0	1.62E-16	3.89E-10	0	0
	Thorium	0	0	2.21E-18	0	0	0	0	0	0	0	2.21E-18	5.29E-12	0	0
EA-9	Uranium	0	0	1.72E-16	0	0	0	0	0	0	0	1.72E-16	4.14E-10	0	0
	Thorium	0	0	2.35E-18	0	0	0	0	0	0	0	2.35E-18	5.63E-12	0	0
EA-10	Uranium	0	0	9.58E-17	0	0	0	0	0	0	0	9.58E-17	2.30E-10	0	0
	Thorium	0	0	1.30E-18	0	0	0	0	0	0	0	1.30E-18	3.13E-12	0	0
EA-11	Uranium	0	0	3.31E-17	0	0	0	0	0	0	0	3.31E-17	7.94E-11	0	0
	Thorium	0	0	4.50E-19	0	0	0	0	0	0	0	4.50E-19	1.08E-12	0	0

1991		Concentration contribution from emission sources (Ci/m^3)										Total conc. (Ci/m^3)	Total intake (mCi)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	0	0	1.12E-16	0	0	0	0	0	0	0	1.12E-16	2.68E-10	0	0
	Thorium	0	0	3.52E-19	0	0	0	0	0	0	0	3.52E-19	8.44E-13	0	0
EA-2	Uranium	0	0	5.74E-16	0	0	0	0	0	0	0	5.74E-16	1.38E-09	0	0
	Thorium	0	0	1.81E-18	0	0	0	0	0	0	0	1.81E-18	4.33E-12	0	0
EA-3	Uranium	0	0	1.15E-17	0	0	0	0	0	0	0	1.15E-17	2.77E-11	0	0
	Thorium	0	0	2.48E-19	0	0	0	0	0	0	0	2.48E-19	5.94E-13	0	0
EA-4	Uranium	0	0	7.87E-17	0	0	0	0	0	0	0	7.87E-17	1.89E-10	0	0
	Thorium	0	0	2.48E-19	0	0	0	0	0	0	0	2.48E-19	5.94E-13	0	0
EA-5	Uranium	0	0	1.07E-16	0	0	0	0	0	0	0	1.07E-16	2.58E-10	0	0
	Thorium	0	0	3.38E-19	0	0	0	0	0	0	0	3.38E-19	8.11E-13	0	0
EA-6	Uranium	0	0	1.70E-16	0	0	0	0	0	0	0	1.70E-16	4.07E-10	0	0
	Thorium	0	0	5.34E-19	0	0	0	0	0	0	0	5.34E-19	1.28E-12	0	0
EA-7	Uranium	0	0	1.33E-16	0	0	0	0	0	0	0	1.33E-16	3.20E-10	0	0
	Thorium	0	0	4.20E-19	0	0	0	0	0	0	0	4.20E-19	1.01E-12	0	0
EA-8	Uranium	0	0	2.34E-16	0	0	0	0	0	0	0	2.34E-16	5.60E-10	0	0
	Thorium	0	0	7.35E-19	0	0	0	0	0	0	0	7.35E-19	1.76E-12	0	0
EA-9	Uranium	0	0	2.49E-16	0	0	0	0	0	0	0	2.49E-16	5.97E-10	0	0
	Thorium	0	0	7.83E-19	0	0	0	0	0	0	0	7.83E-19	1.88E-12	0	0
EA-10	Uranium	0	0	1.38E-16	0	0	0	0	0	0	0	1.38E-16	3.31E-10	0	0
	Thorium	0	0	4.35E-19	0	0	0	0	0	0	0	4.35E-19	1.04E-12	0	0
EA-11	Uranium	0	0	4.77E-17	0	0	0	0	0	0	0	4.77E-17	1.14E-10	0	0
	Thorium	0	0	1.50E-19	0	0	0	0	0	0	0	1.50E-19	3.60E-13	0	0

Appendix 4A (Cont'd). FEMP radionuclide concentration and intake results by exposure area and year.

1992		Concentration contribution from emission sources (Ci/m^3)										Total conc. (Ci/m^3)	Total intake (mCi)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	0	0	1.00E-16	0	0	0	0	0	0	0	1.00E-16	2.40E-10	0	0
	Thorium	0	0	9.85E-19	0	0	0	0	0	0	0	9.85E-19	2.36E-12	0	0
EA-2	Uranium	0	0	5.14E-16	0	0	0	0	0	0	0	5.14E-16	1.23E-09	0	0
	Thorium	0	0	5.06E-18	0	0	0	0	0	0	0	5.06E-18	1.21E-11	0	0
EA-3	Uranium	0	0	1.03E-17	0	0	0	0	0	0	0	1.03E-17	2.48E-11	0	0
	Thorium	0	0	6.94E-19	0	0	0	0	0	0	0	6.94E-19	1.67E-12	0	0
EA-4	Uranium	0	0	7.04E-17	0	0	0	0	0	0	0	7.04E-17	1.69E-10	0	0
	Thorium	0	0	6.94E-19	0	0	0	0	0	0	0	6.94E-19	1.67E-12	0	0
EA-5	Uranium	0	0	9.61E-17	0	0	0	0	0	0	0	9.61E-17	2.31E-10	0	0
	Thorium	0	0	9.48E-19	0	0	0	0	0	0	0	9.48E-19	2.27E-12	0	0
EA-6	Uranium	0	0	1.52E-16	0	0	0	0	0	0	0	1.52E-16	3.64E-10	0	0
	Thorium	0	0	1.50E-18	0	0	0	0	0	0	0	1.50E-18	3.59E-12	0	0
EA-7	Uranium	0	0	1.19E-16	0	0	0	0	0	0	0	1.19E-16	2.86E-10	0	0
	Thorium	0	0	1.18E-18	0	0	0	0	0	0	0	1.18E-18	2.82E-12	0	0
EA-8	Uranium	0	0	2.09E-16	0	0	0	0	0	0	0	2.09E-16	5.02E-10	0	0
	Thorium	0	0	2.06E-18	0	0	0	0	0	0	0	2.06E-18	4.94E-12	0	0
EA-9	Uranium	0	0	2.23E-16	0	0	0	0	0	0	0	2.23E-16	5.34E-10	0	0
	Thorium	0	0	2.19E-18	0	0	0	0	0	0	0	2.19E-18	5.26E-12	0	0
EA-10	Uranium	0	0	1.24E-16	0	0	0	0	0	0	0	1.24E-16	2.97E-10	0	0
	Thorium	0	0	1.22E-18	0	0	0	0	0	0	0	1.22E-18	2.92E-12	0	0
EA-11	Uranium	0	0	4.27E-17	0	0	0	0	0	0	0	4.27E-17	1.02E-10	0	0
	Thorium	0	0	4.21E-19	0	0	0	0	0	0	0	4.21E-19	1.01E-12	0	0

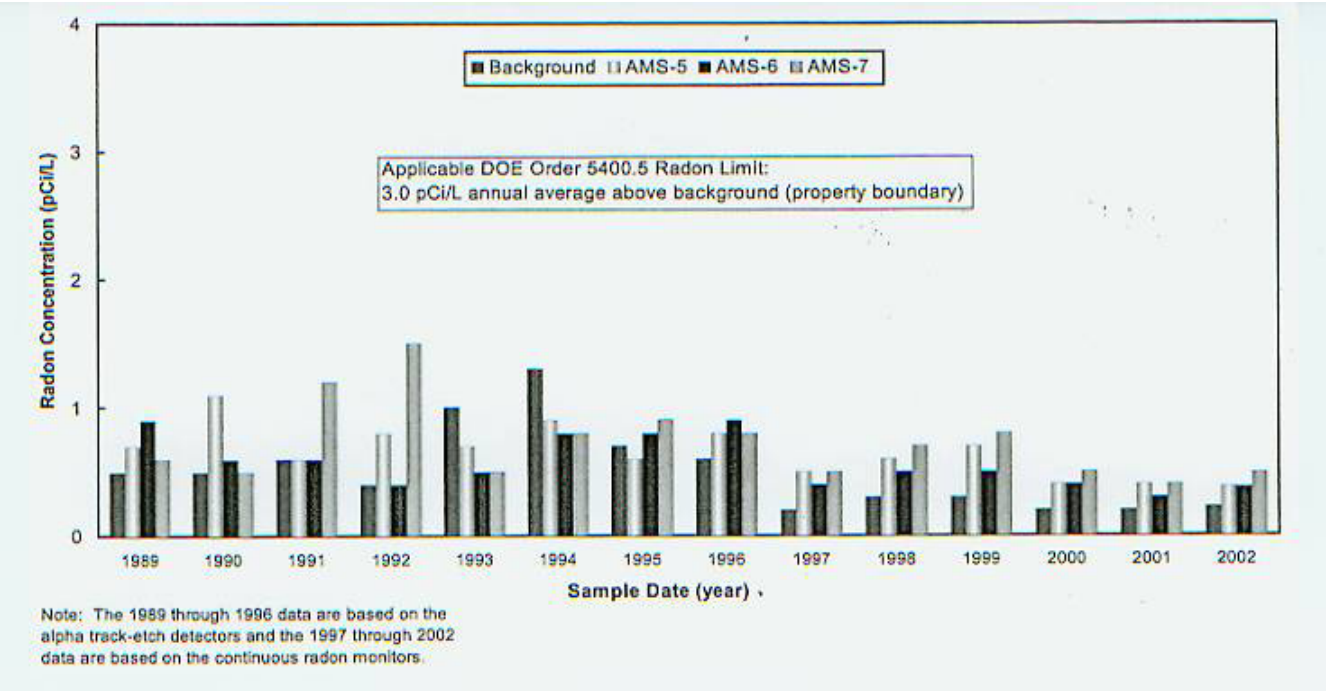
1993		Concentration contribution from emission sources (Ci/m^3)										Total conc. (Ci/m^3)	Total intake (mCi)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	0	0	1.20E-16	0	0	0	0	0	0	0	1.20E-16	2.88E-10	0	0
	Thorium	0	0	9.45E-19	0	0	0	0	0	0	0	9.45E-19	2.27E-12	0	0
EA-2	Uranium	0	0	6.17E-16	0	0	0	0	0	0	0	6.17E-16	1.48E-09	0	0
	Thorium	0	0	4.85E-18	0	0	0	0	0	0	0	4.85E-18	1.16E-11	0	0
EA-3	Uranium	0	0	1.24E-17	0	0	0	0	0	0	0	1.24E-17	2.98E-11	0	0
	Thorium	0	0	6.65E-19	0	0	0	0	0	0	0	6.65E-19	1.60E-12	0	0
EA-4	Uranium	0	0	8.46E-17	0	0	0	0	0	0	0	8.46E-17	2.03E-10	0	0
	Thorium	0	0	6.65E-19	0	0	0	0	0	0	0	6.65E-19	1.60E-12	0	0
EA-5	Uranium	0	0	1.15E-16	0	0	0	0	0	0	0	1.15E-16	2.77E-10	0	0
	Thorium	0	0	9.08E-19	0	0	0	0	0	0	0	9.08E-19	2.18E-12	0	0
EA-6	Uranium	0	0	1.82E-16	0	0	0	0	0	0	0	1.82E-16	4.37E-10	0	0
	Thorium	0	0	1.43E-18	0	0	0	0	0	0	0	1.43E-18	3.44E-12	0	0
EA-7	Uranium	0	0	1.43E-16	0	0	0	0	0	0	0	1.43E-16	3.44E-10	0	0
	Thorium	0	0	1.13E-18	0	0	0	0	0	0	0	1.13E-18	2.71E-12	0	0
EA-8	Uranium	0	0	2.51E-16	0	0	0	0	0	0	0	2.51E-16	6.02E-10	0	0
	Thorium	0	0	1.98E-18	0	0	0	0	0	0	0	1.98E-18	4.74E-12	0	0
EA-9	Uranium	0	0	2.67E-16	0	0	0	0	0	0	0	2.67E-16	6.41E-10	0	0
	Thorium	0	0	2.10E-18	0	0	0	0	0	0	0	2.10E-18	5.05E-12	0	0
EA-10	Uranium	0	0	1.48E-16	0	0	0	0	0	0	0	1.48E-16	3.56E-10	0	0
	Thorium	0	0	1.17E-18	0	0	0	0	0	0	0	1.17E-18	2.80E-12	0	0
EA-11	Uranium	0	0	5.13E-17	0	0	0	0	0	0	0	5.13E-17	1.23E-10	0	0
	Thorium	0	0	4.03E-19	0	0	0	0	0	0	0	4.03E-19	9.68E-13	0	0

Appendix 4A (Cont'd). FEMP radionuclide concentration and intake results by exposure area and year.

1994		Concentration contribution from emission sources (Ci/m^3)										Total conc. (Ci/m^3)	Total intake (mCi)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	0	0	3.16E-17	0	0	0	0	0	0	0	3.16E-17	7.58E-11	0	0
	Thorium	0	0	7.22E-19	0	0	0	0	0	0	0	7.22E-19	1.73E-12	0	0
EA-2	Uranium	0	0	1.62E-16	0	0	0	0	0	0	0	1.62E-16	3.89E-10	0	0
	Thorium	0	0	3.71E-18	0	0	0	0	0	0	0	3.71E-18	8.91E-12	0	0
EA-3	Uranium	0	0	3.26E-18	0	0	0	0	0	0	0	3.26E-18	7.83E-12	0	0
	Thorium	0	0	5.09E-19	0	0	0	0	0	0	0	5.09E-19	1.22E-12	0	0
EA-4	Uranium	0	0	2.22E-17	0	0	0	0	0	0	0	2.22E-17	5.34E-11	0	0
	Thorium	0	0	5.09E-19	0	0	0	0	0	0	0	5.09E-19	1.22E-12	0	0
EA-5	Uranium	0	0	3.04E-17	0	0	0	0	0	0	0	3.04E-17	7.29E-11	0	0
	Thorium	0	0	6.95E-19	0	0	0	0	0	0	0	6.95E-19	1.67E-12	0	0
EA-6	Uranium	0	0	4.79E-17	0	0	0	0	0	0	0	4.79E-17	1.15E-10	0	0
	Thorium	0	0	1.10E-18	0	0	0	0	0	0	0	1.10E-18	2.63E-12	0	0
EA-7	Uranium	0	0	3.77E-17	0	0	0	0	0	0	0	3.77E-17	9.04E-11	0	0
	Thorium	0	0	8.62E-19	0	0	0	0	0	0	0	8.62E-19	2.07E-12	0	0
EA-8	Uranium	0	0	6.60E-17	0	0	0	0	0	0	0	6.60E-17	1.58E-10	0	0
	Thorium	0	0	1.51E-18	0	0	0	0	0	0	0	1.51E-18	3.62E-12	0	0
EA-9	Uranium	0	0	7.03E-17	0	0	0	0	0	0	0	7.03E-17	1.69E-10	0	0
	Thorium	0	0	1.61E-18	0	0	0	0	0	0	0	1.61E-18	3.86E-12	0	0
EA-10	Uranium	0	0	3.90E-17	0	0	0	0	0	0	0	3.90E-17	9.37E-11	0	0
	Thorium	0	0	8.93E-19	0	0	0	0	0	0	0	8.93E-19	2.14E-12	0	0
EA-11	Uranium	0	0	1.35E-17	0	0	0	0	0	0	0	1.35E-17	3.24E-11	0	0
	Thorium	0	0	3.08E-19	0	0	0	0	0	0	0	3.08E-19	7.40E-13	0	0

1995		Concentration contribution from emission sources (Ci/m^3)										Total conc. (Ci/m^3)	Total intake (mCi)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	0	0	2.06E-17	0	0	0	0	0	0	0	2.06E-17	4.94E-11	0	0
	Thorium	0	0	2.77E-19	0	0	0	0	0	0	0	2.77E-19	6.66E-13	0	0
EA-2	Uranium	0	0	1.06E-16	0	0	0	0	0	0	0	1.06E-16	2.54E-10	0	0
	Thorium	0	0	1.43E-18	0	0	0	0	0	0	0	1.43E-18	3.42E-12	0	0
EA-3	Uranium	0	0	2.13E-18	0	0	0	0	0	0	0	2.13E-18	5.11E-12	0	0
	Thorium	0	0	1.95E-19	0	0	0	0	0	0	0	1.95E-19	4.69E-13	0	0
EA-4	Uranium	0	0	1.45E-17	0	0	0	0	0	0	0	1.45E-17	3.48E-11	0	0
	Thorium	0	0	1.95E-19	0	0	0	0	0	0	0	1.95E-19	4.69E-13	0	0
EA-5	Uranium	0	0	1.98E-17	0	0	0	0	0	0	0	1.98E-17	4.75E-11	0	0
	Thorium	0	0	2.67E-19	0	0	0	0	0	0	0	2.67E-19	6.40E-13	0	0
EA-6	Uranium	0	0	3.13E-17	0	0	0	0	0	0	0	3.13E-17	7.50E-11	0	0
	Thorium	0	0	4.21E-19	0	0	0	0	0	0	0	4.21E-19	1.01E-12	0	0
EA-7	Uranium	0	0	2.46E-17	0	0	0	0	0	0	0	2.46E-17	5.90E-11	0	0
	Thorium	0	0	3.31E-19	0	0	0	0	0	0	0	3.31E-19	7.95E-13	0	0
EA-8	Uranium	0	0	4.31E-17	0	0	0	0	0	0	0	4.31E-17	1.03E-10	0	0
	Thorium	0	0	5.80E-19	0	0	0	0	0	0	0	5.80E-19	1.39E-12	0	0
EA-9	Uranium	0	0	4.58E-17	0	0	0	0	0	0	0	4.58E-17	1.10E-10	0	0
	Thorium	0	0	6.17E-19	0	0	0	0	0	0	0	6.17E-19	1.48E-12	0	0
EA-10	Uranium	0	0	2.55E-17	0	0	0	0	0	0	0	2.55E-17	6.11E-11	0	0
	Thorium	0	0	3.43E-19	0	0	0	0	0	0	0	3.43E-19	8.23E-13	0	0
EA-11	Uranium	0	0	8.79E-18	0	0	0	0	0	0	0	8.79E-18	2.11E-11	0	0
	Thorium	0	0	1.18E-19	0	0	0	0	0	0	0	1.18E-19	2.84E-13	0	0

Appendix 4A (Cont'd). FEMP radionuclide concentration and intake results by exposure area and year.

1996		Concentration contribution from emission sources (Ci/m^3)										Total conc. (Ci/m^3)	Total intake (mCi)	Rn-222 Silos (Ci/m^3)	Rn-222 Conc. (pCi/L)
Area	Source	Plant 1	Plant 2/3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Pilot Plant	Waste Pit				
EA-1	Uranium	0	0	2.08E-17	0	0	0	0	0	0	0	2.08E-17	4.99E-11	0	0
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-2	Uranium	0	0	1.07E-16	0	0	0	0	0	0	0	1.07E-16	2.57E-10	0	0
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-3	Uranium	0	0	2.15E-18	0	0	0	0	0	0	0	2.15E-18	5.16E-12	0	0
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-4	Uranium	0	0	1.47E-17	0	0	0	0	0	0	0	1.47E-17	3.52E-11	0	0
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-5	Uranium	0	0	2.00E-17	0	0	0	0	0	0	0	2.00E-17	4.80E-11	0	0
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-6	Uranium	0	0	3.16E-17	0	0	0	0	0	0	0	3.16E-17	7.58E-11	0	0
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-7	Uranium	0	0	2.48E-17	0	0	0	0	0	0	0	2.48E-17	5.96E-11	0	0
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-8	Uranium	0	0	4.35E-17	0	0	0	0	0	0	0	4.35E-17	1.04E-10	0	0
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-9	Uranium	0	0	4.63E-17	0	0	0	0	0	0	0	4.63E-17	1.11E-10	0	0
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-10	Uranium	0	0	2.57E-17	0	0	0	0	0	0	0	2.57E-17	6.17E-11	0	0
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA-11	Uranium	0	0	8.89E-18	0	0	0	0	0	0	0	8.89E-18	2.13E-11	0	0
	Thorium	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix 4B. Annual average radon background concentrations and concentration at selected radon locations, 1989-2002. (Fluor, 2003).