
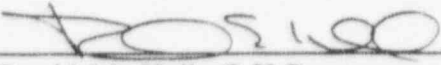


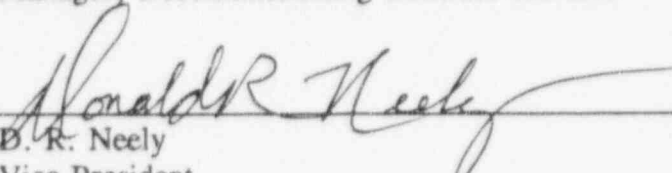
**DOSE ASSESSMENT
WESTINGHOUSE ELECTRIC CORPORATION
BLOOMFIELD LAMP PLANT**

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1.0 INTRODUCTION

1.1 Background

The Westinghouse Electric Corporation's (WEC) Lamp Manufacturing Plant in Bloomfield, New Jersey was involved in the research, development and manufacturing of electric lamps since the early 1900's. Thorium was used in the production of thoriated tungsten wire for use in lamp filaments and welding rods. Uranium was used during studies related to the Manhattan Engineering District Project from 1941 to 1943. From 1943 through the mid 1950's, uranium was machined and used in various experimental and production projects. Operational activities involving the use of these radioactive materials resulted in residual contamination throughout various portions of the facility. The facility ceased operations in 1986.

Since 1989, WEC has been conducting a comprehensive radiological decontamination and decommissioning effort at the former lamp manufacturing facility, under the auspices of the U.S. Nuclear Regulatory Commission (NRC). The remediation objective for the entire site has been to demonstrate that the site meets the NRC criteria for free release for unrestricted use and to terminate Westinghouse Electric Corporation's Part 40 license (No. SMB-1527, Docket No. 040-08976, Control 112591).

At the conclusion of remediation and final survey activities on the east side of Arlington Avenue in December 1995, SEG determined that this portion of the property (including structures, piping, and surrounding grounds), meets the NRC free release criteria for unrestricted use in all except three specific cases. These cases are the focus of this dose assessment. The locations of these three cases are presented on Figure 2-1 and Figure 2-2. Discussions about the specific cases and remedial activities completed are described in more detail in Section 2.0. Final clearance surveys and trench closure packages have been submitted to the NRC under separate cover for the remaining portions of this Westinghouse property.

1.2 Purpose

The purpose of this dose assessment is to demonstrate that the three cases currently not meeting the free release criteria are in compliance with proposed NRC regulations relative to a dose based criteria. These criteria are based on an annual Total Effective Dose Equivalent (TEDE) of 15 mrem/yr, as proposed in Draft NUREG-1500⁽¹⁾. As discussed in NUREG-1500⁽¹⁾ an average individual should not exceed a TEDE of 15 mrem/yr due to residual radioactivity within the facility or on the site. NUREG-1500⁽¹⁾ further requires that residual radioactivity be reduced to levels that are as low as reasonably achievable (ALARA). These alternative criteria are warranted due to the difficulty and expense that would be involved in meeting the approved criteria derived from USNRC Material License Termination Guidelines ⁽²⁾ and Federal Register Notice [Vol. 46, No. 205]⁽³⁾.

The cost estimates for additional remediation in each of the cases are presented in Attachments I, II and III. The dose calculations for these three cases which demonstrate compliance with the proposed NRC regulations are provided in Attachments IV, V, VI, VII, VIII, IX, and X. The RESRAD⁽⁴⁾ computer code (version 5.61) and the Microshield software package (version 4.10) were utilized in computing these doses.

2.0 CASES EXCEEDING CRITERIA

A summary of the cleanup criteria which was implemented at the site for thorium and uranium are provided below in Table 2-1. The criteria for building surfaces were taken from USNRC Termination of License Guidelines ⁽²⁾ and the criteria for soil was taken from the Federal Register [Vol. 46, No. 205]⁽³⁾.

The operations at the Bloomfield site utilized processed uranium, i.e., uranium with its long lived progeny removed. The NRC concluded in their Safety Evaluation Report⁽⁵⁾ (SER), dated 5/24/93, that the criteria for depleted uranium are appropriate for processed uranium.

TABLE 2-1
Approved Criteria for Free Release for Unrestricted Use

	TOTAL URANIUM	TOTAL THORIUM
Total Surface Activity (average) ⁽²⁾	5,000 dpm/100 cm ²	1,000 dpm/100 cm ²
Total Surface Activity (maximum) ⁽²⁾	15,000 dpm/100 cm ²	3,000 dpm/100 cm ²
Removable Surface Activity ⁽²⁾	1,000 dpm/100 cm ²	200 dpm/100 cm ²
Soil Activity Concentration ⁽³⁾	35 pCi/g	10 pCi/g

At the conclusion of remediation and final survey activities on the east side of Arlington Avenue in December 1995, SEG determined that this portion of the property (including structures, piping, and surrounding grounds), meets the free release criteria for unrestricted use in all except three specific cases. These three cases are:

1. Soil and bedrock beneath a portion the basement floor in Building 7.
2. Subsurface storm drain piping (Pipe A), with fixed (internal) contamination, partially located beneath a public roadway.
3. A storm drain pipe (Pipe B), with fixed (internal) contamination, located beneath first floor of Building 7.

Specific details pertaining to these cases are discussed in subsequent Sections 2.1, 2.2 and 2.3, respectively. Actual locations of the materials associated with these three cases are presented on Figure 2-1 and Figure 2-2. Figure 2-1 is a partial plot plan of the facility. Figure 2-2 is a drawing of the first floor and basement of Building 7.

2.1 Soil and Bedrock Beneath Building 7

Approximately 10,000 ft³ of contaminated soil and bedrock exists beneath the basement floor in Building 7. The basement area was used to process uranium. Approximately 150 feet of drain pipes and 800 ft³ of soil and concrete have been excavated from this area and disposed of as low level radioactive waste at a licensed disposal facility. Soil excavation from existing trenches in the basement were extended to bedrock. Samples which were collected indicate the remaining contamination extends approximately 3 to 6 feet horizontally from each trench and approximately 18 inches vertically into the underlying bedrock.

The mean activity concentration of the samples is 154 pCi/g of uranium, with activity concentrations as high as 779 pCi/g uranium. Table 2-2 provides a summary of the samples taken in this area. Although a background study was not performed at the Bloomfield site, the Th-232 activity concentrations are likely due to background. Previous studies, referenced in NUREG-1501⁽⁶⁾, have estimated the background soil activity concentration of Th-232 to be in the range of 1.0 pCi/g. However for the purpose of calculating the TEDE due to this contaminated soil and bedrock, thorium is conservatively included.

The estimated cost to remediate the area beneath the basement floor, to activity concentrations that meet the approved free release criteria in Table 2-1, is \$1,051,862. A detailed summary of these costs are provided in Attachment I. This estimated cost includes: shoring of the Building 7 foundation, excavation of the impacted soil, packaging and shipping the soil to a licensed disposal facility, and disposal costs. Removal of the soil and bedrock from the basement would also result in significant concerns related to safety.

TABLE 2-2
Sample Results From the Elevated Area in the Basement of Building 7

SAMPLE NUMBER	U-238 pCi/g	U-235 pCi/g	Th-232 pCi/g	TOTAL URANIUM ^a pCi/g
94062154	113.24	5.72	1.8	232.20
94062155	20.1	1.09	1.08	41.29
94062156	149.08	8.45	MDA	306.61
94062157	48.29	2.42	1.84	99.00
94062158	54.07	3.53	MDA	111.67
94062159	50.1	2.65	0.46	102.85
94062160	42.54	2.82	1.43	87.90
94062161	69.10	3.86	1.17	142.06
94062162	52.79	3.00	MDA	108.58
94062163	82.93	4.54	MDA	170.40
94062164	46.3	2.82	0.76	95.42
94062165	25.59	1.44	MDA	52.62
94062166	95.75	5.36	0.93	196.86
94062167	30.27	1.66	1.14	62.20
94062168	62.41	3.41	1.22	128.23
94062169	255.89	14.92	0.48	526.7
94062170	57.46	3.1	0.70	118.02
94062171	19.39	1.12	1.20	39.9
94062172	77.16	4.63	1.48	158.95
94062173	89.64	4.59	1.10	183.87
94062174	85.40	5.35	0.86	176.05
94062175	105.52	5.82	1.00	216.86
94062176	32.45	1.5	1.75	66.40
94062177	37.87	2.08	MDA	77.82
94062179	59.52	3.18	1.55	122.22
94062183	115.82	6.28	MDA	237.92
94062184	42.84	2.29	0.90	87.97
94062186	106.01	6.40	1.14	218.42
94062187	126.88	7.01	1.24	260.77
94062188	49.60	2.35	1.72	101.55
94062189	13.82	0.97	0.59	28.61
94062192	31.67	1.94	0.59	65.28

TABEL 2-2
Sample Results From the Elevated Area in the Basement of Building 7
(Continued)

SAMPLE NUMBER	U-238 pCi/g	U-235 pCi/g	Th-232 pCi/g	TOTAL URANIUM* pCi/g
94062195	62.02	3.07	1.18	127.11
94062196	121.77	7.06	1.61	250.60
94062197	106.60	6.13	1.65	219.33
94062200	33.48	1.60	0.98	68.56
94062201	38.60	2.03	MDA	79.23
94062203	11.69	0.66	MDA	24.04
94062204	109.58	5.94	1.26	225.10
94062205	14.33	0.83	MDA	29.49
94062206	379.30	20.24	1.01	778.84
94062208	39.74	1.69	1.28	81.17
94062209	22.32	1.04	0.96	45.68
94062212	95.75	5.36	0.93	196.86
94062213	45.52	2.30	MDA	93.34
94062214	191.87	10.38	1.43	394.12
94062215	16.88	0.93	0.84	34.69
94062216	6.36	MDA	1.15	12.72
94062217	19.62	1.28	1.15	40.52
94062218	173.04	10.45	1.17	356.53
MEAN	75.	4.1	1.17	154
STAN DEV	66.4	3.7	0.354	140
MAXIMUM	380	20.2	1.84	779

* The total uranium activity was calculated by assuming that U-238 and U-234 are in equilibrium.

2.2 Storm Drain (Pipe A)

There is subsurface storm drain piping (approximately 850 feet) which initiates between Buildings 7 & 8 and is routed beneath the public roadway (Arlington Avenue) that divides the Westinghouse property, and continues on the portion of the property adjacent to Building 3. There are eight distinct pipe sections that span between various catch basins and manholes. This piping system is shown on Figure 2-1. The minimum depth of the pipe is 3 feet near the beginning and reaches depths exceeding 12 feet towards the end. The majority of this storm drain piping is still in service and provides storm drainage for Arlington Avenue.

A high pressure wash (water) was applied to the pipe sections in an attempt to decontaminate this storm sewer and to remove sediments from the pipe. Several passes were made with the pressure washer on each pipe section. The operation began at the most upstream section and proceeded to the downstream point (STD-4). The cleaning process utilized conventional sewer cleaning technology which was comprised of a vactor jet rodder (2,000 psi at 65-80 GPM) and an industrial vacuum collection pump (4,500 CFM). The wash water was collected at the most downstream manhole (STD-4) and transferred to a temporary above ground storage tank. A radioactive analysis which was performed on the wash water indicated the concentration was well below the NRC release limits and discharge approval was obtained from the local sanitary sewer authority.

After the high pressure washing techniques were applied, the sewer lines were video-taped and post-radioactive surveys were conducted. There was no appreciable decrease in contamination levels which indicates that the activity is fixed to the internal surfaces of the piping. Table 2-3 summarizes the current radiological condition of the interior pipe surfaces for this line.

The bottom surface at each end of the pipe sections were surveyed using a gas flow proportional detector attached to an extension pole. In pipes with inner diameters greater than 10 inches, the side and top surfaces were also surveyed. Two pipe sections were surveyed by using robotics to move a pressurized gas proportional detector the length of the pipe. The first section of pipe (MH-2, Pipe P2) is located between upstream manhole MH-2 and downstream catch basin STD-1. The other section of pipe (STD-1, Pipe P2) is located between catch basin STD-1 and downstream catch basin STD-2. These sections are located beneath Arlington Avenue and presented on Figure 2-1. Attempts to survey additional sections of pipe with robotics were discontinued due to accessibility problems and damage to the detectors.

The mean contamination level in this piping is estimated to be 9,960 dpm/100 cm² with the highest levels of 182,000 dpm/100 cm². The sediments and pipe scale were removed from the pipes and catch basins. Video inspections showed the pipes to be essentially intact. In shallow and accessible areas, where portions of the piping with elevated activity have been removed (see Figure 2-1), none of the soil surrounding the pipe exceeded the approved criteria for unrestricted use.

Based on past remediation efforts, essentially all of the contaminated sewer pipe would have to be removed in order to achieve compliance with the approved criteria for free release for unrestricted use. Attachment II provides a summary of the estimated costs (\$333,747) associated with removing this pipe. This cost includes excavation, packaging, shipment to a licensed disposal facility, disposal costs, storm drain replacement, and road repair.

TABLE 2-3
Storm Drain (Pipe A)

DESCRIPTION	LENGTH	DIAMETER	AREA cm ²	W _T ²	MEAN CONTAMINATION LEVEL dpm/100 cm ²	MAXIMUM CONTAMINATION LEVEL dpm/100 cm ²	TOTAL ACTIVITY dpm in pipe	RELATIVE FRACTION OF URANIUM	RELATIVE FRACTION OF THORIUM	ESTIMATED TOTAL URANIUM ACTIVITY dpm in pipe	ESTIMATED TOTAL THORIUM ACTIVITY
AREA 1, PIPE P5	39 FT	8 INCH	76,260	0.5	1327	1801	5.06E7	-	1.0	-	5.06E7
AREA 7/8, PIPE P1	33 FT	8 INCH	64,500	1	2569	9073	1.66E8	0.89	0.11	1.47E8	1.82E7
MH-2, PIPE P1	39 FT	8 INCH	76,260	0.5	1740	2346	6.63E7	0.5 ³	0.5 ³	3.32E7	3.32E7
MH-2, PIPE P2	45 FT	12 INCH	131,300	0.5	1576	2130	1.03E8	0.81	0.19	8.34E7	1.96E7
STD-1, PIPE P1	45 FT	12 INCH	331,300	0.5	1968	2707	1.29E8	0.06	0.94	7.74E6	1.21E8
STD-1, PIPE P2	200 FT	12 INCH	583,700	0.5	1553	2251	4.53E8	0.03	0.97	1.36E7	4.39E8
STD-2, PIPE P1	200 FT	12 INCH	583,700	0.5	7316	35382	2.14E9	0.90	0.10	1.93E9	2.14E8
STD-2, PIPE P2	339 FT	18 INCH	1,480,000	0.5	29855	181918	2.22E10	0.5 ³	0.5 ³	1.11E10	1.11E10
STD-3, PIPE P1	339 FT	18 INCH	1,480,000	0.5	4006	9413	2.97E9	0.98	0.02	2.91E9	5.95E7
STD-3, PIPE P2	200 FT	18 INCH	875,600	0.5	6494	56889	2.84E9	0.97	0.03	2.75E9	8.52E7
STD-4, PIPE P1	200 FT	18 INCH	875,600	0.5	3696	6845	1.62E9	0.5 ³	0.5 ³	8.1E8	8.1E8
AREA 7/8, PIPE P11	55 FT	8 INCH	107,016	1	5845	11185	6.26E8	.81	.19	5.07E8	1.19E8
BLDG 7, MH-P1	15 FT	8 INCH	29,186	1	23071	85865	6.73E8	0.5 ³	0.5 ³	3.37E8	3.37E8
STD-4, PIPE 2	<30 FT	15 INCH	109,450 ¹	1	3740	7222	4.09E8	0.5 ³	0.5 ³	2.05E8	2.05E8
			3.46E6				3.44E10			2.08E10 dpm (9.40 mCi)	1.36E10 dpm (6.02 mCi)

1 Estimated

2 Assumes a relative Fraction of 0.5 for both Uranium and Thorium

3 Weighting factors are applied since in some cases the same pipe was surveyed twice, (data provided for both ends of the pipe)

2.3 Storm Drain Beneath Building 7 (Pipe B)

An abandoned storm drain pipe which is approximately 110 feet in length remains buried beneath the first floor of Building 7. This pipe was apparently associated with a roof drain system in which the other portions of the piping system were either removed or released. This segment of pipe remains buried approximately 10 feet beneath the portion of the building with no basement, in close proximity to several supporting structures. Removal of this pipe would pose significant physical safety hazards and challenges. Table 2-4 summarizes the existing radiological condition of this pipe.

The pipe was surveyed in the same manner as the pipe sections in Section 2.3. The inner diameter of this pipe is 8 inches. The mean contamination level in the pipe is estimated to be 17,200 dpm/100 cm² with the highest levels being 19,000 dpm/100 cm². Based on survey results and visual inspections, there is essentially no sludge or sediment in this pipe. Based on field observations, this contamination also appears to be fixed. Due to accessibility issues and the limited success of the other pipe washing techniques, it was decided not to attempt a high pressure wash for this segment. To demonstrate actual compliance with the approved criteria for unrestricted use, this pipe section would have to be removed. Attachment III provides a summary of the estimated costs (\$72,467) associated with removing this pipe. This cost includes excavation, packaging, shipment to a licensed disposal facility, and disposal costs.

TABLE 2-4
Storm Drain Beneath Building 7 (Pipe B)

DESCRIPTION	Length	DIAMETER	Area cm	MEAN CONTAMINATION LEVEL dpm/100 cm ²	MAXIMUM CONTAMINATION LEVEL dpm/100 cm ²	Total Activity dpm in pipe	RELATIVE FRACTION OF URANIUM	RELATIVE FRACTION OF THORIUM	Estimated Total Uranium Activity dpm in pipe	Estimated Total Thorium Activity
Storm Drain	110 ft	8 inches	2.14E5	17,178	18,939	3.68E9	0.5 ¹	0.5 ¹	1.84E9 (.829 mCi)	1.84E9 (.829 mCi)

1 Assumes a relative fraction of 0.5 for both uranium and thorium

3.0 SOURCE TERM

The nuclides used at the Bloomfield Lamp Company consisted of uranium and thorium. This has been confirmed during decontamination and decommissioning. Uranium consists of three radioisotopes: U-234, U-235, and U-238. The relative abundance of these radioisotopes in terms of activity are 0.489, 0.0225, and 0.489, respectively. Thorium is primarily Th-232. The radioisotopes; U-235, U-238, and Th-232 are parents of natural decay chains. U-234 is a long lived member of the U-238 decay chain. The progeny of the Th-232 decay chain are all relatively short lived. The assumption is made that even if pure thorium was used, all of the progeny, including Th-228, will be in equilibrium with Th-232 within 1,000 years. The 1,000 year period corresponds to the future time period that potential doses should be calculated as discussed in NUREG-1500⁽¹⁾. As a result of the half-lives of the progeny associated with the uranium isotopes not all of them will reach equilibrium in 1,000 years. In fact, the activity of many of them will be negligible when compared to the parents. Table 3-1 shows the relative activity of the uranium isotopes and their progeny allowing for 1,050 years of decay. The extra 50 years is based on the assumption that the uranium was processed approximately 50 years ago. Table 3-2 shows the relative activity of Th-232 and its progeny following 1050 years of decay of Th-232.

When developing the source terms to support the dose calculations only U-234, U-235, U-238 and Th-232 were considered to be initially present. Progeny were considered by allowing for 1050 years of decay. For the soil and bedrock beneath Building 7, the activity concentrations of U-235, U-238 and Th-232 were taken directly from the gamma spectral analysis reports. The activity concentration of U-234 was based on its assumed equilibrium with U-238. For the contaminated drain lines, including the one beneath Building 7, the U-234, U-235, U-238 and Th-232 activities were determined based on measurements of surface activity in units of dpm/100 cm² (total of removable + fixed), the relative concentration of uranium and thorium in each line, surface area, and the relative abundance of U-234, U-235 and U-238.

TABLE 3-1
Relative Activity of the Uranium Isotopes and Associated
Progeny Following 1,050 Years of Decay of Processed Uranium

NUCLIDE	RELATIVE FRACTION	NUCLIDE	RELATIVE FRACTION	NUCLIDE	RELATIVE FRACTION
U-234	0.489	U-235	0.0225	U-238	0.489
Th-230	4.593E-3	Th-231	0.0225	Th-234	0.489
Ra-226	9.045E-4	Pa-231	4.943E-4	Pa-234m	0.489
Rn-222	9.045E-4	Ac-227	4.797E-4	Pa-234	7.824E-4
		Fr-223	6.620E-6	U-234	1.453E-3
		Ra-223	4.797E-4	Th-230	6.850E-6
		Rn-219	4.797E-4		

TABLE 3-2
Relative Activity of Thorium-232 and its Daughters Following
1,050 Years of Decay of Thorium 232

NUCLIDE	RELATIVE FRACTION
Th-232	1.0
Ra-228	1.0
Ac-228	1.0
Th-228	1.0
Ra-224	1.0
Rn-220	1.0
Po-216	1.0
Pb-212	1.0
Bi-212	1.0
Po-212	0.641
Tl-208	0.359

4.0 DOSE CALCULATIONS

The residual activity for the three cases which exceed the unrestricted release criteria are modeled independently for the purpose of calculating dose. The three cases were discussed in Section 2.0. Two independent dose calculations were performed for each of these cases. The first calculation is based on several conservative assumptions and represents the most probable dose if the materials were left in place. The worst case, or boundary dose, is based on even more conservative assumptions and assumes the materials were removed and brought to the surface for onsite disposition. Specific assumptions and modeling scenarios for each case are discussed in the subsequent sections.

Compliance with the proposed criteria provided in reference 1 will be demonstrated by summing the resulting doses to obtain the TEDE. In addition, a third calculation has also been performed and assumes that all of the residual activity remaining from these three cases are consolidated into a single source term and the resulting dose is calculated. It was assumed that where the only exposure pathway is due to direct exposure, that the calculated exposure in units of milliroentgens, is equivalent to the TEDE in units of millirem.

4.1 Soil and Bedrock Beneath Building 7

Shortly after NRC clearance has been obtained for Building 7, it will be demolished and the site restored back to grade. The remaining impacted soil and bedrock beneath the former basement in Building 7 will not significantly contribute to dose. Two dose calculations were performed for this material. The first dose calculation, in Section 4.1.1, is performed for the material left in place. The second dose calculated, in Section 4.1.2, is the anticipated dose if the material is brought to the surface for disposition. The calculated doses are mutually exclusive since they represent independent exposure scenarios.

4.1.1 Dose Calculation - Material remains in place

This dose calculation assumes that the contamination is left in place at approximately 10 feet below grade. The Bloomfield site is not zoned for residential use and is located in an industrial setting. Furthermore a deed restriction will be applied to the site limiting the site to non-residential use. Therefore it is expected that there will be no future residents or farming operations on the site. It is also assumed that all drinking water comes from the municipal water system. The computer code Microshield, version 4.10, was used to calculate the potential direct exposure to an individual assuming the individual stands directly above the contamination for 1,000 hours a year. Results of the Microshield run are shown in Attachment IV. **The resulting exposure rate is 8.924E-9 mR/yr.**

4.1.2 Dose Calculation - Material brought to surface

This dose calculation assumes that all of the soil is excavated and redeposited on the surface as thin disk, 1 foot thick with a diameter of 240 feet. The activity in this thin disk will be assumed to be uniform with a total activity equal to that currently beneath Building 7. The diameter of the disc was chosen such that the area of the disc approximates a 1-acre industrial lot.

The computer code RESRAD⁽⁴⁾, version 5.61, was used to estimate the dose to a hypothetical individual based on the occupational scenario contained in USNRC Policy and Guidance Directive PG-8-08⁽⁸⁾. For the purpose of the RESRAD calculations it will be assumed that all of the activity is contained in a soil matrix. The computer code RESRAD was used for this calculation since there are multiple exposure pathways to evaluate. The results of the RESRAD run are shown in Attachment V.

The maximum total effective dose equivalent rate is 1.54 mrem/yr.

4.2 Storm Drain Piping (Pipe A)

The buried storm drain piping will not significantly contribute to dose while left undisturbed. The only realistic exposure scenario for the buried pipe is from direct exposure. However, this is not a significant exposure source since the remaining activity is fixed to the internal surfaces of the pipe. Two dose calculations were performed for this material. The first dose calculation, in Section 4.2.1, is performed for the pipe left in place. The second dose calculated, in Section 4.2.2, is the anticipated dose if the pipe is brought to the surface for disposition. The calculated doses are mutually exclusive since they represent independent exposure scenarios.

4.2.1 Dose Calculation - Pipe (A) remains in place

This dose calculation assumes the pipe is left in place and an individual stands directly above the most contaminated section of pipe for 1,000 hours a year. This calculation assumes that the pipe is located 3 feet below grade. This assumption is conservative because the actual minimum depth is 3 feet and proceeds to over 12 feet in depth at the end of the pipe. The results of the Microshield run are shown in Attachment VI. **The resulting exposure rate is 0.0923 mR/yr.**

4.2.2 Dose Calculation - Pipe (A) brought to surface

This dose calculation assumes that the pipes are removed essentially intact, and placed in a pile on site. The pile was modeled as a sphere with a radius of 167 cm and a density of 0.2 g/cm³. A sphere with a radius of 167 cm approaches the volume of the buried storm drain piping. The assumed density of 0.2 g/cm³ results in minimal credit due to self attenuation.

The computer code Microshield was used to calculate the external dose to a hypothetical individual who spends 1,000 hours a year approximately 100 feet from the pipes. No credit is taken for any shielding that would be afforded if the exposed individual was located in a building. The results of the Microshield run are shown in Attachment VII. **The resulting exposure rate is 2.04 mR/yr.**

4.3 Storm Drain Beneath Building 7 (Pipe B)

The buried storm drain piping will not significantly contribute to dose while left undisturbed. The only realistic exposure scenario for the buried pipe is from direct exposure. However, this is not a significant exposure source since the remaining activity is fixed to the internal surfaces of the pipe. Two dose calculations were performed for this material. The first dose calculation, in Section 4.3.1, is performed for the pipe is left in place. The second dose calculated, in Section 4.3.2, is the anticipated dose if the pipe is brought to the surface for disposition. The calculated doses are mutually exclusive since they represent independent exposure scenarios.

4.3.1 Dose Calculation - Pipe (B) remains in place

This dose calculation assumes that the contamination is left in place approximately 6 feet below grade. The Bloomfield site is not zoned for residential use and is located in an industrial setting. Furthermore a deed restriction will be applied to the site limiting the site to non-residential use. Therefore it is expected that there will be no future residents or farming operations on site. It is also assumes that all drinking water comes from the municipal water system. The computer code Microshield was used to calculate the potential direct exposure to an individual assuming the individual stands directly above the contamination for 1,000 hours a year. The results of the microshield run are shown in Attachment VIII.

The resulting exposure rate is 1.07E-4 mR/yr.

4.3.2 Dose Calculation - Pipe (B) brought to surface

This dose calculation assumes that the pipe is removed essentially intact and placed in a pile on site. The pile was modeled as a sphere with a radius of 64 cm and a density of 0.2 g/cm³. A sphere with a radius of 64 cm approaches the volume of the buried pipe. The assumed density of 0.2 g/cm³ results in minimal credit due to self asttenuation. The computer code Microshield was used to calculate the potential direct exposure to a hypothetical worker assuming he spends 1,000 hours a year, approximately 100 feet from this pipe. The results of the Microshield run are shown in Attachment IX. **The resulting exposure rate is 0.44 mR/yr.**

4.4 Consolidated Source Term

To further demonstrate that the residual activity meets the proposed criteria for unrestricted use, a calculation was performed assuming that all of the residual activity is consolidated into a single source term. The computer code RESRAD⁽⁴⁾ was used to estimate the dose to a hypothetical individual based on the resident scenario contained in USNRC Policy Guidance Directive PG-8-08⁽⁸⁾. Although this is not considered a realistic scenario, it allows for the evaluation of multiple exposure pathways using conservative assumptions. The specified geometry which was used (1 foot thick disc, 240 feet diameter) is the same utilized for the evaluation of the soil beneath Building 7. The results of the RESRAD run are shown in Attachment X.

The maximum total effective dose equivalent rate is 12.1 mrem/yr.

4.5 DOSE SUMMARY

The results of the dose calculations performed earlier in this section are summarized below. There are three conservative dose summation scenarios presented below. The first scenario represents the PROBABLE DOSE to an individual if the material included in this dose assessment remains in place (below grade). The second scenario represents the MAXIMUM CREDIBLE DOSE to an individual if the material is removed and redeposited on the surface. The final dose scenario represents an extremely conservative calculation that evaluates a CONSOLIDATED SINGLE SOURCE TERM by assuming all of the activity is removed and consolidated into a single source term at the surface.

1.) PROBABLE DOSE (Activity left in place):

Soil Beneath Building 7	8.92E-9 mrem/yr
Storm Drain Piping	9.23E-2 mrem/yr
Storm Drain Beneath Building 7	<u>1.07E-4 mrem/yr</u>
Total:	0.0924 mrem/yr

2.) MAXIMUM CREDIBLE DOSE (Activity removed and redeposited):

Soil Beneath Building 7	1.54 mrem/yr
Storm Drain Piping	2.04 mrem/yr
Storm Drain Beneath Building 7	<u>0.44 mrem/yr</u>
Total:	4.02 mrem/yr

3.) CONSOLIDATED SINGLE SOURCE TERM (from Attachment X)

Total:	12.1 mrem/yr
---------------	---------------------

For the purpose of summing the doses due to the various source terms, the maximum doses are presented regardless of the year in which they occur.

5.0 CONCLUSION

The results of the dose calculations demonstrate compliance with proposed NUREG-1500⁽¹⁾ regulations relative to a dose based criteria for residual contamination and, in conjunction with the final survey for the balance of the site, establishes the basis for stating that the site is acceptable for free release, unrestricted use, and license termination. The residual radioactivity has been conservatively modeled and specific calculations performed to estimate the potential doses. The most probable dose equivalent to a hypothetical individual due to this residual radioactivity is calculated to be 0.0924 mrem/yr. The maximum credible calculated dose is 4.02 mrem/yr. The calculated dose from a consolidated source is 12.1 mrem/yr, which is still less than the NUREG-1500⁽¹⁾ TEDE of 15 mrem/yr. However, this latter dose is based on the highly-conservative assumption that all residual activity would be consolidated into a single source term.

The cost to remediate this residual contamination to below the existing guideline values is estimated to be \$1,460,000. Utilizing the calculated most probable dose to a hypothetical individual, and the conservative assumption that this remediation would remove all activity and reduce the dose to zero, the resulting dose reduction would cost over \$15 million/mrem/yr. The cost would be approximately \$358 thousand/mrem/yr using the calculated maximum credible dose to a hypothetical individual. In actuality, the cost for both analyses would be higher since the dose would not be reduced to zero. Based on these dose calculations and remediation estimates, leaving the residual radioactivity in place is consistent with the ALARA philosophy discussed in NUREG-1500⁽¹⁾.

REFERENCES

1. Draft NUREG-1500, *Working Draft Regulatory Guide on Release Criteria for Decommissioning: NRC Staff's Draft for Comment*.
2. NRC "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Materials", August 1987.
3. Federal Register, Vol 46, No. 205, *Disposal or Onsite Storage of Thorium or Uranium Waste From Past Operations*, October 23, 1981.
4. ANL/EAD/lid-2, *Manual for Implementing Residual Radioactive Material Guidelines Using RESRAD, Version 5.0*, Working Draft For Comment.
5. USNRC Safety Evaluation Report for WEC Bloomfield NJ facility, dated May 24, 1993, Docket No. 040-08976, Applicable limits, pp. 3-4.
6. NUREG-1501, *Background as a Residual Radioactivity Criterion for Decommissioning*, Draft Report.
7. Federal Register, Vol. 59, No. 161, Monday, August 22, 1994, Proposed Rules, *Radiological Criteria for Decommissioning*.
8. US NRC Policy Guidance Directive PG-8-08, *Scenarios for Assessing Potential Doses Associated with Residual Radioactivity*, May 1994.

The following reference was not specifically referenced in this report, but was utilized in the preparation of this Dose Assessment.

- * ASTM Standard E 1278-88, *Standard Guide for Radioactive Pathway Methodology for Release of Sites Following Decommissioning*.

ATTACHMENT I

COST ESTIMATE TO REMEDIATE SOIL BENEATH BUILDING 7

Cost Estimate To Remediate Soil Beneath Building 7

Mobilization	\$3,000.00	\$3,000
Technician Labor	532 hrs @ \$34.42/hr	\$18,300
Project Manager	50 hrs @ \$90.00/hr	\$4,500
Engineer	260 hrs @ 75.24/hr	\$19,562
Subcontractor Costs	\$29,500. + 10%	\$32,450
Living Expenses	105 days @ \$110.00/day	\$11,550
Consumable	\$1,000	\$1,000
Equipment Lease	5 weeks @ \$1,000.00/month	\$2,000
Waste Containers	105 @ \$600.00/	\$63,000
Waste Shipments	21 @ \$4,500.00/	\$94,500
Burial Cost	10,000 ft ³ @ \$80.00/ft ³	\$800,000
Demobilization	\$2,000.00	<u>\$2,000</u>

Total: \$1,051,862

ATTACHMENT II

COST ESTIMATE TO REMEDIATE STORM DRAIN PIPING (Pipe A)

Cost Estimate To Remediate Storm Drain Piping (Pipe A)

Mobilization	\$3,000.00	\$3,000
Technician Labor	1,140 hrs @ \$34.42/hr	\$39,238
Project Manager	50 hrs @ \$90.00/hr	\$4,500
Engineer	500 hrs @ \$75.24/hr	\$37,620
Subcontractor Cost	\$85,300.00 + 10%	\$93,830
Living Expenses	215 days @ \$110.00/day	\$23,659
Consumable	\$1,000	\$1,000
Equipment Lease	12 weeks @ \$1,000.00/month	\$3,000
Waste Containers	14 @ \$600.00/	\$8,400
Waste Shipments	3 @ \$4,500/	\$13,500
Burial Cost	1,300 ft ³ @ \$80.00/ft ³	\$104,000
Demobilization	\$2,000.00	<u>\$2,000</u>
Total:		\$333,747

ATTACHMENT III

COST ESTIMATE TO REMEDIATE STORM DRAIN BENEATH BUILDING 7 (Pipe B)

Cost Estimate To Remediate Storm Drain Beneath Building 7 (Pipe B)

Mobilization	\$3,000.00	\$3,000
Technician Labor	300 hrs @ \$34.42/hr	\$10,326
Project Manager	50 hrs @ \$90.00/hr	\$4,500
Engineer	150 hrs @ \$75.24/hr	\$11,286
Subcontractor Cost	\$9,750.00 + 10%	\$10,725
Living Expenses	63 days @ \$110.00/day	\$6,930
Consumable	\$1,000.00	\$1,000
Equipment Lease	3 weeks @ \$1,000.00/month	\$1,000
Waste Containers	2 @ \$600.00/	\$1,200
Waste Shipments	1 @ \$4,500.00/	\$4,500
Burial Cost	200 ft ³ @ \$80.00/ft ³	\$16,000
Demobilization	\$2,000.00	<u>\$2,000</u>
Total:		\$72,467

ATTACHMENT IV

**DOSE CALCULATIONS
SOIL BENEATH BUILDING 7
ACTIVITY LEFT IN PLACE**

Microshield Input**Soil Beneath Building 7, Activity Left In Place**

Volume of contaminated soil and bedrock	10,000 ft ³	
Thickness of contaminated disc	1.5 ft	
Area of contaminated disc	6,667 ft ²	
Radius of disc	46 ft	
Density	1.63 g/cm ³	
Mass	4.62E8 g	
Activity		
U-234	75 pCi/g	0.03465 Ci
U-235	4.1 pCi/g	0.00189 Ci
U-238	75 pCi/g	0.03465 Ci
Th-232	1.17 pCi/g	0.00054 Ci
Th-228	1.17 pCi/g	0.00054 Ci

MicroShield 4.10 - Serial #4.10-00702
SEG

Page : 1
DOS File: SANDB1.MS4
Run Date: December 5, 1995
Run Time: 4:10 p.m. Tuesday
Duration: 0:01:27

File Ref: Bloom
Date: 12/18/95
By: [Signature]
Checked: 841 12/2/95

Case Title: Soil and Bedrock (number 1)

GEOMETRY 8 - Cylinder Volume - End Shields

	centimeters	feet and inches	
Dose point coordinate X:	0.0	0.0	.0
Dose point coordinate Y:	442.0	14.0	6.0
Dose point coordinate Z:	0.0	0.0	.0
Cylinder height:	45.72	1.0	6.0
Cylinder radius:	1402.0	45.0	12.0
Shield 1:	304.8	10.0	.0
Air Gap:	91.48	3.0	.0

Source Volume: 2.82327e+8 cm³ 9970.28 cu ft. 1.72286e+7 cu in.

MATERIAL DENSITIES (g/cm³)

Material	Source Shield	Shield 1 Slab	Air Gap
Air			0.00122
Water	1.63	1.5	

BUILDUP

Method: Buildup Factor Tables
The material reference is Shield 1

INTEGRATION PARAMETERS

	Quadrature Order
Radial	50
Circumferential	50
Y Direction (axial)	50

SOURCE NUCLIDES

Nuclide	curies	microCi/cm ³	Nuclide	curies	microCi/cm ³
Ac-227	4.0296e-005	1.4273e-007	Ac-228	5.4000e-004	1.9127e-006
Bi-210	6.0578e-005	2.1457e-007	Bi-211	4.0291e-005	1.4271e-007
Bi-212	5.4000e-004	1.9127e-006	Bi-214	6.4146e-005	2.2721e-007
Fr-223	5.5609e-007	1.9697e-009	Pa-231	4.1526e-005	1.4708e-007
Pa-234	5.5440e-005	1.9637e-007	Pa-234m	3.4650e-002	1.2273e-004
Pb-210	6.0580e-005	2.1458e-007	Pb-211	4.0291e-005	1.4271e-007
Pb-212	5.4000e-004	1.9127e-006	Pb-214	6.4146e-005	2.2721e-007
Po-210	6.0518e-005	2.1435e-007	Po-211	1.1000e-007	3.8961e-010
Po-212	3.4598e-004	1.2255e-006	Po-214	6.4133e-005	2.2716e-007
Po-215	4.0292e-005	1.4271e-007	Po-216	5.4000e-004	1.9127e-006
Po-218	6.4159e-005	2.2725e-007	Ra-223	4.0292e-005	1.4271e-007
Ra-224	5.4000e-004	1.9127e-006	Ra-226	6.4161e-005	2.2726e-007

Page : 2
 DOS File: SANDB1.MS4
 Run Date: December 5, 1995
 Run Time: 4:10 p.m. Tuesday
 Title : Soil and Bedrock (number 1)

Nuclide	curies	microCi/cm ³	Nuclide	curies	microCi/cm ³
Ra-228	5.4000e-004	1.9127e-006	Rn-219	4.0292e-005	1.4271e-007
Rn-220	5.4000e-004	1.9127e-006	Rn-222	6.4159e-005	2.2725e-007
Th-227	3.9737e-005	1.4075e-007	Th-228	5.4000e-004	1.9127e-006
Th-230	3.2597e-004	1.1546e-006	Th-231	1.8900e-003	6.6944e-006
Th-232	5.4000e-004	1.9127e-006	Th-234	3.4650e-002	1.2273e-004
Tl-207	4.0182e-005	1.4232e-007	Tl-208	1.9402e-004	6.8722e-007
U-234	3.4650e-002	1.2273e-004	U-235	1.8900e-003	6.6944e-006
U-238	3.4650e-002	1.2273e-004			

===== RESULTS =====					
Energy (MeV)	Activity (photons/sec)	Energy Fluence Rate (MeV/sq cm/sec)		Exposure Rate In Air (mR/hr)	
		No Buildup	With Buildup	No Buildup	With Buildup
0.1	8.924e+006	3.993e-038	4.459e-023	6.108e-041	6.822e-026
0.15	1.255e+007	5.012e-034	1.427e-022	8.254e-037	2.350e-025
0.2	5.493e+007	1.216e-030	5.952e-022	2.147e-033	1.050e-024
0.3	6.747e+006	1.061e-027	3.101e-023	2.013e-030	5.882e-026
0.4	1.893e+006	1.431e-025	4.903e-022	2.789e-028	9.553e-025
0.5	3.008e+006	2.249e-023	3.401e-020	4.415e-026	6.676e-023
0.6	8.262e+006	2.365e-021	1.880e-018	4.615e-024	3.670e-021
0.8	1.091e+007	7.790e-019	2.505e-016	1.482e-021	4.766e-019
1.0	2.599e+007	1.070e-016	1.832e-014	1.973e-019	3.377e-017
1.5	3.419e+006	1.272e-014	8.048e-013	2.140e-017	1.354e-015
2.0	7.328e+005	1.987e-013	7.060e-012	3.073e-016	1.092e-014
3.0	7.164e+006	3.707e-010	6.569e-009	5.030e-013	8.912e-012
TOTAL:	1.445e+008	3.709e-010	6.577e-009	5.033e-013	8.924e-012

ATTACHMENT V

**DOSE CALCULATION
SOIL BENEATH BUILDING 7
ACTIVITY REMOVED AND REDEPOSITED**

RESRAD Input

Soil Beneath Building 7, Activity Removed and Redeposited

Volume of contaminated soil and bedrock (original)	10,000 ft ³	
Thickness of contaminated disc	30.48 cm	
Area of contaminated disc	4203 m ²	
Density of disc	1.63 g/cm ³	
Mass of disc	2.09E9 g	
Activity		
U-234	0.03465 Ci	16.58 pCi/g
U-235	0.00189 Ci	0.904 pCi/g
U-238	0.03465 Ci	16.58 pCi/g
Th-232	0.00054 Ci	0.258 pCi/g
Th-228	0.00054 Ci	0.258 pCi/g

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Dose Conversion Factor (and Related) Parameter Summary
File: DOSFAC.BIM

Menu	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	6.720E+00	6.720E+00	DCF2(1)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(2)
B-1	Pb-210+D	2.320E-02	2.320E-02	DCF2(3)
B-1	Ra-226+D	8.600E-03	8.600E-03	DCF2(4)
B-1	Ra-228+D	5.080E-03	5.080E-03	DCF2(5)
B-1	Th-228+D	3.450E-01	3.450E-01	DCF2(6)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(7)
B-1	Th-232	1.640E+00	1.640E+00	DCF2(8)
B-1	U-234	1.320E-01	1.320E-01	DCF2(9)
B-1	U-235+D	1.230E-01	1.230E-01	DCF2(10)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(11)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	1.480E-02	1.480E-02	DCF3(1)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(2)
D-1	Pb-210+D	7.270E-03	7.270E-03	DCF3(3)
D-1	Ra-226+D	1.330E-03	1.330E-03	DCF3(4)
D-1	Ra-228+D	1.440E-03	1.440E-03	DCF3(5)
D-1	Th-228+D	8.080E-04	8.080E-04	DCF3(6)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(7)
D-1	Th-232	2.730E-03	2.730E-03	DCF3(8)
D-1	U-234	2.830E-04	2.830E-04	DCF3(9)
D-1	U-235+D	2.670E-04	2.670E-04	DCF3(10)
D-1	U-238+D	2.690E-04	2.690E-04	DCF3(11)
D-34	Food transfer factors:			
D-34	Ac-227+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(1,1)
D-34	Ac-227+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,2)
D-34	Ac-227+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,3)
D-34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(2,1)
D-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(2,2)
D-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(2,3)
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(3,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(3,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(3,3)
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(4,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,3)
D-34	Ra-228+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(5,1)
D-34	Ra-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(5,2)
D-34	Ra-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(5,3)
D-34	Th-228+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(6,1)
D-34	Th-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(6,2)
D-34	Th-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(6,3)
D-34				

Dose Conversion Factor (and Related) Parameter Summary (continued)
 File: DOSFAC.BIN

Menu	Parameter	Current Value	Default	Parameter Name
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(7,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(7,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(7,3)
D-34				
D-34	Th-232 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(8,1)
D-34	Th-232 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(8,2)
D-34	Th-232 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(8,3)
D-34				
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(9,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(9,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(9,3)
D-34				
D-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(10,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(10,2)
D-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(10,3)
D-34				
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(11,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(11,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(11,3)
	Bioaccumulation factors, fresh water, L/kg:			
-5	Ac-227+D , fish	1.500E+01	1.500E+01	BIOFAC(1,1)
D-5	Ac-227+D , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(1,2)
D-5				
D-5	Pa-231 , fish	1.000E+01	1.000E+01	BIOFAC(2,1)
D-5	Pa-231 , crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC(2,2)
D-5				
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(3,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(3,2)
D-5				
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(4,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(4,2)
D-5				
D-5	Ra-228+D , fish	5.000E+01	5.000E+01	BIOFAC(5,1)
D-5	Ra-228+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(5,2)
D-5				
D-5	Th-228+D , fish	1.000E+02	1.000E+02	BIOFAC(6,1)
D-5	Th-228+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(6,2)
D-5				
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(7,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(7,2)
D-5				
D-5	Th-232 , fish	1.000E+02	1.000E+02	BIOFAC(8,1)
D-5	Th-232 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(8,2)
D-5				
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(9,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(9,2)
D-5				
D-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC(10,1)
D-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(10,2)
D-5				

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: DOSFAC.BIN

Menu	Parameter	Current Value	Default	Parameter Name
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(11,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(11,2)

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	4.023E+03	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	3.048E-01	2.000E+00	---	THICKO
R011	Length parallel to aquifer flow (m)	1.000E+02	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.500E+01	3.000E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	T1
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): Th-228	2.580E-02	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g): Th-232	2.580E-02	0.000E+00	---	S1(8)
R012	Initial principal radionuclide (pCi/g): U-234	1.658E+01	0.000E+00	---	S1(9)
R012	Initial principal radionuclide (pCi/g): U-235	9.040E-01	0.000E+00	---	S1(10)
R012	Initial principal radionuclide (pCi/g): U-238	1.658E+01	0.000E+00	---	S1(11)
R012	Concentration in groundwater (pCi/L): Th-228	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L): Th-232	not used	0.000E+00	---	W1(8)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(9)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W1(10)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(11)
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVERO
R013	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.630E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	3.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone effective porosity	2.000E-01	2.000E-01	---	EPCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Humidity in air (g/cm**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	2.000E-01	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	0.000E+00	1.000E-03	Zero shows Simpson's rule.	EPS
R014	Density of saturated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	4.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.000E-01	2.000E-01	---	EPSZ
R014	Saturated zone hydraulic conductivity (m/yr)	1.000E+02	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	5.300E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT

Site-Specific Parameter Summary (continued)

Item	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBIT
014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
014	Well pumping rate (m ³ /yr)	2.500E+02	2.500E+02	---	WV
015	Number of unsaturated zone strata	not used	1	---	NS
015	Unsat. zone 1, thickness (m)	not used	4.000E+00	---	H(1)
015	Unsat. zone 1, soil density (g/cm ³)	not used	1.500E+00	---	DENSUZ(1)
015	Unsat. zone 1, total porosity	not used	4.000E-01	---	TPUZ(1)
015	Unsat. zone 1, effective porosity	not used	2.000E-01	---	EPUZ(1)
015	Unsat. zone 1, soil-specific b parameter	not used	5.300E+00	---	BUZ(1)
015	Unsat. zone 1, hydraulic conductivity (m/yr)	not used	1.000E+01	---	HCUZ(1)
016	Distribution coefficients for Th-228				
016	Contaminated zone (cm ³ /g)	6.000E+04	6.000E+04	---	DCNUCC(6)
016	Unsat. zone 1 (cm ³ /g)	0.000E+00	6.000E+04	---	DCNUCU(6,1)
016	Saturated zone (cm ³ /g)	0.000E+00	6.000E+04	---	DCNUCS(6)
016	Leach rate (/yr)	0.000E+00	0.000E+00	1.677E-05	ALEACH(6)
016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
016	Distribution coefficients for Th-232				
016	Contaminated zone (cm ³ /g)	6.000E+04	6.000E+04	---	DCNUCC(8)
016	Unsat. zone 1 (cm ³ /g)	0.000E+00	6.000E+04	---	DCNUCU(8,1)
016	Saturated zone (cm ³ /g)	0.000E+00	6.000E+04	---	DCNUCS(8)
016	Leach rate (/yr)	0.000E+00	0.000E+00	1.677E-05	ALEACH(8)
016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
016	Distribution coefficients for U-234				
016	Contaminated zone (cm ³ /g)	5.000E+01	5.000E+01	---	DCNUCC(9)
016	Unsat. zone 1 (cm ³ /g)	0.000E+00	5.000E+01	---	DCNUCU(9,1)
016	Saturated zone (cm ³ /g)	0.000E+00	5.000E+01	---	DCNUCS(9)
016	Leach rate (/yr)	0.000E+00	0.000E+00	2.007E-02	ALEACH(9)
016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(9)
016	Distribution coefficients for U-235				
016	Contaminated zone (cm ³ /g)	5.000E+01	5.000E+01	---	DCNUCC(10)
016	Unsat. zone 1 (cm ³ /g)	0.000E+00	5.000E+01	---	DCNUCU(10,1)
016	Saturated zone (cm ³ /g)	0.000E+00	5.000E+01	---	DCNUCS(10)
016	Leach rate (/yr)	0.000E+00	0.000E+00	2.007E-02	ALEACH(10)
016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(10)
016	Distribution coefficients for U-238				
016	Contaminated zone (cm ³ /g)	5.000E+01	5.000E+01	---	DCNUCC(11)
016	Unsat. zone 1 (cm ³ /g)	0.000E+00	5.000E+01	---	DCNUCU(11,1)
016	Saturated zone (cm ³ /g)	0.000E+00	5.000E+01	---	DCNUCS(11)
016	Leach rate (/yr)	0.000E+00	0.000E+00	2.007E-02	ALEACH(11)
016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(11)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for daughter Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	0.000E+00	2.000E+01	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	0.000E+00	2.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.995E-02	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter Pa-231				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	0.000E+00	5.000E+01	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	0.000E+00	5.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.007E-02	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.005E-02	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(4,1)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.435E-02	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R016	Distribution coefficients for daughter Ra-228				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(5,1)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.435E-02	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R016	Distribution coefficients for daughter Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(7)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(7,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.677E-05	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)
R017	Inhalation rate (m**3/yr)	1.051E+04	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	2.000E-04	2.000E-04	---	MLINH
R017	Dilution length for airborne dust, inhalation (m)	3.000E+00	3.000E+00	---	LM
R017	Exposure duration	3.000E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	5.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	3.300E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	1.800E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	5.000E-02	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	1 shows circular AREA.	FS

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	not used	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	not used	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	not used	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	not used	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	not used	1.000E+00	---	FDW
R018	Contamination fraction of household water	1.000E+00	1.000E+00	---	FHW
R018	Contamination fraction of livestock water	not used	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	not used	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	not used	-1	---	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LF15
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LF16
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LW15
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LW16
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LS1
R019	Mass loading for foliar deposition (g/m**3)	not used	1.000E-04	---	MLFD

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	not used	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	1.000E+00	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	not used	1.000E+00	---	FGWIR
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	not used	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	not used	1.000E+00	---	STOR_T(2)
STOR	Milk	not used	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	not used	2.000E+01	---	STOR_T(4)
STOR	Fish	not used	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	not used	7.000E+00	---	STOR_T(6)
STOR	Well water	not used	1.000E+00	---	STOR_T(7)
STOR	Surface water	not used	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	not used	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	1.500E-01	1.500E-01	---	FLOOR
R021	Bulk density of building foundation (g/cm**3)	2.400E+00	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	1.000E-01	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	3.000E-02	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	3.000E-07	3.000E-07	---	DIFFL
R021	in contaminated zone soil	2.000E-06	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	2.000E+00	2.000E+00	---	HMIX
R021	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
R021	Average building air exchange rate (1/hr)	5.000E-01	5.000E-01	---	REXG
R021	Height of the building (room) (m)	2.500E+00	2.500E+00	---	HRM
R021	Building interior area factor	0.000E+00	0.000E+00	code computed (time dependent)	FAI
R021	Building depth below ground surface (m)	-1.000E+00	-1.000E+00	code computed (time dependent)	DMFL
R021	Emanating power of Rn-222 gas	3.500E-01	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	1.500E-01	1.500E-01	---	EMANA(2)

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	suppressed
4 -- meat ingestion	suppressed
5 -- milk ingestion	suppressed
6 -- aquatic foods	suppressed
7 -- drinking water	suppressed
8 -- soil ingestion	suppressed
9 -- radon	active

Contaminated Zone Dimensions

Area: 4023.00 square meters
Thickness: 0.30 meters
Cover Depth: 0.00 meters

Initial Soil Concentrations, pCi/g

Th-228 2.580E-02
Th-232 2.580E-02
U-234 1.658E+01
U-235 9.040E-01
U-238 1.658E+01

Total Dose TDOSE(t), mrem/yr

Basic Radiation Dose Limit = 15 mrem/yr

Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	1.544E+00	1.507E+00	1.444E+00	1.268E+00	8.755E-01	2.565E-01	4.779E-03	1.307E-05
M(t):	1.029E-01	1.005E-01	9.627E-02	8.454E-02	5.837E-02	1.710E-02	3.186E-04	8.711E-07

Maximum TDOSE(t): 1.544E+00 mrem/yr at t = 0.000E+00 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-228	2.663E-02	0.0173	2.501E-03	0.0016	1.833E-03	0.0012	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	1.394E-06	0.0000	1.189E-02	0.0077	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	6.944E-04	0.0004	6.150E-01	0.3984	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	7.121E-02	0.0461	3.124E-02	0.0202	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	2.330E-01	0.1510	5.497E-01	0.3561	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	3.316E-01	0.2148	1.210E+00	0.7840	1.833E-03	0.0012	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.096E-02	0.0201
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.189E-02	0.0077
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.157E-01	0.3988
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.025E-01	0.0664
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.828E-01	0.5071
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.544E+00	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-228	1.853E-02	0.0123	1.741E-03	0.0012	1.276E-03	0.0008	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	2.274E-03	0.0015	1.194E-02	0.0079	3.401E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	6.806E-04	0.0005	6.028E-01	0.4000	7.586E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	6.980E-02	0.0463	3.063E-02	0.0203	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	2.284E-01	0.1516	5.388E-01	0.3576	7.154E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	3.197E-01	0.2121	1.186E+00	0.7870	1.311E-03	0.0009	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.155E-02	0.0143
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.425E-02	0.0095
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.034E-01	0.4005
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.004E-01	0.0666
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.672E-01	0.5001
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.507E+00	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and fraction of Total Dose At t = 3.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-228	8.976E-03	0.0062	8.434E-04	0.0006	6.182E-04	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	7.952E-03	0.0055	1.221E-02	0.0085	2.246E-04	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	6.542E-04	0.0005	5.791E-01	0.4010	6.649E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	6.706E-02	0.0464	2.944E-02	0.0204	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	2.194E-01	0.1519	5.176E-01	0.3584	1.873E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	3.040E-01	0.2105	1.139E+00	0.7889	8.495E-04	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	1.391E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.044E-02	0.0072
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	3.917E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.038E-02	0.0141
U-234	0.000E+00	0.0000	0.000E+00	0.0000	4.530E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.797E-01	0.4015
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.651E-02	0.0668
U-238	0.000E+00	0.0000	0.000E+00	0.0000	4.388E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.370E-01	0.5104
Total	0.000E+00	0.0000	0.000E+00	0.0000	4.061E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.444E+00	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio- nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
h-228	7.096E-04	0.0006	6.676E-05	0.0001	4.893E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
h-232	2.474E-02	0.0195	1.326E-02	0.0105	9.867E-04	0.0008	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
h-234	5.716E-04	0.0005	5.033E-01	0.3969	6.736E-05	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
h-235	5.831E-02	0.0460	2.566E-02	0.0202	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
h-238	1.906E-01	0.1503	4.498E-01	0.3547	6.231E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
total	2.749E-01	0.2168	9.920E-01	0.7823	1.103E-03	0.0009	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Dependent Pathways

Radio- nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
h-228	0.000E+00	0.0000	0.000E+00	0.0000	2.519E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.253E-04	0.0007
h-232	0.000E+00	0.0000	0.000E+00	0.0000	1.802E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.900E-02	0.0308
h-234	0.000E+00	0.0000	0.000E+00	0.0000	5.951E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.039E-01	0.3974
h-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.396E-02	0.0662
h-238	0.000E+00	0.0000	0.000E+00	0.0000	4.079E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.404E-01	0.5050
total	0.000E+00	0.0000	0.000E+00	0.0000	1.803E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.268E+00	1.0000

Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-228	5.031E-07	0.0000	4.757E-08	0.0000	3.487E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	3.678E-02	0.0420	1.409E-02	0.0161	1.592E-03	0.0018	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	4.042E-04	0.0005	3.371E-01	0.3850	4.666E-04	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	3.909E-02	0.0447	1.739E-02	0.0199	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	1.274E-01	0.1456	3.011E-01	0.3439	1.239E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	2.037E-01	0.2327	6.697E-01	0.7649	2.059E-03	0.0024	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	1.674E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.856E-07	0.0000
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	6.287E-05	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.252E-02	0.0600
U-234	0.000E+00	0.0000	0.000E+00	0.0000	6.382E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.380E-01	0.3860
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.648E-02	0.0645
U-238	0.000E+00	0.0000	0.000E+00	0.0000	1.006E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.285E-01	0.4895
Total	0.000E+00	0.0000	0.000E+00	0.0000	6.293E-05	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.755E-01	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
 As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-228	4.677E-18	0.0000	4.594E-19	0.0000	3.367E-19	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	3.643E-02	0.1420	1.413E-02	0.0551	1.636E-03	0.0064	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	2.169E-04	0.0008	8.322E-02	0.3244	2.118E-03	0.0083	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	9.605E-03	0.0374	4.502E-03	0.0175	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	3.070E-02	0.1197	7.391E-02	0.2881	1.587E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	7.696E-02	0.3000	1.758E-01	0.6852	3.754E-03	0.0146	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
 As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	1.190E-23	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.474E-18	0.0000
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	5.404E-05	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.226E-02	0.2037
U-234	0.000E+00	0.0000	0.000E+00	0.0000	5.483E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.556E-02	0.3335
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.411E-02	0.0550
U-238	0.000E+00	0.0000	0.000E+00	0.0000	1.455E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.046E-01	0.4078
Total	0.000E+00	0.0000	0.000E+00	0.0000	5.459E-05	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.565E-01	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	3.351E-03	0.7011	4.508E-04	0.0943	5.905E-04	0.1235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	2.273E-05	0.0048	6.940E-05	0.0145	1.496E-04	0.0313	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	2.277E-05	0.0048	2.997E-06	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	7.148E-05	0.0150	4.276E-05	0.0089	1.985E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	3.468E-03	0.7256	5.659E-04	0.1184	7.401E-04	0.1549	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	3.133E-06	0.0007	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.396E-03	0.9197
U-234	0.000E+00	0.0000	0.000E+00	0.0000	2.231E-06	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.440E-04	0.0510
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.577E-05	0.0054
U-238	0.000E+00	0.0000	0.000E+00	0.0000	2.029E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.143E-04	0.0239
Total	0.000E+00	0.0000	0.000E+00	0.0000	5.366E-06	0.0011	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.779E-03	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDose(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDose(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	1.306E-05	0.9998	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.306E-05	0.9998
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	2.841E-09	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.841E-09	0.0002
Total	0.000E+00	0.0000	0.000E+00	0.0000	1.307E-05	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.307E-05	1.0000

*Sum of all water independent and dependent pathways.

Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Branch Fraction	DSR(j,t) (mrem/yr)/(pCi/g)							
		t=	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-228	Th-228	1.000E+00	1.200E+00	8.353E-01	4.045E-01	3.199E-02	2.270E-05	2.122E-16	0.000E+00	0.000E+00
Th-232	Th-232	1.000E+00	4.609E-01	4.609E-01	4.609E-01	4.608E-01	4.606E-01	4.601E-01	1.469E-02	0.000E+00
Th-232	Ra-228	1.000E+00	0.000E+00	6.909E-02	1.822E-01	4.051E-01	5.363E-01	5.327E-01	5.192E-02	0.000E+00
Th-232	Th-228	1.000E+00	0.000E+00	2.226E-02	1.470E-01	6.457E-01	1.039E+00	1.033E+00	1.038E-01	7.604E-41
Th-232	ΣDSR(j)		4.609E-01	5.522E-01	7.900E-01	1.512E+00	2.036E+00	2.025E+00	1.704E-01	7.604E-41
U-234	U-234	1.000E+00	3.713E-02	3.639E-02	3.496E-02	3.038E-02	2.034E-02	4.990E-03	2.918E-06	0.000E+00
U-234	Th-230	1.000E+00	0.000E+00	8.175E-07	2.404E-06	7.480E-06	1.860E-05	3.555E-05	1.76E-06	0.000E+00
U-234	Ra-226	1.000E+00	0.000E+00	4.796E-08	4.204E-07	4.261E-06	2.957E-05	1.352E-04	1.048E-05	7.879E-07
U-234	Pb-210	1.000E+00	0.000E+00	1.419E-13	3.690E-12	1.199E-10	2.252E-09	2.656E-08	3.781E-09	0.000E+00
U-234	ΣDSR(j)		3.713E-02	3.640E-02	3.497E-02	3.039E-02	2.038E-02	5.160E-03	1.471E-05	7.879E-07
U-235	U-235	1.000E+00	1.133E-01	1.111E-01	1.067E-01	9.277E-02	6.215E-02	1.524E-02	2.765E-05	0.000E+00
U-235	Pa-231	1.000E+00	0.000E+00	7.870E-06	2.268E-05	6.569E-05	1.319E-04	1.078E-04	2.132E-07	0.000E+00
U-235	Ac-227	1.000E+00	0.000E+00	6.780E-07	5.630E-06	4.751E-05	2.047E-04	2.574E-04	6.384E-07	0.000E+00
U-235	ΣDSR(j)		1.133E-01	1.111E-01	1.068E-01	9.288E-02	6.248E-02	1.560E-02	2.850E-05	0.000E+00
U-238	U-238	1.000E+00	4.721E-02	4.627E-02	4.445E-02	3.862E-02	2.585E-02	6.308E-03	6.887E-06	0.000E+00
U-238	U-234	1.000E+00	0.000E+00	1.032E-07	2.974E-07	8.613E-07	1.730E-06	1.415E-06	2.483E-09	0.000E+00
U-238	Th-230	1.000E+00	0.000E+00	1.155E-12	1.012E-11	1.025E-10	7.123E-10	3.459E-09	1.834E-10	0.000E+00
U-238	Ra-226	1.000E+00	0.000E+00	4.523E-14	3.831E-12	6.402E-11	8.459E-10	1.022E-08	1.495E-09	1.713E-10
U-238	Pb-210	1.000E+00	0.000E+00	1.006E-19	7.841E-18	8.473E-16	4.727E-14	1.726E-12	4.898E-13	0.000E+00
U-238	ΣDSR(j)		4.721E-02	4.627E-02	4.445E-02	3.863E-02	2.585E-02	6.310E-03	6.892E-06	1.713E-10

Branch Fraction is the cumulative factor for the j'th principal radionuclide daughter: CUMBRF(j) = BRF(1)*BRF(2)* ... BRF(j).
The DSR includes contributions from associated (half-life ≤ 0.5 yr) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 15 mrem/yr

Nuclide (i)	t=	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-228		1.250E+01	1.796E+01	3.708E+01	4.689E+02	6.609E+05	*8.192E+14	*8.192E+14	*8.192E+14
Th-232		3.255E+01	2.716E+01	1.899E+01	9.923E+00	7.369E+00	7.406E+00	8.804E+01	*1.096E+05
U-234		4.040E+02	4.121E+02	4.290E+02	4.936E+02	7.359E+02	2.907E+03	1.019E+06	1.904E+07
U-235		1.324E+02	1.350E+02	1.405E+02	1.615E+02	2.401E+02	9.613E+02	5.263E+05	*2.160E+06
U-238		3.177E+02	3.242E+02	3.374E+02	3.883E+02	5.803E+02	2.377E+03	*3.360E+05	*3.360E+05

*At specific activity limit

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 0.000E+00 years

Nuclide (i)	Initial pCi/g	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
Th-228	2.580E-02	0.000E+00	1.200E+00	1.250E+01	1.200E+00	1.250E+01
Th-232	2.580E-02	47.37 ± 0.05	2.064E+00	7.268E+00	4.609E-01	3.255E+01
U-234	1.658E+01	0.000E+00	3.713E-02	4.040E+02	3.713E-02	4.040E+02
U-235	9.040E-01	0.000E+00	1.133E-01	1.324E+02	1.133E-01	1.324E+02
U-238	1.658E+01	0.000E+00	4.721E-02	3.177E+02	4.721E-02	3.177E+02

Individual Nuclide Dose Summed Over All Pathways
 Parent Nuclide and Branch Fraction Indicated

Nuclide Parent (j)	BRF(i) (i)	DOSE(j,t), mrem/yr							
		t=	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02 1.000E+03
Th-228	Th-228	1.000E+00	3.096E-02	2.155E-02	1.044E-02	8.253E-04	5.856E-07	5.474E-18	0.000E+00 0.000E+00
Th-228	Th-232	1.000E+00	0.000E+00	5.744E-04	3.792E-03	1.666E-02	2.680E-02	2.664E-02	2.677E-03 0.000E+00
Th-228	ΣDOSE(j):		3.096E-02	2.212E-02	1.423E-02	1.748E-02	2.680E-02	2.664E-02	2.677E-03 0.000E+00
Th-232	Th-232	1.000E+00	1.189E-02	1.189E-02	1.189E-02	1.189E-02	1.188E-02	1.187E-02	3.790E-04 0.000E+00
Ra-228	Th-232	1.000E+00	0.000E+00	1.782E-03	4.700E-03	1.045E-02	1.384E-02	1.374E-02	1.340E-03 0.000E+00
U-234	U-234	1.000E+00	6.157E-01	6.034E-01	5.797E-01	5.037E-01	3.372E-01	8.273E-02	4.838E-05 0.000E+00
U-234	U-238	1.000E+00	0.000E+00	1.711E-06	4.930E-06	1.428E-05	2.868E-05	2.346E-05	4.116E-08 0.000E+00
U-234	ΣDOSE(j):		6.157E-01	6.034E-01	5.797E-01	5.037E-01	3.372E-01	8.273E-02	4.842E-05 0.000E+00
Th-230	U-234	1.000E+00	0.000E+00	1.355E-05	3.986E-05	1.240E-04	3.084E-04	5.894E-04	2.182E-05 0.000E+00
Th-230	U-238	1.000E+00	0.000E+00	1.915E-11	1.678E-10	1.699E-09	1.181E-08	5.735E-08	3.041E-09 0.000E+00
Th-230	ΣDOSE(j):		0.000E+00	1.355E-05	3.986E-05	1.240E-04	3.084E-04	5.895E-04	2.182E-05 0.000E+00
Ra-226	U-234	1.000E+00	0.000E+00	7.952E-07	6.971E-06	7.065E-05	4.903E-04	2.242E-03	1.737E-04 1.306E-05
Ra-226	U-238	1.000E+00	0.000E+00	7.499E-13	6.351E-11	1.061E-09	1.402E-08	1.694E-07	2.478E-08 2.841E-09
Ra-226	ΣDOSE(j):		0.000E+00	7.952E-07	6.971E-06	7.066E-05	4.903E-04	2.242E-03	1.737E-04 1.307E-05
Pb-210	U-234	1.000E+00	0.000E+00	2.353E-12	6.118E-11	1.988E-09	3.733E-08	4.404E-07	6.269E-08 0.000E+00
Pb-210	U-238	1.000E+00	0.000E+00	1.668E-18	1.300E-16	1.405E-14	7.837E-13	2.863E-11	8.121E-12 0.000E+00
Pb-210	ΣDOSE(j):		0.000E+00	2.353E-12	6.118E-11	1.988E-09	3.733E-08	4.404E-07	6.270E-08 0.000E+00
U-235	U-235	1.000E+00	1.025E-01	1.004E-01	9.648E-02	8.386E-02	5.618E-02	1.378E-02	2.500E-05 0.000E+00
Pa-231	U-235	1.000E+00	0.000E+00	7.114E-06	2.050E-05	5.938E-05	1.192E-04	9.743E-05	1.928E-07 0.000E+00
Ac-227	U-235	1.000E+00	0.000E+00	6.129E-07	5.090E-06	4.295E-05	1.851E-04	2.327E-04	5.771E-07 0.000E+00
U-238	U-238	1.000E+00	7.828E-01	7.672E-01	7.370E-01	6.404E-01	4.285E-01	1.046E-01	1.142E-04 0.000E+00

BRF(i) is the branch fraction of the parent nuclide.

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	BRF(i)	S(j,t), pCi/g							
			t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-228	Th-228	1.000E+00	2.580E-02	1.796E-02	8.700E-03	6.887E-04	4.907E-07	4.739E-18	0.000E+00	0.000E+00
Th-228	Th-232	1.000E+00	0.000E+00	4.787E-04	3.161E-03	1.389E-02	2.241E-02	2.302E-02	2.294E-02	2.268E-02
Th-228	ΣS(j):		2.580E-02	1.844E-02	1.186E-02	1.458E-02	2.241E-02	2.302E-02	2.294E-02	2.268E-02
Th-232	Th-232	1.000E+00	2.580E-02	2.580E-02	2.580E-02	2.580E-02	2.579E-02	2.576E-02	2.567E-02	2.537E-02
Ra-228	Th-232	1.000E+00	0.000E+00	2.909E-03	7.673E-03	1.707E-02	2.264E-02	2.302E-02	2.294E-02	2.268E-02
U-234	U-234	1.000E+00	1.658E+01	1.625E+01	1.561E+01	1.356E+01	9.080E+00	2.228E+00	4.023E-02	3.182E-08
U-234	U-238	1.000E+00	0.000E+00	4.607E-05	1.328E-04	3.846E-04	7.723E-04	6.317E-04	3.123E-05	9.033E-11
U-234	ΣS(j):		1.658E+01	1.625E+01	1.561E+01	1.357E+01	9.081E+00	2.229E+00	4.026E-02	3.191E-08
Th-230	U-234	1.000E+00	0.000E+00	1.478E-04	4.345E-04	1.352E-03	3.362E-03	6.426E-03	7.370E-03	7.256E-03
Th-230	U-238	1.000E+00	0.000E+00	2.087E-10	1.829E-09	1.853E-08	1.287E-07	6.252E-07	1.027E-06	1.026E-06
Th-230	ΣS(j):		0.000E+00	1.478E-04	4.345E-04	1.352E-03	3.362E-03	6.427E-03	7.371E-03	7.257E-03
Ra-226	U-234	1.000E+00	0.000E+00	3.196E-08	2.810E-07	2.881E-06	2.070E-05	1.111E-04	2.086E-04	2.131E-04
Ra-226	U-238	1.000E+00	0.000E+00	3.013E-14	7.916E-13	2.665E-11	5.497E-10	8.320E-09	2.768E-08	3.014E-08
Ra-226	ΣS(j):		0.000E+00	3.196E-08	2.810E-07	2.881E-06	2.070E-05	1.111E-04	2.086E-04	2.131E-04
Pb-210	U-234	1.000E+00	0.000E+00	3.287E-10	8.544E-09	2.776E-07	5.214E-06	6.151E-05	1.546E-04	1.611E-04
Pb-210	U-238	1.000E+00	0.000E+00	2.329E-16	1.815E-14	1.962E-12	1.094E-10	3.998E-09	2.003E-08	2.279E-08
Pb-210	ΣS(j):		0.000E+00	3.287E-10	8.544E-09	2.776E-07	5.214E-06	6.152E-05	1.546E-04	1.611E-04
U-235	U-235	1.000E+00	9.040E-01	8.860E-01	8.512E-01	7.396E-01	4.951E-01	1.215E-01	2.195E-03	1.740E-09
Pa-231	U-235	1.000E+00	0.000E+00	1.875E-05	5.403E-05	1.565E-04	3.142E-04	2.568E-04	1.389E-05	3.642E-11
Ac-227	U-235	1.000E+00	0.000E+00	2.924E-07	2.428E-06	2.049E-05	8.828E-05	1.111E-04	6.779E-06	1.849E-11
U-238	U-238	1.000E+00	1.658E+01	1.625E+01	1.561E+01	1.357E+01	9.081E+00	2.229E+00	4.026E-02	3.191E-08

BRF(i) is the branch fraction of the parent nuclide.

ATTACHMENT VI

DOSE CALCULATION
STORM DRAIN PIPING (Pipe A)
ACTIVITY LEFT IN PLACE

Microshield Input
Storm Drain Piping (Pipe A), Activity Left In Place

Pipe of concern (from Table 2-3)		STD-2, Pipe P2	
		STD-3, Pipe P1	
Length of pipe		339 ft	
Total Uranium Activity	1.11E10 dpm	5.00E-3 Ci	
	2.91E9 dpm	1.31E-3 Ci	
			<u>6.31E-3 Ci</u>
	% U-2	48.9%	3.08E-3 Ci
	% U-235	2.25%	1.41E-4 Ci
	% U-238	48.9%	3.08E-3 Ci
Total Thorium Activity	1.11E10 dpm	5.00 E-3 Ci	
	5.95E7 dpm	2.68E-5 Ci	
			<u>5.03E-3 Ci</u>
	% Th-228	50%	2.51E-3 Ci
	% Th-232	50%	2.51E-3 Ci

Page : 1
DOS File: SD1.MS4
Run Date: December 20, 1995
Run Time: 1:46 p.m. Wednesday
Duration: 0:00:08

File Ref: B100m
Date: 12/20/95
By: [Signature]
Checked: 12/20/95

Case Title: Storm Drain (number 1)

GEOMETRY 2 - Line
centimeters feet and inches
Dose point coordinate X: 183.0 6.0 .0
Dose point coordinate Y: 595.0 19.0 6.3
Dose point coordinate Z: 0.0 0.0 .0
Line length: 10332.72 339.0 .0
Line Angle: 90.0 degrees
Shield 1: 91.4 2.0 12.0
Air Gap: 91.6 3.0 .1

MATERIAL DENSITIES (g/cm³)
Material Shield 1 Air Gap
Slab
Air 0.00122
Water 1.63

BUILDUP
Method: Buildup Factor Tables
The material reference is Shield 1

INTEGRATION PARAMETERS
Quadrature Order
Length Segments 50

SOURCE NUCLIDES					
Nuclide	curies	microCi/cm	Nuclide	curies	microCi/cm
Ac-227	3.0062e-006	2.9094e-004	Ac-228	2.5200e-003	2.4389e-001
Bi-210	5.3847e-006	5.2113e-004	Bi-211	3.0059e-006	2.9091e-004
Bi-212	2.5200e-003	2.4389e-001	Bi-214	5.7019e-006	5.5183e-004
Fr-223	4.1486e-008	4.0150e-006	Pa-231	3.0979e-006	2.9982e-004
Pa-234	4.9280e-006	4.7693e-004	Pa-234m	3.0800e-003	2.9808e-001
Pb-210	5.3849e-006	5.2115e-004	Pb-211	3.0059e-006	2.9091e-004
Pb-212	2.5200e-003	2.4389e-001	Pb-214	5.7019e-006	5.5183e-004
Po-210	5.3793e-006	5.2061e-004	Po-211	8.2060e-009	7.9418e-007
Po-212	1.6146e-003	1.5626e-001	Po-214	5.7007e-006	5.5171e-004
Po-215	3.0059e-006	2.9091e-004	Po-216	2.5200e-003	2.4389e-001
Po-218	5.7030e-006	5.5194e-004	Ra-223	3.0059e-006	2.9091e-004
Ra-224	2.5200e-003	2.4389e-001	Ra-226	5.7032e-006	5.5195e-004
Ra-228	2.5200e-003	2.4389e-001	Rn-219	3.0059e-006	2.9091e-004
Rn-220	2.5200e-003	2.4389e-001	Rn-222	5.7030e-006	5.5194e-004

Page : 2
 DOS File: SD1.MS4
 Run Date: December 20, 1995
 Run Time: 1:46 p.m. Wednesday
 Title : Storm Drain (number 1)

Nuclide	curies	microCi/cm	Nuclide	curies	microCi/cm
Th-227	2.9645e-006	2.8691e-004	Th-228	2.5200e-003	2.4389e-001
Th-230	2.8975e-005	2.8042e-003	Th-231	1.4100e-004	1.3646e-002
Th-232	2.5200e-003	2.4389e-001	Th-234	3.0800e-003	2.9808e-001
Tl-207	2.9977e-006	2.9011e-004	Tl-208	9.0544e-004	8.7628e-002
U-234	3.0800e-003	2.9808e-001	U-235	1.4100e-004	1.3646e-002
U-238	3.0800e-003	2.9808e-001			

===== RESULTS =====

Energy (MeV)	Activity (photons/sec)	Energy Fluence Rate (MeV/sq cm/sec)		Exposure Rate In Air (mR/hr)	
		No Buildup	With Buildup	No Buildup	With Buildup
0.1	2.769e+006	8.112e-014	3.767e-010	1.241e-016	5.762e-013
0.15	4.802e+006	3.526e-012	1.032e-008	5.807e-015	1.700e-011
0.2	5.395e+007	3.720e-010	5.654e-007	6.566e-013	9.980e-010
0.3	2.443e+007	3.900e-009	2.049e-006	7.399e-012	3.886e-009
0.4	2.327e+006	3.315e-009	8.032e-007	6.459e-012	1.565e-009
0.5	1.295e+007	9.444e-008	1.296e-005	1.854e-010	2.544e-008
0.6	2.982e+007	7.958e-007	7.091e-005	1.553e-009	1.384e-007
0.8	3.011e+007	5.767e-006	2.711e-004	1.097e-008	5.157e-007
1.0	5.557e+007	4.553e-005	1.366e-003	8.393e-008	2.517e-006
1.5	1.257e+007	1.201e-004	1.764e-003	2.021e-007	2.968e-006
2.0	3.427e+005	1.568e-005	1.522e-004	2.425e-008	2.354e-007
3.0	3.343e+007	1.075e-002	6.332e-002	1.459e-005	8.591e-005
TOTAL:	2.631e+008	1.094e-002	6.696e-002	1.491e-005	9.232e-005

ATTACHMENT VII

DOSE CALCULATION
STORM DRAIN PIPING (Pipe A)
ACTIVITY REMOVED

Microshield Input
Storm Drain Piping (Pipe A), Activity Removed

Length of pipes	956 ft
Average diameter of pipes	1 ft
Volume of pipes	751 ft ³
Radius of sphere	5.64 ft
Density of sphere	0.2 g/cm ³
Total Uranium Activity	2.08E10 dpm 0.0094 Ci
% U-234	48.9% 4.60E-3 Ci
% U-235	2.25% 2.12E-4 Ci
% U-238	48.9% 4.60E-3 Ci
Total Thorium Activity	1.36E10 dpm 0.00602 Ci
% Th-228	50% 3.01E-3 Ci
% Th-232	50% 3.01E-3 Ci

SEG

Page : 1
 DOS File: SD2.MS4
 Run Date: December 7, 1995
 Run Time: 1:36 p.m. Thursday
 Duration: 0:00:55

File Ref: Blaan
 Date: 12/19/95
 By: SS
 Checked: SS 12/21/95

Case Title: Storm Drain (number 2)

GEOMETRY 6 - Sphere Volume

	centimeters	feet and inches	
Dose point coordinate X:	3215.0	105.0	5.7
Dose point coordinate Y:	0.0	0.0	.0
Dose point coordinate Z:	0.0	0.0	.0
Sphere radius:	171.9072	5.0	7.7
Air Gap:	3043.0928	99.0	10.1

Source Volume: 2.128e+7 cm³ 751.495 cu ft. 1.29858e+6 cu in.

MATERIAL DENSITIES (g/cm³)

Material	Source Shield	Transition Shield	Air Gap
Air		0.00122	0.00122
Water	0.2		

BUILDUP

Method: Buildup Factor Tables
 The material reference is Source

INTEGRATION PARAMETERS

	Quadrature Order
Radial	50
Angle	50

SOURCE NUCLIDES

Nuclide	curies	microCi/cm ³	Nuclide	curies	microCi/cm ³
Ac-227	4.5200e-006	2.1241e-007	Ac-228	3.0100e-003	1.4145e-004
Bi-210	8.0421e-006	3.7792e-007	Bi-211	4.5195e-006	2.1238e-007
Bi-212	3.0100e-003	1.4145e-004	Bi-214	8.5158e-006	4.0018e-007
Fr-223	6.2376e-008	2.9312e-009	Pa-231	4.6579e-006	2.1889e-007
Pa-234	7.3600e-006	3.4587e-007	Pa-234m	4.6000e-003	2.1617e-004
Pb-210	8.0424e-006	3.7793e-007	Pb-211	4.5195e-006	2.1238e-007
Pb-212	3.0100e-003	1.4145e-004	Pb-214	8.5158e-006	4.0018e-007
Po-210	8.0341e-006	3.7754e-007	Po-211	1.2338e-008	5.7980e-010
Po-212	1.9285e-003	9.0625e-005	Po-214	8.5140e-006	4.0009e-007
Po-215	4.5195e-006	2.1238e-007	Po-216	3.0100e-003	1.4145e-004
Po-218	8.5175e-006	4.0026e-007	Ra-223	4.5195e-006	2.1238e-007
Ra-224	3.0100e-003	1.4145e-004	Ra-226	8.5177e-006	4.0027e-007
Ra-228	3.0100e-003	1.4145e-004	Rn-219	4.5195e-006	2.1238e-007
Rn-220	3.0100e-003	1.4145e-004	Rn-222	8.5175e-006	4.0026e-007

Page : 2
 DOS File: SD2.MS4
 Run Date: December 7, 1995
 Run Time: 1:36 p.m. Thursday
 Title : Storm Drain (number 2)

Nuclide	curies	microCi/cm ³	Nuclide	curies	microCi/cm ³
Th-227	4.4573e-006	2.0946e-007	Th-228	3.0100e-003	1.4145e-004
Th-230	4.3274e-005	2.0336e-006	Th-231	2.1200e-004	9.9624e-006
Th-232	3.0100e-003	1.4145e-004	Th-234	4.6000e-003	2.1617e-004
Tl-207	4.5071e-006	2.1180e-007	Tl-208	1.0815e-003	5.0822e-005
U-234	4.6000e-003	2.1617e-004	U-235	2.1200e-004	9.9624e-006
U-238	4.6000e-003	2.1617e-004			

===== RESULTS =====

Energy (MeV)	Activity (photons/sec)	Energy Fluence Rate (MeV/sq cm/sec)		Exposure Rate In Air (mR/hr)	
		No Buildup	With Buildup	No Buildup	With Buildup
0.1	3.520e+006	1.966e-004	1.992e-003	3.008e-007	3.048e-006
0.15	6.008e+006	6.009e-004	4.690e-003	9.895e-007	7.723e-006
0.2	6.545e+007	9.934e-003	6.331e-002	1.753e-005	1.117e-004
0.3	2.922e+007	8.082e-003	3.715e-002	1.533e-005	7.048e-005
0.4	2.816e+006	1.200e-003	4.558e-003	2.339e-006	8.881e-006
0.5	1.548e+007	9.249e-003	3.054e-002	1.815e-005	5.995e-005
0.6	3.566e+007	2.811e-002	8.371e-002	5.488e-005	1.634e-004
0.8	3.609e+007	4.413e-002	1.128e-001	8.394e-005	2.145e-004
1.0	6.676e+007	1.148e-001	2.647e-001	2.116e-004	4.879e-004
1.5	1.504e+007	4.793e-002	9.321e-002	8.064e-005	1.568e-004
2.0	4.272e+005	2.095e-003	3.686e-003	3.239e-006	5.699e-006
3.0	3.994e+007	3.533e-001	5.495e-001	4.793e-004	7.455e-004
TOTAL:	3.164e+008	6.196e-001	1.250e+000	9.683e-004	2.036e-003

ATTACHMENT VIII

DOSE CALCULATION
STORM DRAIN BENEATH BUILDING 7 (Pipe B)
ACTIVITY LEFT IN PLACE

Microshield Input

Storm Drain Beneath Building 7 (Pipe B), Activity Left In Place

Pipe of concern (from Table 2-4)

Length of pipe	110 ft
Total Uranium Activity	1.84E9 dpm 0.000829 Ci
% U-234	48.9% 4.05E-4 Ci
% U-235	2.25% 1.86E-5 Ci
% U-238	48.9% 4.05E-4 Ci
Total Thorium Activity	1.84E9 dpm 0.000829 Ci
% TH-228	50% 4.14E-4 Ci
% TH-232	50% 4.14E-4 Ci

Page : 1
DOS File: SDBB71.MS4
Run Date: December 20, 1995
Run Time: 3:28 p.m. Wednesday
Duration: 0:00:08

File Ref: Bloo-
Date: 12/20/95
By: JB
Checked: 12/20/95

Case Title: Storm Drain Beneath Building 7 (number 1)

GEOMETRY 2 - Line

	centimeters	feet	inches
Dose point coordinate X:	274.0	8.0	11.9
Dose point coordinate Y:	1676.0	54.0	11.8
Dose point coordinate Z:	0.0	0.0	.0
Line length:	3353.0	110.0	.1
Line Angle:	90.0	degrees	
Shield 1:	183.0	6.0	.0
Air Gap:	91.0	2.0	11.8

MATERIAL DENSITIES (g/cm³)

Material	Shield 1 Slab	Air Gap
Air		0.00122
Water	1.63	

BUILDUP
Method: Buildup Factor Tables
The material reference is Shield 1

INTEGRATION PARAMETERS
Quadrature Order
Length Segments 50

SOURCE NUCLIDES

Nuclide	curies	microCi/cm	Nuclide	curies	microCi/cm
Ac-227	3.9657e-007	1.1827e-004	Ac-228	4.1400e-004	1.2347e-001
Bi-210	7.0806e-007	2.1117e-004	Bi-211	3.9652e-007	1.1826e-004
Bi-212	4.1400e-004	1.2347e-001	Bi-214	7.4976e-007	2.2361e-004
Fr-223	5.4726e-009	1.6322e-006	Pa-231	4.0866e-007	1.2188e-004
Pa-234	6.4800e-007	1.9326e-004	Pa-234m	4.0500e-004	1.2079e-001
Pb-210	7.0808e-007	2.1118e-004	Pb-211	3.9652e-007	1.1826e-004
Pb-212	4.1400e-004	1.2347e-001	Pb-214	7.4976e-007	2.2361e-004
Po-210	7.0735e-007	2.1096e-004	Po-211	1.0825e-009	3.2284e-007
Po-212	2.6525e-004	7.9108e-002	Po-214	7.4960e-007	2.2356e-004
Po-215	3.9652e-007	1.1826e-004	Po-216	4.1400e-004	1.2347e-001
Po-218	7.4991e-007	2.2365e-004	Ra-223	3.9652e-007	1.1826e-004
Ra-224	4.1400e-004	1.2347e-001	Ra-226	7.4993e-007	2.2366e-004
Ra-228	4.1400e-004	1.2347e-001	Rn-219	3.9652e-007	1.1826e-004
Rn-220	4.1400e-004	1.2347e-001	Rn-222	7.4991e-007	2.2365e-004

Page : 2
 DOS File: SDBB71.MS4
 Run Date: December 20, 1995
 Run Time: 3:28 p.m. Wednesday
 Title : Storm Drain Beneath Building 7 (number 1)

Nuclide	curies	microCi/cm	Nuclide	curies	microCi/cm
Th-227	3.9107e-007	1.1663e-004	Th-228	4.1400e-004	1.2347e-001
Th-230	3.8100e-006	1.1363e-003	Th-231	1.8600e-005	5.5473e-003
Th-232	4.1400e-004	1.2347e-001	Th-234	4.0500e-004	1.2079e-001
Tl-207	3.9544e-007	1.1794e-004	Tl-208	1.4875e-004	4.4363e-002
U-234	4.0500e-004	1.2079e-001	U-235	1.8600e-005	5.5473e-003
U-238	4.0500e-004	1.2079e-001			

===== RESULTS =====					
Energy (MeV)	Activity (photons/sec)	Energy Fluence Rate (MeV/sq cm/sec)		Exposure Rate In Air (mR/hr)	
		No Buildup	With Buildup	No Buildup	With Buildup
0.1	4.319e+005	2.577e-025	1.068e-020	3.943e-028	1.633e-023
0.15	7.603e+005	1.799e-022	5.623e-018	2.963e-025	9.259e-021
0.2	8.756e+006	1.315e-019	1.944e-015	2.321e-022	3.431e-018
0.3	4.010e+006	2.020e-017	6.531e-014	3.831e-020	1.239e-016
0.4	3.783e+005	1.084e-016	1.271e-013	2.112e-019	2.476e-016
0.5	2.127e+006	1.228e-014	6.961e-012	2.410e-017	1.366e-014
0.6	4.893e+006	3.051e-013	9.933e-011	5.956e-016	1.939e-013
0.8	4.934e+006	1.125e-011	1.642e-009	2.140e-014	3.123e-012
1.0	9.088e+006	2.903e-010	2.409e-008	5.352e-013	4.441e-011
1.5	2.063e+006	5.495e-009	1.883e-007	9.245e-012	3.168e-010
2.0	5.434e+004	2.344e-009	4.785e-008	3.624e-012	7.400e-011
3.0	5.493e+006	7.167e-006	7.845e-005	9.724e-009	1.064e-007
TOTAL:	4.299e+007	7.175e-006	7.871e-005	9.737e-009	1.069e-007

ATTACHMENT IX

**DOSE CALCULATION
STORM DRAIN BENEATH BUILDING 7 (Pipe B)
ACTIVITY REMOVED**

Microshield Input

Storm Drain Beneath Building 7 (Pipe B), Activity Removed

Pipe of concern (from Table 2-4)

Length of pipe 110 ft

Diameter of pipe .667 ft

Volume of pipe 38.8 ft³

Radius of sphere 2 ft

Total Uranium Activity 1.84E9 dpm 0.000829 Ci

% U-234 48.9% 4.05E-4 Ci

% U-235 2.25% 1.86E-5 Ci

% U-238 48.9% 4.05E-4 Ci

Total Thorium Activity 1.84E9 dpm 0.000829 Ci

% TH-228 50% 4.14E-4 Ci

% TH-232 50% 4.14E-4 Ci

Page : 1
DOS File: STBB72!.MS4
Run Date: March 19, 1996
Run Time: 10:16 a.m. Tuesday
Duration: 0:00:55

File Ref: Slaw
Date: 3/19/96
By: CS
Checked: ELK

Case Title: Storm Drain Beneath Building 7 (number 2)

GEOMETRY 6 - Sphere Volume

	centimeters	feet and inches	
Dose point coordinate X:	3112.008	102.0	1.2
Dose point coordinate Y:	0.0	0.0	.0
Dose point coordinate Z:	0.0	0.0	.0
Sphere radius:	64.008	2.0	1.2
Air Gap:	3048.0	100.0	.0

Source Volume: 1.09848e+6 cm³ 38.7924 cu ft. 67033.2 cu in.

MATERIAL DENSITIES (g/cm³)

Material	Source Shield	Transition Shield	Air Gap
Air		0.00122	0.00122
Water	0.2		

BUILDUP

Method: Buildup Factor Tables
The material reference is Source

INTEGRATION PARAMETERS

	Quadrature Order
Radial	50
Angle	50

SOURCE NUCLIDES

Nuclide	curies	microCi/cm ³	Nuclide	curies	microCi/cm ³
Ac-227	3.9657e-007	3.6101e-007	Ac-228	4.1400e-004	3.7689e-004
Bi-210	7.0806e-007	6.4458e-007	Bi-211	3.9652e-007	3.6097e-007
Bi-212	4.1400e-004	3.7689e-004	Bi-214	7.4976e-007	6.8254e-007
Fr-223	5.4726e-009	4.9820e-009	Pa-231	4.0866e-007	3.7203e-007
Pa-234	6.4800e-007	5.8991e-007	Pa-234m	4.0500e-004	3.6869e-004
Pb-210	7.0808e-007	6.4460e-007	Pb-211	3.9652e-007	3.6097e-007
Pb-212	4.1400e-004	3.7689e-004	Pb-214	7.4976e-007	6.8254e-007
Po-210	7.0735e-007	6.4394e-007	Po-211	1.0825e-009	9.8545e-010
Po-212	2.6525e-004	2.4147e-004	Po-214	7.4960e-007	6.8240e-007
Po-215	3.9652e-007	3.6097e-007	Po-216	4.1400e-004	3.7689e-004
Po-218	7.4991e-007	6.8268e-007	Ra-223	3.9652e-007	3.6097e-007
Ra-224	4.1400e-004	3.7689e-004	Ra-226	7.4993e-007	6.8270e-007
Ra-228	4.1400e-004	3.7689e-004	Rn-219	3.9652e-007	3.6097e-007
Rn-220	4.1400e-004	3.7689e-004	Rn-222	7.4991e-007	6.8268e-007

Page : 2
 DOS File: STBB72!.MS4
 Run Date: March 19, 1996
 Run Time: 10:16 a.m. Tuesday
 Title : Storm Drain Beneath Building 7 (number 2)

Nuclide	curies	microCi/cm ³	Nuclide	curies	microCi/cm ³
Th-227	3.9107e-007	3.5601e-007	Th-228	4.1400e-004	3.7689e-004
Th-230	3.8100e-006	3.4685e-006	Th-231	1.8600e-005	1.6933e-005
Th-232	4.1400e-004	3.7689e-004	Th-234	4.0500e-004	3.6869e-004
Tl-207	3.9544e-007	3.5999e-007	Tl-208	1.4875e-004	1.3541e-004
U-234	4.0500e-004	3.6869e-004	U-235	1.8600e-005	1.6933e-005
U-238	4.0500e-004	3.6869e-004			

===== RESULTS =====

Energy (MeV)	Activity (photons/sec)	Energy Fluence Rate (MeV/sq cm/sec)		Exposure Rate In Air (mR/hr)	
		No Buildup	With Buildup	No Buildup	With Buildup
0.1	4.319e+005	6.344e-005	5.003e-004	9.705e-008	7.654e-007
0.15	7.603e+005	1.957e-004	1.142e-003	3.223e-007	1.881e-006
0.2	8.756e+006	3.358e-003	1.583e-002	5.926e-006	2.794e-005
0.3	4.010e+006	2.711e-003	9.149e-003	5.143e-006	1.736e-005
0.4	3.783e+005	3.830e-004	1.074e-003	7.462e-007	2.093e-006
0.5	2.127e+006	2.941e-003	7.231e-003	5.773e-006	1.419e-005
0.6	4.893e+006	8.718e-003	1.949e-002	1.702e-005	3.803e-005
0.8	4.934e+006	1.309e-002	2.548e-002	2.489e-005	4.847e-005
1.0	9.088e+006	3.271e-002	5.838e-002	6.030e-005	1.076e-004
1.5	2.063e+006	1.282e-002	1.985e-002	2.157e-005	3.340e-005
2.0	5.434e+004	4.925e-004	7.052e-004	7.617e-007	1.090e-006
3.0	5.493e+006	8.336e-002	1.090e-001	1.131e-004	1.479e-004
TOTAL:	4.299e+007	1.608e-001	2.679e-001	2.556e-004	4.408e-004

ATTACHMENT X

DOSE CALCULATION
CONSOLIDATED SOURCE TERM

**RESRAD Input
Consolidated Source Term**

Thickness of contaminated disc	30.48 cm
Area of contaminated disc	4,203 m ²
Density of disc	1.63 g/cm ³
Mass of disc	2.09E9 g

Activity

	From Att IV	From Att VII	From Att VIII	TOTAL	
U-234	.0365	.00460	.000405	0.041 Ci	19.0 pCi/g
U-235	.00189	.000212	.0000186	0.0021 Ci	1.005 pCi/g
U-238	.03465	.00460	.000405	0.0397 Ci	19.0 pCi/g
Th-232	.00054	.00301	.000414	0.0040 Ci	1.91 pCi/g
Th-228	.00054	.00301	.000414	0.0040 Ci	1.91 pCi/g

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Time = 1.000E+00	13
Time = 3.000E+00	14
Time = 1.000E+01	15
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Dose Conversion Factor (and Related) Parameter Summary
File: DOSFAC.BIW

Menu	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	6.720E+00	6.720E+00	DCF2(1)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(2)
B-1	Pb-210+D	2.320E-02	2.320E-02	DCF2(3)
B-1	Ra-226+D	8.600E-03	8.600E-03	DCF2(4)
B-1	Ra-228+D	5.080E-03	5.080E-03	DCF2(5)
B-1	Th-228+D	3.450E-01	3.450E-01	DCF2(6)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(7)
B-1	Th-232	1.640E+00	1.640E+00	DCF2(8)
B-1	U-234	1.320E-01	1.320E-01	DCF2(9)
B-1	U-235+D	1.230E-01	1.230E-01	DCF2(10)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(11)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	1.480E-02	1.480E-02	DCF3(1)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(2)
D-1	Pb-210+D	7.270E-03	7.270E-03	DCF3(3)
D-1	Ra-226+D	1.330E-03	1.330E-03	DCF3(4)
D-1	Ra-228+D	1.440E-03	1.440E-03	DCF3(5)
D-1	Th-228+D	8.080E-04	8.080E-04	DCF3(6)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(7)
D-1	Th-232	2.730E-03	2.730E-03	DCF3(8)
D-1	U-234	2.830E-04	2.830E-04	DCF3(9)
D-1	U-235+D	2.670E-04	2.670E-04	DCF3(10)
D-1	U-238+D	2.690E-04	2.690E-04	DCF3(11)
D-34	Food transfer factors:			
D-34	Ac-227+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(1,1)
D-34	Ac-227+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,2)
D-34	Ac-227+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,3)
D-34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(2,1)
D-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(2,2)
D-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(2,3)
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(3,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(3,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(3,3)
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(4,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,3)
D-34	Ra-228+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(5,1)
D-34	Ra-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(5,2)
D-34	Ra-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(5,3)
D-34	Th-228+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(6,1)
D-34	Th-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(6,2)
D-34	Th-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(6,3)

Dose Conversion Factor (and Related) Parameter Summary (continued)
 File: DOSFAC.BIN

Menu	Parameter	Current Value	Default	Parameter Name
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(7,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(7,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(7,3)
D-34	Th-232 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(8,1)
D-34	Th-232 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(8,2)
D-34	Th-232 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(8,3)
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(9,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(9,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(9,3)
D-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(10,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(10,2)
D-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(10,3)
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(11,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(11,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(11,3)
	Bioaccumulation factors, fresh water, L/kg:			
	Ac-227+D , fish	1.500E+01	1.500E+01	BIOFAC(1,1)
D-5	Ac-227+D , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(1,2)
D-5	Pa-231 , fish	1.000E+01	1.000E+01	BIOFAC(2,1)
D-5	Pa-231 , crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC(2,2)
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(3,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(3,2)
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(4,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(4,2)
D-5	Ra-228+D , fish	5.000E+01	5.000E+01	BIOFAC(5,1)
D-5	Ra-228+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(5,2)
D-5	Th-228+D , fish	1.000E+02	1.000E+02	BIOFAC(6,1)
D-5	Th-228+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(6,2)
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(7,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(7,2)
D-5	Th-232 , fish	1.000E+02	1.000E+02	BIOFAC(8,1)
D-5	Th-232 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(8,2)
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(9,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(9,2)
D-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC(10,1)
D-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(10,2)

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: DOSFAC.BIN

Menu	Parameter	Current Value	Default	Parameter Name
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(11,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(11,2)

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (if different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	4.023E+03	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	3.048E-01	2.000E+00	---	THICKO
R011	Length parallel to aquifer flow (m)	1.000E+02	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.500E+01	3.000E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	T1
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): Th-228	1.910E+00	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g): Th-232	1.910E+00	0.000E+00	---	S1(8)
R012	Initial principal radionuclide (pCi/g): U-234	1.900E+01	0.000E+00	---	S1(9)
R012	Initial principal radionuclide (pCi/g): U-235	1.005E+00	0.000E+00	---	S1(10)
R012	Initial principal radionuclide (pCi/g): U-238	1.900E+01	0.000E+00	---	S1(11)
R012	Concentration in groundwater (pCi/L): Th-228	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L): Th-232	not used	0.000E+00	---	W1(8)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(9)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W1(10)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(11)
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVERO
R013	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.630E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	3.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone effective porosity	2.000E-01	2.000E-01	---	EPCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Humidity in air (g/cm**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	2.000E-01	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	0.000E+00	1.000E-03	Zero shows Simpson's rule.	EPS
R014	Density of saturated zone (g/cm**3)	1.630E+00	1.500E+00	---	DENSAO
R014	Saturated zone total porosity	3.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.000E-01	2.000E-01	---	EPSZ
R014	Saturated zone hydraulic conductivity (m/yr)	1.000E+02	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	5.300E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	UW
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	4.000E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.630E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	3.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for Th-228				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(6)
R016	Unsat. zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(6,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.677E-05	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
R016	Distribution coefficients for Th-232				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(8)
R016	Unsat. zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(8,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.677E-05	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(9)
R016	Unsat. zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(9,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.007E-02	ALEACH(9)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(9)
R016	Distribution coefficients for U-235				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(10)
R016	Unsat. zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(10,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(10)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.007E-02	ALEACH(10)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(10)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(11)
R016	Unsat. zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(11,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(11)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.007E-02	ALEACH(11)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(11)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
016	Distribution coefficients for daughter Ac-227				
016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(1)
016	Unsaturated zone 1 (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCU(1,1)
016	Saturated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCS(1)
016	Leach rate (/yr)	0.000E+00	0.000E+00	4.995E-02	ALEACH(1)
016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
016	Distribution coefficients for daughter Pa-231				
016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(2)
016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(2,1)
016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(2)
016	Leach rate (/yr)	0.000E+00	0.000E+00	2.007E-02	ALEACH(2)
016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
016	Distribution coefficients for daughter Pb-210				
016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(3)
016	Unsaturated zone 1 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(3,1)
016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCS(3)
016	Leach rate (/yr)	0.000E+00	0.000E+00	1.005E-02	ALEACH(3)
016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
016	Distribution coefficients for daughter Ra-226				
016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(4)
016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(4,1)
016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(4)
016	Leach rate (/yr)	0.000E+00	0.000E+00	1.435E-02	ALEACH(4)
016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
016	Distribution coefficients for daughter Ra-228				
016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(5)
016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(5,1)
016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(5)
016	Leach rate (/yr)	0.000E+00	0.000E+00	1.435E-02	ALEACH(5)
016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
016	Distribution coefficients for daughter Th-230				
016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(7)
016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(7,1)
016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(7)
016	Leach rate (/yr)	0.000E+00	0.000E+00	1.677E-05	ALEACH(7)
016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)
017	Inhalation rate (m**3/yr)	1.051E+04	8.400E+03	---	INHALR
017	Mass loading for inhalation (g/m**3)	2.000E-04	2.000E-04	---	MLINH
017	Dilution length for airborne dust, inhalation (m)	3.000E+00	3.000E+00	---	LM
017	Exposure duration	3.000E+01	3.000E+01	---	ED
017	Shielding factor, inhalation	5.000E-01	4.000E-01	---	SHF3
017	Shielding factor, external gamma	3.300E-01	7.000E-01	---	SHF1
017	Fraction of time spent indoors	4.000E-01	5.000E-01	---	FIND
017	Fraction of time spent outdoors (on site)	1.000E-01	2.500E-01	---	FOTD
017	Shape factor flag, external gamma	1.000E+00	1.000E+00	1 shows circular AREA.	FS

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (if different from user input)	Parameter Name
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
D18	Fruits, vegetables and grain consumption (kg/yr)	8.300E+01	1.600E+02	---	DIET(1)
D18	Leafy vegetable consumption (kg/yr)	6.000E+00	1.400E+01	---	DIET(2)
D18	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
D18	Meat and poultry consumption (kg/yr)	not used	6.300E+01	---	DIET(4)
D18	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)
D18	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)
D18	Soil ingestion rate (g/yr)	1.000E+01	3.650E+01	---	SOIL
D18	Drinking water intake (L/yr)	7.300E+02	5.100E+02	---	DWI
D18	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
D18	Contamination fraction of household water	1.000E+00	1.000E+00	---	FHHW
D18	Contamination fraction of livestock water	not used	1.000E+00	---	FLW
D18	Contamination fraction of irrigation water	1.000E+00	1.000E+00	---	FIRW
D18	Contamination fraction of aquatic food	not used	5.000E-01	---	FRF
D18	Contamination fraction of plant food	-1	-1	0.500E+00	FPLANT
D18	Contamination fraction of meat	not used	-1	---	FMEAT
D18	Contamination fraction of milk	not used	-1	---	FMILK
D19	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LF15
D19	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LF16
D19	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LW15
D19	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LW16
D19	Livestock soil intake (kg/day)	not used	5.000E-01	---	LST
D19	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	MLFD

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	1.000E+00	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	1.000E+00	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	not used	1.000E+00	---	FGWIR
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
	Milk	not used	1.000E+00	---	STOR_T(3)
	Meat and poultry	not used	2.000E+01	---	STOR_T(4)
	Fish	not used	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	not used	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	not used	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	1.500E-01	1.500E-01	---	FLOOR
R021	Bulk density of building foundation (g/cm**3)	2.400E+00	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	1.000E-01	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	3.000E-02	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	3.000E-07	3.000E-07	---	DIFFL
R021	in contaminated zone soil	2.000E-06	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	2.000E+00	2.000E+00	---	HMIX
R021	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
R021	Average building air exchange rate (1/hr)	5.000E-01	5.000E-01	---	REXG
R021	Height of the building (room) (m)	2.500E+00	2.500E+00	---	HRM
R021	Building interior area factor	0.000E+00	0.000E+00	code computed (time dependent)	FAI
R021	Building depth below ground surface (m)	-1.000E+00	-1.000E+00	code computed (time dependent)	DMFL
R021	Emanating power of Rn-222 gas	3.500E-01	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	1.500E-01	1.500E-01	---	EMANA(2)

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	active
4 -- meat ingestion	suppressed
5 -- milk ingestion	suppressed
6 -- aquatic foods	suppressed
7 -- drinking water	active
8 -- soil ingestion	active
9 -- radon	active

Contaminated Zone Dimensions

Initial Soil Concentrations, pCi/g

Area: 4023.00 square meters
 Thickness: 0.30 meters
 Cover Depth: 0.00 meters

Th-228 1.910E+00
 Th-232 1.910E+00
 U-234 1.900E+01
 U-235 1.005E+00
 U-238 1.900E+01

Total Dose TDOSE(t), mrem/yr

Basic Radiation Dose Limit = 15 mrem/yr

Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	1.103E+01	1.002E+01	9.367E+00	1.084E+01	1.197E+01	9.886E+00	7.226E-01	6.745E+00
M(t):	7.356E-01	6.678E-01	6.245E-01	7.230E-01	7.978E-01	6.590E-01	4.817E-02	4.497E-01

Maximum TDOSE(t): 1.207E+01 mrem/yr at t = 23.63 ± 0.02 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 23.63 years

Water Independent Pathways (Inhalation excludes radon)

Radionuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-228	7.971E-04	0.0001	7.602E-05	0.0000	5.752E-05	0.0000	4.143E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.478E-06	0.0000
Th-232	5.589E+00	0.4631	2.222E+00	0.1841	2.506E-01	0.0208	1.407E+00	0.1166	0.000E+00	0.0000	0.000E+00	0.0000	4.428E-02	0.0037
U-234	1.089E-03	0.0001	9.405E-01	0.0779	8.008E-04	0.0001	1.173E-01	0.0097	0.000E+00	0.0000	0.000E+00	0.0000	1.674E-02	0.0014
U-235	1.047E-01	0.0087	4.688E-02	0.0039	0.000E+00	0.0000	6.356E-03	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	8.573E-04	0.0001
U-238	3.521E-01	0.0292	8.403E-01	0.0696	1.699E-08	0.0000	1.115E-01	0.0092	0.000E+00	0.0000	0.000E+00	0.0000	1.591E-02	0.0013
Total	6.048E+00	0.5011	4.049E+00	0.3355	2.514E-01	0.0208	1.642E+00	0.1360	0.000E+00	0.0000	0.000E+00	0.0000	7.779E-02	0.0064

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 23.63 years

Water Dependent Pathways

Radionuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.362E-04	0.0001
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.512E+00	0.7882
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.076E+00	0.0892
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.588E-01	0.0132
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.320E+00	0.1094
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.207E+01	1.0000

Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
 As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-228	4.181E+00	0.3789	3.968E-01	0.0360	3.002E-01	0.0272	2.340E-02	0.0021	0.000E+00	0.0000	0.000E+00	0.0000	7.716E-03	0.0007
Th-232	2.189E-04	0.0000	1.886E+00	0.1709	0.000E+00	0.0000	8.010E-02	0.0073	0.000E+00	0.0000	0.000E+00	0.0000	2.607E-02	0.0024
U-234	1.687E-03	0.0002	1.510E+00	0.1369	0.000E+00	0.0000	2.042E-01	0.0185	0.000E+00	0.0000	0.000E+00	0.0000	2.689E-02	0.0024
U-235	1.679E-01	0.0152	7.443E-02	0.0067	0.000E+00	0.0000	1.019E-02	0.0009	0.000E+00	0.0000	0.000E+00	0.0000	1.342E-03	0.0001
U-238	5.663E-01	0.0513	1.350E+00	0.1223	0.000E+00	0.0000	1.941E-01	0.0176	0.000E+00	0.0000	0.000E+00	0.0000	2.555E-02	0.0023
Total	4.917E+00	0.4456	5.217E+00	0.4728	3.002E-01	0.0272	5.119E-01	0.0464	0.000E+00	0.0000	0.000E+00	0.0000	8.757E-02	0.0079

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
 As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.909E+00	0.4449
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.992E+00	0.1806
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.743E+00	0.1580
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.538E-01	0.0230
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.136E+00	0.1936
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.103E+01	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
 As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-228	2.910E+00	0.2904	2.762E-01	0.0276	2.090E-01	0.0209	1.624E-02	0.0016	0.000E+00	0.0000	0.000E+00	0.0000	5.371E-03	0.0005
Th-232	3.570E-01	0.0356	1.894E+00	0.1891	5.570E-03	0.0006	2.675E-01	0.0267	0.000E+00	0.0000	0.000E+00	0.0000	2.777E-02	0.0028
U-234	1.654E-03	0.0002	1.480E+00	0.1478	1.932E-06	0.0000	1.994E-01	0.0199	0.000E+00	0.0000	0.000E+00	0.0000	2.635E-02	0.0026
U-235	1.646E-01	0.0164	7.297E-02	0.0073	0.000E+00	0.0000	9.987E-03	0.0010	0.000E+00	0.0000	0.000E+00	0.0000	1.316E-03	0.0001
U-238	5.551E-01	0.0554	1.323E+00	0.1321	1.822E-12	0.0000	1.896E-01	0.0189	0.000E+00	0.0000	0.000E+00	0.0000	2.505E-02	0.0025
Total	3.988E+00	0.3981	5.046E+00	0.5038	2.145E-01	0.0214	6.827E-01	0.0682	0.000E+00	0.0000	0.000E+00	0.0000	8.585E-02	0.0086

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
 As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.416E+00	0.3410
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.552E+00	0.2547
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.708E+00	0.1705
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.488E-01	0.0248
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.093E+00	0.2089
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.002E+01	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-228	1.409E+00	0.1504	1.338E-01	0.0143	1.012E-01	0.0108	7.816E-03	0.0008	0.000E+00	0.0000	0.000E+00	0.0000	2.602E-03	0.0003
Th-232	1.248E+00	0.1333	1.936E+00	0.2067	3.678E-02	0.0039	5.723E-01	0.0611	0.000E+00	0.0000	0.000E+00	0.0000	3.111E-02	0.0033
U-234	1.590E-03	0.0002	1.422E+00	0.1518	1.693E-05	0.0000	1.903E-01	0.0203	0.000E+00	0.0000	0.000E+00	0.0000	2.532E-02	0.0027
U-235	1.581E-01	0.0169	7.014E-02	0.0075	0.000E+00	0.0000	9.596E-03	0.0010	0.000E+00	0.0000	0.000E+00	0.0000	1.267E-03	0.0001
U-238	5.332E-01	0.0569	1.271E+00	0.1357	4.770E-11	0.0000	1.809E-01	0.0193	0.000E+00	0.0000	0.000E+00	0.0000	2.406E-02	0.0026
Total	3.350E+00	0.3577	4.833E+00	0.5160	1.380E-01	0.0147	9.610E-01	0.1026	0.000E+00	0.0000	0.000E+00	0.0000	8.435E-02	0.0090

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.655E+00	0.1766
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.825E+00	0.4083
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.639E+00	0.1750
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.391E-01	0.0255
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.009E+00	0.2145
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.367E+00	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
 As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-228	1.114E-01	0.0103	1.059E-02	0.0010	8.014E-03	0.0007	6.046E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	2.060E-04	0.0000
Th-232	3.884E+00	0.3581	2.103E+00	0.1939	1.616E-01	0.0149	1.155E+00	0.1065	0.000E+00	0.0000	0.000E+00	0.0000	3.932E-02	0.0036
U-234	1.389E-03	0.0001	1.236E+00	0.1140	1.715E-04	0.0000	1.616E-01	0.0149	0.000E+00	0.0000	0.000E+00	0.0000	2.200E-02	0.0020
U-235	1.375E-01	0.0127	6.112E-02	0.0056	0.000E+00	0.0000	8.347E-03	0.0008	0.000E+00	0.0000	0.000E+00	0.0000	1.109E-03	0.0001
U-238	4.632E-01	0.0427	1.105E+00	0.1019	1.587E-09	0.0000	1.536E-01	0.0142	0.000E+00	0.0000	0.000E+00	0.0000	2.091E-02	0.0019
Total	4.597E+00	0.4239	4.515E+00	0.4164	1.698E-01	0.0157	1.479E+00	0.1364	0.000E+00	0.0000	0.000E+00	0.0000	8.354E-02	0.0077

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
 As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.308E-01	0.0121
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.342E+00	0.6771
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.421E+00	0.1310
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.080E-01	0.0192
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.742E+00	0.1607
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.084E+01	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

radio- nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
h-228	7.899E-05	0.0000	7.547E-06	0.0000	5.710E-06	0.0000	4.021E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.468E-07	0.0000
h-232	5.774E+00	0.4825	2.235E+00	0.1868	2.607E-01	0.0218	1.407E+00	0.1176	0.000E+00	0.0000	0.000E+00	0.0000	4.483E-02	0.0037
-234	9.824E-04	0.0001	8.278E-01	0.0692	1.188E-03	0.0001	1.009E-01	0.0084	0.000E+00	0.0000	0.000E+00	0.0000	1.473E-02	0.0012
-235	9.216E-02	0.0077	4.143E-02	0.0035	0.000E+00	0.0000	5.590E-03	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	7.606E-04	0.0001
-238	3.097E-01	0.0259	7.394E-01	0.0618	3.156E-08	0.0000	9.591E-02	0.0080	0.000E+00	0.0000	0.000E+00	0.0000	1.400E-02	0.0012
total	6.177E+00	0.5162	3.843E+00	0.3212	2.619E-01	0.0219	1.610E+00	0.1345	0.000E+00	0.0000	0.000E+00	0.0000	7.432E-02	0.0062

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Dependent Pathways

radio- nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
-28	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.279E-05	0.0000
h-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.722E+00	0.8124
-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.456E-01	0.0790
-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.399E-01	0.0117
-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.159E+00	0.0969
total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.197E+01	1.0000

Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio- nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
h-228	7.343E-16	0.0000	7.288E-17	0.0000	5.514E-17	0.0000	2.915E-18	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.417E-18	0.0000
h-232	5.720E+00	0.5786	2.242E+00	0.2268	2.679E-01	0.0271	1.066E+00	0.1078	0.000E+00	0.0000	0.000E+00	0.0000	4.518E-02	0.0046
h-234	5.270E-04	0.0001	2.044E-01	0.0207	5.395E-03	0.0005	1.866E-02	0.0019	0.000E+00	0.0000	0.000E+00	0.0000	3.636E-03	0.0004
h-235	2.264E-02	0.0023	1.072E-02	0.0011	0.000E+00	0.0000	1.278E-03	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	2.046E-04	0.0000
h-238	7.461E-02	0.0075	1.815E-01	0.0184	4.041E-07	0.0000	1.760E-02	0.0018	0.000E+00	0.0000	0.000E+00	0.0000	3.436E-03	0.0003
Total	5.817E+00	0.5885	2.639E+00	0.2669	2.732E-01	0.0276	1.104E+00	0.1116	0.000E+00	0.0000	0.000E+00	0.0000	5.246E-02	0.0053

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Dependent Pathways

Radio- nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
h-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.667E-16	0.0000
h-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.341E+00	0.9449
h-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.326E-01	0.0235
h-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.485E-02	0.0035
h-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.772E-01	0.0280
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.886E+00	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	5.261E-01	0.7281	7.151E-02	0.0990	9.670E-02	0.1338	2.493E-02	0.0345	0.000E+00	0.0000	0.000E+00	0.0000	1.441E-03	0.0020
U-234	5.525E-05	0.0001	1.704E-04	0.0002	3.809E-04	0.0005	1.511E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.085E-06	0.0000
U-235	5.368E-05	0.0001	7.140E-06	0.0000	0.000E+00	0.0000	8.498E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.483E-07	0.0000
U-238	1.737E-04	0.0002	1.050E-04	0.0001	5.055E-08	0.0000	7.487E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.988E-06	0.0000
Total	5.264E-01	0.7285	7.179E-02	0.0994	9.708E-02	0.1344	2.495E-02	0.0345	0.000E+00	0.0000	0.000E+00	0.0000	1.446E-03	0.0020

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.207E-01	0.9974
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.248E-04	0.0009
U-235	8.886E-04	0.0012	0.000E+00	0.0000	0.000E+00	0.0000	2.348E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.738E-04	0.0013
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.882E-04	0.0004
Total	8.886E-04	0.0012	0.000E+00	0.0000	0.000E+00	0.0000	2.348E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.226E-01	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and fraction of Total Dose At t = 1.000E+03 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	3.026E+00	0.4486	0.000E+00	0.0000	9.409E-04	0.0001	8.002E-02	0.0119	0.000E+00	0.0000	0.000E+00	0.0000	3.106E+00	0.4606
U-235	6.912E-01	0.1025	0.000E+00	0.0000	0.000E+00	0.0000	1.828E-02	0.0027	0.000E+00	0.0000	0.000E+00	0.0000	7.095E-01	0.1052
U-238	2.853E+00	0.4231	0.000E+00	0.0000	2.449E-06	0.0000	7.546E-02	0.0112	0.000E+00	0.0000	0.000E+00	0.0000	2.929E+00	0.4342
Total	6.570E+00	0.9741	0.000E+00	0.0000	9.433E-04	0.0001	1.738E-01	0.0258	0.000E+00	0.0000	0.000E+00	0.0000	6.745E+00	1.0000

*Sum of all water independent and dependent pathways.

Dose/Source Ratios Summed Over All Pathways
 Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Branch Fraction	DSR(j,t) (mrem/yr)/(pCi/g)							
			t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-228	Th-228	1.000E+00	2.570E+00	1.789E+00	8.663E-01	6.849E-02	4.858E-05	4.538E-16	0.000E+00	0.000E+00
Th-232	Th-232	1.000E+00	1.043E+00	1.043E+00	1.043E+00	1.042E+00	1.039E+00	1.028E+00	3.258E-02	0.000E+00
Th-232	Ra-228	1.000E+00	0.000E+00	2.446E-01	6.432E-01	1.417E+00	1.828E+00	1.655E+00	1.224E-01	0.000E+00
Th-232	Th-228	1.000E+00	0.000E+00	4.838E-02	3.166E-01	1.385E+00	2.223E+00	2.208E+00	2.223E-01	0.000E+00
Th-232	ΣDSR(j)		1.043E+00	1.336E+00	2.003E+00	3.844E+00	5.090E+00	4.891E+00	3.773E-01	0.000E+00
U-234	U-234	1.000E+00	9.173E-02	8.987E-02	8.627E-02	7.476E-02	4.966E-02	1.186E-02	6.775E-06	1.612E-01
U-234	Th-230	1.000E+00	0.000E+00	1.858E-06	5.448E-06	1.692E-05	4.196E-05	7.946E-05	2.919E-06	9.846E-07
U-234	Ra-226	1.000E+00	0.000E+00	1.079E-07	9.459E-07	9.585E-06	6.647E-05	3.033E-04	2.301E-05	5.128E-04
U-234	Pb-210	1.000E+00	0.000E+00	3.210E-11	6.683E-10	1.945E-08	3.327E-07	2.950E-06	1.812E-07	1.752E-03
U-234	ΣDSR(j)		9.173E-02	8.987E-02	8.628E-02	7.479E-02	4.977E-02	1.224E-02	3.288E-05	1.635E-01
U-235	U-235	1.000E+00	2.526E-01	2.475E-01	2.378E-01	2.065E-01	1.380E-01	3.352E-02	5.919E-05	1.525E-01
U-235	Pa-231	1.000E+00	0.000E+00	5.134E-05	1.467E-04	4.181E-04	8.027E-04	5.517E-04	8.703E-07	1.268E-01
U-235	Ac-227	1.000E+00	0.000E+00	1.709E-06	1.389E-05	1.161E-04	4.958E-04	6.072E-04	9.089E-04	4.266E-01
U-235	ΣDSR(j)		2.526E-01	2.476E-01	2.379E-01	2.070E-01	1.392E-01	3.468E-02	9.690E-04	7.059E-01
U-238	U-238	1.000E+00	1.124E-01	1.101E-01	1.058E-01	9.170E-02	6.100E-02	1.458E-02	1.516E-05	1.537E-01
U-238	U-234	1.000E+00	0.000E+00	2.559E-07	7.347E-07	2.120E-06	4.224E-06	3.362E-06	5.765E-09	4.577E-04
U-238	Th-230	1.000E+00	0.000E+00	2.634E-12	2.296E-11	2.319E-10	1.607E-09	7.731E-09	4.067E-10	2.217E-09
U-238	Ra-226	1.000E+00	0.000E+00	1.019E-13	2.665E-12	8.866E-11	1.765E-09	2.272E-08	3.053E-09	1.335E-06
U-238	Pb-210	1.000E+00	0.000E+00	2.4E-17	1.477E-15	1.392E-13	7.015E-12	1.919E-10	2.348E-11	4.497E-06
U-238	ΣDSR(j)		1.124E-01	1.101E-01	1.058E-01	9.170E-02	6.100E-02	1.459E-02	1.517E-05	1.542E-01

Branch Fraction is the cumulative factor for the j'th principal radionuclide daughter: CUMBRF(j) = BRF(1)*BRF(2)* ... BRF(j).
 The DSR includes contributions from associated (half-life ≤ 0.5 yr) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
 Basic Radiation Dose Limit = 15 mrem/yr

Nuclide (i)	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-228	5.836E+00	8.386E+00	1.732E+01	2.190E+02	3.087E+05	*8.192E+14	*8.192E+14	*8.192E+14
Th-232	1.438E+01	1.123E+01	7.490E+00	3.902E+00	2.947E+00	3.067E+00	3.975E+01	*1.096E+05
U-234	1.635E+02	1.669E+02	1.739E+02	2.006E+02	3.014E+02	1.225E+03	4.561E+05	9.174E+01
U-235	5.939E+01	6.058E+01	6.305E+01	7.246E+01	1.077E+02	4.326E+02	1.548E+04	2.125E+01
U-238	1.334E+02	1.362E+02	1.418E+02	1.636E+02	2.459E+02	1.028E+03	*3.360E+05	9.730E+01

*At specific activity limit

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
 and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
 at tmin = time of minimum single radionuclide soil guideline
 and at tmax = time of maximum total dose = 23.63 ± 0.02 years

Nuclide (i)	Initial pCi/g	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
Th-228	1.910E+00	0.000E+00	2.570E+00	5.836E+00	4.902E-04	3.060E+04
Th-232	1.910E+00	39.37 ± 0.04	5.125E+00	2.927E+00	4.980E+00	3.012E+00
U-234	1.900E+01	1.000E+03	1.635E-01	9.174E+01	5.666E-02	2.648E+02
U-235	1.005E+00	1.000E+03	7.059E-01	2.125E+01	1.580E-01	9.494E+01
U-238	1.900E+01	1.000E+03	1.542E-01	9.730E+01	6.947E-02	2.159E+02

Individual Nuclide Dose Summed Over All Pathways
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	BRF(i)	DOSE(j,t), mrem/yr							
			t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
h-228	Th-228	1.000E+00	4.909E+00	3.416E+00	1.655E+00	1.308E-01	9.279E-05	8.667E-16	0.000E+00	0.000E+00
h-228	Th-232	1.000E+00	0.000E+00	9.241E-02	6.047E-01	2.645E+00	4.246E+00	4.217E+00	4.246E-01	0.000E+00
h-228	ΣDOSE(j):		4.909E+00	3.509E+00	2.259E+00	2.776E+00	4.246E+00	4.217E+00	4.246E-01	0.000E+00
h-232	Th-232	1.000E+00	1.992E+00	1.992E+00	1.992E+00	1.990E+00	1.984E+00	1.963E+00	6.223E-02	0.000E+00
a-228	Th-232	1.000E+00	0.000E+00	4.672E-01	1.229E+00	2.707E+00	3.492E+00	3.161E+00	2.338E-01	0.000E+00
U-234	U-234	1.000E+00	1.743E+00	1.708E+00	1.639E+00	1.420E+00	9.435E-01	2.253E-01	1.287E-04	3.063E+00
U-234	U-238	1.000E+00	0.000E+00	4.861E-06	1.396E-05	4.029E-05	8.026E-05	6.387E-05	1.095E-07	8.697E-03
U-234	ΣDOSE(j):		1.743E+00	1.708E+00	1.639E+00	1.421E+00	9.436E-01	2.253E-01	1.288E-04	3.072E+00
h-230	U-234	1.000E+00	0.000E+00	3.529E-05	1.035E-04	3.215E-04	7.973E-04	1.510E-03	5.546E-05	1.871E-05
h-230	U-238	1.000E+00	0.000E+00	5.004E-11	4.363E-10	4.407E-09	3.053E-08	1.469E-07	7.728E-09	4.212E-08
h-230	ΣDOSE(j):		0.000E+00	3.529E-05	1.035E-04	3.215E-04	7.973E-04	1.510E-03	5.546E-05	1.875E-05
a-226	U-234	1.000E+00	0.000E+00	2.050E-06	1.797E-05	1.821E-04	1.263E-03	5.763E-03	4.372E-04	9.744E-03
a-226	U-238	1.000E+00	0.000E+00	1.933E-12	5.063E-11	1.685E-09	3.354E-08	4.318E-07	5.801E-08	2.536E-05
a-226	ΣDOSE(j):		0.000E+00	2.050E-06	1.797E-05	1.821E-04	1.263E-03	5.764E-03	4.372E-04	9.769E-03
U-210	U-234	1.000E+00	0.000E+00	6.099E-10	1.270E-08	3.695E-07	6.321E-06	5.605E-05	3.444E-06	3.328E-02
U-210	U-238	1.000E+00	0.000E+00	4.740E-16	2.806E-14	2.645E-12	1.333E-10	3.647E-09	4.462E-10	8.544E-05
U-210	ΣDOSE(j):		0.000E+00	6.099E-10	1.270E-08	3.695E-07	6.321E-06	5.605E-05	3.444E-06	3.337E-02
U-235	U-235	1.000E+00	2.538E-01	2.488E-01	2.389E-01	2.075E-01	1.386E-01	3.369E-02	5.949E-05	1.533E-01
a-231	U-235	1.000E+00	0.000E+00	5.159E-05	1.475E-04	4.202E-04	8.067E-04	5.545E-04	8.746E-07	1.274E-01
U-227	U-235	1.000E+00	0.000E+00	1.718E-06	1.396E-05	1.167E-04	4.982E-04	6.102E-04	9.135E-04	4.287E-01
U-238	U-238	1.000E+00	2.136E+00	2.093E+00	2.009E+00	1.742E+00	1.159E+00	2.771E-01	2.881E-04	2.920E+00

BRF(i) is the branch fraction of the parent nuclide.

Individual Nuclide Soil Concentration
 Parent Nuclide and Branch Fraction Indicated

Nuclide Parent		BRF(i)	S(j,t), pCi/g								
(j)	(i)		t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03	
h-228	Th-228	1.000E+00	1.910E+00	1.329E+00	6.441E-01	5.098E-02	3.633E-05	3.508E-16	0.000E+00	0.000E+00	
h-228	Th-232	1.000E+00	0.000E+00	3.544E-02	2.340E-01	1.028E+00	1.659E+00	1.704E+00	1.699E+00	1.679E+00	
h-228	Σ(j):		1.910E+00	1.365E+00	8.781E-01	1.079E+00	1.659E+00	1.704E+00	1.699E+00	1.679E+00	
h-232	Th-232	1.000E+00	1.910E+00	1.910E+00	1.910E+00	1.910E+00	1.909E+00	1.907E+00	1.900E+00	1.878E+00	
a-228	Th-232	1.000E+00	0.000E+00	2.154E-01	5.680E-01	1.264E+00	1.676E+00	1.704E+00	1.699E+00	1.679E+00	
h-234	U-234	1.000E+00	1.900E+01	1.862E+01	1.789E+01	1.554E+01	1.041E+01	2.553E+00	4.610E-02	3.646E-08	
h-234	U-238	1.000E+00	0.000E+00	5.279E-05	1.522E-04	4.407E-04	8.850E-04	7.239E-04	3.922E-05	1.035E-10	
h-234	Σ(j):		1.900E+01	1.862E+01	1.789E+01	1.555E+01	1.041E+01	2.554E+00	4.614E-02	3.657E-08	
h-230	U-234	1.000E+00	0.000E+00	1.693E-04	4.979E-04	1.549E-03	3.853E-03	7.364E-03	8.446E-03	8.315E-03	
h-230	U-238	1.000E+00	0.000E+00	2.392E-10	2.096E-09	2.123E-08	1.475E-07	7.165E-07	1.177E-06	1.176E-06	
h-230	Σ(j):		0.000E+00	1.693E-04	4.979E-04	1.549E-03	3.853E-03	7.365E-03	8.447E-03	8.316E-03	
a-226	U-234	1.000E+00	0.000E+00	3.662E-08	3.220E-07	3.301E-06	2.372E-05	1.273E-04	2.390E-04	2.442E-04	
a-226	U-238	1.000E+00	0.000E+00	3.453E-14	9.072E-13	3.054E-11	6.299E-10	9.534E-09	3.172E-08	3.453E-08	
a-226	Σ(j):		0.000E+00	3.662E-08	3.220E-07	3.301E-06	2.372E-05	1.273E-04	2.391E-04	2.442E-04	
h-210	U-234	1.000E+00	0.000E+00	3.766E-10	9.792E-09	3.181E-07	5.975E-06	7.049E-05	1.772E-04	1.846E-04	
h-210	U-238	1.000E+00	0.000E+00	2.669E-16	2.080E-14	2.248E-12	1.254E-10	4.582E-09	2.296E-08	2.611E-08	
h-210	Σ(j):		0.000E+00	3.766E-10	9.792E-09	3.181E-07	5.975E-06	7.050E-05	1.772E-04	1.846E-04	
h-235	U-235	1.000E+00	1.005E+00	9.850E-01	9.463E-01	8.223E-01	5.504E-01	1.351E-01	2.440E-03	1.934E-09	
a-231	U-235	1.000E+00	0.000E+00	2.084E-05	6.006E-05	1.740E-04	3.493E-04	2.855E-04	1.544E-05	4.049E-11	
h-227	U-235	1.000E+00	0.000E+00	3.250E-07	2.699E-06	2.277E-05	9.814E-05	1.235E-04	7.536E-06	2.055E-11	
h-238	U-238	1.000E+00	1.900E+01	1.862E+01	1.789E+01	1.555E+01	1.041E+01	2.554E+00	4.614E-02	3.657E-08	

BRF(i) is the branch fraction of the parent nuclide.

D

DETAIL A

CONTAMINATED SOIL
AND BEDROCK

PIPE B

BUILDING 7
MH-P1

MACARTHUR AVENUE

BUILDING 6

BUILDING 8

BUILDING 7

AREA 7/8
POE P11

ARLINGTON AVENUE

AREA 1 POE P5/MH-2 POE P1

MH-2 PIPE P2
STD-1 PIPE P1

STD-1 PIPE P2
STD-2 PIPE P1

RECEIVING PLATFORM

STD-2 PIPE P2
STD-3 PIPE P1

BUILDING 3

C

B

A

REVISIONS	DESCRIPTION
	ZONE

4

3

2

1

D

C

B

A

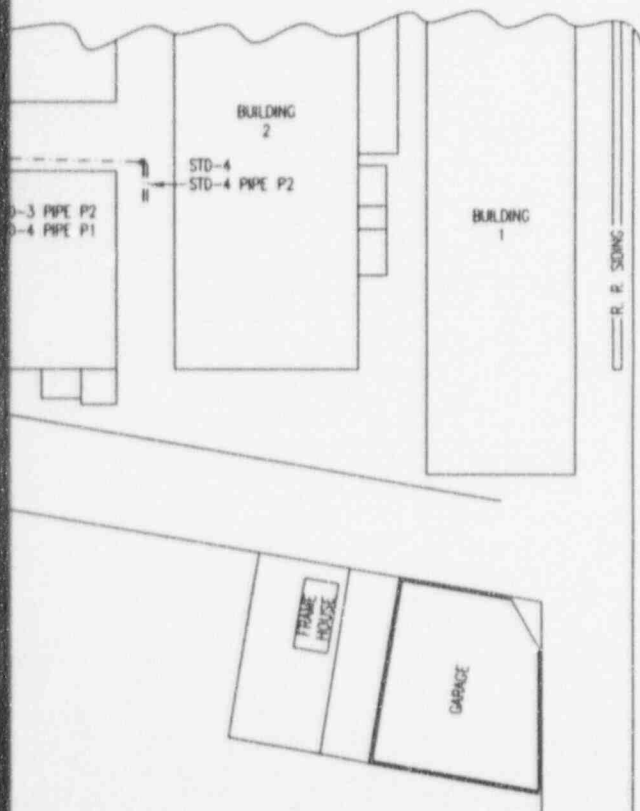
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FRACTIONS 3 PL DEC 3 PL DEC N/A N/A N/A N/A		ANGLES 125 1/4"		DSGN ENGR DATE		DSGN MGR DATE		MFG DATE		QA DATE		APPROVD DATE	
BREAK ALL SHARP EDGES FILET RADII .03 MAX THIRD ANGLE PROJECTION				SIZE D DWG NO SEG-96-033 REV 0		SCALE NONE SHEET 1 OF 2		BLOOMFIELD PROJECT FIGURE 1 STORM DRAIN PIPE A		DATE		DATE	

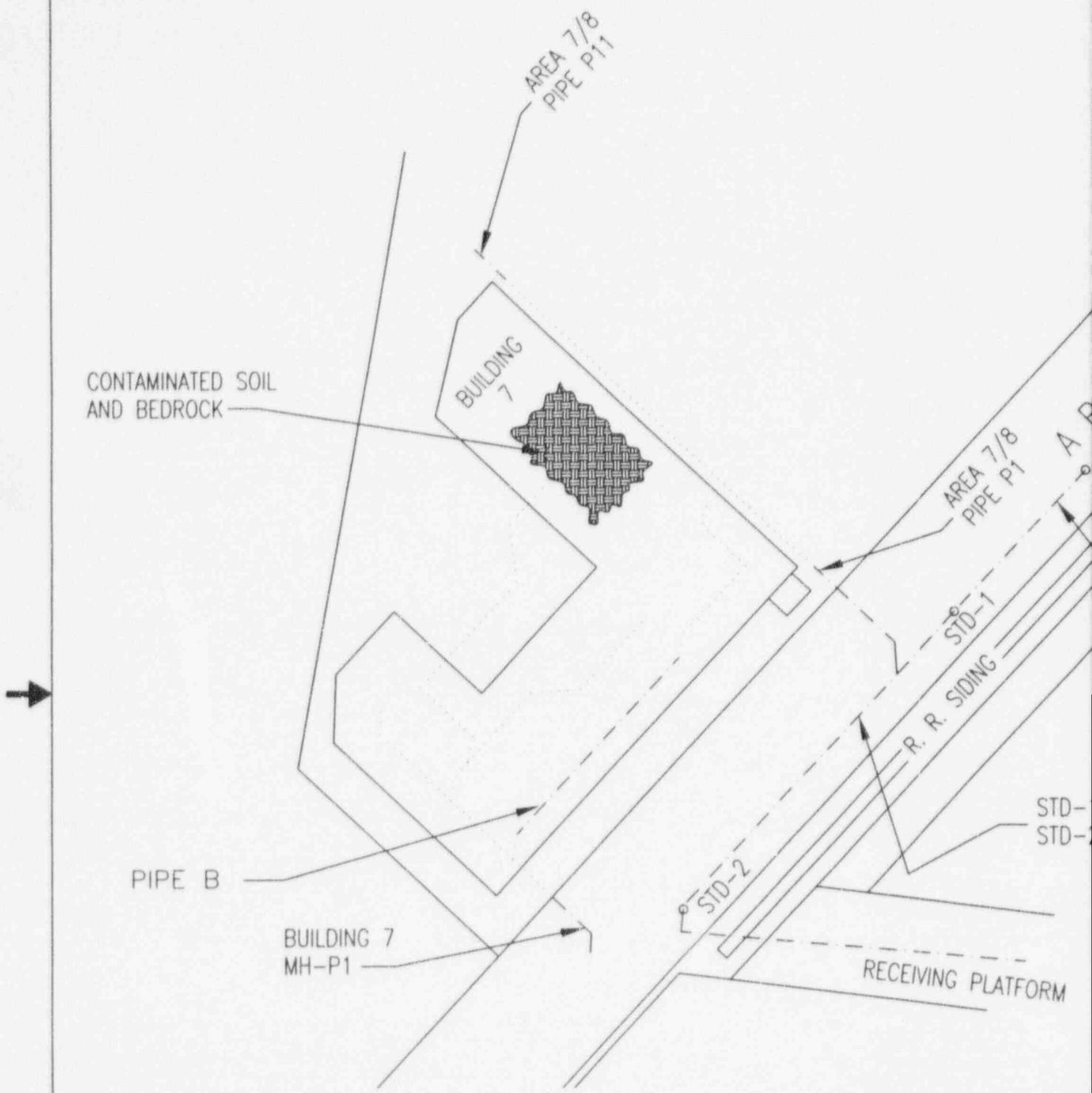
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LEGEND

PIPES REMOVED

PIPES > GUIDELINE VALUES

MH-2 PIPE P2
STD-1 PIPE P1

PIPE P2
PIPE P1

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DETAIL A

INFORMATION

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O.G.	12-05-95
CHKR	DATE
DSGN ENGR	DATE
DSGN MGR	DATE
MFG	DATE
QA	DATE
APPRVD	DATE



Oak Ridge Engineering
Oak Ridge, Tennessee

FIG. II STORM DRAIN PIPE B
& SOIL BENEATH BLDG. 7

SIZE B	DWG NO SEG-96-033	REV 0
SCALE NONE		SHEET 2 OF 2

G9603302