

Phase II Final Status Survey Report Mallinckrodt Columbium-Tantalum Plant


St. Louis, Missouri

Chapter 26

Project No. 137131**Revision 0**

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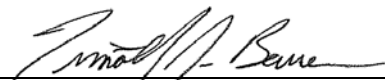


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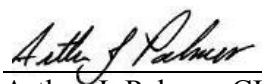


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Date

- Non-Proprietary
 Proprietary
 Restricted Information
 Safeguards Information
 Sensitive Security Information

- New
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ABBREVIATIONS AND ACRONYMS

%	percent
σ	sigma; standard deviation
AECOM	AECOM Technical Services
bgs	below grade surface
C-T	columbium-tantalum
CFR	Code of Federal Regulations
cpm	counts per minute
DCGL	derived concentration guideline level
DP	decommissioning plan
DQO	data quality objectives
EMC	elevated measurement comparison
EnergySolutions	EnergySolutions, LLC
FSS	Final Status Survey
FSSR	Final Status Survey Report
ft	feet
GPS	global positioning system
m ²	square meters
MARSSIM	Multi-Agency Radiation and Site Investigation Manual (NUREG-1575)
MDC	minimum detectable concentration
mrem/yr	millirem per year
NaI	sodium iodide
NIST	National Institute of Standards and Technology
NRC	U.S. Nuclear Regulatory Commission
pCi/g	picoCuries per gram
Ra	radium
SOF	sum of fractions
Th	thorium
U	uranium
WRS	Wilcoxon Rank Sum

26.0 RESULTS SUMMARY FOR PLANT 5 SUBSURFACE SU20

This chapter of the Final Status Survey Report (FSSR) presents the results of the final status survey (FSS) and data assessment for Plant 5 subsurface survey unit SU20 in accordance with Columbium-Tantalum (C-T) Phase II Decommissioning Plan (DP) Section 14.5. The FSS for this Class 1 survey unit was completed by AECOM Technical Services (AECOM) in January 2012. The SU20 data assessment was performed based on the assumptions, methods, and performance criteria established to satisfy the data quality objectives (DQOs) in accordance with the C-T Phase II DP Section 14.4.3.8. The summary statistics provide numerical values for measures of central tendency (i.e., mean, median), variation (i.e., standard deviation), and spread (i.e., minimum, maximum). Data evaluation and statistical analyses were performed and a separate decision was made for each survey unit of the C-T Plant as to its suitability for release for unrestricted use based upon the industrial use scenario release criterion as established in C-T Phase II DP Chapter 5.

26.1 OVERVIEW

SU20 is a Class 1 survey unit located in the central portion of C-T Plant 5. The excavated area east of Building 250 encompassing AECOM grids E5 and generally the west half of AECOM grids F3, F4, F5, F6, and F8. The survey unit is approximately 294 square meters (m²) in size, which is less than the size limit of 3,000 m² for Class 1 survey units for subsurface material (per C-T Phase II DP, Table 14-4). Class 1 was the appropriate classification because the survey unit contained residual radioactivity that exceeded the DCGL_W prior to remediation. Figure 26-1 shows the location of SU20 within the Plant 5 area. Figure 26-2 provides features within the survey unit including the Plant 5 grids as established by AECOM as well as the approximate locations and directions of photographs taken and presented in this section to facilitate the text.



Figure 26-1 Location of Subsurface SU20 in C-T Plant 5

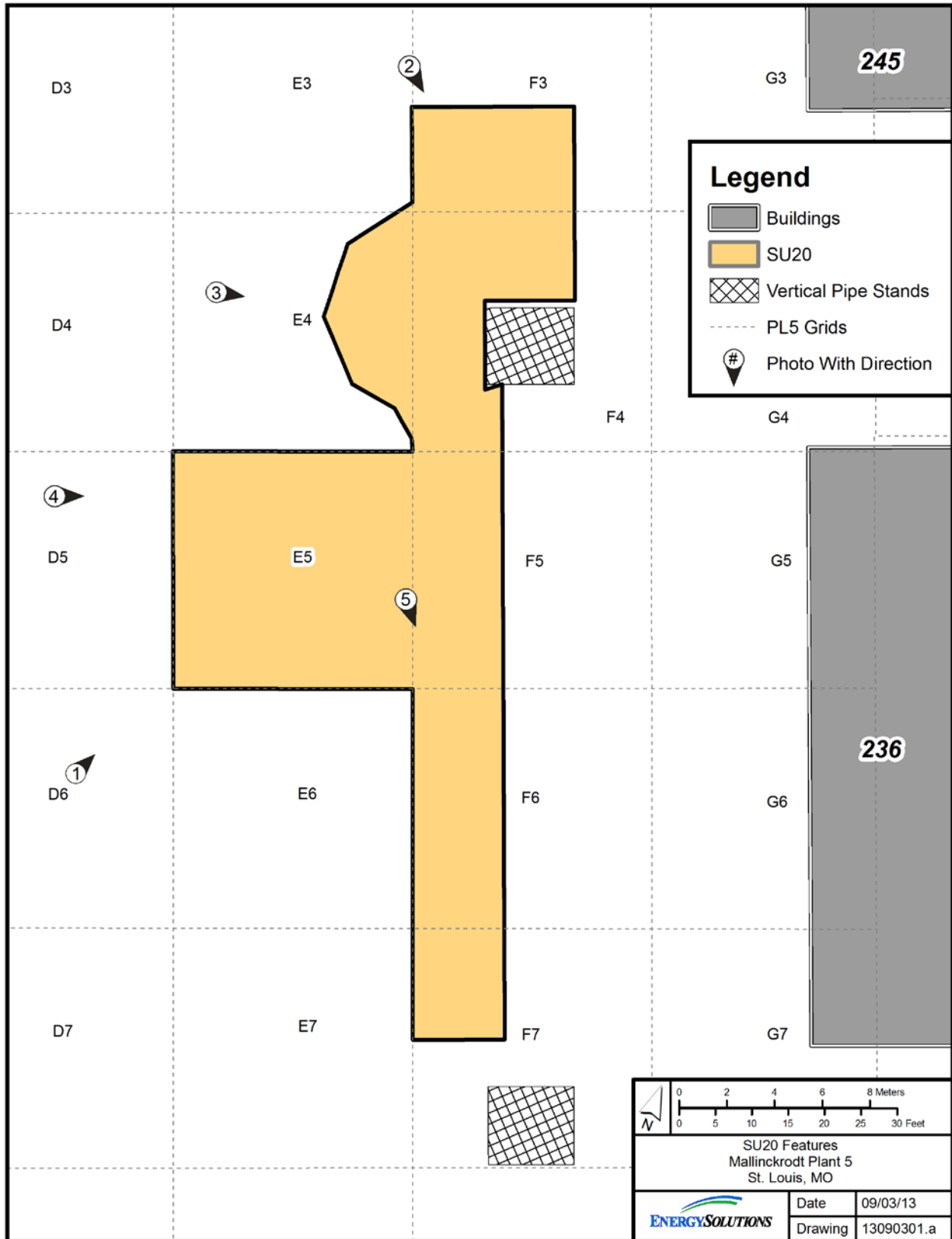


Figure 26-2 SU20 Feature Diagram

Figure 26-3 through Figure 26-7 are photographs of the SU20 general excavation that were taken during or after FSS with the approximate position and orientation of the photographs as provided on Figure 26-2. Figure 26-3 (photograph 1) was taken following remediation at the time of backfill as viewed from the west side of the survey unit looking northeast with the 7th street alley and Buildings 236 and 245 in the background.



Figure 26-3 Photograph (1) of SU20 Looking East during backfill (Northeast View)

The survey unit is bounded on the west by SU07, SU08, and SU09; the south by SU16; the east by SU11 and SU12 (i.e., 7th street alley); and, the north by SU11 and SU15. Soil and related debris were removed from the area to an excavated depth range of approximately 16 to 18 ft below grade surface (bgs), corresponding to the relatively impermeable clay layer found at that depth.

The vertical pipe stand in AECOM grid F4 continued to support active plant operations and remained in place on the east boundary of the survey unit as shown in Figure 26-2. It measured approximately 12 ft by 12 ft wide and 6 ft deep, and was constructed of poured concrete within a timber form sitting atop historical brick structural material as well as soil consisting of ash, cinder, and clay. Due to structural stability concerns around the vertical pipe stand, extreme caution was exercised during the removal of material in the vicinity of the pipe stand and its supporting column of soil. Rather than excavate the entire survey unit simultaneously prior to survey and release, AECOM remediated discrete areas around the pipe stand and immediately backfilled once necessary confirmatory data were gathered. One face of the pipe stand was revealed at a time, bringing the excavation level down to approximate 16 ft bgs to allow scanning of the floor and the collection of systematic and biased samples, as necessary. Figure 26-4 (photograph 2) shows the north end of the excavation, AECOM grids F3 and F4, north of the pile cap as viewed toward the southeast. Figure 26-5 (photograph 3) shows the west side of the pile cap, AECOM grids E4 and F4, as exposed during remediation including the active sewer located directly under the pile cap at approximately 7-8 feet bgs which was plugged at the time of excavation with an expandable plug and re-connected upon backfill.

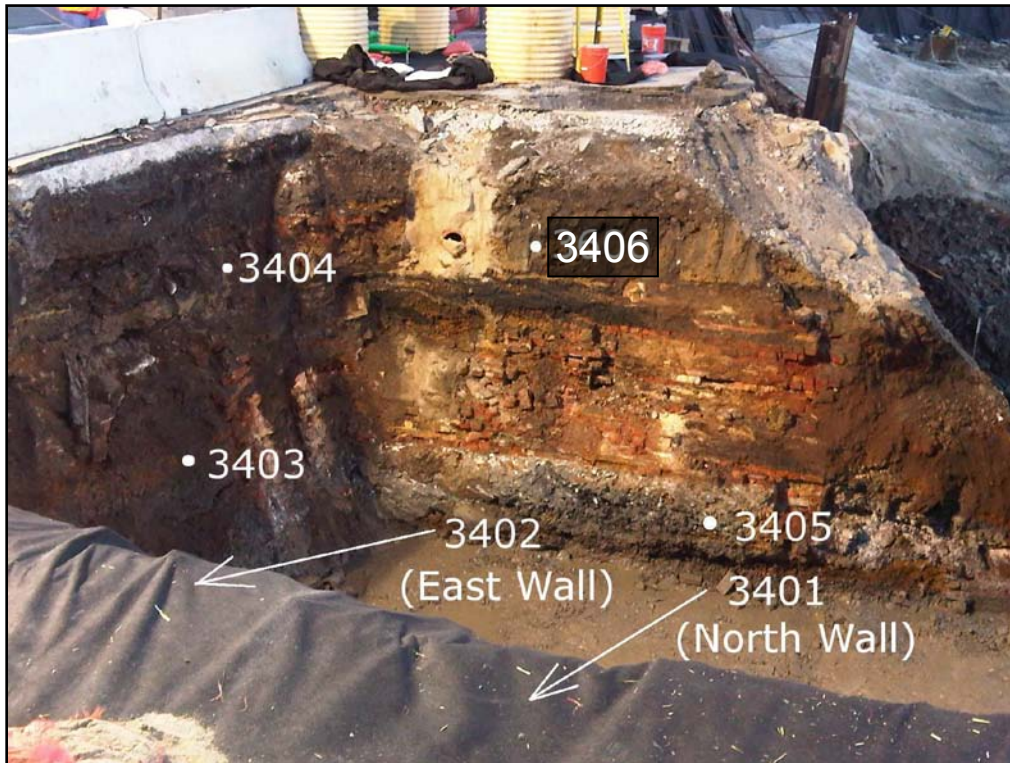


Figure 26-4 Photograph (2) of SU20 North of Pile Cap (Southeast View)



Figure 26-5 Photograph (3) of SU20 West Side of Pile Cap (East View)

Figure 26-6 (photograph 4) shows the central portion of the excavation, AECOM grids E5 and F5, south of the pile cap as viewed toward the east with Building 236 in the background. Figure 26-7 (photograph 5) shows the southern end of the SU20 excavations, AECOM grids F6 and F7 as viewed toward the southeast.



Figure 26-6 Photograph (4) of SU20 AECOM Grids E5/F5 (East View)



Figure 26-7 Photograph (5) of SU20 AECOM Grids F6/F7 (Southeast View)

Sample ID's have been included on several of the photographs as presented in Figure 26-4 through Figure 26-7. These correspond to sample locations and sample results as presented in Section 26.2 as applicable. AECOM did not provide annotation for Figure 26-6 (photograph 4).

26.2 DATA COLLECTION

Data collection was performed based on the assumptions, methods, and performance criteria established to satisfy the DQOs in accordance with the C-T Phase II DP, Sections 14.4.1 and 14.4.3. Details regarding FSS design and quality assurance and quality control applicable to all survey units were discussed in Chapters 4 and 5, respectively, of this FSSR. FSS data as collected for SU20 is summarized as follows:

26.2.1 Gamma Scans

Gamma surveys were performed where possible over the excavation floor using a 2-inch by 2-inch or 3-inch by 3-inch NaI detector. Due to the proximity to vertical walls at the edge of the excavation, overhead structures and the depth of excavation, GPS data logging was not performed. A manual grid system was established and a cpm reading recorded for each grid as could be safely accessed. A 1-meter grid was generally used over the bottom of the excavation. AECOM grid F5 was not gridded due to the stability of the vertical face. Remote gamma surveys were performed using the NaI detector tethered to an arm attached to an excavator boom as necessary. Data were then assessed to aid in the selection of biased sample locations as necessary.

As each area of SU20 was excavated, gamma scan surveys were performed and documented. No AECOM-documented survey was identified showing survey data for the bottom of the excavation at the north end for AECOM grids F3 and F4. AECOM survey #1762 as provided in Figure 26-8 shows the gamma scan survey data for the bottom of the excavation west of the pipe stand for AECOM grids E4 and F4. AECOM survey #1780 as provided in Figure 26-9 shows the gamma scan data for the bottom of the central portion of the excavation for AECOM grids E5 and F5. AECOM survey #1835 as provided in Figure 26-9 shows the gamma scan data for the bottom of the excavation at the south end for AECOM grids F6 and F7.

In general, gamma scan results on the bottom of the excavation ranged between 20,000 to 80,000 cpm for the northern end of the excavation within AECOM grids E4 and F4. Survey results for the southern end of the excavation for AECOM grids F6 and F7 ranged from 13,000 to 20,000 cpm. Survey results for the central portion of the excavation for AECOM grid E5 ranged from 30,000 to 100,000 cpm while the highest readings were within the central area of the excavation south of the pile cap within AECOM grid F5 near the vertical wall of the excavation. Additional excavation in this area (grid F5) was not practical due to the potential to destabilize the vertical face of the excavation.

The characterization of the vertical faces of the pipe stand within AECOM grid F4 and the east wall of the excavation is discussed within Section 26.2.4.

Survey Information Sheet

Technician: <u>R. Gordon</u>	Date: <u>1/11/12</u>	RSO: <u>AMS</u>	Date: <u>1/11/12</u>
------------------------------	----------------------	-----------------	----------------------

NORTH FACE PEAK STAND

14,640	16,560 • 3406	16,930
18,037	19,184	18,332
21,465	19,784	24,798
20,062	24,471	32,917 340

PEAK STAND
WEST FACE PEAK STAND

• 3411	49,312 • 3415	• 3410	18,111 • 3409
38,713	44,177	54,113	
29,551	28,741	31,791 • 3412	30,941
30,942	23,614	22,176	29,655
• 3413 • 3414 • 3415	21,314	26,422	22,511
25,165	22,302	20,199	21,917 • 3408

FLOOR IN FRONT OF WEST FACE

PLUGGED
SEWER PEAK

WOOD PIPE
2.20, 000, 000

Bottom of excavation

General Information		<u>1/11/12</u>	
Survey #:	60162412-SURV-PL5- INUS -1762	Instrument S/N:	Ludlum 343 242
Site / WBS#:	60162412	Probe S/N:	PR 230 091
Tech(s):	<u>R. Gordon</u>	Cal Due Date:	<u>4/13/12</u>
Comments:	<u>SEAL OF NORTH WEST PIPE STAND WALLS + FLOOR WEST OF PEAK STAND</u>		

Figure 26-8 Survey of North Excavation AECOM Grids E4/F4 West of the Vertical Pipe Stand

Survey Information Sheet

Technician: R. Gordon Date: 1/25/12 RSO: J. Miller Date: 1/25/12

N Tit St ALLEY

WOOD PEAK 20,879
WOOD PEAK 21,777

	W	3449 13,410	15,196	17,361	15,779 3448	17,391	18,101	14,140	14,389	15,109	14,110	15,387	19,710	23,080 3448
	A	12,917	12,160	12,105	13,480	16,274	15,631	15,164	15,684	16,407	24,635	16,201	13,557	15,187
	L	20,011	19,021	17,828	18,999	17,694	15,940	14,101	30,622	44,961 3448	22,470	14,635	16,287	13,445
	L	18,207	19,111	19,221	16,476	18,947 3448	18,595	16,203	17,805	20,431	21,369	22,575	21,210	19,180
	F				3441									
	L	19,110	18,101	16,493	14,616	15,120	15,941	16,338 14,203	16,984 17,805	16,254 20,431	16,987	17,750	13,745 25,411	25,411
	O	14,121	15,021	15,086	14,374	14,689	14,223	14,848	3442 14,25	15,743	17,047	16,417	17,550	20,401
	R	17,411	12,811	12,848	16,496	12,627	12,677	13,351	14,489	14,806	15,166	14,698	15,031	15,007

PLATEAU

BACKFILL

Bottom of Excavation

General Information

Survey #: 60162412-SURV-PL5- INFO-1835

Site / WBS#: 60162412

Tech(s): R. Gordon

Comments: SCANS OF EAST WALL & FLOOR SU-20 F6 & F7 1/25/12

Ludlum 2 x 2

Instrument S/N: 1977901

Probe S/N: P2230091

Cal Due Date: 4/13/12

Page: 1 of 1

Figure 26-10 Survey of South Excavation for AECOM Grids F6/F7 (Floor and East Wall)

26.2.2 Soil Sampling

The southern boundary of SU20 was moved north approximately 20 feet (ft)—the excluded area was evaluated as part of survey unit SU16. This change was made to protect the vertical pipe stand in AECOM grid F7. This resulted in the elimination of systematic sample location #1 and offsetting systematic sample position #2 by approximately one foot to the north.

Soil samples to be used for the statistical testing were collected at a frequency and at representative locations throughout SU20 such that a statistically sound conclusion regarding the radiological condition of the survey unit could be developed. Biased soil samples were also collected at locations of elevated residual radioactivity identified by gamma scans. The FSS soil sampling locations are provided on Figure 26-11. A total of 25 (18 systematic and 7 biased) soil samples were collected over the areal footprint SU20.

All soil samples were analyzed on site via gamma spectroscopy analysis. Any remaining sieved material from each sample was analyzed separately to verify residual radioactivity was consistent with sample results. The radiological screening process did not identify any significant levels of radioactivity in the sieved materials removed from samples.

The C-T Phase II DP, Table 4-17, provided mean background activity levels of 1.3, 2.5, and 4.4 picoCuries per gram (pCi/g) for thorium-232 (^{232}Th), radium-226 (^{226}Ra), and uranium-238 (^{238}U), respectively. These values were used to calculate net sum of fractions (SOF) values for the individual sample results—note that when measured activity concentration levels were less than the background mean resulting in a negative value, the net activity concentration was set equal to zero for the net SOF calculation.

To mitigate the risk of backfilling, the on-site laboratory analytical results were reviewed to determine the likelihood of the survey unit failing to meet the criteria for radiological release. The on-site laboratory, by design, reported conservative sample results.

Table 26-1 provides the sample results and summary statistics for the 18 systematic samples. Table 26-2 provides the sample results for the 7 gamma scan biased samples.

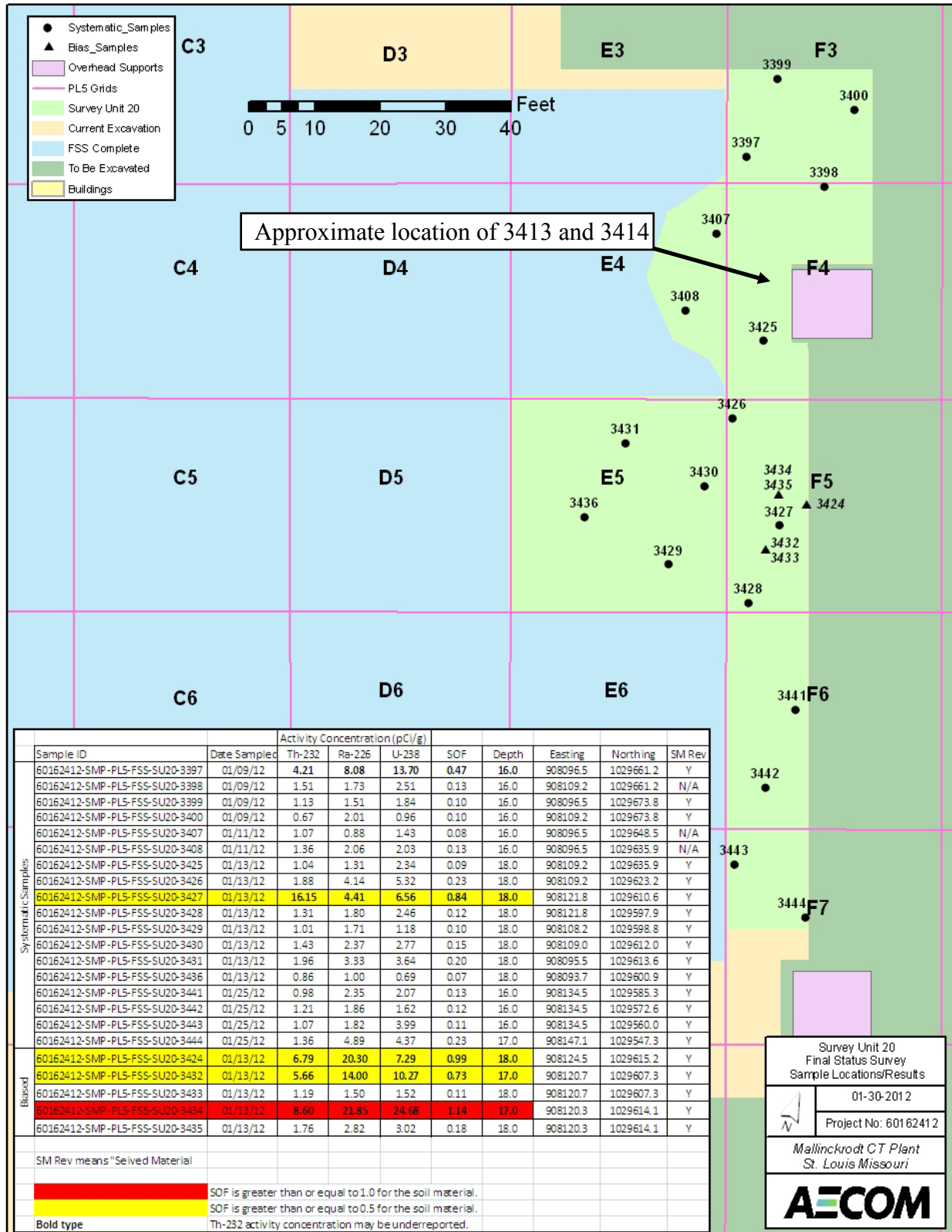


Figure 26-11 Soil Sampling Locations

Table 26-1 Gamma Spectroscopy Systematic Sample Analytical Results

Sample ID	Depth (ft bgs)	On-Site Results											Off-Site Results ^a											On-Site/ Off-Site Gross SOF Ratio	
		Concentration (pCi/g)									SOF ^b		Concentration (pCi/g)									SOF ^b			
		²³² Th			²²⁶ Ra			²³⁸ U			Gross	Net ^c	²³² Th			²²⁶ Ra			²³⁸ U			Gross	Net ^c		
Result	Uncert. (2σ)	MDC	Result	Uncert. (2σ)	MDC	Result	Uncert. (2σ)	MDC	Gross	Net ^c	Result	Uncert. (2σ)	MDC	Result	Uncert. (2σ)	MDC	Result	Uncert. (2σ)	MDC	Result	Uncert. (2σ)	MDC	Gross	Net ^c	
3397	16	4.21	0.53	0.16	8.08	2.08	1.48	13.70	2.35	1.32	0.47	0.32	5.54	0.74	0.33	5.93	0.73	0.10	6.51	0.78	0.09	0.44	0.30	1.06	
3398	16	1.51	0.22	0.02	1.73	0.81	0.60	2.51	1.19	0.76	0.13	0.01	1.82	0.46	0.37	1.26	0.22	0.10	1.72	0.27	0.10	0.12	0.02	1.03	
3399	16	1.13	0.24	0.06	1.51	0.82	0.61	1.84	1.02	0.66	0.10	0.00	0.94	0.37	0.33	1.26	0.19	0.09	1.30	0.19	0.09	0.08	0.00	1.21	
3400	16	0.67	0.17	0.04	2.01	0.71	0.48	0.96	0.62	0.45	0.10	0.00	0.62	0.15	0.12	0.92	0.14	0.04	1.10	0.13	0.04	0.06	0.00	1.67	
3407	16	1.07	0.22	0.03	0.88	0.79	0.61	1.43	0.83	0.55	0.08	0.00	0.89	0.23	0.20	1.09	0.15	0.06	1.25	0.17	0.06	0.08	0.00	1.01	
3408	16	1.36	0.23	0.10	2.06	0.84	0.59	2.03	0.94	0.59	0.13	0.00	1.14	0.29	0.24	1.58	0.22	0.07	1.77	0.23	0.07	0.10	0.00	1.25	
3425	18	1.04	0.21	0.06	1.31	0.80	0.60	2.34	0.93	0.57	0.09	0.00	1.00	0.26	0.19	1.46	0.19	0.05	1.53	0.20	0.06	0.09	0.00	0.97	
3426	18	1.88	0.36	0.10	4.14	1.41	1.03	5.32	1.56	0.92	0.23	0.08	2.03	0.51	0.38	3.61	0.49	0.10	4.25	0.56	0.11	0.21	0.07	1.06	
3427	18	16.15	1.18	0.22	4.41	2.04	1.56	6.56	2.57	1.75	0.83	0.69	21.20	2.60	0.44	3.99	0.52	0.15	4.65	0.57	0.13	1.03	0.88	0.81	
3428	18	1.31	0.23	0.02	1.80	0.82	0.59	2.46	1.05	0.64	0.12	0.00	1.25	0.24	0.16	1.21	0.17	0.05	1.25	0.16	0.05	0.10	0.00	1.26	
3429	18	1.01	0.22	0.05	1.71	0.82	0.59	1.18	0.79	0.54	0.10	0.00	1.16	0.29	0.22	1.28	0.18	0.06	1.41	0.19	0.06	0.09	0.00	1.09	
3430	18	1.43	0.27	0.05	2.37	0.92	0.64	2.77	1.01	0.63	0.14	0.01	1.29	0.29	0.24	1.36	0.20	0.07	1.41	0.18	0.07	0.10	0.00	1.41	
3431	18	1.96	0.32	0.12	3.33	1.15	0.82	3.64	1.02	0.67	0.20	0.06	2.25	0.48	0.41	2.64	0.35	0.10	2.92	0.38	0.12	0.19	0.04	1.07	
3436	18	0.86	0.17	0.04	1.00	0.61	0.45	0.69	0.57	0.41	0.07	0.00	0.74	0.22	0.17	0.68	0.11	0.05	0.78	0.12	0.05	0.06	0.00	1.28	
3441	16	0.98	0.21	0.06	2.35	0.79	0.53	2.07	0.82	0.52	0.12	0.00	1.11	0.22	0.18	1.51	0.21	0.06	1.71	0.21	0.05	0.10	0.00	1.24	
3442	16	1.21	0.24	0.06	1.86	0.75	0.52	1.62	0.98	0.63	0.12	0.00	1.45	0.25	0.13	1.32	0.21	0.06	1.43	0.20	0.06	0.11	0.01	1.08	
3443	16	1.07	0.23	0.06	1.82	0.85	0.62	3.99	1.14	0.65	0.11	0.00	1.27	0.23	0.15	1.21	0.18	0.07	1.27	0.18	0.07	0.10	0.00	1.17	
3444	17	1.36	0.20	0.09	4.89	0.99	0.60	4.37	1.05	0.65	0.23	0.08	1.82	0.31	0.16	1.67	0.23	0.08	1.95	0.25	0.07	0.14	0.02	1.69	
Summary Statistics																									
Count:	18				18						18	18	18				18			18			18	18	18
Average:	2.23				2.63						0.19	0.07	2.64				1.89			2.12			0.18	0.07	1.19
Median:	1.26				1.93						0.12	0.00	1.26				1.34			1.48			0.10	0.00	1.13
Standard Dev.:	3.56				1.78						0.19	0.17	4.76				1.34			1.51			0.23	0.21	0.23
Minimum:	0.67				0.88						0.07	0.00	0.62				0.68			0.78			0.06	0.00	0.81
Maximum:	16.15				8.08						0.83	0.69	21.20				5.93			6.51			1.03	0.88	1.69
Range:	15.48				7.20						0.76	0.69	20.58				5.25			5.73			0.97	0.88	0.88

^a Off-site laboratory results as reported by TestAmerica after sufficient in-growth time to reach ²²⁶Ra progeny equilibrium.

^b **Bolded orange** SOF values indicate a result >0.5 but ≤1 and **bolded red** SOF values indicate a result >1.

^c Calculated as discussed in Section 26.2.2.

Table 26-2 Gamma Spectroscopy Biased Sample Analytical Results

Sample ID	Depth (ft bgs)	On-Site Results											Off-Site Results ^a										On-Site/ Off-Site Gross SOF Ratio	
		Concentration (pCi/g)									SOF ^b		Concentration (pCi/g)									SOF ^b		
		²³² Th			²²⁶ Ra			²³⁸ U			Gross	Net ^c	²³² Th			²²⁶ Ra			²³⁸ U			Gross		Net ^c
Result	Uncert. (2σ)	MDC	Result	Uncert. (2σ)	MDC	Result	Uncert. (2σ)	MDC	Result	Uncert. (2σ)			MDC	Result	Uncert. (2σ)	MDC	Result	Uncert. (2σ)	MDC	Result	Uncert. (2σ)		MDC	
Gamma Scan Biased Samples																								
3413	15	60.90	3.33	0.78	221.42	11.41	4.43	8.64	4.77	3.73	10.09	9.95	AECOM did not provide a reason for not sending these samples to the off-site laboratory.											
3414 ^d	16	1.58	0.28	0.75	4.12	1.24	1.36	14.22	1.59	0.80	0.23	0.08												
3424	18	6.79	0.70	0.21	20.30	2.36	1.42	7.29	2.13	1.39	0.98	0.84	9.17	1.40	0.84	22.00	2.60	0.21	23.20	2.75	0.24	1.16	1.02	0.85
3432	17	5.66	0.63	0.15	14.00	2.35	1.58	10.27	2.34	1.45	0.73	0.58	6.06	0.90	0.47	14.10	1.60	0.12	15.70	1.90	0.13	0.75	0.61	0.96
3433 ^e	18	1.19	0.27	0.11	1.50	0.87	0.64	1.52	0.91	0.62	0.10	0.00	1.76	0.44	0.32	1.70	0.26	0.09	1.86	0.29	0.09	0.13	0.02	0.77
3434	17	8.60	0.82	0.24	21.85	3.13	2.13	24.68	3.19	1.81	1.14	0.99	9.98	1.30	0.49	19.60	2.40	0.15	21.10	2.50	0.14	1.11	0.97	1.02
3435 ^f	18	1.76	0.29	0.07	2.82	0.98	0.69	3.02	1.13	0.70	0.17	0.03	1.70	0.31	0.19	2.55	0.34	0.06	2.76	0.33	0.06	0.16	0.02	1.07

^a Off-site laboratory results as reported by TestAmerica after sufficient in-growth time to reach ²²⁶Ra progeny equilibrium.

^b **Bolded orange** SOF values indicate a result >0.5 but ≤1 and **bolded red** SOF values indicate a result >1.

^c Calculated as discussed in Section 26.2.2.

^d Collected to a depth of 1 ft beneath sample 3413 to demonstrate that elevated residual radioactivity did not extend into the clay layer.

^e Collected to a depth of 1 ft beneath sample 3432 to demonstrate that elevated residual radioactivity did not extend into the clay layer.

^f Collected to a depth of 1 ft beneath sample 3434 to demonstrate that elevated residual radioactivity did not extend into the clay layer.

26.2.3 Core Boring

The C-T Phase II DP, Table 4-7, provided characterization borehole results. Of the locations provided in the table, one was collected within the extent of SU20: BH-014. Table 26-3 provides the data for this location. This was a shallow borehole with a maximum depth of 4.5 ft and therefore does not provide any value for demonstrating that additional subsurface contamination was not reasonably expected. AECOM collected subsurface samples at two locations from the excavation bottom (samples 3432 and 3434; see Table 26-2) to demonstrate that contamination did not extend into the clay layer.

Table 26-3 Characterization Borehole Results

Location ID	Sample Depth (ft)	Activity Concentration (pCi/g)			SOF ^a	
		²³² Th	²²⁶ Ra	²³⁸ U	Gross	Net ^b
BH-014	1 - 2	1.40	0.49	7.20	0.09	0.01
	2 - 3	2.48	2.97	11.10	0.22	0.07
	3 - 4	1.99	3.37	30.90	0.24	0.10
	4 - 4.5	11.90	16.40	28.70	1.10	0.95

^a **Bolded orange** SOF values indicate a result >0.5 but ≤1 and **bolded red** SOF values indicate a result >1.

^b Calculated as discussed in Section 26.2.2.

In accordance with Table 14-5 of the C-T Phase II DP, the Class 1 subsurface investigation level is the DCGL_w (1 SOF) plus the mean of background (0.15 SOF) plus six standard deviations of background (6 × 0.09 SOF = 0.54 SOF), using data from Tables 4-17 and B-1. This evaluates to a gross SOF of 1.69. All subsurface samples were below this investigation level.

26.2.4 Characterization of Excavation Face (East Wall) and the Vertical Pipe Stand

AECOM performed characterization surveys of the east wall of the excavation along survey units SU11 and SU12 as well as the north, west, and south faces of the vertical pipe stand located in AECOM grid F4. This included both gamma scans of the excavated face as well as soil samples based upon the survey results as summarized in the following sections.

26.2.4.1 Gamma Scans

Due to proximity to the vertical walls at the edge of the excavation, remote gamma surveys were performed using a 2-inch by 2-inch NaI detector tethered to an arm attached to an excavator boom. This remote surveying technique did not allow for global positioning system (GPS) data logging. A survey grid system was established and a count per minute (cpm) reading recorded for each grid surveyed.

As each area of SU20 was excavated, gamma scan surveys were performed and documented along the exposed face of the east wall and vertical pipe stand. Figure 26-12 shows the locations where each AECOM survey was performed as provided in Figure 26-13 through Figure 26-19.

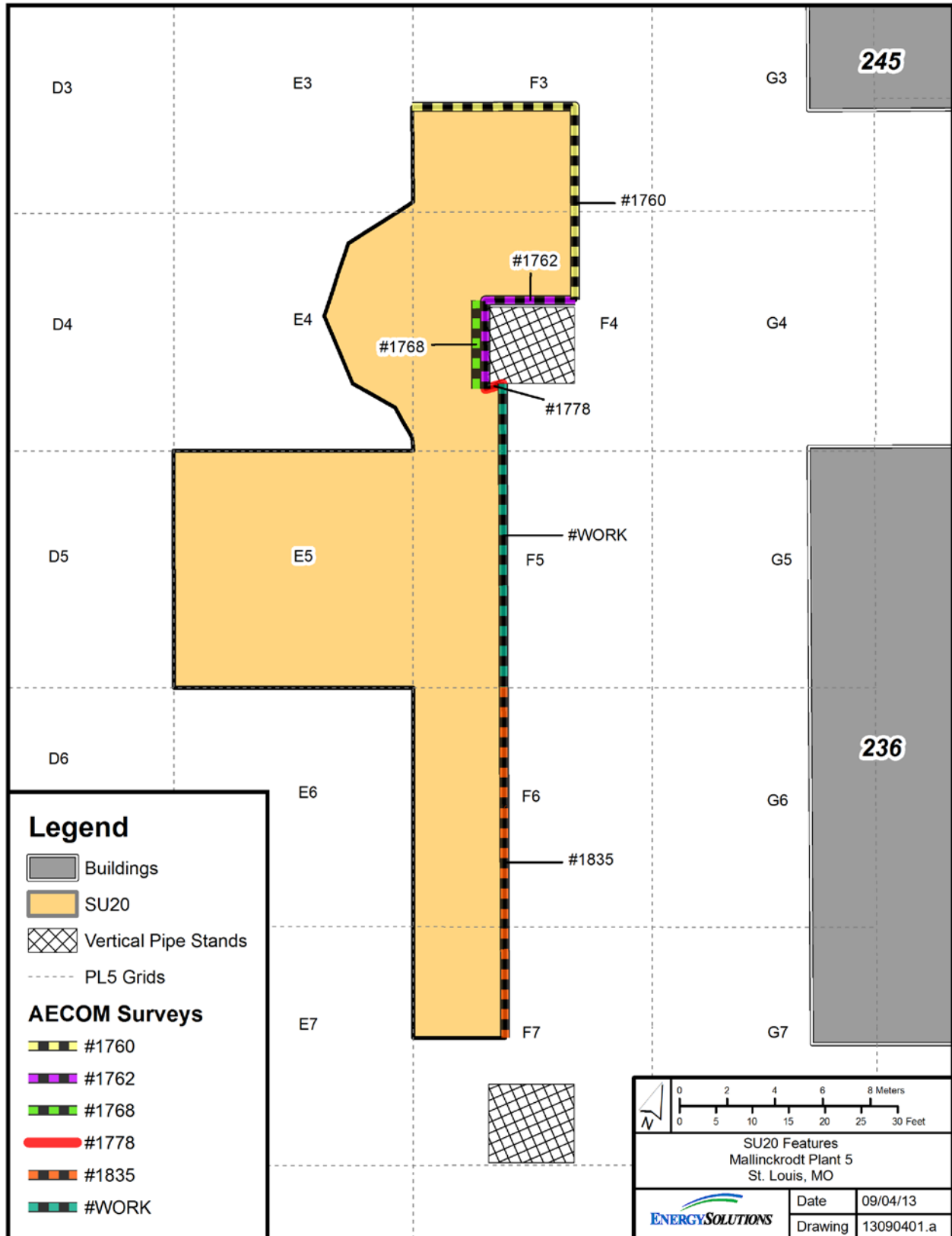


Figure 26-12 SU20 Characterization of East Wall (AECOM Surveys)

Survey Information Sheet

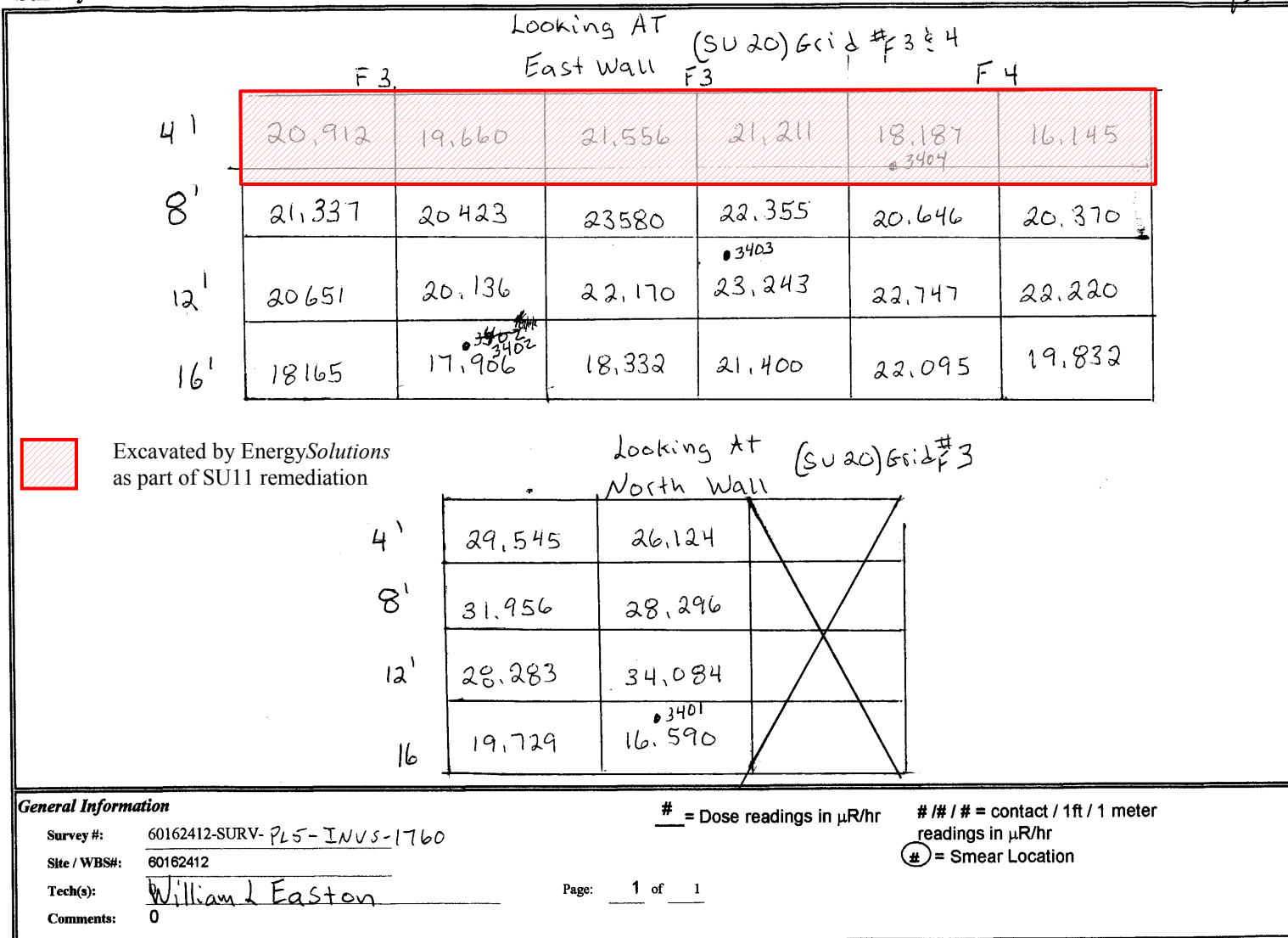


Figure 26-13 Survey of North Excavation for AECOM Grids F3 and F4 (North and East Walls)

Survey Information Sheet

Technician: <u>R. Gordon</u>	Date: <u>1/11/12</u>	RSO: <u>AMS</u>	Date: <u>1/11/12</u>
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○ PEAK STAND

○ WEST FACE PEAK STAND

NORTH FACE PEAK STAND

14,640	16,560 • 3406	16,930
18,037	19,184	18,332
21,465	19,784	24,798
20,062	24,471	32,917 340

• 3411	49,312 • 3415	• 3410	18,111 • 3409
39,713	44,177	54,113	
29,551	28,741	31,791 • 3412	30,941

PLUGGED
SUNKEN PEAK

WOOD PIPE
220,000µm

FLOOR IN FRONT OF WEST FACE

F55 SAMPLER

F55 SAMPLER

Bottom of excavation

General Information		<u>1/11/12</u>	
Survey #:	<u>60162412-SURV-PL5- INUS -1762</u>	Instrument S/N:	<u>Ludlum 323 2A2</u>
Site / WBS#:	<u>60162412</u>	Probe S/N:	<u>PR 230 091</u>
Tech(s):	<u>R. Gordon</u>	Cal Due Date:	<u>4/13/12</u>
Comments:	<u>SEAL OF NORTH WEST PIPE STAND WALLS + FLOOR WEST OF PEAK STAND</u>		

Figure 26-14 Characterization Survey of the Vertical Pipe Stand (North and West Face)

Survey Information Sheet

Technician: <u>J. Michel</u>	Date: <u>1/11/12</u>	RSO: <u>Max On</u>	Date: <u>1/16/12</u>
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The diagram shows a vertical pipe stand with a height of 3m and a width of 5m. At the top, there is a 'PIPE RACK' supported by 'WOOD PLANKS' on an 'ASPHALT' surface. The stand is divided into three vertical sections. The left section has points labeled 10K, 10K, 11K, 10K, 11K, 15K, 14K, 15K, 13K, 24K, and 38K. The middle section has points labeled 10K, 10K, 11K, 10K, 12K, 10K, 13K, 20K, 26K, and a '12" PIPE' at the bottom. The right section has points labeled 13K, 12K, 11K, 12K, 60K, 30K, 60K, 90K, and 140K. A north arrow is in the top right. Points 3418 and 3419 are marked on the left side. A vertical dimension line on the left indicates 3m, and a horizontal dimension line at the bottom indicates 5m.

SU-20, GRID F3

General Information			
Survey #:	60162412-SURV-PL5-NORL-1768	Ludlum 3x3 2x2	
Site / WBS#:	60162412	Instrument S/N:	197794
Tech(s):	J. MICHEL 1/11/12	Probe S/N:	PR 230091
Comments:		Cal Due Date:	4/13/12

Page: 1 of 1

Figure 26-15 Characterization Survey of the Vertical Pipe Stand (Upper West Face)

Survey Information Sheet

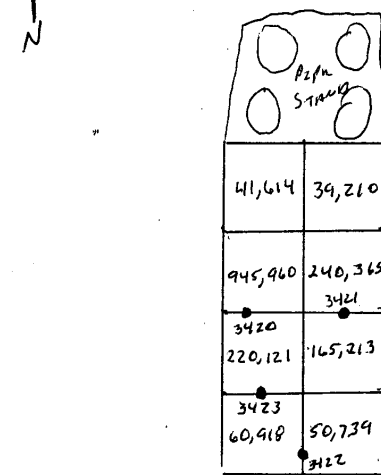
Technician: <u>K. Gordon</u>	Date: <u>1/16/12</u>	RSO: <u>[Signature]</u>	Date: <u>1/16/12</u>
			
General Information Survey #: <u>60162412-SURV-PLS- INFO -1778</u> Site / WBS#: <u>60162412</u> Tech(s): <u>K. Gordon</u> Comments: <u>SOUTH FACE PIPE STAND</u>		Ludlum 322 ³²² Instrument S/N: <u>197794</u> Probe S/N: <u>DK230091</u> Cal Due Date: <u>4/13/12</u>	Page: 1 of 1

Figure 26-16 Characterization Survey of the Vertical Pipe Stand (South Face)

Survey Information Sheet

Technician: <u>R. Gordon</u>	Date: <u>1/18/12</u>	RSO: <u>[Signature]</u>	Date: <u>1/18/12</u>								
General Information Survey #: 60162412-SURV-PL5- INFO-1798 Site / WBS#: 60162412 Tech(s): K. Gordon Comments: SCAN PIPE UNDER PEPE STAND 5m. WEST TO EAST 1/18/12		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;"></td> <td style="width: 50%;">Ludlum 3x3 <u>242</u></td> </tr> <tr> <td>Instrument S/N:</td> <td>197794</td> </tr> <tr> <td>Probe S/N:</td> <td>PN230091</td> </tr> <tr> <td>Cal Due Date:</td> <td>4/13/12</td> </tr> </table>		Ludlum 3x3 <u>242</u>	Instrument S/N:	197794	Probe S/N:	PN230091	Cal Due Date:	4/13/12	Page: 1 of 1
	Ludlum 3x3 <u>242</u>										
Instrument S/N:	197794										
Probe S/N:	PN230091										
Cal Due Date:	4/13/12										

Figure 26-17 Characterization Survey of Pipe under Vertical Pipe Stand AECOM Grid F4

Survey Information Sheet

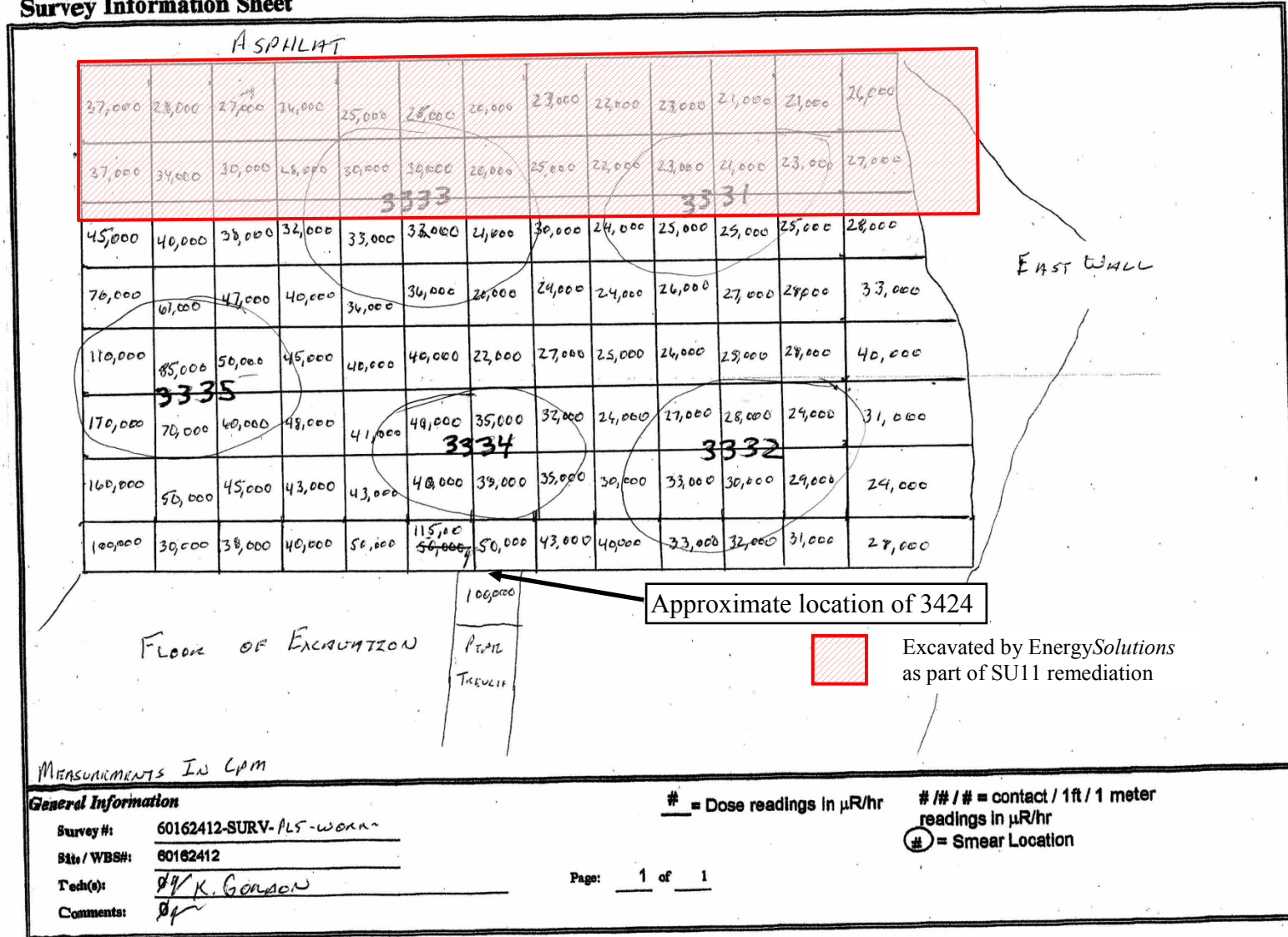


Figure 26-18 Survey of Central Excavation for AECOM Grid F4 and F5 (East Wall)

Survey Information Sheet

Technician: <u>R. Gordon</u>	Date: <u>1/25/12</u>	RSO: <u>J. Miller</u>	Date: <u>1/25/12</u>
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N 7TH ST ALLEY

WOODS PEAK
20,879
LPM

WOODS PEAK
21,777
LPM

A202
STAIRS

A204

19,210

SOUTH WALL

PLATEAU

	15,410	15,196	17,361	15,779	17,391	18,101	14,140	14,384	15,109	14,107	15,382	19,700	23,080
A	12,917	12,160	12,105	13,480	16,274	15,771	15,766	15,684	16,407	24,645	16,201	15,557	15,787
L	20,011	19,021	17,828	18,999	17,694	15,940	14,101	30,622	19,911	22,470	14,635	16,287	13,495
L	18,207	19,111	19,221	16,476	18,947	18,595	16,203	17,805	20,431	21,305	22,575	21,210	19,180

Bottom of Excavation

Excavated by EnergySolutions as part of SU11 and SU12 remediation.

General Information		
Survey #:	60162412-SURV-PL5- INFO-1835	
Site / WBS#:	60162412	
Tech(s):	R. Gordon	
Comments:	SEAS OF EAST WALL & FLOOR SU-20 F6 & F7	
	1/25/12	
		Ludlum 2x2
		Instrument S/N: 1977901
		Probe S/N: P0230091
		Cal Due Date: 4/13/12
		Page: 1 of 1

Figure 26-19 Survey of South Excavation for AECOM Grids F6 and F7 (East Wall)

As part of the survey unit SU11 and SU12 remediation, EnergySolutions excavated to a depth of approximately 5 ft bgs along the survey unit boundary. The excavation then sloped downward (southward) within AECOM grid F6 to approximately 14-15 feet bgs at the vertical pipe stand within AECOM grid F7. The red hatched areas as shown on Figure 26-13, Figure 26-18, and Figure 26-19 indicate data that does not represent the as-left condition. These areas were removed as part of the EnergySolutions remediation.

In general, gamma scan results ranged between 15,000 to 40,000 cpm along the exposed face of the excavation with higher readings ranging from 40,000 to 945,000 cpm around the south side of the vertical pipe stand (AECOM survey #1778; Figure 26-16) as well as the east wall directly south of the pipe stand within AECOM grid F4 (north portion of AECOM survey #WORK; Figure 26-18). Elevated readings were also identified in the vicinity of the pipe trench as identified within AECOM grid F5 at a depth of approximately 15-16 feet bgs (AECOM survey #WORK). Gamma measurements at the pipe trench ranged between 100,000 to 115,000 cpm.

In addition to the wall survey, the active sewer under the vertical pipe stand in AECOM grid F4, as illustrated in Figure 26-5 and Figure 26-15, was surveyed up to 5-meters into the pipe. A copy of the pipe survey is provided as Figure 26-17. Gamma measurements within the pipe ranged from 30,000 to 360,000 cpm (AECOM survey #1798; Figure 26-17).

26.2.4.2 Soil Sampling

As part of the characterization of the vertical pipe stand within AECOM grid F4 and the exposed face of the excavation along the east wall, soil samples were collected as part of the surveys performed. The approximate sample locations and sample IDs are provided on Figure 26-13 through Figure 26-19. The locations and IDs are also provided as part of photographs 2, 3 and 5. A total of 27 biased samples were taken along the exposed face of the excavation, 14 along the east wall and 13 around the vertical pipe stand and one from the exposed opening to the active sewer pipe on the west face. As previously discussed, EnergySolutions excavated to a depth of approximately 5 ft bgs along the SU11 survey unit boundary and ramped from 5 ft bgs to 14-15 ft bgs to the SU12 survey unit boundary as shown by the red hatched areas in the Figure 26-19. Seven of the samples collected along the east wall were ultimately removed and are not reflective of the as left condition of the survey unit.

Table 26-4 provides the on-site laboratory sample results for the 7 remaining samples along the exposed face of the east wall and Table 26-5 provides the sample results for the 14 samples from the exposed faces under the vertical pipe stand.

Table 26-4 Gamma Spectroscopy East Wall Characterization Sample Analytical Results

Sample ID	Gross				Net ^a			
	Concentration (pCi/g)			SOF ^b	Concentration (pCi/g)			SOF ^b
	²³² Th	²²⁶ Ra	²³⁸ U		²³² Th	²²⁶ Ra	²³⁸ U	
North Wall, AECOM Grid F3								
3401	1.98	1.62	2.76	0.14	0.68	0	0	0.03
East Wall, AECOM Grids F3 and F4 (north of pile cap)								
3402	3.08	3.16	5.00	0.24	1.78	0.66	0.60	0.10
3403	5.13	13.54	7.43	0.69	3.83	11.04	3.03	0.54
East Wall, AECOM Grids F4 and F5 (south of pile cap)								
3332	3.01	12.17	12.03	0.56	1.71	9.67	7.63	0.41
3334	48.20	63.21	20.10	4.19	46.9	60.71	15.7	4.05
3335	82.98	94.59	20.17	6.72	81.68	92.09	15.77	6.57
East Wall, AECOM Grids F6 and F7								
3447	1.54	15.89	23.85	0.64	0.24	13.39	19.45	0.49

^a Negative net concentrations were set equal to zero.

^b **Bolded orange** SOF values indicate a result >0.5 but ≤1 and **bolded red** SOF values indicate a result >1.

Table 26-5 Gamma Spectroscopy Pipe Stand Characterization Sample Analytical Results

Sample ID	Gross				Net ^a			
	Concentration (pCi/g)			SOF ^b	Concentration (pCi/g)			SOF ^b
	²³² Th	²²⁶ Ra	²³⁸ U		²³² Th	²²⁶ Ra	²³⁸ U	
North Face								
3405	64.89	147.08	9.89	7.73	63.59	144.58	5.49	7.59
3406	1.06	2.98	4.06	0.15	0	0.48	0	0.02
West Face								
3409	17.52	43.01	20.25	2.22	16.22	40.51	15.85	2.08
3410	6.76	16.13	10.70	0.85	5.46	13.63	6.30	0.70
3411	3.46	2.67	0.74	0.24	2.16	0.17	0	0.10
3412	16.24	4.83	8.89	0.86	14.94	2.33	4.49	0.71
3415	397.42	265.05	63.76	25.73	396.12	262.55	59.36	25.59
3418	0.84	5.30	67.63	0.31	0	2.80	63.23	0.18
3419	4.61	4.67	17.09	0.38	3.31	2.17	12.69	0.23
South Face								
3420	198.69	636.07	52.18	30.02	197.39	633.57	47.78	29.88
3421	268.50	283.19	53.55	20.94	267.20	280.69	49.15	20.80
3422	5.78	4.61	14.92	0.42	4.48	2.11	10.52	0.27
3423	223.30	1,123.50	65.45	47.65	222.00	1,121.00	61.05	47.50
Deep Sewer Pipe Contents								
3437	3.35	13.84	6.08	0.62	2.05	11.34	1.68	0.47

^a Negative net concentrations were set equal to zero.

^b **Bolded orange** SOF values indicate a result >0.5 but ≤1 and **bolded red** SOF values indicate a result >1.

26.3 DATA ANALYSIS

The data analysis was performed based on the assumptions, methods, and performance criteria established to satisfy the DQOs in accordance with the C-T Phase II DP, Sections 14.4.1 and 14.4.3. Details regarding FSS design and quality assurance and quality control applicable to all survey units were discussed in Chapters 4 and 5, respectively, of this FSSR.

26.3.1 Elevated Area Evaluation

Equation 9 from C-T Phase II DP, Section 5.8.7 provides for the calculation of an *Index* value that represents the fraction or multiple of the $DCGL_{EMC}$. If the *Index* value is greater than one, then the $DCGL_{EMC}$ is exceeded.

Biased samples 3424 and 3434 were collected from an area of elevated gamma radiation on the excavation floor in the vicinity of the pipe trench as shown in Figure 26-9 and Figure 26-18, noted as Elevated Area #1. AECOM defined the elevated area as shown in Figure 26-20. Parameters necessary to calculate the *Index* value for Elevated Area #1 are discussed below.

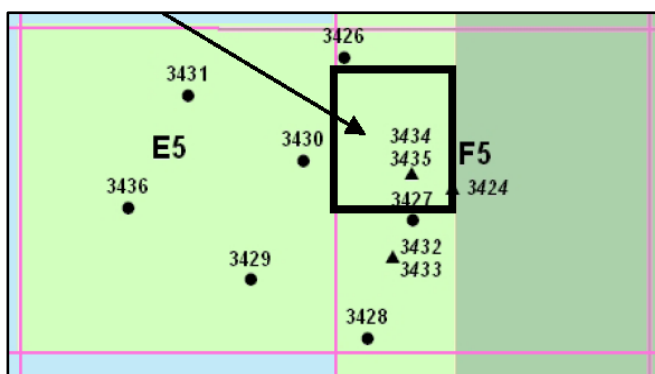


Figure 26-20 Elevated Area #1

- The elevated area activity levels, represented by the average of samples 3424 and 3434, were 9.58, 20.80, and 22.15 pCi/g for ^{232}Th , ^{226}Ra , and ^{238}U , respectively (from Table 26-2);
- Mean background activity levels were 1.3, 2.5, and 4.4 pCi/g for ^{232}Th , ^{226}Ra , and ^{238}U , respectively (from C-T Phase II DP Table 4-17);
- The size of the elevated area was determined to be approximately 20 m²; and,
- The area factors from C-T Phase II DP Figure 5-3 for the elevated area were 1.8, 1.95, and 2.7 for ^{232}Th , ^{226}Ra , and ^{238}U , respectively.

The calculation of the *Index* value is shown below. Because the *Index* value as calculated in accordance with the DP was less than one, this elevated area is compliant with the C-T Phase II DP for elevated measurements in soil.

$$Index = \frac{(9.58 - 1.3) \text{ pCi/g}}{(1.8 \times 23.9 \text{ pCi/g})_{Th \text{ series}}} + \frac{(20.80 - 2.5) \text{ pCi/g}}{(1.95 \times 29.4 \text{ pCi/g})_{Ra226}} + \frac{(22.15 - 4.4) \text{ pCi/g}}{(2.7 \times 721 \text{ pCi/g})_U} = 0.52$$

Parameters necessary to calculate the *Index* value for Elevated Area #2 (shown on Figure 26-2), the material under the elevated pipe stand, are discussed below.

- The elevated area activity levels, represented by the average of samples 3405, 3415, and 3423 (maximum result for the north, west, and south face, respectively), were 228.54, 511.88, and 46.37 pCi/g for ²³²Th, ²²⁶Ra, and ²³⁸U, respectively (from Table 26-5);
- Mean background activity levels were 1.3, 2.5, and 4.4 pCi/g for ²³²Th, ²²⁶Ra, and ²³⁸U, respectively (from C-T Phase II DP Table 4-17);
- The size of the elevated area was determined to be approximately 12 ft by 12 ft or 13.4 m²; and,
- The area factors from C-T Phase II DP Figure 5-3 for the elevated area were 2.0, 2.2, and 3.0 for ²³²Th, ²²⁶Ra, and ²³⁸U, respectively.

The calculation of the *Index* value is shown below. Because the *Index* value as calculated in accordance with the DP was greater than one, this elevated area is not compliant with the C-T Phase II DP for elevated measurements in soil. Section 26.4 discusses a dose assessment performed to evaluate the impact of this area that is not compliant with the DCGLs.

$$Index = \frac{(228.54 - 1.3) \text{ pCi/g}}{(2.0 \times 23.9 \text{ pCi/g})_{Th \text{ series}}} + \frac{(511.88 - 2.5) \text{ pCi/g}}{(2.2 \times 29.4 \text{ pCi/g})_{Ra226}} + \frac{(46.37 - 4.4) \text{ pCi/g}}{(3.0 \times 721 \text{ pCi/g})_U} = 12.65$$

Parameters necessary to calculate the *Index* value for Elevated Area #3, the elevated area off the northwest corner of the vertical pipe stand in AECOM grid F4, are discussed below.

- The elevated area activity levels, represented by sample 3413 (shown on Figure 26-14), were 60.90, 221.42, and 8.64 pCi/g for ²³²Th, ²²⁶Ra, and ²³⁸U, respectively (from Table 26-2);
- Mean background activity levels were 1.3, 2.5, and 4.4 pCi/g for ²³²Th, ²²⁶Ra, and ²³⁸U, respectively (from C-T Phase II DP Table 4-17);
- The size of the elevated area was determined to be approximately 1 m² based on a review of Figure 26-8; and,
- The area factors from C-T Phase II DP Figure 5-3 for the elevated area were 2.2, 2.4, and 3.3 for ²³²Th, ²²⁶Ra, and ²³⁸U, respectively.

The calculation of the *Index* value is shown below. Because the *Index* value as calculated in accordance with the DP was greater than one, this elevated area is not compliant with the C-T Phase II DP for elevated measurements in soil. Section 26.4 discusses a dose assessment performed to evaluate the impact of this area that is not compliant with the DCGLs.

$$Index = \frac{(60.90 - 1.3) \text{ pCi/g}}{(2.2 \times 23.9 \text{ pCi/g})_{Th \text{ series}}} + \frac{(221.42 - 2.5) \text{ pCi/g}}{(2.4 \times 29.4 \text{ pCi/g})_{Ra226}} + \frac{(8.64 - 4.4) \text{ pCi/g}}{(3.3 \times 721 \text{ pCi/g})_U} = 4.24$$

26.3.2 Data Set Screening Analysis

Table 26-6 summarizes the results of the screening tests performed in accordance with Pages 14-27 through 14-29 of the C-T Phase II DP. All applicable tests demonstrating compliance passed.

Table 26-6 Screening Tests Results

Screening Test	Test Value	Conclusion
Min/Max	1.01	FAIL; conduct DCGL test
Low Level	N/A	Not applicable; Class 1 survey unit
DCGL _W	0.03	PASS; conduct WRS test
EMC Limit	0.21	PASS

26.3.2.1 Min/Max

In accordance with Page 14-27 of the C-T Phase II DP, the Min/Max screening test value was calculated by subtracting the minimum reference area result from the maximum survey unit systematic result. Sample 3427 with a gross SOF of 1.03 (from Table 26-1) was the maximum survey unit systematic result. Sample BH-Z-08 with a calculated gross SOF of 0.02 (from C-T Phase II DP Table B-1) was the minimum reference area result. The Min/Max screening test value was calculated to be 1.01. Because the test value was greater than one, further computations are required, i.e., DCGL_W screening and Wilcoxon Rank Sum (WRS) tests.

26.3.2.2 Low Level

In accordance with Page 14-27 of the C-T Phase II DP, the Low Level screening test is not applicable to Class 1 survey units.

26.3.2.3 DCGL_W

In accordance with Page 14-28 of the C-T Phase II DP and because the Min/Max test value was greater than one, the DCGL_W screening test value was calculated by subtracting the reference area average gross SOF from the survey unit average gross SOF. The survey unit average gross SOF was 0.18 (from Table 26-1). The reference area average gross SOF was calculated to be 0.15 using average activity concentrations from C-T Phase II DP Table 4-17. The DCGL_W screening test value was calculated to be 0.03. Because the test value was less than one, the WRS test is required per C-T Phase II DP Table 14-6.

26.3.2.4 EMC Limit

In accordance with Page 14-26 of the C-T Phase II DP, the DCGL_{EMC} is not applicable to subsurface survey units, in this case the assessment of the subsurface material under the vertical pipe stand. Thus, the EMC limit is not applicable.

In accordance with Page 14-28 of the C-T Phase II DP, the EMC limit screening test was applied to the two other elevated areas: Elevated Area #1 in AECOM grid F5 and Elevated Area #3 in AECOM grid F4. Parameters necessary to calculate the exposure-weighted fraction of the DCGL_W, F , were:

- The size of the elevated areas was determined to be approximately 20 m² for area #1 and approximately 1 m² for area #3, as discussed in Section 26.3.1;

- The area factor from C-T Phase II DP Figure 5-3 was conservatively set to 1.8 and 2.2 for areas #1 and #3, respectively (based on thorium series only);
- The average elevated area activity level for area #1 was a gross SOF = 1.14 based on samples 3424 and 3434 and for area #3 was a gross SOF = 10.09 based on sample 3413; and,
- The survey unit average was a gross SOF = 0.18 (from Table 26-1).

The calculation of the EMC screening test result is shown below, using C-T Phase II DP Equation 14-7. A separate term was included for each elevated area.

$$F = \left[\frac{20 \text{ m}^2}{294 \text{ m}^2} \times \frac{1.15}{1.8 \times 1} \right] + \left[\frac{1 \text{ m}^2}{294 \text{ m}^2} \times \frac{10.09}{2.2 \times 1} \right] + \left[\frac{(294 - 20 - 1) \text{ m}^2}{294 \text{ m}^2} \times \frac{0.18}{1} \right] = 0.23$$

In accordance with the C-T Phase II DP and because the result was less than one, the total radioactivity concentration in the survey unit is within the release criterion. However, elevated area #3 failed the elevated area evaluation and is evaluated using a dose assessment in Section 26.4.

26.3.3 WRS Test

In accordance with Page 14-29 of the C-T Phase II DP, because the Min/Max test value was greater than one and the DCGL_w test was less than one, the WRS Test was required to demonstrate compliance. The test was completed in accordance with Pages 14-29 and 14-30 of the C-T Phase II DP. The result was that the survey unit passed, with the calculation details provided in Table 26-7.

Table 26-7 WRS Test Results

Sample ID	Area	On-Site Results				Off-Site Results					
		Data (SOF)	Adjusted Data (SOF)	Ranks	RA Ranks	Data (SOF)	Adjusted Data (SOF)	Ranks	RA Ranks		
BH-013	RA	0.11	1.11	26	26	0.11	1.11	26	26		
BH-016	RA	0.42	1.42	33	33	0.42	1.42	33	33		
BH-028	RA	0.10	1.10	25	25	0.10	1.10	25	25		
BH-031	RA	0.09	1.09	22	22	0.09	1.09	22	22		
BH-034	RA	0.29	1.29	32	32	0.29	1.29	32	32		
BH-037	RA	0.22	1.22	29	29	0.22	1.22	29	29		
BH-045	RA	0.10	1.10	24	24	0.10	1.10	24	24		
BH-053	RA	0.16	1.16	27	27	0.16	1.16	27	27		
BH-065	RA	0.23	1.23	30	30	0.23	1.23	30	30		
BH-083	RA	0.07	1.07	21	21	0.07	1.07	21	21		
BH-091	RA	0.24	1.24	31	31	0.24	1.24	31	31		
BH-093	RA	0.10	1.10	23	23	0.10	1.10	23	23		
BH-099	RA	0.22	1.22	28	28	0.22	1.22	28	28		
BH-Z-02	RA	0.07	1.07	20	20	0.07	1.07	20	20		
BH-Z-09	RA	0.05	1.05	19	19	0.05	1.05	19	19		
3397	SU	0.47	0.47	17	0	0.44	0.44	17	0		
3398	SU	0.13	0.13	11	0	0.12	0.12	13	0		
3399	SU	0.10	0.10	5	0	0.08	0.08	4	0		
3400	SU	0.10	0.10	4	0	0.06	0.06	2	0		
3407	SU	0.08	0.08	2	0	0.08	0.08	3	0		
3408	SU	0.13	0.13	12	0	0.10	0.10	11	0		
3425	SU	0.09	0.09	3	0	0.09	0.09	5	0		
3426	SU	0.23	0.23	15	0	0.21	0.21	16	0		
3427	SU	0.83	0.83	18	0	1.03	1.03	18	0		
3428	SU	0.12	0.12	9	0	0.10	0.10	7	0		
3429	SU	0.10	0.10	6	0	0.09	0.09	6	0		
3430	SU	0.14	0.14	13	0	0.10	0.10	10	0		
3431	SU	0.20	0.20	14	0	0.19	0.19	15	0		
3436	SU	0.07	0.07	1	0	0.06	0.06	1	0		
3441	SU	0.12	0.12	10	0	0.10	0.10	9	0		
3442	SU	0.12	0.12	8	0	0.11	0.11	12	0		
3443	SU	0.11	0.11	7	0	0.10	0.10	8	0		
3444	SU	0.23	0.23	16	0	0.14	0.14	14	0		
Sum:				561	390	Sum:				561	390
Critical Value:				301		Critical Value:				301	
Conclusion:				PASS		Conclusion:				PASS	

26.3.4 Retrospective Analysis

A retrospective analysis was performed of the FSS results to determine whether the results met the survey design objectives, in accordance with Page 14-30 of the C-T Phase II DP. Table 26-8 provides the results of the retrospective analysis. Because the actual sample size exceeded the retrospective value sample size, the conclusion is that the survey design objectives were met.

Table 26-8 Retrospective Analysis

Parameter	<i>A Priori</i> Value	Retrospective Value Based on FSS Results (Gross SOF)
Upper Bound of Gray Region	DCGL = 1	1
Lower Bound of Gray Region	0.5 x DCGL = 0.5	0.18
Spatial Variability (standard deviation)	1/6 x DCGL = 0.17	0.23
Type I Error (false positive)	0.05	0.05
Type II Error (false negative)	0.05	0.05
Relative Shift	3	3.5
Calculated N/2 Sample Size	15 ^a	9
Actual N/2 Sample Size	--	18

^aThe *a priori* value of 15 for the N/2 sample size was determined to be a conservative value that would allow application of either the Sign or WRS test. The *a priori* value for N/2 is 10 based on MARSSIM Table 5.3.

26.4 DOSE ASSESSMENT OF ELEVATED AREAS #2 AND #3

The elevated area evaluation of Elevated Area #2 (Section 26.3.1) calculated an *Index* value of 12.65 for the area under the vertical pipe stand. The elevated area evaluation of Elevated Area #3 (Section 26.3.1) calculated an *Index* value of 4.27 for the area off the northwest corner of the vertical pipe stand in AECOM grid F4. Because these values were greater than one, the elevated areas failed to demonstrate compliance using the DCGLs developed in C-T Phase II DP Chapter 5. As an alternative, this section presents the results of dose assessments to evaluate Elevated Areas #2 and #3.

26.4.1 Verification of RESRAD v6.5

C-T Phase II DP Chapter 5 presented three dose models (cases) in the development of the DCGLs. 408guti, 407guti, and 399guti were the RESRAD v6.4 cases for the thorium series, natural uranium, and “ $6^{230}\text{Th} + 226\text{Ra} + 210\text{Pb}$,” respectively. EnergySolutions was currently using RESRAD v6.5; therefore, to ensure comparable results, the three cases mentioned were run in the later version. Section 12.5.1 of this FSSR documents the results of the comparison. In conclusion, RESRAD v6.5 provided identical or comparable results to RESRAD v6.4 and therefore RESRAD v6.5 was used to perform the dose assessments of Elevated Areas #2 and #3.

26.4.2 Elevated Area Characterization

26.4.2.1 Elevated Area Size

Elevated Area #2 had a footprint under the vertical pipe stand of 12 ft by 12 ft, or 13.4 m². The contamination started at approximately 6 ft bgs and continued to 16 ft bgs; therefore the thickness was 10 ft or 3.05 m.

Elevated Area #3 had a footprint of approximately 1 m² based on a review of Figure 26-8. Sample 3414 (Table 26-2) was collected below sample 3413 and demonstrated that the thickness of the residual contamination was 30 cm.

26.4.2.2 Radionuclide Concentrations

Elevated Area #2 gross activity levels, represented by the average of samples 3405, 3415, and 3423 (maximum result for the north, west, and south face, respectively), were 228.54, 511.88, and 46.37 pCi/g for ²³²Th, ²²⁶Ra, and ²³⁸U, respectively (from Table 26-5). The elevated area net activity levels were 227.24, 509.38, and 41.97 pCi/g for ²³²Th, ²²⁶Ra, and ²³⁸U, respectively.

Elevated Area #3 gross activity levels, represented by sample 3413, were 60.90, 221.42, and 8.64 pCi/g for ²³²Th, ²²⁶Ra, and ²³⁸U, respectively (from Table 26-2). The elevated area net activity levels were 59.60, 218.92, and 4.24 pCi/g for ²³²Th, ²²⁶Ra, and ²³⁸U, respectively.

26.4.3 *In Situ* Models and Results

26.4.3.1 RESRAD Models

The C-T Phase II DP Chapter 5 RESRAD models 408guti, 407guti, and 399guti were identical except for the entered radionuclide concentrations. Three models were run in order to develop independent DCGLs. For these elevated areas, the actual radionuclide concentrations were established based on sampling and therefore independent models with respect to modeled radionuclides were not required. Table 26-9 and Table 26-10 provide the RESRAD *in situ* model parameters that were changed from the C-T Phase II DP Chapter 5 RESRAD models and the justification for each change for Elevated Areas #2 and #3, respectively.

Table 26-9 RESRAD *In Situ* Model Parameter Values for Elevated Area #2

Parameter	Value	Justification
<i>Soil Concentrations</i>		
²²⁸ Ra, ²²⁸ Th, and ²³² Th	227.24 pCi/g	Thorium series in secular equilibrium per C-T Phase II DP Section 5.8.2. Average net ²³² Th concentration from Section 26.4.2.2.
²²⁶ Ra and ²¹⁰ Pb	509.38 pCi/g	²²⁶ Ra and progeny in secular equilibrium per C-T Phase II DP Section 5.8.4. Average net ²²⁶ Ra concentration from Section 26.4.2.2.
²³⁰ Th	3,056.28 pCi/g	²³⁰ Th was not measured in FSS samples. The ²³⁰ Th / ²²⁶ Ra ratio of 6 was assumed per C-T Phase II DP Section 5.8.4.
²³⁸ U and ²³⁴ U	41.97 pCi/g	For natural uranium, the concentrations of ²³⁸ U and ²³⁴ U are equal per C-T Phase II DP Section 5.8.3. Average net ²³⁸ U concentration from Section 26.4.2.2.
²³⁵ U, ²³¹ Pa, and ²²⁷ Ac	1.91 pCi/g	²³⁵ U and progeny in naturally-occurring proportion (²³⁵ U / ²³⁸ U = 0.0455) per C-T Phase II DP Section 5.8.3.
<i>Contaminated Zone</i>		
Area	13.4 m ²	Area of vertical pipe stand as discussed in Section 26.4.2.1.
Thickness	3.05 m	Thickness of elevated area under vertical pipe stand as discussed in Section 26.4.2.1.
<i>Cover/Hydrol.</i>		
Cover depth	1.83 m	The first 6 ft bgs is vertical pipe stand made from poured concrete. Modeled as soil.

Table 26-10 RESRAD *In Situ* Model Parameter Values for Elevated Area #3

Parameter	Value	Justification
<i>Soil Concentrations</i>		
²²⁸ Ra, ²²⁸ Th, and ²³² Th	59.60 pCi/g	Thorium series in secular equilibrium per C-T Phase II DP Section 5.8.2. Average net ²³² Th concentration from Section 26.4.2.2.
²²⁶ Ra and ²¹⁰ Pb	218.92 pCi/g	²²⁶ Ra and progeny in secular equilibrium per C-T Phase II DP Section 5.8.4. Average net ²²⁶ Ra concentration from Section 26.4.2.2.
²³⁰ Th	1,313.52 pCi/g	²³⁰ Th was not measured in FSS samples. The ²³⁰ Th / ²²⁶ Ra ratio of 6 was assumed per C-T Phase II DP Section 5.8.4.
²³⁸ U and ²³⁴ U	4.24 pCi/g	For natural uranium, the concentrations of ²³⁸ U and ²³⁴ U are equal per C-T Phase II DP Section 5.8.3. Average net ²³⁸ U concentration from Section 26.4.2.2.
²³⁵ U, ²³¹ Pa, and ²²⁷ Ac	0.19 pCi/g	²³⁵ U and progeny in naturally-occurring proportion (²³⁵ U / ²³⁸ U = 0.0455) per C-T Phase II DP Section 5.8.3.
<i>Contaminated Zone</i>		
Area	1 m ²	Area as discussed in Section 26.4.2.1.
Thickness	0.30 m	Thickness of elevated area as discussed in Section 26.4.2.1.
<i>Cover/Hydrol.</i>		
Cover depth	4.9 m	The excavation was approximately 16 ft at this location.

26.4.3.2 Results

The maximum dose for Elevated Area #2 was 9.276E-02 millirem per year (mrem/yr) at year 1,000. Appendix A provides the RESRAD summary report.

The maximum dose for Elevated Area #3 was 6.457E-16 mrem/yr at year 1,000. Appendix B provides the RESRAD summary report.

26.4.4 Excavation Scenario Models and Results

In addition to evaluating the dose from the elevated areas *in situ*, an excavation scenario was developed to evaluate the dose if the contaminated material was exposed. It is unlikely, based on the future use scenario described in C-T Phase II DP Chapter 5, that large areas of contaminated material would be exposed during future site activities. No building foundations or basements are expected to be installed at the site, so excavation to expose the entire Elevated Area #2 is unlikely. Elevated Area #3 is small and may be completely exposed. Utility systems are likely to be installed and most systems are installed in the 6 ft bgs depth range; however, the specific depths of the elevated areas are not evaluated in this scenario.

For Elevated Area #2, the scenario assumes that a 3-ft (0.9-m) wide trench is excavated to the shallowest depth of the elevated area; however, because the vertical pipe stand is a structure, it is likely that it would all be removed and therefore the trench will be considered 12 ft, or 3.66 m, wide for this evaluation. The length of the trench, assumed to be equivalent to the width of the vertical pipe stand is 12 ft, or 3.66 m. Therefore, the area of the trench (excavation) is 13.4 m²

and this is the size of the elevated area for which the critical receptor will be exposed. The critical receptor is an industrial worker, but not the same individual as that evaluated using the DCGLs, e.g. a contractor is performing the work.

It is assumed that the industrial worker will spend a total of 0.5 hours per meter of trench. Examples of activities being performed include trench bottom preparation, such as leveling aggregate, and pipe joining, such as welding. Total time in this trench would be 1.83 hours (0.5 hours per meter of trench × 3.66 m length). RESRAD evaluates dose on an annual basis. Therefore, 1.83 hours out of a year's time would be an outdoor time fraction of 0.00021 hours (1.83 hours / 8,766 hours). Indoor time fraction is zero since this is not an indoor scenario.

For Elevated Area #3, the scenario assumes that the elevated area is completely exposed similarly as with Elevated Area #2. Total time in the trench exposed to Elevated Area #3 is 0.5 hours, which equates to an outdoor time fraction of 0.000057 hours. Indoor time fraction is zero.

26.4.4.1 RESRAD Models

Similar to the *in situ* models discussed in Section 26.4.3.1, one RESRAD model was developed for the excavation scenario for each elevated area. Table 26-11 and Table 26-12 provide the RESRAD excavation scenario model parameters that were changed from the C-T Phase II DP Chapter 5 RESRAD models and the justification for each change for Elevated Areas #2 and #3, respectively.

Table 26-11 RESRAD Excavation Scenario Model Parameter Values for Elevated Area #2

Parameter	Value	Justification
<i>Soil Concentrations</i>		
²²⁸ Ra, ²²⁸ Th, and ²³² Th	227.24 pCi/g	Thorium series in secular equilibrium per C-T Phase II DP Section 5.8.2. Average net ²³² Th concentration from Section 26.4.2.2.
²²⁶ Ra and ²¹⁰ Pb	509.38 pCi/g	²²⁶ Ra and progeny in secular equilibrium per C-T Phase II DP Section 5.8.4. Average net ²²⁶ Ra concentration from Section 26.4.2.2.
²³⁰ Th	3,056.28 pCi/g	²³⁰ Th was not measured in FSS samples. The ²³⁰ Th / ²²⁶ Ra ratio of 6 was assumed per C-T Phase II DP Section 5.8.4.
²³⁸ U and ²³⁴ U	41.97 pCi/g	For natural uranium, the concentrations of ²³⁸ U and ²³⁴ U are equal per C-T Phase II DP Section 5.8.3. Average net ²³⁸ U concentration from Section 26.4.2.2.
²³⁵ U, ²³¹ Pa, and ²²⁷ Ac	1.91 pCi/g	²³⁵ U and progeny in naturally-occurring proportion (²³⁵ U / ²³⁸ U = 0.0455) per C-T Phase II DP Section 5.8.3.
<i>Contaminated Zone</i>		
Area	13.4 m ²	Trench area of 13.4 m ² assuming 12-ft (3.66-m) wide and 12-ft (3.66-m) long trench.

**Table 26-11 RESRAD Excavation Scenario Model Parameter Values for Elevated Area #2
(continued)**

Parameter	Value	Justification
Thickness	0.30 m	C-T Phase II DP Appendix D, Page D-17, documents that for the radionuclide mixture used to develop the DCGLs that the maximum dose rate by direct radiation is reached asymptotically when the contaminated zone thickness reaches about 30 cm. Additional contaminated zone thickness does not result in additional dose.
<i>Occupancy, Inhalation, and External Gamma Data</i>		
Indoor time fraction	0	No internal exposure applicable for the critical receptor within a trench.
Outdoor time fraction	0.00021 hours	1.83 hours for this length of trench within any given modeled year.

Table 26-12 RESRAD Excavation Scenario Model Parameter Values for Elevated Area #3

Parameter	Value	Justification
<i>Soil Concentrations</i>		
²²⁸ Ra, ²²⁸ Th, and ²³² Th	59.60 pCi/g	Thorium series in secular equilibrium per C-T Phase II DP Section 5.8.2. Average net ²³² Th concentration from Section 26.4.2.2.
²²⁶ Ra and ²¹⁰ Pb	218.92 pCi/g	²²⁶ Ra and progeny in secular equilibrium per C-T Phase II DP Section 5.8.4. Average net ²²⁶ Ra concentration from Section 26.4.2.2.
²³⁰ Th	1,313.52 pCi/g	²³⁰ Th was not measured in FSS samples. The ²³⁰ Th / ²²⁶ Ra ratio of 6 was assumed per C-T Phase II DP Section 5.8.4.
²³⁸ U and ²³⁴ U	4.24 pCi/g	For natural uranium, the concentrations of ²³⁸ U and ²³⁴ U are equal per C-T Phase II DP Section 5.8.3. Average net ²³⁸ U concentration from Section 26.4.2.2.
²³⁵ U, ²³¹ Pa, and ²²⁷ Ac	0.19 pCi/g	²³⁵ U and progeny in naturally-occurring proportion (²³⁵ U / ²³⁸ U = 0.0455) per C-T Phase II DP Section 5.8.3.
<i>Contaminated Zone</i>		
Area	1 m ²	Total area of Elevated Area #3 assumed to be completely exposed.
Thickness	0.30 m	C-T Phase II DP Appendix D, Page D-17, documents that for the radionuclide mixture used to develop the DCGLs that the maximum dose rate by direct radiation is reached asymptotically when the contaminated zone thickness reaches about 30 cm. Additional contaminated zone thickness does not result in additional dose.
<i>Occupancy, Inhalation, and External Gamma Data</i>		
Indoor time fraction	0	No internal exposure applicable for the critical receptor within a trench.
Outdoor time fraction	0.000057 hours	0.5 hours for this length of trench within any given modeled year.

26.4.4.2 Results

The maximum dose for Elevated Area #2 was 9.214E-01 mrem/yr at year 0. Appendix C provides the RESRAD summary report.

The maximum dose for Elevated Area #3 was 1.734E-02 mrem/yr at year 0. Appendix D provides the RESRAD summary report.

26.4.5 Dose Using Survey Unit Average

Table 26-1 provided the systematic sample results for the excavated surface. The average net SOF result is 0.07. This corresponds to a dose of 1.75 mrem/yr.

26.4.6 Conclusion

Adding together the *in situ* doses of 9.276E-02 mrem/yr and 6.457E-16 mrem/yr for Elevated Areas #2 and #3, respectively, and the maximum dose from the survey unit average of 1.75 mrem/yr, the as-left total dose from the survey unit is 1.84 mrem/yr.

The independently-evaluated excavation scenario doses were 0.9214 mrem/yr and 0.01734 mrem/yr for Elevated Areas #2 and #3, respectively. The total excavation scenario dose is 0.94 mrem/yr.

26.5 DEVIATIONS

In accordance with the second bullet in Section 14.5 of the C-T Phase II DP, the FSSR is required to list changes made in the FSS from what was proposed in the DP. Two deviations were noted.

- Page 14-27 of the C-T Phase II DP indicated that the “data set for the survey unit will be processed within a database using screening software developed and verified for the project.” This database was not developed; instead, a combination of Microsoft® Excel® spreadsheets and hand calculations was utilized. This deviation is not significant and does not affect the data collection or assessment.
- No gamma scan data over the bottom of the excavation within AECOM grids F3 and the north half of F4 were documented as specified in Section 26.2.1. Systematic samples 3397, 3398, 3399, 3400 and 3407 were collected throughout this area and no elevated activity was identified as presented in Table 26-1. This deviation, although there is a lack of data, is not considered significant because of the sample results as taken in the area.

26.6 NRC INSPECTIONS

A summary of NRC inspections applicable to the FSS are provided in Section 5.8 of this FSSR. The scope of the inspections included, but was not limited to: review of project plans, interviewing of project personnel, evaluation of the on-site laboratory, and independent confirmatory surveys conducted by the NRC after backfilling. Inspection Report 040-06563/11-003 noted that the NRC reviewed the FSS data package for SU20 to ensure the licensee

conducted the surveys in accordance with the NRC-approved DP and work plans. No violations were identified. No findings of significance were identified.

26.7 CONCLUSION

FSS data were verified to be reliable, appropriately documented, and technically defensible. Specifically, the following conclusions are made:

- The instruments used to collect the data were capable of detecting the radiation type (i.e., gamma) at or below the release criteria (described in Sections 4.4 and 4.5 of this FSSR).
- The calibration of the instruments used to collect the data was current and radioactive sources used for calibration were National Institute of Standards and Technology (NIST) traceable (described in Section 5.4 of this FSSR). Specific records available upon request.
- Instrument response was checked before instrument use each day, at minimum (described in Section 5.4 of this FSSR). Specific records available upon request.
- The survey methods used to collect the data were appropriate for the media and type of radiation being measured (described in Sections 4.4, 4.5, and 4.6 of this FSSR).
- The custody of samples collected for laboratory analysis was tracked from the point of collection until final results were obtained (described in Section 5.5.2 of this FSSR). Specific records available upon request.
- The survey data consist of qualified measurement results that are representative of the area of interest.
- Areas identified with elevated residual radioactivity (i.e. $SO_F > 1.0$) were appropriately investigated and the $DCGL_{EMC}$ properly applied.

All the applicable screening tests passed or a dose assessment was performed, the retrospective analysis found that the survey design objectives were met, and additional subsurface contamination was not reasonably suspected. SU20 meets the industrial use scenario release criterion as established in the C-T Phase II DP Chapter 5; and therefore, satisfies the unrestricted release provisions of Title 10, Code of Federal Regulations (CFR), Part 20, Subpart E.

26.8 REFERENCES

Mallinckrodt, *Mallinckrodt Columbium-Tantalum Phase II Decommissioning Plan*, Revision 2, August 2008.

APPENDIX A

RESRAD v6.5 Summary Report for Elevated Area #2 *In Situ* Model

RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 11:54 Page 1
Summary : SU20 Elevated Area #2 In Situ
File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA2 IN SITU.RAD

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Summary : SU20 Elevated Area #2 In Situ

File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA2 IN SITU.RAD

Dose Conversion Factor (and Related) Parameter Summary
Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
A-1	DCF's for external ground radiation, (mrem/yr)/(pCi/g)			
A-1	Ac-227 (Source: FGR 12)	4.951E-04	4.951E-04	DCF1(1)
A-1	Ac-228 (Source: FGR 12)	5.978E+00	5.978E+00	DCF1(2)
A-1	At-218 (Source: FGR 12)	5.847E-03	5.847E-03	DCF1(3)
A-1	Bi-210 (Source: FGR 12)	3.606E-03	3.606E-03	DCF1(4)
A-1	Bi-211 (Source: FGR 12)	2.559E-01	2.559E-01	DCF1(5)
A-1	Bi-212 (Source: FGR 12)	1.171E+00	1.171E+00	DCF1(6)
A-1	Bi-214 (Source: FGR 12)	9.808E+00	9.808E+00	DCF1(7)
A-1	Fr-223 (Source: FGR 12)	1.980E-01	1.980E-01	DCF1(8)
A-1	Pa-231 (Source: FGR 12)	1.906E-01	1.906E-01	DCF1(9)
A-1	Pa-234 (Source: FGR 12)	1.155E+01	1.155E+01	DCF1(10)
A-1	Pa-234m (Source: FGR 12)	8.967E-02	8.967E-02	DCF1(11)
A-1	Pb-210 (Source: FGR 12)	2.447E-03	2.447E-03	DCF1(12)
A-1	Pb-211 (Source: FGR 12)	3.064E-01	3.064E-01	DCF1(13)
A-1	Pb-212 (Source: FGR 12)	7.043E-01	7.043E-01	DCF1(14)
A-1	Pb-214 (Source: FGR 12)	1.341E+00	1.341E+00	DCF1(15)
A-1	Po-210 (Source: FGR 12)	5.231E-05	5.231E-05	DCF1(16)
A-1	Po-211 (Source: FGR 12)	4.764E-02	4.764E-02	DCF1(17)
A-1	Po-212 (Source: FGR 12)	0.000E+00	0.000E+00	DCF1(18)
A-1	Po-214 (Source: FGR 12)	5.138E-04	5.138E-04	DCF1(19)
A-1	Po-215 (Source: FGR 12)	1.016E-03	1.016E-03	DCF1(20)
A-1	Po-216 (Source: FGR 12)	1.042E-04	1.042E-04	DCF1(21)
A-1	Po-218 (Source: FGR 12)	5.642E-05	5.642E-05	DCF1(22)
A-1	Ra-223 (Source: FGR 12)	6.034E-01	6.034E-01	DCF1(23)
A-1	Ra-224 (Source: FGR 12)	5.119E-02	5.119E-02	DCF1(24)
A-1	Ra-226 (Source: FGR 12)	3.176E-02	3.176E-02	DCF1(25)
A-1	Ra-228 (Source: FGR 12)	0.000E+00	0.000E+00	DCF1(26)
A-1	Rn-219 (Source: FGR 12)	3.083E-01	3.083E-01	DCF1(27)
A-1	Rn-220 (Source: FGR 12)	2.298E-03	2.298E-03	DCF1(28)
A-1	Rn-222 (Source: FGR 12)	2.354E-03	2.354E-03	DCF1(29)
A-1	Th-227 (Source: FGR 12)	5.212E-01	5.212E-01	DCF1(30)
A-1	Th-228 (Source: FGR 12)	7.940E-03	7.940E-03	DCF1(31)
A-1	Th-230 (Source: FGR 12)	1.209E-03	1.209E-03	DCF1(32)
A-1	Th-231 (Source: FGR 12)	3.643E-02	3.643E-02	DCF1(33)
A-1	Th-232 (Source: FGR 12)	5.212E-04	5.212E-04	DCF1(34)
A-1	Th-234 (Source: FGR 12)	2.410E-02	2.410E-02	DCF1(35)
A-1	Tl-207 (Source: FGR 12)	1.980E-02	1.980E-02	DCF1(36)
A-1	Tl-208 (Source: FGR 12)	2.298E+01	2.298E+01	DCF1(37)
A-1	Tl-210 (Source: no data)	0.000E+00	-2.000E+00	DCF1(38)
A-1	U-234 (Source: FGR 12)	4.017E-04	4.017E-04	DCF1(39)
A-1	U-235 (Source: FGR 12)	7.211E-01	7.211E-01	DCF1(40)
A-1	U-238 (Source: FGR 12)	1.031E-04	1.031E-04	DCF1(41)
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	6.724E+00	6.700E+00	DCF2(1)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(2)
B-1	Pb-210+D	1.380E-02	1.360E-02	DCF2(3)
B-1	Po-210	9.400E-03	9.400E-03	DCF2(4)
B-1	Ra-226+D	8.594E-03	8.580E-03	DCF2(5)
B-1	Ra-228+D	5.078E-03	4.770E-03	DCF2(6)

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Dose Conversion Factor (and Related) Parameter Summary (continued)

Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
B-1	Th-228+D	3.454E-01	3.420E-01	DCF2(7)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(8)
B-1	Th-232	1.640E+00	1.640E+00	DCF2(9)
B-1	U-234	1.320E-01	1.320E-01	DCF2(10)
B-1	U-235+D	1.230E-01	1.230E-01	DCF2(11)
B-1	U-238	1.180E-01	1.180E-01	DCF2(12)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(13)
Dose conversion factors for ingestion, mrem/pCi:				
D-1	Ac-227+D	1.480E-02	1.410E-02	DCF3(1)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(2)
D-1	Pb-210+D	5.376E-03	5.370E-03	DCF3(3)
D-1	Po-210	1.900E-03	1.900E-03	DCF3(4)
D-1	Ra-226+D	1.321E-03	1.320E-03	DCF3(5)
D-1	Ra-228+D	1.442E-03	1.440E-03	DCF3(6)
D-1	Th-228+D	8.086E-04	3.960E-04	DCF3(7)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(8)
D-1	Th-232	2.730E-03	2.730E-03	DCF3(9)
D-1	U-234	2.830E-04	2.830E-04	DCF3(10)
D-1	U-235+D	2.673E-04	2.660E-04	DCF3(11)
D-1	U-238	2.550E-04	2.550E-04	DCF3(12)
D-1	U-238+D	2.687E-04	2.550E-04	DCF3(13)
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	Po-210 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(4,1)
D-34	Po-210 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(4,2)
D-34	Po-210 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.400E-04	3.400E-04	RTF(4,3)
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(5,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(5,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(5,3)
D-34	Ra-228+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(6,1)
D-34	Ra-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(6,2)
D-34	Ra-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(6,3)
D-34				

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Dose Conversion Factor (and Related) Parameter Summary (continued)

Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
D-34	Th-228+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(7,1)
D-34	Th-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(7,2)
D-34	Th-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(7,3)
D-34				
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(8,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(8,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(8,3)
D-34				
D-34	Th-232 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(9,1)
D-34	Th-232 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(9,2)
D-34	Th-232 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(9,3)
D-34				
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(10,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(10,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(10,3)
D-34				
D-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(11,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(11,2)
D-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(11,3)
D-34				
D-34	U-238 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(12,1)
D-34	U-238 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(12,2)
D-34	U-238 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(12,3)
D-34				
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(13,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(13,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(13,3)
D-5				
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-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	Po-210 , fish	1.000E+02	1.000E+02	BIOFAC(4,1)
D-5	Po-210 , crustacea and mollusks	2.000E+04	2.000E+04	BIOFAC(4,2)
D-5				
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(5,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(5,2)
D-5				
D-5	Ra-228+D , fish	5.000E+01	5.000E+01	BIOFAC(6,1)
D-5	Ra-228+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(6,2)
D-5				
D-5	Th-228+D , fish	1.000E+02	1.000E+02	BIOFAC(7,1)
D-5	Th-228+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(7,2)
D-5				

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Dose Conversion Factor (and Related) Parameter Summary (continued)
Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(8,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(8,2)
D-5				
D-5	Th-232 , fish	1.000E+02	1.000E+02	BIOFAC(9,1)
D-5	Th-232 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(9,2)
D-5				
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(10,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(10,2)
D-5				
D-5	U-235D , fish	1.000E+01	1.000E+01	BIOFAC(11,1)
D-5	U-235D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(11,2)
D-5				
D-5	U-238 , fish	1.000E+01	1.000E+01	BIOFAC(12,1)
D-5	U-238 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(12,2)
D-5				
D-5	U-238D , fish	1.000E+01	1.000E+01	BIOFAC(13,1)
D-5	U-238D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(13,2)

#For DCF1(XXX) only, factors are for infinite depth & area. See ETFG table in Ground Pathway of Detailed Report.
*Base Case means Default.Lib w/o Associate Nuclide contributions.

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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)	1.340E+01	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	3.050E+00	2.000E+00	---	THICK0
R011	Fraction of contamination that is submerged	0.000E+00	0.000E+00	---	SUBMFRACT
R011	Length parallel to aquifer flow (m)	not used	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	2.500E+01	3.000E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
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): Ac-227	1.910E+00	0.000E+00	---	S1(1)
R012	Initial principal radionuclide (pCi/g): Pa-231	1.910E+00	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g): Pb-210	5.094E+02	0.000E+00	---	S1(3)
R012	Initial principal radionuclide (pCi/g): Ra-226	5.094E+02	0.000E+00	---	S1(5)
R012	Initial principal radionuclide (pCi/g): Ra-228	2.272E+02	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g): Th-228	2.272E+02	0.000E+00	---	S1(7)
R012	Initial principal radionuclide (pCi/g): Th-230	3.100E+03	0.000E+00	---	S1(8)
R012	Initial principal radionuclide (pCi/g): Th-232	2.272E+02	0.000E+00	---	S1(9)
R012	Initial principal radionuclide (pCi/g): U-234	4.197E+01	0.000E+00	---	S1(10)
R012	Initial principal radionuclide (pCi/g): U-235	1.910E+00	0.000E+00	---	S1(11)
R012	Initial principal radionuclide (pCi/g): U-238	4.197E+01	0.000E+00	---	S1(12)
R012	Concentration in groundwater (pCi/L): Ac-227	not used	0.000E+00	---	W1(1)
R012	Concentration in groundwater (pCi/L): Pa-231	not used	0.000E+00	---	W1(2)
R012	Concentration in groundwater (pCi/L): Pb-210	not used	0.000E+00	---	W1(3)
R012	Concentration in groundwater (pCi/L): Ra-226	not used	0.000E+00	---	W1(5)
R012	Concentration in groundwater (pCi/L): Ra-228	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L): Th-228	not used	0.000E+00	---	W1(7)
R012	Concentration in groundwater (pCi/L): Th-230	not used	0.000E+00	---	W1(8)
R012	Concentration in groundwater (pCi/L): Th-232	not used	0.000E+00	---	W1(9)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(10)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W1(11)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(12)
R013	Cover depth (m)	1.830E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	1.500E+00	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	---	FCCZ
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	Average annual wind speed (m/sec)	4.000E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID

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Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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)	0.000E+00	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)	not used	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	not used	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	not used	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	not used	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	not used	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	not used	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	not used	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	not used	2.000E-02	---	HGWT
R014	Saturated zone b parameter	not used	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	not used	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	not used	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	not used	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	not used	2.500E+02	---	UW
R015	Number of unsaturated zone strata	not used	1	---	NS
R015	Unsat. zone 1, thickness (m)	not used	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	not used	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	not used	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	not used	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	not used	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	not used	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	not used	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(1)
R016	Unsat. zone 1 (cm**3/g)	not used	2.000E+01	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	not used	2.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.326E-03	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for Pa-231				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(2)
R016	Unsat. zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.741E-03	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(3)
R016	Unsat. zone 1 (cm**3/g)	not used	1.000E+02	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	not used	1.000E+02	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	8.725E-04	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)

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Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	not used	7.000E+01	---	DCNUCU(5,1)
R016	Saturated zone (cm**3/g)	not used	7.000E+01	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.245E-03	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R016	Distribution coefficients for Ra-228				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	not used	7.000E+01	---	DCNUCU(6,1)
R016	Saturated zone (cm**3/g)	not used	7.000E+01	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.245E-03	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
R016	Distribution coefficients for Th-228				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(7)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(7,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.457E-06	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)
R016	Distribution coefficients for Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(8,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.457E-06	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
R016	Distribution coefficients for Th-232				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(9)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(9,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.457E-06	ALEACH(9)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(9)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(10)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(10,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(10)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.741E-03	ALEACH(10)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(10)
R016	Distribution coefficients for U-235				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(11)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(11,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(11)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.741E-03	ALEACH(11)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(11)

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Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(12)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(12,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(12)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.741E-03	ALEACH(12)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(12)
R016	Distribution coefficients for daughter Po-210				
R016	Contaminated zone (cm**3/g)	1.000E+01	1.000E+01	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	not used	1.000E+01	---	DCNUCU(4,1)
R016	Saturated zone (cm**3/g)	not used	1.000E+01	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	8.563E-03	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R017	Inhalation rate (m**3/yr)	1.227E+04	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	3.500E-05	1.000E-04	---	MLINH
R017	Exposure duration	3.000E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	6.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	1.700E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	1.825E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	4.563E-02	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS
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)

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Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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)	3.650E+01	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	not used	1.000E+00	---	FHHW
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	---	FP LANT
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	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	not used	1.000E-04	---	MLFD
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	not used	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	not used	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	not used	7.000E-01	---	YV (1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	not used	1.500E+00	---	YV (2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	---	YV (3)
R19B	Growing Season for Non-Leafy (years)	not used	1.700E-01	---	TE (1)
R19B	Growing Season for Leafy (years)	not used	2.500E-01	---	TE (2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE (3)
R19B	Translocation Factor for Non-Leafy	not used	1.000E-01	---	TIV (1)
R19B	Translocation Factor for Leafy	not used	1.000E+00	---	TIV (2)
R19B	Translocation Factor for Fodder	not used	1.000E+00	---	TIV (3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RDRY (1)
R19B	Dry Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RDRY (2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RDRY (3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RWET (1)
R19B	Wet Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RWET (2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET (3)
R19B	Weathering Removal Constant for Vegetation	not used	2.000E+01	---	WLAM
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	---	C12CC
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL

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Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	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	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	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	not used	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	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	32	---	---	NPTS
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	1	---	---	KYMAX

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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	active
9 -- radon	suppressed
Find peak pathway doses	active

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Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	13.40 square meters	Ac-227	1.910E+00
Thickness:	3.05 meters	Pa-231	1.910E+00
Cover Depth:	1.83 meters	Pb-210	5.094E+02
		Ra-226	5.094E+02
		Ra-228	2.272E+02
		Th-228	2.272E+02
		Th-230	3.100E+03
		Th-232	2.272E+02
		U-234	4.197E+01
		U-235	1.910E+00
		U-238	4.197E+01

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 2.500E+01 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):	4.113E-06	4.152E-06	4.229E-06	4.508E-06	5.457E-06	1.079E-05	7.683E-05	9.276E-02
M(t):	1.645E-07	1.661E-07	1.692E-07	1.803E-07	2.183E-07	4.317E-07	3.073E-06	3.710E-03

Maximum TDOSE(t): 9.276E-02 mrem/yr at t = 1.000E+03 years

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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.
Ac-227	1.557E-13	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
Pa-231	2.886E-15	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
Pb-210	1.858E-14	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
Ra-226	3.800E-07	0.0924	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
Ra-228	5.872E-07	0.1428	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-228	3.121E-06	0.7587	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-230	5.020E-10	0.0001	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	2.479E-08	0.0060	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	2.041E-17	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	3.536E-18	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	7.233E-12	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	4.113E-06	1.0000	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 = 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.
Ac-227	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	1.557E-13	0.0000
Pa-231	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	2.886E-15	0.0000
Pb-210	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	1.858E-14	0.0000
Ra-226	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	3.800E-07	0.0924
Ra-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	5.872E-07	0.1428
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	3.121E-06	0.7587
Th-230	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	5.020E-10	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	2.479E-08	0.0060
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	2.041E-17	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	3.536E-18	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	7.233E-12	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	4.113E-06	1.0000

*Sum of all water independent and dependent pathways.

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Columbium-Tantalum Plant, Chapter 26**

**CS-RS-RP-009-26
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Summary : SU20 Elevated Area #2 In Situ

File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA2 IN SITU.RAD

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.
Ac-227	1.524E-13	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
Pa-231	7.859E-15	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
Pb-210	3.143E-14	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
Ra-226	3.837E-07	0.0924	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
Ra-228	1.423E-06	0.3427	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-228	2.193E-06	0.5281	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-230	1.520E-09	0.0004	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	1.510E-07	0.0364	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	1.441E-16	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	3.718E-18	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	7.318E-12	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	4.152E-06	1.0000	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+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.
Ac-227	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	1.524E-13	0.0000
Pa-231	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	7.859E-15	0.0000
Pb-210	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	3.143E-14	0.0000
Ra-226	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	3.837E-07	0.0924
Ra-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	1.423E-06	0.3427
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	2.193E-06	0.5281
Th-230	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	1.520E-09	0.0004
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	1.510E-07	0.0364
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	1.441E-16	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	3.718E-18	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	7.318E-12	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	4.152E-06	1.0000

*Sum of all water independent and dependent pathways.

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Columbium-Tantalum Plant, Chapter 26**

**CS-RS-RP-009-26
Revision 0**

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Summary : SU20 Elevated Area #2 In Situ

File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA2 IN SITU.RAD

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.
Ac-227	1.459E-13	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
Pa-231	1.768E-14	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
Pb-210	3.272E-14	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
Ra-226	3.911E-07	0.0925	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
Ra-228	2.144E-06	0.5071	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-228	1.083E-06	0.2560	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-230	3.620E-09	0.0009	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	6.072E-07	0.1436	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	7.767E-16	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	4.407E-18	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	7.491E-12	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	4.229E-06	1.0000	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 = 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.
Ac-227	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	1.459E-13	0.0000
Pa-231	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	1.768E-14	0.0000
Pb-210	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	3.272E-14	0.0000
Ra-226	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	3.911E-07	0.0925
Ra-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	2.144E-06	0.5071
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	1.083E-06	0.2560
Th-230	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	3.620E-09	0.0009
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	6.072E-07	0.1436
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	7.767E-16	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	4.407E-18	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	7.491E-12	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	4.229E-06	1.0000

*Sum of all water independent and dependent pathways.

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Summary : SU20 Elevated Area #2 In Situ

File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA2 IN SITU.RAD

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.
Ac-227	1.253E-13	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
Pa-231	5.092E-14	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
Pb-210	2.881E-14	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
Ra-226	4.182E-07	0.0928	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
Ra-228	1.582E-06	0.3508	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-228	9.158E-08	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	0.000E+00	0.0000
Th-230	1.168E-08	0.0026	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	2.405E-06	0.5335	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	7.456E-15	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	1.030E-17	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	8.130E-12	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	4.508E-06	1.0000	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+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.
Ac-227	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	1.253E-13	0.0000
Pa-231	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	5.092E-14	0.0000
Pb-210	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	2.881E-14	0.0000
Ra-226	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	4.182E-07	0.0928
Ra-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	1.582E-06	0.3508
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	9.158E-08	0.0203
Th-230	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	1.168E-08	0.0026
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	2.405E-06	0.5335
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	7.456E-15	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	1.030E-17	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	8.130E-12	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	4.508E-06	1.0000

*Sum of all water independent and dependent pathways.

**Phase II Final Status Survey Report Mallinckrodt
Columbium-Tantalum Plant, Chapter 26**

**CS-RS-RP-009-26
Revision 0**

RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 11:54 Page 18
Summary : SU20 Elevated Area #2 In Situ
File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA2 IN SITU.RAD

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.
Ac-227	8.123E-14	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
Pa-231	1.401E-13	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
Pb-210	1.992E-14	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
Ra-226	5.064E-07	0.0928	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
Ra-228	1.817E-07	0.0333	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-228	7.885E-11	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-230	4.178E-08	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	0.000E+00	0.0000
Th-232	4.727E-06	0.8662	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	7.694E-14	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	5.935E-17	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	1.027E-11	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	5.457E-06	1.0000	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 = 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.
Ac-227	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	8.123E-14	0.0000
Pa-231	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	1.401E-13	0.0000
Pb-210	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-14	0.0000
Ra-226	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	5.064E-07	0.0928
Ra-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	1.817E-07	0.0333
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	7.885E-11	0.0000
Th-230	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	4.178E-08	0.0077
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	4.727E-06	0.8662
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	7.694E-14	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	5.935E-17	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	1.027E-11	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	5.457E-06	1.0000

*Sum of all water independent and dependent pathways.

**Phase II Final Status Survey Report Mallinckrodt
Columbium-Tantalum Plant, Chapter 26**

**CS-RS-RP-009-26
Revision 0**

RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 11:54 Page 19
Summary : SU20 Elevated Area #2 In Situ
File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA2 IN SITU.RAD

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.
Ac-227	1.780E-14	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
Pa-231	5.081E-13	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
Pb-210	5.475E-15	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
Ra-226	9.897E-07	0.0917	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
Ra-228	6.993E-11	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-228	1.477E-21	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-230	2.855E-07	0.0265	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	9.516E-06	0.8818	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	1.696E-12	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	8.282E-16	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	2.328E-11	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	1.079E-05	1.0000	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+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.
Ac-227	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	1.780E-14	0.0000
Pa-231	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	5.081E-13	0.0000
Pb-210	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	5.475E-15	0.0000
Ra-226	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	9.897E-07	0.0917
Ra-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	6.993E-11	0.0000
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	1.477E-21	0.0000
Th-230	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	2.855E-07	0.0265
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	9.516E-06	0.8818
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	1.696E-12	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	8.282E-16	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	2.328E-11	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	1.079E-05	1.0000

*Sum of all water independent and dependent pathways.

**Phase II Final Status Survey Report Mallinckrodt
Columbium-Tantalum Plant, Chapter 26**

**CS-RS-RP-009-26
Revision 0**

RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 11:54 Page 20

Summary : SU20 Elevated Area #2 In Situ

File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA2 IN SITU.RAD

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.
Ac-227	2.343E-16	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
Pa-231	6.731E-12	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
Pb-210	1.369E-16	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
Ra-226	6.712E-06	0.0874	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
Ra-228	1.224E-20	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-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-230	6.904E-06	0.0899	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	6.322E-05	0.8228	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	1.152E-10	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	3.984E-14	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	2.416E-10	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	7.683E-05	1.0000	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 = 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.
Ac-227	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	2.343E-16	0.0000
Pa-231	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	6.731E-12	0.0000
Pb-210	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	1.369E-16	0.0000
Ra-226	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	6.712E-06	0.0874
Ra-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	1.224E-20	0.0000
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-230	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	6.904E-06	0.0899
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	6.322E-05	0.8228
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	1.152E-10	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	3.984E-14	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	2.416E-10	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	7.683E-05	1.0000

*Sum of all water independent and dependent pathways.

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Columbium-Tantalum Plant, Chapter 26**

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RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 11:54 Page 21
Summary : SU20 Elevated Area #2 In Situ
File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA2 IN SITU.RAD

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.
Ac-227	7.300E-23	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
Pa-231	6.215E-08	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
Pb-210	4.381E-22	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
Ra-226	5.464E-03	0.0589	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
Ra-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-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-230	3.719E-02	0.4009	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	5.010E-02	0.5401	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	1.634E-06	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	1.894E-09	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	8.843E-07	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	9.276E-02	1.0000	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.
Ac-227	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	7.300E-23	0.0000
Pa-231	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	6.215E-08	0.0000
Pb-210	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	4.381E-22	0.0000
Ra-226	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	5.464E-03	0.0589
Ra-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-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-230	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	3.719E-02	0.4009
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	5.010E-02	0.5401
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	1.634E-06	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	1.894E-09	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	8.843E-07	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	9.276E-02	1.0000

*Sum of all water independent and dependent pathways.

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Columbium-Tantalum Plant, Chapter 26**

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Summary : SU20 Elevated Area #2 In Situ

File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA2 IN SITU.RAD

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

Parent (i)	Product (j)	Thread Fraction	DSR(j,t) At Time in Years (mrem/yr)/(pCi/g)																	
			0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03										
Ac-227+D	Ac-227+D	1.000E+00	8.152E-14	7.977E-14	7.639E-14	6.563E-14	4.253E-14	9.322E-15	1.227E-16	3.822E-23										
Pa-231	Pa-231	1.000E+00	2.030E-16	2.062E-16	2.127E-16	2.373E-16	3.245E-16	9.696E-16	2.212E-14	1.255E-09										
Pa-231	Ac-227+D	1.000E+00	1.308E-15	3.908E-15	9.044E-15	2.642E-14	7.302E-14	2.651E-13	3.502E-12	3.128E-08										
Pa-231	ΣDSR(j)		1.511E-15	4.115E-15	9.257E-15	2.666E-14	7.334E-14	2.660E-13	3.524E-12	3.254E-08										
Pb-210+D	Pb-210+D	1.000E+00	3.325E-20	3.285E-20	3.207E-20	2.949E-20	2.319E-20	1.001E-20	9.070E-22	2.032E-25										
Pb-210+D	Po-210	1.000E+00	3.645E-17	6.166E-17	6.420E-17	5.654E-17	3.909E-17	1.074E-17	2.679E-19	6.568E-25										
Pb-210+D	ΣDSR(j)		3.648E-17	6.170E-17	6.423E-17	5.657E-17	3.911E-17	1.075E-17	2.688E-19	8.600E-25										
Ra-226+D	Ra-226+D	1.000E+00	7.460E-10	7.532E-10	7.678E-10	8.210E-10	9.942E-10	1.943E-09	1.318E-08	1.073E-05										
Ra-226+D	Pb-210+D	1.000E+00	5.209E-22	1.567E-21	3.681E-21	1.133E-20	3.614E-20	2.051E-19	8.323E-18	2.985E-12										
Ra-226+D	Po-210	1.000E+00	4.297E-19	2.087E-18	6.174E-18	2.041E-17	5.924E-17	2.163E-16	2.418E-15	9.490E-12										
Ra-226+D	ΣDSR(j)		7.460E-10	7.532E-10	7.678E-10	8.210E-10	9.942E-10	1.943E-09	1.318E-08	1.073E-05										
Ra-228+D	Ra-228+D	1.000E+00	4.875E-11	4.370E-11	3.512E-11	1.634E-11	1.834E-12	8.696E-16	2.767E-25	0.000E+00										
Ra-228+D	Th-228+D	1.000E+00	2.535E-09	6.219E-09	9.401E-09	6.944E-09	7.979E-10	3.069E-13	5.360E-23	0.000E+00										
Ra-228+D	ΣDSR(j)		2.584E-09	6.262E-09	9.436E-09	6.960E-09	7.997E-10	3.078E-13	5.388E-23	0.000E+00										
Th-228+D	Th-228+D	1.000E+00	1.373E-08	9.650E-09	4.765E-09	4.030E-10	3.470E-13	6.501E-24	0.000E+00	0.000E+00										
Th-230	Th-230	1.000E+00	4.131E-27	4.249E-27	4.494E-27	5.468E-27	9.581E-27	6.821E-26	1.859E-23	6.216E-15										
Th-230	Ra-226+D	1.000E+00	1.619E-13	4.903E-13	1.168E-12	3.768E-12	1.348E-11	9.209E-11	2.227E-09	1.200E-05										
Th-230	Pb-210+D	1.000E+00	7.556E-26	5.329E-25	2.866E-24	2.732E-23	2.801E-22	6.896E-21	1.221E-18	3.124E-12										
Th-230	Po-210	1.000E+00	5.032E-23	5.714E-22	4.192E-21	4.665E-20	4.499E-19	7.219E-18	3.537E-16	9.919E-12										
Th-230	ΣDSR(j)		1.619E-13	4.903E-13	1.168E-12	3.768E-12	1.348E-11	9.209E-11	2.227E-09	1.200E-05										
Th-232	Th-232	1.000E+00	5.285E-30	5.452E-30	5.803E-30	7.220E-30	1.347E-29	1.197E-28	6.135E-26	1.872E-16										
Th-232	Ra-228+D	1.000E+00	3.005E-12	8.645E-12	1.845E-11	4.189E-11	7.265E-11	1.780E-10	2.146E-09	1.308E-05										
Th-232	Th-228+D	1.000E+00	1.061E-10	6.559E-10	2.654E-09	1.054E-08	2.073E-08	4.170E-08	2.761E-07	2.074E-04										
Th-232	ΣDSR(j)		1.091E-10	6.646E-10	2.672E-09	1.058E-08	2.080E-08	4.188E-08	2.782E-07	2.205E-04										
U-234	U-234	1.000E+00	1.683E-28	1.730E-28	1.827E-28	2.212E-28	3.824E-28	2.595E-27	6.169E-25	1.278E-16										
U-234	Th-230	1.000E+00	1.867E-32	5.738E-32	1.413E-31	5.123E-31	2.562E-30	5.663E-29	3.920E-26	2.658E-17										
U-234	Ra-226+D	1.000E+00	4.862E-19	3.433E-18	1.851E-17	1.776E-16	1.833E-15	4.041E-14	2.744E-12	3.892E-08										
U-234	Pb-210+D	1.000E+00	1.704E-31	2.581E-30	3.077E-29	8.829E-28	2.734E-26	2.435E-24	1.374E-21	9.926E-15										
U-234	Po-210	1.000E+00	9.549E-29	2.352E-27	4.012E-26	1.436E-24	4.310E-23	2.535E-21	3.973E-19	3.151E-14										
U-234	ΣDSR(j)		4.862E-19	3.433E-18	1.851E-17	1.776E-16	1.833E-15	4.041E-14	2.744E-12	3.892E-08										
U-235+D	U-235+D	1.000E+00	1.840E-18	1.875E-18	1.947E-18	2.224E-18	3.249E-18	1.225E-17	5.431E-16	3.152E-10										
U-235+D	Pa-231	1.000E+00	2.153E-21	6.550E-21	1.576E-20	5.274E-20	2.095E-19	2.064E-18	1.411E-16	2.686E-11										
U-235+D	Ac-227+D	1.000E+00	9.261E-21	6.490E-20	3.440E-19	3.114E-18	2.762E-17	4.193E-16	2.017E-14	6.497E-10										
U-235+D	ΣDSR(j)		1.851E-18	1.946E-18	2.307E-18	5.390E-18	3.107E-17	4.336E-16	2.086E-14	9.918E-10										
U-238	U-238	5.400E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.724E-34									

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Summary : SU20 Elevated Area #2 In Situ
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Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,t) At Time in Years (mrem/yr)/(pCi/g)							
			0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-238+D	U-238+D	9.999E-01	1.723E-13	1.744E-13	1.785E-13	1.937E-13	2.447E-13	5.547E-13	5.756E-12	2.104E-08
U-238+D	U-234	9.999E-01	2.396E-34	7.366E-34	1.814E-33	6.587E-33	3.306E-32	7.394E-31	5.257E-28	3.630E-19
U-238+D	Th-230	9.999E-01	1.768E-38	1.266E-37	7.052E-37	7.609E-36	1.098E-34	7.834E-33	1.526E-29	2.733E-20
U-238+D	Ra-226+D	9.999E-01	3.447E-25	5.215E-24	6.202E-23	1.763E-21	5.261E-20	3.779E-18	7.434E-16	3.090E-11
U-238+D	Pb-210+D	9.999E-01	9.680E-38	3.033E-36	7.826E-35	6.681E-33	6.144E-31	1.914E-28	3.417E-25	7.685E-18
U-238+D	Po-210	9.999E-01	4.688E-35	2.423E-33	9.237E-32	1.038E-29	9.518E-28	1.981E-25	9.864E-23	2.438E-17
U-238+D	ΣDSR(j)		1.723E-13	1.744E-13	1.785E-13	1.937E-13	2.447E-13	5.547E-13	5.756E-12	2.107E-08

The DSR includes contributions from associated (half-life ≤ 30 days) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 2.500E+01 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
Ac-227	*7.232E+13	*7.232E+13	*7.232E+13	*7.232E+13	*7.232E+13	*7.232E+13	*7.232E+13	*7.232E+13
Pa-231	*4.723E+10	*4.723E+10	*4.723E+10	*4.723E+10	*4.723E+10	*4.723E+10	*4.723E+10	7.683E+08
Pb-210	*7.634E+13	*7.634E+13	*7.634E+13	*7.634E+13	*7.634E+13	*7.634E+13	*7.634E+13	*7.634E+13
Ra-226	3.351E+10	3.319E+10	3.256E+10	3.045E+10	2.515E+10	1.287E+10	1.897E+09	2.331E+06
Ra-228	9.675E+09	3.992E+09	2.649E+09	3.592E+09	3.126E+10	8.123E+13	*2.726E+14	*2.726E+14
Th-228	1.820E+09	2.591E+09	5.247E+09	6.204E+10	7.205E+13	*8.195E+14	*8.195E+14	*8.195E+14
Th-230	*2.018E+10	*2.018E+10	*2.018E+10	*2.018E+10	*2.018E+10	*2.018E+10	1.122E+10	2.084E+06
Th-232	*1.097E+05	*1.097E+05	*1.097E+05	*1.097E+05	*1.097E+05	*1.097E+05	*1.097E+05	*1.097E+05
U-234	*6.247E+09	*6.247E+09	*6.247E+09	*6.247E+09	*6.247E+09	*6.247E+09	*6.247E+09	6.423E+08
U-235	*2.161E+06	*2.161E+06	*2.161E+06	*2.161E+06	*2.161E+06	*2.161E+06	*2.161E+06	*2.161E+06
U-238	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05

*At specific activity limit

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Summary : SU20 Elevated Area #2 In Situ

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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 = 1.000E+03 years

Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
Ac-227	1.910E+00	0.000E+00	8.152E-14	*7.232E+13	3.822E-23	*7.232E+13
Pa-231	1.910E+00	1.000E+03	3.254E-08	7.683E+08	3.254E-08	7.683E+08
Pb-210	5.094E+02	2.118 ± 0.004	6.476E-17	*7.634E+13	8.600E-25	*7.634E+13
Ra-226	5.094E+02	1.000E+03	1.073E-05	2.331E+06	1.073E-05	2.331E+06
Ra-228	2.272E+02	4.268 ± 0.009	9.820E-09	2.546E+09	0.000E+00	*2.726E+14
Th-228	2.272E+02	0.000E+00	1.373E-08	1.820E+09	0.000E+00	*8.195E+14
Th-230	3.100E+03	1.000E+03	1.200E-05	2.084E+06	1.200E-05	2.084E+06
Th-232	2.272E+02	1.000E+03	2.205E-04	*1.097E+05	2.205E-04	*1.097E+05
U-234	4.197E+01	1.000E+03	3.892E-08	6.423E+08	3.892E-08	6.423E+08
U-235	1.910E+00	1.000E+03	9.918E-10	*2.161E+06	9.918E-10	*2.161E+06
U-238	4.197E+01	1.000E+03	2.107E-08	*3.361E+05	2.107E-08	*3.361E+05

*At specific activity limit

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Revision 0**

RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 11:54 Page 25

Summary : SU20 Elevated Area #2 In Situ

File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA2 IN SITU.RAD

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

Nuclide	Parent	THF (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
Ac-227	Ac-227	1.000E+00	1.557E-13	1.524E-13	1.459E-13	1.253E-13	8.123E-14	1.780E-14	2.343E-16	7.300E-23
Ac-227	Pa-231	1.000E+00	2.498E-15	7.465E-15	1.727E-14	5.046E-14	1.395E-13	5.063E-13	6.689E-12	5.975E-08
Ac-227	U-235	1.000E+00	1.769E-20	1.240E-19	6.570E-19	5.948E-18	5.275E-17	8.009E-16	3.853E-14	1.241E-09
Ac-227	ΣDOSE(j)		1.582E-13	1.598E-13	1.632E-13	1.758E-13	2.207E-13	5.249E-13	6.728E-12	6.099E-08
Pa-231	Pa-231	1.000E+00	3.877E-16	3.938E-16	4.063E-16	4.533E-16	6.198E-16	1.852E-15	4.226E-14	2.398E-09
Pa-231	U-235	1.000E+00	4.112E-21	1.251E-20	3.010E-20	1.007E-19	4.001E-19	3.942E-18	2.695E-16	5.130E-11
Pa-231	ΣDOSE(j)		3.877E-16	3.938E-16	4.064E-16	4.534E-16	6.202E-16	1.856E-15	4.253E-14	2.449E-09
Pb-210	Pb-210	1.000E+00	1.694E-17	1.673E-17	1.634E-17	1.502E-17	1.181E-17	5.098E-18	4.620E-19	1.035E-22
Pb-210	Ra-226	1.000E+00	2.654E-19	7.983E-19	1.875E-18	5.771E-18	1.841E-17	1.045E-16	4.240E-15	1.521E-09
Pb-210	Th-230	1.000E+00	2.342E-22	1.652E-21	8.884E-21	8.469E-20	8.684E-19	2.138E-17	3.784E-15	9.684E-09
Pb-210	U-234	1.000E+00	0.000E+00	1.083E-28	1.291E-27	3.706E-26	1.147E-24	1.022E-22	5.766E-20	4.166E-13
Pb-210	U-238	9.999E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	8.034E-27	1.434E-23	3.225E-16
Pb-210	ΣDOSE(j)		1.720E-17	1.753E-17	1.822E-17	2.088E-17	3.109E-17	1.310E-16	8.024E-15	1.120E-08
Po-210	Pb-210	1.000E+00	1.857E-14	3.141E-14	3.270E-14	2.880E-14	1.991E-14	5.470E-15	1.365E-16	3.346E-22
Po-210	Ra-226	1.000E+00	2.189E-16	1.063E-15	3.145E-15	1.039E-14	3.018E-14	1.102E-13	1.232E-12	4.834E-09
Po-210	Th-230	1.000E+00	1.560E-19	1.771E-18	1.299E-17	1.446E-16	1.395E-15	2.238E-14	1.096E-12	3.075E-08
Po-210	U-234	1.000E+00	4.008E-27	9.872E-26	1.684E-24	6.027E-23	1.809E-21	1.064E-19	1.668E-17	1.322E-12
Po-210	U-238	9.999E-01	0.000E+00	0.000E+00	0.000E+00	4.356E-28	3.995E-26	8.314E-24	4.140E-21	1.023E-15
Po-210	ΣDOSE(j)		1.879E-14	3.247E-14	3.586E-14	3.934E-14	5.148E-14	1.380E-13	2.328E-12	3.558E-08
Ra-226	Ra-226	1.000E+00	3.800E-07	3.837E-07	3.911E-07	4.182E-07	5.064E-07	9.897E-07	6.712E-06	5.464E-03
Ra-226	Th-230	1.000E+00	5.020E-10	1.520E-09	3.620E-09	1.168E-08	4.178E-08	2.855E-07	6.904E-06	3.719E-02
Ra-226	U-234	1.000E+00	2.041E-17	1.441E-16	7.767E-16	7.456E-15	7.694E-14	1.696E-12	1.152E-10	1.634E-06
Ra-226	U-238	9.999E-01	1.447E-23	2.189E-22	2.603E-21	7.398E-20	2.208E-18	1.586E-16	3.120E-14	1.297E-09
Ra-226	ΣDOSE(j)		3.805E-07	3.852E-07	3.947E-07	4.299E-07	5.482E-07	1.275E-06	1.362E-05	4.265E-02
Ra-228	Ra-228	1.000E+00	1.108E-08	9.931E-09	7.980E-09	3.712E-09	4.168E-10	1.976E-13	6.287E-23	0.000E+00
Ra-228	Th-232	1.000E+00	6.828E-10	1.964E-09	4.193E-09	9.518E-09	1.651E-08	4.045E-08	4.878E-07	2.971E-03
Ra-228	ΣDOSE(j)		1.176E-08	1.190E-08	1.217E-08	1.323E-08	1.693E-08	4.045E-08	4.878E-07	2.971E-03
Th-228	Ra-228	1.000E+00	5.761E-07	1.413E-06	2.136E-06	1.578E-06	1.813E-07	6.974E-11	1.218E-20	0.000E+00
Th-228	Th-228	1.000E+00	3.121E-06	2.193E-06	1.083E-06	9.158E-08	7.885E-11	1.477E-21	0.000E+00	0.000E+00
Th-228	Th-232	1.000E+00	2.411E-08	1.491E-07	6.030E-07	2.396E-06	4.711E-06	9.476E-06	6.273E-05	4.713E-02
Th-228	ΣDOSE(j)		3.721E-06	3.755E-06	3.822E-06	4.065E-06	4.892E-06	9.476E-06	6.273E-05	4.713E-02
Th-230	Th-230	1.000E+00	1.281E-23	1.317E-23	1.393E-23	1.695E-23	2.970E-23	2.114E-22	5.763E-20	1.927E-11
Th-230	U-234	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.075E-28	2.377E-27	1.645E-24	1.116E-15
Th-230	U-238	9.999E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.403E-28	1.147E-18
Th-230	ΣDOSE(j)		1.281E-23	1.317E-23	1.393E-23	1.695E-23	2.970E-23	2.114E-22	5.764E-20	1.927E-11
Th-232	Th-232	1.000E+00	1.201E-27	1.239E-27	1.319E-27	1.641E-27	3.062E-27	2.719E-26	1.394E-23	4.255E-14
U-234	U-234	1.000E+00	7.063E-27	7.259E-27	7.667E-27	9.285E-27	1.605E-26	1.089E-25	2.589E-23	5.364E-15
U-234	U-238	9.999E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.206E-26	1.524E-17
U-234	ΣDOSE(j)		7.063E-27	7.259E-27	7.667E-27	9.285E-27	1.605E-26	1.089E-25	2.591E-23	5.379E-15
U-235	U-235	1.000E+00	3.514E-18	3.581E-18	3.720E-18	4.248E-18	6.206E-18	2.340E-17	1.037E-15	6.021E-10

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RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 11:54 Page 26
Summary : SU20 Elevated Area #2 In Situ
File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA2 IN SITU.RAD

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

Nuclide (j)	Parent (i)	THF(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	
U-238	U-238	5.400E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238	U-238	9.999E-01	7.233E-12	7.318E-12	7.491E-12	8.130E-12	1.027E-11	2.328E-11	2.416E-10	8.830E-07	
U-238	∑DOSE(j)		7.233E-12	7.318E-12	7.491E-12	8.130E-12	1.027E-11	2.328E-11	2.416E-10	8.830E-07	

THF(i) is the thread fraction of the parent nuclide.

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Summary : SU20 Elevated Area #2 In Situ

File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA2 IN SITU.RAD

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF (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
Ac-227	Ac-227	1.000E+00	1.910E+00	1.842E+00	1.714E+00	1.330E+00	6.455E-01	5.135E-02	3.712E-05	3.771E-16
Ac-227	Pa-231	1.000E+00	0.000E+00	5.967E-02	1.724E-01	5.055E-01	1.079E+00	1.434E+00	1.042E+00	3.034E-01
Ac-227	U-235	1.000E+00	0.000E+00	6.348E-07	5.566E-06	5.654E-05	4.005E-04	2.255E-03	5.989E-03	6.297E-03
Ac-227	ΣS(j):		1.910E+00	1.902E+00	1.886E+00	1.836E+00	1.725E+00	1.488E+00	1.048E+00	3.097E-01
Pa-231	Pa-231	1.000E+00	1.910E+00	1.907E+00	1.900E+00	1.877E+00	1.812E+00	1.601E+00	1.126E+00	3.278E-01
Pa-231	U-235	1.000E+00	0.000E+00	4.034E-05	1.206E-04	3.971E-04	1.150E-03	3.392E-03	7.168E-03	7.010E-03
Pa-231	ΣS(j):		1.910E+00	1.907E+00	1.900E+00	1.877E+00	1.813E+00	1.605E+00	1.133E+00	3.348E-01
Pb-210	Pb-210	1.000E+00	5.094E+02	4.934E+02	4.628E+02	3.701E+02	1.953E+02	2.086E+01	3.497E-02	6.746E-12
Pb-210	Ra-226	1.000E+00	0.000E+00	1.557E+01	4.518E+01	1.343E+02	2.968E+02	4.207E+02	3.160E+02	9.761E+01
Pb-210	Th-230	1.000E+00	0.000E+00	2.064E-02	1.817E-01	1.871E+00	1.373E+01	8.551E+01	2.814E+02	6.210E+02
Pb-210	U-234	1.000E+00	0.000E+00	8.405E-10	2.230E-08	7.775E-07	1.783E-05	4.066E-04	4.281E-03	2.670E-02
Pb-210	U-238	9.999E-01	0.000E+00	5.965E-16	4.761E-14	5.586E-12	3.937E-10	3.179E-08	1.063E-06	2.067E-05
Pb-210	ΣS(j):		5.094E+02	5.090E+02	5.082E+02	5.063E+02	5.058E+02	5.271E+02	5.974E+02	7.186E+02
Po-210	Pb-210	1.000E+00	0.000E+00	4.176E+02	4.667E+02	3.748E+02	1.978E+02	2.113E+01	3.542E-02	6.833E-12
Po-210	Ra-226	1.000E+00	0.000E+00	8.442E+00	3.711E+01	1.275E+02	2.923E+02	4.188E+02	3.148E+02	9.724E+01
Po-210	Th-230	1.000E+00	0.000E+00	8.434E-03	1.276E-01	1.679E+00	1.325E+01	8.451E+01	2.796E+02	6.179E+02
Po-210	U-234	1.000E+00	0.000E+00	2.776E-10	1.375E-08	6.632E-07	1.688E-05	3.995E-04	4.246E-03	2.656E-02
Po-210	U-238	9.999E-01	0.000E+00	1.658E-16	2.621E-14	4.541E-12	3.662E-10	3.106E-08	1.052E-06	2.055E-05
Po-210	ΣS(j):		0.000E+00	4.261E+02	5.040E+02	5.040E+02	5.034E+02	5.244E+02	5.945E+02	7.152E+02
Ra-226	Ra-226	1.000E+00	5.094E+02	5.085E+02	5.068E+02	5.009E+02	4.844E+02	4.307E+02	3.079E+02	9.508E+01
Ra-226	Th-230	1.000E+00	0.000E+00	1.342E+00	4.019E+00	1.332E+01	3.929E+01	1.236E+02	3.160E+02	6.465E+02
Ra-226	U-234	1.000E+00	0.000E+00	8.174E-08	7.340E-07	8.091E-06	7.117E-05	7.305E-04	5.264E-03	2.839E-02
Ra-226	U-238	9.999E-01	0.000E+00	7.723E-14	2.080E-12	7.634E-11	2.009E-09	6.798E-08	1.424E-06	2.252E-05
Ra-226	ΣS(j):		5.094E+02	5.099E+02	5.108E+02	5.142E+02	5.237E+02	5.542E+02	6.239E+02	7.416E+02
Ra-228	Ra-228	1.000E+00	2.272E+02	2.012E+02	1.577E+02	6.723E+01	5.884E+00	1.167E-03	3.078E-14	0.000E+00
Ra-228	Th-232	1.000E+00	0.000E+00	2.579E+01	6.884E+01	1.584E+02	2.191E+02	2.249E+02	2.248E+02	2.246E+02
Ra-228	ΣS(j):		2.272E+02	2.270E+02	2.265E+02	2.256E+02	2.250E+02	2.249E+02	2.248E+02	2.246E+02
Th-228	Ra-228	1.000E+00	0.000E+00	6.479E+01	1.221E+02	9.213E+01	8.857E+00	1.758E-03	4.637E-14	0.000E+00
Th-228	Th-228	1.000E+00	2.272E+02	1.582E+02	7.663E+01	6.067E+00	4.324E-03	4.180E-14	0.000E+00	0.000E+00
Th-228	Th-232	1.000E+00	0.000E+00	4.235E+00	2.822E+01	1.277E+02	2.161E+02	2.249E+02	2.248E+02	2.246E+02
Th-228	ΣS(j):		2.272E+02	2.272E+02	2.269E+02	2.259E+02	2.250E+02	2.249E+02	2.248E+02	2.246E+02
Th-230	Th-230	1.000E+00	3.100E+03	3.100E+03	3.100E+03	3.100E+03	3.099E+03	3.097E+03	3.090E+03	3.068E+03
Th-230	U-234	1.000E+00	0.000E+00	3.775E-04	1.130E-03	3.745E-03	1.104E-02	3.465E-02	8.810E-02	1.776E-01
Th-230	U-238	9.999E-01	0.000E+00	5.349E-10	4.803E-09	5.293E-08	4.654E-07	4.770E-06	3.424E-05	1.825E-04
Th-230	ΣS(j):		3.100E+03	3.100E+03	3.100E+03	3.100E+03	3.099E+03	3.097E+03	3.090E+03	3.068E+03
Th-232	Th-232	1.000E+00	2.272E+02	2.272E+02	2.272E+02	2.272E+02	2.272E+02	2.272E+02	2.271E+02	2.269E+02
U-234	U-234	1.000E+00	4.197E+01	4.190E+01	4.175E+01	4.124E+01	3.983E+01	3.525E+01	2.487E+01	7.336E+00
U-234	U-238	9.999E-01	0.000E+00	1.188E-04	3.551E-04	1.169E-03	3.387E-03	9.995E-03	2.116E-02	2.083E-02
U-234	ΣS(j):		4.197E+01	4.190E+01	4.175E+01	4.125E+01	3.983E+01	3.526E+01	2.489E+01	7.357E+00
U-235	U-235	1.000E+00	1.910E+00	1.907E+00	1.900E+00	1.877E+00	1.813E+00	1.605E+00	1.133E+00	3.348E-01

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Revision 0**

RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 11:54 Page 28
Summary : SU20 Elevated Area #2 In Situ
File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA2 IN SITU.RAD

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(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
U-238	U-238	5.400E-05	2.266E-03	2.262E-03	2.255E-03	2.227E-03	2.151E-03	1.904E-03	1.344E-03	3.973E-04
U-238	U-238	9.999E-01	4.197E+01	4.189E+01	4.175E+01	4.124E+01	3.983E+01	3.526E+01	2.489E+01	7.357E+00
U-238	ΣS(j):		4.197E+01	4.190E+01	4.175E+01	4.125E+01	3.983E+01	3.526E+01	2.489E+01	7.357E+00

THF(i) is the thread fraction of the parent nuclide.

RESCALC.EXE execution time = 2.20 seconds

APPENDIX B

RESRAD v6.5 Summary Report for Elevated Area #3 *In Situ* Model

RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 11:56 Page 1
Summary : SU20 Elevated Area #3 In Situ
File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA3 IN SITU.RAD

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Total Dose Components	
Time = 0.000E+00	14
Time = 1.000E+00	15
Time = 3.000E+00	16
Time = 1.000E+01	17
Time = 3.000E+01	18
Time = 1.000E+02	19
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Summary : SU20 Elevated Area #3 In Situ

File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA3 IN SITU.RAD

Dose Conversion Factor (and Related) Parameter Summary
Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
A-1	DCF's for external ground radiation, (mrem/yr)/(pCi/g)			
A-1	Ac-227 (Source: FGR 12)	4.951E-04	4.951E-04	DCF1(1)
A-1	Ac-228 (Source: FGR 12)	5.978E+00	5.978E+00	DCF1(2)
A-1	At-218 (Source: FGR 12)	5.847E-03	5.847E-03	DCF1(3)
A-1	Bi-210 (Source: FGR 12)	3.606E-03	3.606E-03	DCF1(4)
A-1	Bi-211 (Source: FGR 12)	2.559E-01	2.559E-01	DCF1(5)
A-1	Bi-212 (Source: FGR 12)	1.171E+00	1.171E+00	DCF1(6)
A-1	Bi-214 (Source: FGR 12)	9.808E+00	9.808E+00	DCF1(7)
A-1	Fr-223 (Source: FGR 12)	1.980E-01	1.980E-01	DCF1(8)
A-1	Pa-231 (Source: FGR 12)	1.906E-01	1.906E-01	DCF1(9)
A-1	Pa-234 (Source: FGR 12)	1.155E+01	1.155E+01	DCF1(10)
A-1	Pa-234m (Source: FGR 12)	8.967E-02	8.967E-02	DCF1(11)
A-1	Pb-210 (Source: FGR 12)	2.447E-03	2.447E-03	DCF1(12)
A-1	Pb-211 (Source: FGR 12)	3.064E-01	3.064E-01	DCF1(13)
A-1	Pb-212 (Source: FGR 12)	7.043E-01	7.043E-01	DCF1(14)
A-1	Pb-214 (Source: FGR 12)	1.341E+00	1.341E+00	DCF1(15)
A-1	Po-210 (Source: FGR 12)	5.231E-05	5.231E-05	DCF1(16)
A-1	Po-211 (Source: FGR 12)	4.764E-02	4.764E-02	DCF1(17)
A-1	Po-212 (Source: FGR 12)	0.000E+00	0.000E+00	DCF1(18)
A-1	Po-214 (Source: FGR 12)	5.138E-04	5.138E-04	DCF1(19)
A-1	Po-215 (Source: FGR 12)	1.016E-03	1.016E-03	DCF1(20)
A-1	Po-216 (Source: FGR 12)	1.042E-04	1.042E-04	DCF1(21)
A-1	Po-218 (Source: FGR 12)	5.642E-05	5.642E-05	DCF1(22)
A-1	Ra-223 (Source: FGR 12)	6.034E-01	6.034E-01	DCF1(23)
A-1	Ra-224 (Source: FGR 12)	5.119E-02	5.119E-02	DCF1(24)
A-1	Ra-226 (Source: FGR 12)	3.176E-02	3.176E-02	DCF1(25)
A-1	Ra-228 (Source: FGR 12)	0.000E+00	0.000E+00	DCF1(26)
A-1	Rn-219 (Source: FGR 12)	3.083E-01	3.083E-01	DCF1(27)
A-1	Rn-220 (Source: FGR 12)	2.298E-03	2.298E-03	DCF1(28)
A-1	Rn-222 (Source: FGR 12)	2.354E-03	2.354E-03	DCF1(29)
A-1	Th-227 (Source: FGR 12)	5.212E-01	5.212E-01	DCF1(30)
A-1	Th-228 (Source: FGR 12)	7.940E-03	7.940E-03	DCF1(31)
A-1	Th-230 (Source: FGR 12)	1.209E-03	1.209E-03	DCF1(32)
A-1	Th-231 (Source: FGR 12)	3.643E-02	3.643E-02	DCF1(33)
A-1	Th-232 (Source: FGR 12)	5.212E-04	5.212E-04	DCF1(34)
A-1	Th-234 (Source: FGR 12)	2.410E-02	2.410E-02	DCF1(35)
A-1	Tl-207 (Source: FGR 12)	1.980E-02	1.980E-02	DCF1(36)
A-1	Tl-208 (Source: FGR 12)	2.298E+01	2.298E+01	DCF1(37)
A-1	Tl-210 (Source: no data)	0.000E+00	-2.000E+00	DCF1(38)
A-1	U-234 (Source: FGR 12)	4.017E-04	4.017E-04	DCF1(39)
A-1	U-235 (Source: FGR 12)	7.211E-01	7.211E-01	DCF1(40)
A-1	U-238 (Source: FGR 12)	1.031E-04	1.031E-04	DCF1(41)
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	6.724E+00	6.700E+00	DCF2(1)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(2)
B-1	Pb-210+D	1.380E-02	1.360E-02	DCF2(3)
B-1	Po-210	9.400E-03	9.400E-03	DCF2(4)
B-1	Ra-226+D	8.594E-03	8.580E-03	DCF2(5)
B-1	Ra-228+D	5.078E-03	4.770E-03	DCF2(6)

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Summary : SU20 Elevated Area #3 In Situ
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Dose Conversion Factor (and Related) Parameter Summary (continued)
Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
B-1	Th-228+D	3.454E-01	3.420E-01	DCF2(7)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(8)
B-1	Th-232	1.640E+00	1.640E+00	DCF2(9)
B-1	U-234	1.320E-01	1.320E-01	DCF2(10)
B-1	U-235+D	1.230E-01	1.230E-01	DCF2(11)
B-1	U-238	1.180E-01	1.180E-01	DCF2(12)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(13)
Dose conversion factors for ingestion, mrem/pCi:				
D-1	Ac-227+D	1.480E-02	1.410E-02	DCF3(1)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(2)
D-1	Pb-210+D	5.376E-03	5.370E-03	DCF3(3)
D-1	Po-210	1.900E-03	1.900E-03	DCF3(4)
D-1	Ra-226+D	1.321E-03	1.320E-03	DCF3(5)
D-1	Ra-228+D	1.442E-03	1.440E-03	DCF3(6)
D-1	Th-228+D	8.086E-04	3.960E-04	DCF3(7)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(8)
D-1	Th-232	2.730E-03	2.730E-03	DCF3(9)
D-1	U-234	2.830E-04	2.830E-04	DCF3(10)
D-1	U-235+D	2.673E-04	2.660E-04	DCF3(11)
D-1	U-238	2.550E-04	2.550E-04	DCF3(12)
D-1	U-238+D	2.687E-04	2.550E-04	DCF3(13)
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	Po-210 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(4,1)
D-34	Po-210 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(4,2)
D-34	Po-210 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.400E-04	3.400E-04	RTF(4,3)
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(5,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(5,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(5,3)
D-34	Ra-228+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(6,1)
D-34	Ra-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(6,2)
D-34	Ra-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(6,3)
D-34				

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Dose Conversion Factor (and Related) Parameter Summary (continued)

Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
D-34	Th-228+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(7,1)
D-34	Th-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(7,2)
D-34	Th-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(7,3)
D-34				
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(8,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(8,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(8,3)
D-34				
D-34	Th-232 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(9,1)
D-34	Th-232 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(9,2)
D-34	Th-232 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(9,3)
D-34				
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(10,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(10,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(10,3)
D-34				
D-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(11,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(11,2)
D-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(11,3)
D-34				
D-34	U-238 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(12,1)
D-34	U-238 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(12,2)
D-34	U-238 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(12,3)
D-34				
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(13,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(13,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(13,3)
D-5				
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-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	Po-210 , fish	1.000E+02	1.000E+02	BIOFAC(4,1)
D-5	Po-210 , crustacea and mollusks	2.000E+04	2.000E+04	BIOFAC(4,2)
D-5				
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(5,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(5,2)
D-5				
D-5	Ra-228+D , fish	5.000E+01	5.000E+01	BIOFAC(6,1)
D-5	Ra-228+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(6,2)
D-5				
D-5	Th-228+D , fish	1.000E+02	1.000E+02	BIOFAC(7,1)
D-5	Th-228+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(7,2)
D-5				

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Dose Conversion Factor (and Related) Parameter Summary (continued)
Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(8,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(8,2)
D-5				
D-5	Th-232 , fish	1.000E+02	1.000E+02	BIOFAC(9,1)
D-5	Th-232 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(9,2)
D-5				
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(10,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(10,2)
D-5				
D-5	U-235D , fish	1.000E+01	1.000E+01	BIOFAC(11,1)
D-5	U-235D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(11,2)
D-5				
D-5	U-238 , fish	1.000E+01	1.000E+01	BIOFAC(12,1)
D-5	U-238 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(12,2)
D-5				
D-5	U-238D , fish	1.000E+01	1.000E+01	BIOFAC(13,1)
D-5	U-238D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(13,2)

#For DCF1(XXX) only, factors are for infinite depth & area. See ETFG table in Ground Pathway of Detailed Report.
*Base Case means Default.Lib w/o Associate Nuclide contributions.

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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)	1.000E+00	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	3.000E-01	2.000E+00	---	THICK0
R011	Fraction of contamination that is submerged	0.000E+00	0.000E+00	---	SUBMFRACT
R011	Length parallel to aquifer flow (m)	not used	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	2.500E+01	3.000E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
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): Ac-227	1.900E-01	0.000E+00	---	S1(1)
R012	Initial principal radionuclide (pCi/g): Pa-231	1.900E-01	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g): Pb-210	2.189E+02	0.000E+00	---	S1(3)
R012	Initial principal radionuclide (pCi/g): Ra-226	2.189E+02	0.000E+00	---	S1(5)
R012	Initial principal radionuclide (pCi/g): Ra-228	5.960E+01	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g): Th-228	5.960E+01	0.000E+00	---	S1(7)
R012	Initial principal radionuclide (pCi/g): Th-230	1.300E+03	0.000E+00	---	S1(8)
R012	Initial principal radionuclide (pCi/g): Th-232	5.960E+01	0.000E+00	---	S1(9)
R012	Initial principal radionuclide (pCi/g): U-234	4.240E+00	0.000E+00	---	S1(10)
R012	Initial principal radionuclide (pCi/g): U-235	1.900E-01	0.000E+00	---	S1(11)
R012	Initial principal radionuclide (pCi/g): U-238	4.240E+00	0.000E+00	---	S1(12)
R012	Concentration in groundwater (pCi/L): Ac-227	not used	0.000E+00	---	W1(1)
R012	Concentration in groundwater (pCi/L): Pa-231	not used	0.000E+00	---	W1(2)
R012	Concentration in groundwater (pCi/L): Pb-210	not used	0.000E+00	---	W1(3)
R012	Concentration in groundwater (pCi/L): Ra-226	not used	0.000E+00	---	W1(5)
R012	Concentration in groundwater (pCi/L): Ra-228	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L): Th-228	not used	0.000E+00	---	W1(7)
R012	Concentration in groundwater (pCi/L): Th-230	not used	0.000E+00	---	W1(8)
R012	Concentration in groundwater (pCi/L): Th-232	not used	0.000E+00	---	W1(9)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(10)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W1(11)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(12)
R013	Cover depth (m)	4.900E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	1.500E+00	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	---	FCCZ
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	Average annual wind speed (m/sec)	4.000E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID

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Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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)	0.000E+00	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)	not used	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	not used	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	not used	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	not used	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	not used	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	not used	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	not used	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	not used	2.000E-02	---	HGWT
R014	Saturated zone b parameter	not used	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	not used	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	not used	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	not used	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	not used	2.500E+02	---	UW
R015	Number of unsaturated zone strata	not used	1	---	NS
R015	Unsat. zone 1, thickness (m)	not used	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	not used	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	not used	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	not used	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	not used	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	not used	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	not used	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(1)
R016	Unsat. zone 1 (cm**3/g)	not used	2.000E+01	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	not used	2.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.398E-02	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for Pa-231				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(2)
R016	Unsat. zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.770E-02	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(3)
R016	Unsat. zone 1 (cm**3/g)	not used	1.000E+02	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	not used	1.000E+02	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	8.870E-03	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)

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Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	not used	7.000E+01	---	DCNUCU(5,1)
R016	Saturated zone (cm**3/g)	not used	7.000E+01	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.266E-02	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R016	Distribution coefficients for Ra-228				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	not used	7.000E+01	---	DCNUCU(6,1)
R016	Saturated zone (cm**3/g)	not used	7.000E+01	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.266E-02	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
R016	Distribution coefficients for Th-228				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(7)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(7,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.481E-05	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)
R016	Distribution coefficients for Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(8,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.481E-05	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
R016	Distribution coefficients for Th-232				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(9)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(9,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.481E-05	ALEACH(9)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(9)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(10)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(10,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(10)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.770E-02	ALEACH(10)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(10)
R016	Distribution coefficients for U-235				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(11)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(11,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(11)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.770E-02	ALEACH(11)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(11)

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Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(12)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(12,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(12)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.770E-02	ALEACH(12)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(12)
R016	Distribution coefficients for daughter Po-210				
R016	Contaminated zone (cm**3/g)	1.000E+01	1.000E+01	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	not used	1.000E+01	---	DCNUCU(4,1)
R016	Saturated zone (cm**3/g)	not used	1.000E+01	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	8.706E-02	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R017	Inhalation rate (m**3/yr)	1.227E+04	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	3.500E-05	1.000E-04	---	MLINH
R017	Exposure duration	3.000E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	6.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	1.700E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	1.825E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	4.563E-02	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS
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)

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Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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)	3.650E+01	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	not used	1.000E+00	---	FHHW
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	---	FP LANT
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	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	not used	1.000E-04	---	MLFD
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	not used	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	not used	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	not used	7.000E-01	---	YV (1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	not used	1.500E+00	---	YV (2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	---	YV (3)
R19B	Growing Season for Non-Leafy (years)	not used	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	not used	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	not used	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	not used	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	not used	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RDRY (1)
R19B	Dry Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RDRY (2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RDRY (3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RWET (1)
R19B	Wet Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RWET (2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET (3)
R19B	Weathering Removal Constant for Vegetation	not used	2.000E+01	---	WLAM
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	---	C12CC
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL

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Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	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	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	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	not used	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	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	32	---	---	NPTS
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	1	---	---	KYMAX

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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	active
9 -- radon	suppressed
Find peak pathway doses	active

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Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	1.00 square meters	Ac-227	1.900E-01
Thickness:	0.30 meters	Pa-231	1.900E-01
Cover Depth:	4.90 meters	Pb-210	2.189E+02
		Ra-226	2.189E+02
		Ra-228	5.960E+01
		Th-228	5.960E+01
		Th-230	1.300E+03
		Th-232	5.960E+01
		U-234	4.240E+00
		U-235	1.900E-01
		U-238	4.240E+00

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 2.500E+01 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):	5.693E-20	5.727E-20	5.765E-20	5.890E-20	6.862E-20	1.324E-19	8.738E-19	6.457E-16
M(t):	2.277E-21	2.291E-21	2.306E-21	2.356E-21	2.745E-21	5.296E-21	3.495E-20	2.583E-17

Maximum TDOSE(t): 6.457E-16 mrem/yr at t = 1.000E+03 years

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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.
Ac-227	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
Pa-231	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
Pb-210	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
Ra-226	4.188E-23	0.0007	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
Ra-228	8.779E-21	0.1542	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-228	4.774E-20	0.8386	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-230	5.408E-26	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	3.677E-22	0.0065	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	5.693E-20	1.0000	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 = 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.
Ac-227	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
Pa-231	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
Pb-210	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
Ra-226	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	4.188E-23	0.0007
Ra-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	8.779E-21	0.1542
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	4.774E-20	0.8386
Th-230	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	5.408E-26	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	3.677E-22	0.0065
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	5.693E-20	1.0000

*Sum of all water independent and dependent pathways.

**Phase II Final Status Survey Report Mallinckrodt
Columbium-Tantalum Plant, Chapter 26**

**CS-RS-RP-009-26
Revision 0**

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Summary : SU20 Elevated Area #3 In Situ

File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA3 IN SITU.RAD

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.
Ac-227	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
Pa-231	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
Pb-210	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
Ra-226	4.180E-23	0.0007	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
Ra-228	2.142E-20	0.3740	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-228	3.354E-20	0.5857	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-230	1.629E-25	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	2.266E-21	0.0396	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	5.727E-20	1.0000	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+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.
Ac-227	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
Pa-231	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
Pb-210	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
Ra-226	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	4.180E-23	0.0007
Ra-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	2.142E-20	0.3740
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	3.354E-20	0.5857
Th-230	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	1.629E-25	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	2.266E-21	0.0396
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	5.727E-20	1.0000

*Sum of all water independent and dependent pathways.

**Phase II Final Status Survey Report Mallinckrodt
Columbium-Tantalum Plant, Chapter 26**

**CS-RS-RP-009-26
Revision 0**

RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 11:56 Page 16
Summary : SU20 Elevated Area #3 In Situ
File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA3 IN SITU.RAD

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.
Ac-227	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
Pa-231	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
Pb-210	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
Ra-226	4.164E-23	0.0007	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
Ra-228	3.194E-20	0.5541	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-228	1.656E-20	0.2873	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-230	3.837E-25	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	9.098E-21	0.1578	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	5.765E-20	1.0000	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 = 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.
Ac-227	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
Pa-231	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
Pb-210	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
Ra-226	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	4.164E-23	0.0007
Ra-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	3.194E-20	0.5541
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	1.656E-20	0.2873
Th-230	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	3.837E-25	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	9.098E-21	0.1578
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	5.765E-20	1.0000

*Sum of all water independent and dependent pathways.

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Columbium-Tantalum Plant, Chapter 26**

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Summary : SU20 Elevated Area #3 In Situ

File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA3 IN SITU.RAD

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.
Ac-227	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
Pa-231	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
Pb-210	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
Ra-226	4.111E-23	0.0007	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
Ra-228	2.223E-20	0.3774	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-228	1.401E-21	0.0238	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-230	1.190E-24	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	3.523E-20	0.5981	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	5.890E-20	1.0000	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+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.
Ac-227	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
Pa-231	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
Pb-210	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
Ra-226	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	4.111E-23	0.0007
Ra-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	2.223E-20	0.3774
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	1.401E-21	0.0238
Th-230	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	1.190E-24	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	3.523E-20	0.5981
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	5.890E-20	1.0000

*Sum of all water independent and dependent pathways.

**Phase II Final Status Survey Report Mallinckrodt
Columbium-Tantalum Plant, Chapter 26**

**CS-RS-RP-009-26
Revision 0**

RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 11:56 Page 18

Summary : SU20 Elevated Area #3 In Situ

File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA3 IN SITU.RAD

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.
Ac-227	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
Pa-231	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
Pb-210	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
Ra-226	3.962E-23	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	0.000E+00	0.0000
Ra-228	2.055E-21	0.0300	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-228	1.206E-24	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-230	3.820E-24	0.0001	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	6.652E-20	0.9694	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	6.862E-20	1.0000	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 = 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.
Ac-227	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
Pa-231	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
Pb-210	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
Ra-226	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	3.962E-23	0.0006
Ra-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	2.055E-21	0.0300
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	1.206E-24	0.0000
Th-230	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	3.820E-24	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	6.652E-20	0.9694
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	6.862E-20	1.0000

*Sum of all water independent and dependent pathways.

**Phase II Final Status Survey Report Mallinckrodt
Columbium-Tantalum Plant, Chapter 26**

**CS-RS-RP-009-26
Revision 0**

RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 11:56 Page 19

Summary : SU20 Elevated Area #3 In Situ

File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA3 IN SITU.RAD

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.
Ac-227	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
Pa-231	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
Pb-210	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
Ra-226	3.483E-23	0.0003	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
Ra-228	3.556E-25	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-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-230	1.864E-23	0.0001	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	1.324E-19	0.9996	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	1.899E-29	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	1.324E-19	1.0000	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+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.
Ac-227	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
Pa-231	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
Pb-210	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
Ra-226	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	3.483E-23	0.0003
Ra-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	3.556E-25	0.0000
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-230	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	1.864E-23	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	1.324E-19	0.9996
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	1.899E-29	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	1.324E-19	1.0000

*Sum of all water independent and dependent pathways.

**Phase II Final Status Survey Report Mallinckrodt
Columbium-Tantalum Plant, Chapter 26**

**CS-RS-RP-009-26
Revision 0**

RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 11:56 Page 20
Summary : SU20 Elevated Area #3 In Situ
File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA3 IN SITU.RAD

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.
Ac-227	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
Pa-231	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
Pb-210	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
Ra-226	2.409E-23	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
Ra-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-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-230	2.360E-22	0.0003	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	8.735E-19	0.9997	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	3.751E-28	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	8.738E-19	1.0000	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 = 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.
Ac-227	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
Pa-231	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
Pb-210	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
Ra-226	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	2.409E-23	0.0000
Ra-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-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-230	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	2.360E-22	0.0003
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	8.735E-19	0.9997
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	3.751E-28	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	8.738E-19	1.0000

*Sum of all water independent and dependent pathways.

**Phase II Final Status Survey Report Mallinckrodt
Columbium-Tantalum Plant, Chapter 26**

**CS-RS-RP-009-26
Revision 0**

RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 11:56 Page 21
Summary : SU20 Elevated Area #3 In Situ
File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA3 IN SITU.RAD

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.
Ac-227	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
Pa-231	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
Pb-210	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
Ra-226	6.627E-24	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
Ra-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-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-230	6.228E-19	0.0010	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	6.451E-16	0.9990	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	1.034E-24	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	1.658E-28	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	6.457E-16	1.0000	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.
Ac-227	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
Pa-231	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
Pb-210	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
Ra-226	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	6.627E-24	0.0000
Ra-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-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-230	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	6.228E-19	0.0010
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	6.451E-16	0.9990
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	1.034E-24	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	1.658E-28	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	6.457E-16	1.0000

*Sum of all water independent and dependent pathways.

**Phase II Final Status Survey Report Mallinckrodt
Columbium-Tantalum Plant, Chapter 26**

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Revision 0**

RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 11:56 Page 22

Summary : SU20 Elevated Area #3 In Situ

File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA3 IN SITU.RAD

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

Parent (i)	Product (j)	Thread Fraction	DSR(j,t) At Time in Years (mrem/yr)/(pCi/g)							
			0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Ac-227+D	Ac-227+D	1.000E+00	1.583E-33	1.489E-33	1.317E-33	8.564E-34	2.506E-34	3.397E-36	1.565E-41	0.000E+00
Pa-231	Pa-231	1.000E+00	5.250E-40	5.248E-40	5.245E-40	5.233E-40	5.199E-40	5.083E-40	4.763E-40	3.796E-40
Pa-231	Ac-227+D	1.000E+00	2.543E-35	7.414E-35	1.625E-34	3.943E-34	6.702E-34	6.369E-34	3.271E-34	3.165E-35
Pa-231	ΣDSR(j)		2.543E-35	7.414E-35	1.625E-34	3.943E-34	6.702E-34	6.369E-34	3.271E-34	3.165E-35
Pb-210+D	Pb-210+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pb-210+D	Po-210	1.000E+00	1.123E-35	1.861E-35	1.894E-35	1.576E-35	9.287E-36	1.458E-36	7.345E-39	0.000E+00
Pb-210+D	ΣDSR(j)		1.123E-35	1.861E-35	1.894E-35	1.576E-35	9.287E-36	1.458E-36	7.345E-39	0.000E+00
Ra-226+D	Ra-226+D	1.000E+00	1.913E-25	1.909E-25	1.902E-25	1.878E-25	1.810E-25	1.591E-25	1.100E-25	3.027E-26
Ra-226+D	Pb-210+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.784E-44
Ra-226+D	Po-210	1.000E+00	1.327E-37	6.335E-37	1.823E-36	5.601E-36	1.329E-35	2.304E-35	2.682E-35	3.565E-35
Ra-226+D	ΣDSR(j)		1.913E-25	1.909E-25	1.902E-25	1.878E-25	1.810E-25	1.591E-25	1.100E-25	3.027E-26
Ra-228+D	Ra-228+D	1.000E+00	3.574E-28	3.168E-28	2.488E-28	1.068E-28	9.547E-30	2.036E-33	6.586E-44	0.000E+00
Ra-228+D	Th-228+D	1.000E+00	1.473E-22	3.593E-22	5.360E-22	3.730E-22	3.448E-23	5.966E-27	1.062E-37	0.000E+00
Ra-228+D	ΣDSR(j)		1.473E-22	3.593E-22	5.360E-22	3.730E-22	3.448E-23	5.966E-27	1.062E-37	0.000E+00
Th-228+D	Th-228+D	1.000E+00	8.010E-22	5.628E-22	2.779E-22	2.350E-23	2.023E-26	3.786E-37	0.000E+00	0.000E+00
Th-230	Th-230	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-230	Ra-226+D	1.000E+00	4.160E-29	1.253E-28	2.952E-28	9.156E-28	2.938E-27	1.434E-26	1.815E-25	4.791E-22
Th-230	Pb-210+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.090E-40
Th-230	Po-210	1.000E+00	1.559E-41	1.748E-40	1.256E-39	1.327E-38	1.129E-37	1.235E-36	2.927E-35	3.770E-31
Th-230	ΣDSR(j)		4.160E-29	1.253E-28	2.952E-28	9.156E-28	2.938E-27	1.434E-26	1.815E-25	4.791E-22
Th-232	Th-232	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Ra-228+D	1.000E+00	2.207E-29	6.319E-29	1.335E-28	2.946E-28	4.932E-28	1.198E-27	1.441E-26	8.691E-23
Th-232	Th-228+D	1.000E+00	6.170E-24	3.802E-23	1.527E-22	5.911E-22	1.116E-21	2.221E-21	1.466E-20	1.082E-17
Th-232	ΣDSR(j)		6.170E-24	3.802E-23	1.527E-22	5.911E-22	1.116E-21	2.221E-21	1.466E-20	1.082E-17
U-234	U-234	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-234	Th-230	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-234	Ra-226+D	1.000E+00	1.245E-34	8.725E-34	4.621E-33	4.165E-32	3.602E-31	4.478E-30	8.847E-29	2.439E-25
U-234	Pb-210+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.074E-43
U-234	Po-210	1.000E+00	0.000E+00	0.000E+00	1.121E-44	3.994E-43	1.004E-41	3.300E-40	1.401E-38	1.919E-34
U-234	ΣDSR(j)		1.245E-34	8.725E-34	4.621E-33	4.165E-32	3.602E-31	4.478E-30	8.847E-29	2.439E-25
U-235+D	U-235+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.204E-45
U-235+D	Pa-231	1.000E+00	5.605E-45	1.682E-44	3.924E-44	1.163E-43	3.363E-43	1.082E-42	3.038E-42	8.121E-42
U-235+D	Ac-227+D	1.000E+00	1.802E-40	1.237E-39	6.263E-39	4.825E-38	2.771E-37	1.127E-36	1.967E-36	6.654E-37
U-235+D	ΣDSR(j)		1.802E-40	1.237E-39	6.263E-39	4.825E-38	2.771E-37	1.127E-36	1.967E-36	6.654E-37
U-238	U-238	5.400E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

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Summary : SU20 Elevated Area #3 In Situ
File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA3 IN SITU.RAD

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

Parent (i)	Product (j)	Thread Fraction	DSR(j,t) At Time in Years (mrem/yr)/(pCi/g)							
			0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-238+D	U-238+D	9.999E-01	8.373E-32	8.336E-32	8.263E-32	8.012E-32	7.335E-32	5.388E-32	2.233E-32	1.036E-33
U-238+D	U-234	9.999E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238+D	Th-230	9.999E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238+D	Ra-226+D	9.999E-01	8.813E-41	1.321E-39	1.539E-38	4.058E-37	9.795E-36	3.469E-34	1.288E-32	3.911E-29
U-238+D	Pb-210+D	9.999E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238+D	Po-210	9.999E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.242E-44	1.977E-42	3.077E-38
U-238+D	ΣDSR(j)		8.373E-32	8.336E-32	8.263E-32	8.012E-32	7.336E-32	5.422E-32	3.521E-32	3.911E-29

The DSR includes contributions from associated (half-life ≤ 30 days) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 2.500E+01 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
Ac-227	*7.232E+13	*7.232E+13	*7.232E+13	*7.232E+13	*7.232E+13	*7.232E+13	*7.232E+13	*7.232E+13
Pa-231	*4.723E+10	*4.723E+10	*4.723E+10	*4.723E+10	*4.723E+10	*4.723E+10	*4.723E+10	*4.723E+10
Pb-210	*7.634E+13	*7.634E+13	*7.634E+13	*7.634E+13	*7.634E+13	*7.634E+13	*7.634E+13	*7.634E+13
Ra-226	*9.885E+11	*9.885E+11	*9.885E+11	*9.885E+11	*9.885E+11	*9.885E+11	*9.885E+11	*9.885E+11
Ra-228	*2.726E+14	*2.726E+14	*2.726E+14	*2.726E+14	*2.726E+14	*2.726E+14	*2.726E+14	*2.726E+14
Th-228	*8.195E+14	*8.195E+14	*8.195E+14	*8.195E+14	*8.195E+14	*8.195E+14	*8.195E+14	*8.195E+14
Th-230	*2.018E+10	*2.018E+10	*2.018E+10	*2.018E+10	*2.018E+10	*2.018E+10	*2.018E+10	*2.018E+10
Th-232	*1.097E+05	*1.097E+05	*1.097E+05	*1.097E+05	*1.097E+05	*1.097E+05	*1.097E+05	*1.097E+05
U-234	*6.247E+09	*6.247E+09	*6.247E+09	*6.247E+09	*6.247E+09	*6.247E+09	*6.247E+09	*6.247E+09
U-235	*2.161E+06	*2.161E+06	*2.161E+06	*2.161E+06	*2.161E+06	*2.161E+06	*2.161E+06	*2.161E+06
U-238	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05

*At specific activity limit

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Columbium-Tantalum Plant, Chapter 26**

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Revision 0**

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Summary : SU20 Elevated Area #3 In Situ

File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA3 IN SITU.RAD

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 = 1.000E+03 years

Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
Ac-227	1.900E-01	0.000E+00	0.000E+00	*7.232E+13	0.000E+00	*7.232E+13
Pa-231	1.900E-01	0.000E+00	0.000E+00	*4.723E+10	0.000E+00	*4.723E+10
Pb-210	2.189E+02	0.000E+00	0.000E+00	*7.634E+13	0.000E+00	*7.634E+13
Ra-226	2.189E+02	0.000E+00	1.913E-25	*9.885E+11	3.027E-26	*9.885E+11
Ra-228	5.960E+01	4.096 ± 0.008	5.532E-22	*2.726E+14	0.000E+00	*2.726E+14
Th-228	5.960E+01	0.000E+00	8.010E-22	*8.195E+14	0.000E+00	*8.195E+14
Th-230	1.300E+03	1.000E+03	4.791E-22	*2.018E+10	4.791E-22	*2.018E+10
Th-232	5.960E+01	1.000E+03	1.082E-17	*1.097E+05	1.082E-17	*1.097E+05
U-234	4.240E+00	1.000E+03	2.439E-25	*6.247E+09	2.439E-25	*6.247E+09
U-235	1.900E-01	0.000E+00	0.000E+00	*2.161E+06	0.000E+00	*2.161E+06
U-238	4.240E+00	1.000E+03	3.911E-29	*3.361E+05	3.911E-29	*3.361E+05

*At specific activity limit

**Phase II Final Status Survey Report Mallinckrodt
Columbium-Tantalum Plant, Chapter 26**

**CS-RS-RP-009-26
Revision 0**

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Summary : SU20 Elevated Area #3 In Situ

File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA3 IN SITU.RAD

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

Nuclide (j)	Parent (i)	THF (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				
Ac-227	Ac-227	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Ac-227	Pa-231	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Ac-227	U-235	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Ac-227	ΣDOSE(j)		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pa-231	Pa-231	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pa-231	U-235	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pa-231	ΣDOSE(j)		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pb-210	Pb-210	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pb-210	Ra-226	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pb-210	Th-230	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pb-210	U-234	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pb-210	U-238	9.999E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pb-210	ΣDOSE(j)		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Po-210	Pb-210	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Po-210	Ra-226	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Po-210	Th-230	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Po-210	U-234	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Po-210	U-238	9.999E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Po-210	ΣDOSE(j)		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Ra-226	Ra-226	1.000E+00	4.188E-23	4.180E-23	4.164E-23	4.111E-23	3.962E-23	3.483E-23	2.409E-23	6.627E-24				
Ra-226	Th-230	1.000E+00	5.408E-26	1.629E-25	3.837E-25	1.190E-24	3.820E-24	1.864E-23	2.360E-22	6.228E-19				
Ra-226	U-234	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.899E-29	3.751E-28	1.034E-24			
Ra-226	U-238	9.999E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.658E-28			
Ra-226	ΣDOSE(j)		4.193E-23	4.196E-23	4.203E-23	4.230E-23	4.344E-23	5.347E-23	2.601E-22	6.228E-19				
Ra-228	Ra-228	1.000E+00	2.130E-26	1.888E-26	1.483E-26	6.368E-27	5.690E-28	0.000E+00	0.000E+00	0.000E+00				
Ra-228	Th-232	1.000E+00	1.315E-27	3.766E-27	7.957E-27	1.756E-26	2.939E-26	7.142E-26	8.589E-25	5.180E-21				
Ra-228	ΣDOSE(j)		2.262E-26	2.265E-26	2.279E-26	2.393E-26	2.996E-26	7.142E-26	8.589E-25	5.180E-21				
Th-228	Ra-228	1.000E+00	8.779E-21	2.142E-20	3.194E-20	2.223E-20	2.055E-21	3.556E-25	0.000E+00	0.000E+00				
Th-228	Th-228	1.000E+00	4.774E-20	3.354E-20	1.656E-20	1.401E-21	1.206E-24	0.000E+00	0.000E+00	0.000E+00				
Th-228	Th-232	1.000E+00	3.677E-22	2.266E-21	9.098E-21	3.523E-20	6.652E-20	1.324E-19	8.735E-19	6.451E-16				
Th-228	ΣDOSE(j)		5.689E-20	5.723E-20	5.760E-20	5.886E-20	6.857E-20	1.324E-19	8.735E-19	6.451E-16				
Th-230	Th-230	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00				
Th-230	U-234	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00				
Th-230	U-238	9.999E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00				
Th-230	ΣDOSE(j)		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00				
Th-232	Th-232	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00				
U-234	U-234	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00				
U-234	U-238	9.999E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00				
U-234	ΣDOSE(j)		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00				
U-235	U-235	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00				

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Columbium-Tantalum Plant, Chapter 26**

**CS-RS-RP-009-26
Revision 0**

RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 11:56 Page 26
Summary : SU20 Elevated Area #3 In Situ
File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA3 IN SITU.RAD

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

Nuclide (j)	Parent (i)	THF(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		
U-238	U-238	5.400E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238	U-238	9.999E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238	∑DOSE(j)		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

THF(i) is the thread fraction of the parent nuclide.

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Columbium-Tantalum Plant, Chapter 26**

**CS-RS-RP-009-26
Revision 0**

RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 11:56 Page 27

Summary : SU20 Elevated Area #3 In Situ

File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA3 IN SITU.RAD

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF (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
Ac-227	Ac-227	1.000E+00	1.900E-01	1.761E-01	1.513E-01	8.902E-02	1.954E-02	9.684E-05	2.516E-11	2.249E-34
Ac-227	Pa-231	1.000E+00	0.000E+00	5.773E-03	1.579E-02	3.843E-02	5.047E-02	1.764E-02	5.108E-04	2.089E-09
Ac-227	U-235	1.000E+00	0.000E+00	6.167E-08	5.157E-07	4.457E-06	2.046E-05	3.104E-05	3.065E-06	4.389E-11
Ac-227	ΣS(j):		1.900E-01	1.819E-01	1.671E-01	1.275E-01	7.003E-02	1.777E-02	5.139E-04	2.133E-09
Pa-231	Pa-231	1.000E+00	1.900E-01	1.867E-01	1.802E-01	1.591E-01	1.116E-01	3.228E-02	9.321E-04	3.812E-09
Pa-231	U-235	1.000E+00	0.000E+00	3.950E-06	1.144E-05	3.367E-05	7.089E-05	6.838E-05	5.935E-06	8.151E-11
Pa-231	ΣS(j):		1.900E-01	1.867E-01	1.802E-01	1.592E-01	1.117E-01	3.235E-02	9.380E-04	3.893E-09
Pb-210	Pb-210	1.000E+00	2.189E+02	2.103E+02	1.942E+02	1.468E+02	6.603E+01	4.029E+00	1.364E-03	9.748E-16
Pb-210	Ra-226	1.000E+00	0.000E+00	6.627E+00	1.886E+01	5.235E+01	9.463E+01	6.374E+01	4.985E+00	5.215E-04
Pb-210	Th-230	1.000E+00	0.000E+00	8.599E-03	7.473E-02	7.359E-01	4.775E+00	2.030E+01	3.232E+01	3.275E+01
Pb-210	U-234	1.000E+00	0.000E+00	8.416E-11	2.194E-09	7.192E-08	1.385E-06	1.769E-05	5.045E-05	5.439E-05
Pb-210	U-238	9.999E-01	0.000E+00	5.964E-17	4.664E-15	5.093E-13	2.927E-11	1.178E-09	7.120E-09	8.720E-09
Pb-210	ΣS(j):		2.189E+02	2.170E+02	2.131E+02	1.999E+02	1.654E+02	8.807E+01	3.731E+01	3.275E+01
Po-210	Pb-210	1.000E+00	0.000E+00	1.737E+02	1.886E+02	1.431E+02	6.437E+01	3.927E+00	1.330E-03	9.503E-16
Po-210	Ra-226	1.000E+00	0.000E+00	3.533E+00	1.504E+01	4.798E+01	8.991E+01	6.120E+01	4.791E+00	5.012E-04
Po-210	Th-230	1.000E+00	0.000E+00	3.466E-03	5.114E-02	6.380E-01	4.438E+00	1.930E+01	3.085E+01	3.127E+01
Po-210	U-234	1.000E+00	0.000E+00	2.749E-11	1.323E-09	5.942E-08	1.266E-06	1.674E-05	4.813E-05	5.192E-05
Po-210	U-238	9.999E-01	0.000E+00	1.642E-17	2.518E-15	4.020E-13	2.631E-11	1.110E-09	6.788E-09	8.324E-09
Po-210	ΣS(j):		0.000E+00	1.772E+02	2.037E+02	1.917E+02	1.587E+02	8.442E+01	3.564E+01	3.127E+01
Ra-226	Ra-226	1.000E+00	2.189E+02	2.161E+02	2.105E+02	1.921E+02	1.478E+02	5.911E+01	4.309E+00	4.506E-04
Ra-226	Th-230	1.000E+00	0.000E+00	5.595E-01	1.657E+00	5.278E+00	1.397E+01	3.135E+01	4.194E+01	4.208E+01
Ra-226	U-234	1.000E+00	0.000E+00	8.183E-09	7.215E-08	7.466E-07	5.502E-06	3.183E-05	6.664E-05	6.986E-05
Ra-226	U-238	9.999E-01	0.000E+00	7.718E-15	2.034E-13	6.923E-12	1.473E-10	2.457E-09	9.698E-09	1.120E-08
Ra-226	ΣS(j):		2.189E+02	2.166E+02	2.121E+02	1.973E+02	1.618E+02	9.046E+01	4.624E+01	4.208E+01
Ra-228	Ra-228	1.000E+00	5.960E+01	5.217E+01	3.997E+01	1.573E+01	1.096E+00	9.775E-05	2.629E-16	0.000E+00
Ra-228	Th-232	1.000E+00	0.000E+00	6.727E+00	1.777E+01	3.970E+01	5.293E+01	5.386E+01	5.370E+01	5.315E+01
Ra-228	ΣS(j):		5.960E+01	5.889E+01	5.773E+01	5.543E+01	5.402E+01	5.386E+01	5.370E+01	5.315E+01
Th-228	Ra-228	1.000E+00	0.000E+00	1.689E+01	3.142E+01	2.236E+01	1.731E+00	1.546E-04	4.158E-16	0.000E+00
Th-228	Th-228	1.000E+00	5.960E+01	4.148E+01	2.010E+01	1.591E+00	1.134E-03	1.095E-14	0.000E+00	0.000E+00
Th-228	Th-232	1.000E+00	0.000E+00	1.106E+00	7.315E+00	3.226E+01	5.235E+01	5.386E+01	5.370E+01	5.315E+01
Th-228	ΣS(j):		5.960E+01	5.948E+01	5.883E+01	5.621E+01	5.408E+01	5.386E+01	5.370E+01	5.315E+01
Th-230	Th-230	1.000E+00	1.300E+03	1.300E+03	1.300E+03	1.300E+03	1.299E+03	1.297E+03	1.291E+03	1.269E+03
Th-230	U-234	1.000E+00	0.000E+00	3.783E-05	1.115E-04	3.498E-04	8.880E-04	1.786E-03	2.133E-03	2.108E-03
Th-230	U-238	9.999E-01	0.000E+00	5.346E-11	4.700E-10	4.811E-09	3.444E-08	1.822E-07	3.329E-07	3.380E-07
Th-230	ΣS(j):		1.300E+03	1.300E+03	1.300E+03	1.300E+03	1.299E+03	1.297E+03	1.291E+03	1.269E+03
Th-232	Th-232	1.000E+00	5.960E+01	5.960E+01	5.960E+01	5.959E+01	5.957E+01	5.951E+01	5.934E+01	5.872E+01
U-234	U-234	1.000E+00	4.240E+00	4.166E+00	4.021E+00	3.552E+00	2.493E+00	7.218E-01	2.092E-02	8.664E-08
U-234	U-238	9.999E-01	0.000E+00	1.181E-05	3.419E-05	1.007E-04	2.120E-04	2.046E-04	1.779E-05	2.459E-10
U-234	ΣS(j):		4.240E+00	4.166E+00	4.021E+00	3.552E+00	2.493E+00	7.220E-01	2.093E-02	8.688E-08
U-235	U-235	1.000E+00	1.900E-01	1.867E-01	1.802E-01	1.592E-01	1.117E-01	3.235E-02	9.380E-04	3.893E-09

**Phase II Final Status Survey Report Mallinckrodt
Columbium-Tantalum Plant, Chapter 26**

**CS-RS-RP-009-26
Revision 0**

RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 11:56 Page 28
Summary : SU20 Elevated Area #3 In Situ
File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA3 IN SITU.RAD

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(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
U-238	U-238	5.400E-05	2.290E-04	2.249E-04	2.171E-04	1.918E-04	1.346E-04	3.899E-05	1.130E-06	4.692E-12
U-238	U-238	9.999E-01	4.240E+00	4.165E+00	4.020E+00	3.552E+00	2.493E+00	7.219E-01	2.093E-02	8.688E-08
U-238	ΣS(j):		4.240E+00	4.166E+00	4.021E+00	3.552E+00	2.493E+00	7.220E-01	2.093E-02	8.688E-08

THF(i) is the thread fraction of the parent nuclide.

RESCALC.EXE execution time = 2.26 seconds

APPENDIX C

RESRAD v6.5 Summary Report for Elevated Area #2 Excavation Scenario Model

RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 12:17 Page 1
Summary : SU20 Elevated Area #2 Excavation
File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA2 EXCAVATION.RAD

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Summary : SU20 Elevated Area #2 Excavation

File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA2 EXCAVATION.RAD

Dose Conversion Factor (and Related) Parameter Summary
Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
A-1	DCF's for external ground radiation, (mrem/yr)/(pCi/g)			
A-1	Ac-227 (Source: FGR 12)	4.951E-04	4.951E-04	DCF1(1)
A-1	Ac-228 (Source: FGR 12)	5.978E+00	5.978E+00	DCF1(2)
A-1	At-218 (Source: FGR 12)	5.847E-03	5.847E-03	DCF1(3)
A-1	Bi-210 (Source: FGR 12)	3.606E-03	3.606E-03	DCF1(4)
A-1	Bi-211 (Source: FGR 12)	2.559E-01	2.559E-01	DCF1(5)
A-1	Bi-212 (Source: FGR 12)	1.171E+00	1.171E+00	DCF1(6)
A-1	Bi-214 (Source: FGR 12)	9.808E+00	9.808E+00	DCF1(7)
A-1	Fr-223 (Source: FGR 12)	1.980E-01	1.980E-01	DCF1(8)
A-1	Pa-231 (Source: FGR 12)	1.906E-01	1.906E-01	DCF1(9)
A-1	Pa-234 (Source: FGR 12)	1.155E+01	1.155E+01	DCF1(10)
A-1	Pa-234m (Source: FGR 12)	8.967E-02	8.967E-02	DCF1(11)
A-1	Pb-210 (Source: FGR 12)	2.447E-03	2.447E-03	DCF1(12)
A-1	Pb-211 (Source: FGR 12)	3.064E-01	3.064E-01	DCF1(13)
A-1	Pb-212 (Source: FGR 12)	7.043E-01	7.043E-01	DCF1(14)
A-1	Pb-214 (Source: FGR 12)	1.341E+00	1.341E+00	DCF1(15)
A-1	Po-210 (Source: FGR 12)	5.231E-05	5.231E-05	DCF1(16)
A-1	Po-211 (Source: FGR 12)	4.764E-02	4.764E-02	DCF1(17)
A-1	Po-212 (Source: FGR 12)	0.000E+00	0.000E+00	DCF1(18)
A-1	Po-214 (Source: FGR 12)	5.138E-04	5.138E-04	DCF1(19)
A-1	Po-215 (Source: FGR 12)	1.016E-03	1.016E-03	DCF1(20)
A-1	Po-216 (Source: FGR 12)	1.042E-04	1.042E-04	DCF1(21)
A-1	Po-218 (Source: FGR 12)	5.642E-05	5.642E-05	DCF1(22)
A-1	Ra-223 (Source: FGR 12)	6.034E-01	6.034E-01	DCF1(23)
A-1	Ra-224 (Source: FGR 12)	5.119E-02	5.119E-02	DCF1(24)
A-1	Ra-226 (Source: FGR 12)	3.176E-02	3.176E-02	DCF1(25)
A-1	Ra-228 (Source: FGR 12)	0.000E+00	0.000E+00	DCF1(26)
A-1	Rn-219 (Source: FGR 12)	3.083E-01	3.083E-01	DCF1(27)
A-1	Rn-220 (Source: FGR 12)	2.298E-03	2.298E-03	DCF1(28)
A-1	Rn-222 (Source: FGR 12)	2.354E-03	2.354E-03	DCF1(29)
A-1	Th-227 (Source: FGR 12)	5.212E-01	5.212E-01	DCF1(30)
A-1	Th-228 (Source: FGR 12)	7.940E-03	7.940E-03	DCF1(31)
A-1	Th-230 (Source: FGR 12)	1.209E-03	1.209E-03	DCF1(32)
A-1	Th-231 (Source: FGR 12)	3.643E-02	3.643E-02	DCF1(33)
A-1	Th-232 (Source: FGR 12)	5.212E-04	5.212E-04	DCF1(34)
A-1	Th-234 (Source: FGR 12)	2.410E-02	2.410E-02	DCF1(35)
A-1	Tl-207 (Source: FGR 12)	1.980E-02	1.980E-02	DCF1(36)
A-1	Tl-208 (Source: FGR 12)	2.298E+01	2.298E+01	DCF1(37)
A-1	Tl-210 (Source: no data)	0.000E+00	-2.000E+00	DCF1(38)
A-1	U-234 (Source: FGR 12)	4.017E-04	4.017E-04	DCF1(39)
A-1	U-235 (Source: FGR 12)	7.211E-01	7.211E-01	DCF1(40)
A-1	U-238 (Source: FGR 12)	1.031E-04	1.031E-04	DCF1(41)
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	6.724E+00	6.700E+00	DCF2(1)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(2)
B-1	Pb-210+D	1.380E-02	1.360E-02	DCF2(3)
B-1	Po-210	9.400E-03	9.400E-03	DCF2(4)
B-1	Ra-226+D	8.594E-03	8.580E-03	DCF2(5)
B-1	Ra-228+D	5.078E-03	4.770E-03	DCF2(6)

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Summary : SU20 Elevated Area #2 Excavation

File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA2 EXCAVATION.RAD

Dose Conversion Factor (and Related) Parameter Summary (continued)

Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
B-1	Th-228+D	3.454E-01	3.420E-01	DCF2(7)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(8)
B-1	Th-232	1.640E+00	1.640E+00	DCF2(9)
B-1	U-234	1.320E-01	1.320E-01	DCF2(10)
B-1	U-235+D	1.230E-01	1.230E-01	DCF2(11)
B-1	U-238	1.180E-01	1.180E-01	DCF2(12)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(13)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	1.480E-02	1.410E-02	DCF3(1)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(2)
D-1	Pb-210+D	5.376E-03	5.370E-03	DCF3(3)
D-1	Po-210	1.900E-03	1.900E-03	DCF3(4)
D-1	Ra-226+D	1.321E-03	1.320E-03	DCF3(5)
D-1	Ra-228+D	1.442E-03	1.440E-03	DCF3(6)
D-1	Th-228+D	8.086E-04	3.960E-04	DCF3(7)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(8)
D-1	Th-232	2.730E-03	2.730E-03	DCF3(9)
D-1	U-234	2.830E-04	2.830E-04	DCF3(10)
D-1	U-235+D	2.673E-04	2.660E-04	DCF3(11)
D-1	U-238	2.550E-04	2.550E-04	DCF3(12)
D-1	U-238+D	2.687E-04	2.550E-04	DCF3(13)
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	Po-210 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(4,1)
D-34	Po-210 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(4,2)
D-34	Po-210 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.400E-04	3.400E-04	RTF(4,3)
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(5,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(5,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(5,3)
D-34	Ra-228+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(6,1)
D-34	Ra-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(6,2)
D-34	Ra-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(6,3)
D-34				

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Summary : SU20 Elevated Area #2 Excavation

File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA2 EXCAVATION.RAD

Dose Conversion Factor (and Related) Parameter Summary (continued)

Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
D-34	Th-228+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(7,1)
D-34	Th-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(7,2)
D-34	Th-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(7,3)
D-34				
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(8,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(8,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(8,3)
D-34				
D-34	Th-232 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(9,1)
D-34	Th-232 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(9,2)
D-34	Th-232 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(9,3)
D-34				
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(10,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(10,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(10,3)
D-34				
D-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(11,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(11,2)
D-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(11,3)
D-34				
D-34	U-238 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(12,1)
D-34	U-238 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(12,2)
D-34	U-238 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(12,3)
D-34				
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(13,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(13,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(13,3)
D-5				
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-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	Po-210 , fish	1.000E+02	1.000E+02	BIOFAC(4,1)
D-5	Po-210 , crustacea and mollusks	2.000E+04	2.000E+04	BIOFAC(4,2)
D-5				
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(5,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(5,2)
D-5				
D-5	Ra-228+D , fish	5.000E+01	5.000E+01	BIOFAC(6,1)
D-5	Ra-228+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(6,2)
D-5				
D-5	Th-228+D , fish	1.000E+02	1.000E+02	BIOFAC(7,1)
D-5	Th-228+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(7,2)
D-5				

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Summary : SU20 Elevated Area #2 Excavation

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Dose Conversion Factor (and Related) Parameter Summary (continued)

Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(8,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(8,2)
D-5				
D-5	Th-232 , fish	1.000E+02	1.000E+02	BIOFAC(9,1)
D-5	Th-232 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(9,2)
D-5				
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(10,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(10,2)
D-5				
D-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC(11,1)
D-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(11,2)
D-5				
D-5	U-238 , fish	1.000E+01	1.000E+01	BIOFAC(12,1)
D-5	U-238 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(12,2)
D-5				
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(13,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(13,2)

#For DCF1(XXX) only, factors are for infinite depth & area. See ETFG table in Ground Pathway of Detailed Report.

*Base Case means Default.Lib w/o Associate Nuclide contributions.

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Summary : SU20 Elevated Area #2 Excavation
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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)	1.340E+01	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	3.000E-01	2.000E+00	---	THICK0
R011	Fraction of contamination that is submerged	0.000E+00	0.000E+00	---	SUBMFRACT
R011	Length parallel to aquifer flow (m)	not used	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	2.500E+01	3.000E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
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): Ac-227	1.910E+00	0.000E+00	---	S1(1)
R012	Initial principal radionuclide (pCi/g): Pa-231	1.910E+00	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g): Pb-210	5.094E+02	0.000E+00	---	S1(3)
R012	Initial principal radionuclide (pCi/g): Ra-226	5.094E+02	0.000E+00	---	S1(5)
R012	Initial principal radionuclide (pCi/g): Ra-228	2.272E+02	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g): Th-228	2.272E+02	0.000E+00	---	S1(7)
R012	Initial principal radionuclide (pCi/g): Th-230	3.100E+03	0.000E+00	---	S1(8)
R012	Initial principal radionuclide (pCi/g): Th-232	2.272E+02	0.000E+00	---	S1(9)
R012	Initial principal radionuclide (pCi/g): U-234	4.197E+01	0.000E+00	---	S1(10)
R012	Initial principal radionuclide (pCi/g): U-235	1.910E+00	0.000E+00	---	S1(11)
R012	Initial principal radionuclide (pCi/g): U-238	4.197E+01	0.000E+00	---	S1(12)
R012	Concentration in groundwater (pCi/L): Ac-227	not used	0.000E+00	---	W1(1)
R012	Concentration in groundwater (pCi/L): Pa-231	not used	0.000E+00	---	W1(2)
R012	Concentration in groundwater (pCi/L): Pb-210	not used	0.000E+00	---	W1(3)
R012	Concentration in groundwater (pCi/L): Ra-226	not used	0.000E+00	---	W1(5)
R012	Concentration in groundwater (pCi/L): Ra-228	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L): Th-228	not used	0.000E+00	---	W1(7)
R012	Concentration in groundwater (pCi/L): Th-230	not used	0.000E+00	---	W1(8)
R012	Concentration in groundwater (pCi/L): Th-232	not used	0.000E+00	---	W1(9)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(10)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W1(11)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(12)
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
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)	1.500E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	---	FCCZ
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	Average annual wind speed (m/sec)	4.000E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID

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Summary : SU20 Elevated Area #2 Excavation

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Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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)	0.000E+00	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)	not used	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	not used	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	not used	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	not used	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	not used	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	not used	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	not used	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	not used	2.000E-02	---	HGWT
R014	Saturated zone b parameter	not used	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	not used	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	not used	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	not used	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	not used	2.500E+02	---	UW
R015	Number of unsaturated zone strata	not used	1	---	NS
R015	Unsat. zone 1, thickness (m)	not used	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	not used	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	not used	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	not used	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	not used	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	not used	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	not used	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(1)
R016	Unsat. zone 1 (cm**3/g)	not used	2.000E+01	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	not used	2.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.398E-02	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for Pa-231				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(2)
R016	Unsat. zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.770E-02	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(3)
R016	Unsat. zone 1 (cm**3/g)	not used	1.000E+02	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	not used	1.000E+02	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	8.870E-03	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)

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Summary : SU20 Elevated Area #2 Excavation

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Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	not used	7.000E+01	---	DCNUCU(5,1)
R016	Saturated zone (cm**3/g)	not used	7.000E+01	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.266E-02	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R016	Distribution coefficients for Ra-228				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	not used	7.000E+01	---	DCNUCU(6,1)
R016	Saturated zone (cm**3/g)	not used	7.000E+01	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.266E-02	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
R016	Distribution coefficients for Th-228				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(7)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(7,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.481E-05	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)
R016	Distribution coefficients for Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(8,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.481E-05	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
R016	Distribution coefficients for Th-232				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(9)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(9,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.481E-05	ALEACH(9)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(9)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(10)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(10,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(10)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.770E-02	ALEACH(10)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(10)
R016	Distribution coefficients for U-235				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(11)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(11,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(11)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.770E-02	ALEACH(11)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(11)

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R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(12)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(12,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(12)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.770E-02	ALEACH(12)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(12)
R016	Distribution coefficients for daughter Po-210				
R016	Contaminated zone (cm**3/g)	1.000E+01	1.000E+01	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	not used	1.000E+01	---	DCNUCU(4,1)
R016	Saturated zone (cm**3/g)	not used	1.000E+01	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	8.706E-02	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R017	Inhalation rate (m**3/yr)	1.227E+04	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	3.500E-05	1.000E-04	---	MLINH
R017	Exposure duration	3.000E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	6.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	1.700E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	0.000E+00	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	2.100E-04	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS
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)

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Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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)	3.650E+01	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	not used	1.000E+00	---	FHHW
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	---	FP LANT
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	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	not used	1.000E-04	---	MLFD
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	not used	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	not used	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	not used	7.000E-01	---	YV (1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	not used	1.500E+00	---	YV (2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	---	YV (3)
R19B	Growing Season for Non-Leafy (years)	not used	1.700E-01	---	TE (1)
R19B	Growing Season for Leafy (years)	not used	2.500E-01	---	TE (2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE (3)
R19B	Translocation Factor for Non-Leafy	not used	1.000E-01	---	TIV (1)
R19B	Translocation Factor for Leafy	not used	1.000E+00	---	TIV (2)
R19B	Translocation Factor for Fodder	not used	1.000E+00	---	TIV (3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RDRY (1)
R19B	Dry Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RDRY (2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RDRY (3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RWET (1)
R19B	Wet Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RWET (2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET (3)
R19B	Weathering Removal Constant for Vegetation	not used	2.000E+01	---	WLAM
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	---	C12CC
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL

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Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	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	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	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	not used	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	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	32	---	---	NPTS
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	1	---	---	KYMAX

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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	active
9 -- radon	suppressed
Find peak pathway doses	active

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Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	13.40 square meters	Ac-227	1.910E+00
Thickness:	0.30 meters	Pa-231	1.910E+00
Cover Depth:	0.00 meters	Pb-210	5.094E+02
		Ra-226	5.094E+02
		Ra-228	2.272E+02
		Th-228	2.272E+02
		Th-230	3.100E+03
		Th-232	2.272E+02
		U-234	4.197E+01
		U-235	1.910E+00
		U-238	4.197E+01

Total Dose TDOSE(t), mrem/yr

Basic Radiation Dose Limit = 2.500E+01 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):	9.214E-01	9.128E-01	8.951E-01	8.393E-01	7.287E-01	5.112E-01	0.000E+00	0.000E+00
M(t):	3.686E-02	3.651E-02	3.580E-02	3.357E-02	2.915E-02	2.045E-02	0.000E+00	0.000E+00

Maximum TDOSE(t): 9.214E-01 mrem/yr at t = 0.000E+00 years

**Phase II Final Status Survey Report Mallinckrodt
Columbium-Tantalum Plant, Chapter 26**

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RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 12:17 Page 14
Summary : SU20 Elevated Area #2 Excavation
File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA2 EXCAVATION.RAD

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.
Ac-227	3.991E-04	0.0004	5.009E-05	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.796E-06	0.0000
Pa-231	4.512E-05	0.0000	1.062E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.106E-06	0.0000
Pb-210	3.410E-04	0.0004	3.802E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.276E-04	0.0004
Ra-226	5.565E-01	0.6040	1.817E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.357E-05	0.0001
Ra-228	1.611E-01	0.1748	5.332E-05	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.442E-05	0.0000
Th-228	1.850E-01	0.2008	2.666E-04	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.583E-05	0.0000
Th-230	1.166E-03	0.0013	4.093E-03	0.0044	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.746E-04	0.0002
Th-232	9.265E-03	0.0101	1.512E-03	0.0016	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.578E-05	0.0001
U-234	1.984E-06	0.0000	2.224E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.209E-06	0.0000
U-235	1.598E-04	0.0002	9.432E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.201E-08	0.0000
U-238	6.533E-04	0.0007	1.989E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.148E-06	0.0000
Total	9.146E-01	0.9926	6.085E-03	0.0066	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.991E-04	0.0008

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.
Ac-227	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	4.520E-04	0.0005
Pa-231	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	5.784E-05	0.0001
Pb-210	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	7.066E-04	0.0008
Ra-226	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	5.566E-01	0.6041
Ra-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	1.612E-01	0.1749
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	1.853E-01	0.2011
Th-230	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	5.434E-03	0.0059
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	1.084E-02	0.0118
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	2.543E-05	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	1.608E-04	0.0002
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	6.744E-04	0.0007
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	9.214E-01	1.0000

*Sum of all water independent and dependent pathways.

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Columbium-Tantalum Plant, Chapter 26**

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RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 12:17 Page 15
Summary : SU20 Elevated Area #2 Excavation
File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA2 EXCAVATION.RAD

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.
Ac-227	3.699E-04	0.0004	4.643E-05	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.591E-06	0.0000
Pa-231	5.644E-05	0.0001	1.195E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.154E-06	0.0000
Pb-210	3.285E-04	0.0004	4.338E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.499E-04	0.0004
Ra-226	5.490E-01	0.6014	1.922E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.324E-05	0.0001
Ra-228	1.933E-01	0.2118	1.222E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.461E-05	0.0000
Th-228	1.287E-01	0.1410	1.856E-04	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.102E-05	0.0000
Th-230	2.622E-03	0.0029	4.093E-03	0.0045	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.748E-04	0.0002
Th-232	3.086E-02	0.0338	1.523E-03	0.0017	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.996E-05	0.0001
U-234	1.949E-06	0.0000	2.185E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.188E-06	0.0000
U-235	1.570E-04	0.0002	9.269E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.114E-08	0.0000
U-238	6.416E-04	0.0007	1.954E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.128E-06	0.0000
Total	9.060E-01	0.9925	6.087E-03	0.0067	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.306E-04	0.0008

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.
Ac-227	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	4.189E-04	0.0005
Pa-231	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	7.054E-05	0.0001
Pb-210	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	7.218E-04	0.0008
Ra-226	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	5.491E-01	0.6015
Ra-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	1.934E-01	0.2119
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	1.289E-01	0.1412
Th-230	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	6.890E-03	0.0075
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	3.245E-02	0.0356
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	2.499E-05	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	1.579E-04	0.0002
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	6.623E-04	0.0007
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	9.128E-01	1.0000

*Sum of all water independent and dependent pathways.

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Columbium-Tantalum Plant, Chapter 26**

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RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 12:17 Page 16

Summary : SU20 Elevated Area #2 Excavation

File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA2 EXCAVATION.RAD

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.
Ac-227	3.177E-04	0.0004	3.990E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.227E-06	0.0000
Pa-231	7.590E-05	0.0001	1.423E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.229E-06	0.0000
Pb-210	3.034E-04	0.0003	4.116E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.287E-04	0.0004
Ra-226	5.341E-01	0.5967	2.134E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.020E-04	0.0001
Ra-228	2.051E-01	0.2292	1.763E-04	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.143E-05	0.0000
Th-228	6.225E-02	0.0695	8.991E-05	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.339E-06	0.0000
Th-230	5.473E-03	0.0061	4.093E-03	0.0046	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.753E-04	0.0002
Th-232	7.984E-02	0.0892	1.560E-03	0.0017	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.798E-05	0.0001
U-234	1.882E-06	0.0000	2.109E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.147E-06	0.0000
U-235	1.515E-04	0.0002	8.952E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.945E-08	0.0000
U-238	6.189E-04	0.0007	1.886E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.089E-06	0.0000
Total	8.883E-01	0.9924	6.077E-03	0.0068	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.275E-04	0.0008

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.
Ac-227	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	3.598E-04	0.0004
Pa-231	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	9.235E-05	0.0001
Pb-210	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	6.733E-04	0.0008
Ra-226	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	5.343E-01	0.5969
Ra-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	2.053E-01	0.2294
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	6.234E-02	0.0696
Th-230	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	9.741E-03	0.0109
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	8.147E-02	0.0910
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	2.412E-05	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	1.524E-04	0.0002
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	6.388E-04	0.0007
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	8.951E-01	1.0000

*Sum of all water independent and dependent pathways.

**Phase II Final Status Survey Report Mallinckrodt
Columbium-Tantalum Plant, Chapter 26**

**CS-RS-RP-009-26
Revision 0**

RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 12:17 Page 17
Summary : SU20 Elevated Area #2 Excavation
File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA2 EXCAVATION.RAD

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.
Ac-227	1.865E-04	0.0002	2.347E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.310E-06	0.0000
Pa-231	1.182E-04	0.0001	1.902E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.329E-06	0.0000
Pb-210	2.292E-04	0.0003	3.114E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.486E-04	0.0003
Ra-226	4.853E-01	0.5782	2.692E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.526E-04	0.0002
Ra-228	1.111E-01	0.1324	1.141E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.502E-05	0.0000
Th-228	4.900E-03	0.0058	7.117E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.226E-07	0.0000
Th-230	1.483E-02	0.0177	4.093E-03	0.0049	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.776E-04	0.0002
Th-232	2.152E-01	0.2564	1.691E-03	0.0020	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.727E-05	0.0001
U-234	1.671E-06	0.0000	1.864E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.013E-06	0.0000
U-235	1.337E-04	0.0002	7.932E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.401E-08	0.0000
U-238	5.452E-04	0.0006	1.666E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.619E-07	0.0000
Total	8.326E-01	0.9920	6.042E-03	0.0072	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.972E-04	0.0008

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.
Ac-227	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	2.113E-04	0.0003
Pa-231	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	1.396E-04	0.0002
Pb-210	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	5.089E-04	0.0006
Ra-226	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	4.855E-01	0.5784
Ra-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	1.113E-01	0.1326
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	4.908E-03	0.0058
Th-230	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	1.910E-02	0.0228
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	2.170E-01	0.2586
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	2.132E-05	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	1.345E-04	0.0002
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	5.629E-04	0.0007
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	8.393E-01	1.0000

*Sum of all water independent and dependent pathways.

**Phase II Final Status Survey Report Mallinckrodt
Columbium-Tantalum Plant, Chapter 26**

**CS-RS-RP-009-26
Revision 0**

RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 12:17 Page 18
Summary : SU20 Elevated Area #2 Excavation
File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA2 EXCAVATION.RAD

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.
Ac-227	4.073E-05	0.0001	5.152E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.875E-07	0.0000
Pa-231	1.315E-04	0.0002	1.954E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.980E-06	0.0000
Pb-210	1.028E-04	0.0001	1.401E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.118E-04	0.0002
Ra-226	3.685E-01	0.5056	3.225E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.095E-04	0.0003
Ra-228	8.147E-03	0.0112	8.724E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.093E-06	0.0000
Th-228	3.433E-06	0.0000	5.072E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.011E-10	0.0000
Th-230	3.683E-02	0.0505	4.092E-03	0.0056	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.875E-04	0.0003
Th-232	3.079E-01	0.4226	1.793E-03	0.0025	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.102E-04	0.0002
U-234	1.227E-06	0.0000	1.309E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.114E-07	0.0000
U-235	9.354E-05	0.0001	5.639E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.167E-08	0.0000
U-238	3.794E-04	0.0005	1.169E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.751E-07	0.0000
Total	7.221E-01	0.9909	5.990E-03	0.0082	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.238E-04	0.0009

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.
Ac-227	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	4.617E-05	0.0001
Pa-231	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	1.530E-04	0.0002
Pb-210	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	2.286E-04	0.0003
Ra-226	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	3.687E-01	0.5059
Ra-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	8.156E-03	0.0112
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	3.438E-06	0.0000
Th-230	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	4.111E-02	0.0564
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	3.098E-01	0.4252
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	1.502E-05	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	9.413E-05	0.0001
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	3.918E-04	0.0005
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	7.287E-01	1.0000

*Sum of all water independent and dependent pathways.

**Phase II Final Status Survey Report Mallinckrodt
Columbium-Tantalum Plant, Chapter 26**

**CS-RS-RP-009-26
Revision 0**

RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 12:17 Page 19
Summary : SU20 Elevated Area #2 Excavation
File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA2 EXCAVATION.RAD

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.
Ac-227	1.958E-07	0.0000	2.553E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.425E-09	0.0000
Pa-231	4.302E-05	0.0001	6.454E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.174E-07	0.0000
Pb-210	6.187E-06	0.0000	8.545E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.822E-06	0.0000
Ra-226	1.373E-01	0.2686	1.839E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.276E-04	0.0002
Ra-228	6.718E-07	0.0000	7.789E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.751E-11	0.0000
Th-228	3.045E-17	0.0000	4.899E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.909E-21	0.0000
Th-230	7.571E-02	0.1481	4.090E-03	0.0080	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.201E-04	0.0004
Th-232	2.916E-01	0.5705	1.799E-03	0.0035	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.111E-04	0.0002
U-234	6.566E-07	0.0000	3.809E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.070E-07	0.0000
U-235	2.664E-05	0.0001	1.726E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.007E-08	0.0000
U-238	1.050E-04	0.0002	3.387E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.956E-07	0.0000
Total	5.048E-01	0.9875	5.922E-03	0.0116	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.667E-04	0.0009

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.
Ac-227	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	2.227E-07	0.0000
Pa-231	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	5.009E-05	0.0001
Pb-210	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	1.386E-05	0.0000
Ra-226	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	1.374E-01	0.2688
Ra-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	6.727E-07	0.0000
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	3.050E-17	0.0000
Th-230	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	8.002E-02	0.1565
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	2.935E-01	0.5742
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	4.673E-06	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	2.682E-05	0.0001
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	1.086E-04	0.0002
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	5.112E-01	1.0000

*Sum of all water independent and dependent pathways.

**Phase II Final Status Survey Report Mallinckrodt
Columbium-Tantalum Plant, Chapter 26**

**CS-RS-RP-009-26
Revision 0**

RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 12:17 Page 20
Summary : SU20 Elevated Area #2 Excavation
File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA2 EXCAVATION.RAD

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.
Ac-227	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
Pa-231	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
Pb-210	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
Ra-226	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
Ra-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-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-230	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 = 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.
Ac-227	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
Pa-231	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
Pb-210	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
Ra-226	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
Ra-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-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-230	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

*Sum of all water independent and dependent pathways.

**Phase II Final Status Survey Report Mallinckrodt
Columbium-Tantalum Plant, Chapter 26**

**CS-RS-RP-009-26
Revision 0**

RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 12:17 Page 21
Summary : SU20 Elevated Area #2 Excavation
File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA2 EXCAVATION.RAD

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.
Ac-227	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
Pa-231	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
Pb-210	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
Ra-226	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
Ra-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-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-230	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.
Ac-227	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
Pa-231	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
Pb-210	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
Ra-226	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
Ra-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-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-230	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

*Sum of all water independent and dependent pathways.

**Phase II Final Status Survey Report Mallinckrodt
Columbium-Tantalum Plant, Chapter 26**

**CS-RS-RP-009-26
Revision 0**

RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 12:17 Page 22
Summary : SU20 Elevated Area #2 Excavation
File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA2 EXCAVATION.RAD

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

Parent (i)	Product (j)	Thread Fraction	DSR(j,t) At Time in Years (mrem/yr)/(pCi/g)							
			0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Ac-227+D	Ac-227+D	1.000E+00	2.367E-04	2.193E-04	1.884E-04	1.106E-04	2.417E-05	1.166E-07	0.000E+00	0.000E+00
Pa-231	Pa-231	1.000E+00	2.649E-05	2.602E-05	2.510E-05	2.215E-05	1.547E-05	4.367E-06	0.000E+00	0.000E+00
Pa-231	Ac-227+D	1.000E+00	3.792E-06	1.091E-05	2.325E-05	5.093E-05	6.464E-05	2.186E-05	0.000E+00	0.000E+00
Pa-231	ΣDSR(j)		3.028E-05	3.693E-05	4.835E-05	7.307E-05	8.011E-05	2.623E-05	0.000E+00	0.000E+00
Pb-210+D	Pb-210+D	1.000E+00	1.263E-06	1.213E-06	1.120E-06	8.463E-07	3.801E-07	2.303E-08	0.000E+00	0.000E+00
Pb-210+D	Po-210	1.000E+00	1.245E-07	2.038E-07	2.018E-07	1.528E-07	6.872E-08	4.188E-09	0.000E+00	0.000E+00
Pb-210+D	ΣDSR(j)		1.387E-06	1.417E-06	1.322E-06	9.991E-07	4.488E-07	2.722E-08	0.000E+00	0.000E+00
Ra-226+D	Ra-226+D	1.000E+00	1.093E-03	1.078E-03	1.049E-03	9.527E-04	7.232E-04	2.694E-04	0.000E+00	0.000E+00
Ra-226+D	Pb-210+D	1.000E+00	1.967E-08	5.763E-08	1.277E-07	3.190E-07	5.580E-07	3.696E-07	0.000E+00	0.000E+00
Ra-226+D	Po-210	1.000E+00	1.468E-09	6.929E-09	1.942E-08	5.430E-08	9.834E-08	6.620E-08	0.000E+00	0.000E+00
Ra-226+D	ΣDSR(j)		1.093E-03	1.078E-03	1.049E-03	9.530E-04	7.238E-04	2.698E-04	0.000E+00	0.000E+00
Ra-228+D	Ra-228+D	1.000E+00	5.595E-04	4.895E-04	3.746E-04	1.469E-04	1.011E-05	8.459E-10	0.000E+00	0.000E+00
Ra-228+D	Th-228+D	1.000E+00	1.497E-04	3.618E-04	5.290E-04	3.427E-04	2.579E-05	2.115E-09	0.000E+00	0.000E+00
Ra-228+D	ΣDSR(j)		7.092E-04	8.513E-04	9.036E-04	4.896E-04	3.589E-05	2.960E-09	0.000E+00	0.000E+00
Th-228+D	Th-228+D	1.000E+00	8.154E-04	5.671E-04	2.743E-04	2.160E-05	1.513E-08	1.342E-19	0.000E+00	0.000E+00
Th-230	Th-230	1.000E+00	1.516E-06	1.516E-06	1.515E-06	1.515E-06	1.514E-06	1.511E-06	0.000E+00	0.000E+00
Th-230	Ra-226+D	1.000E+00	2.372E-07	7.070E-07	1.627E-06	4.645E-06	1.174E-05	2.428E-05	0.000E+00	0.000E+00
Th-230	Pb-210+D	1.000E+00	2.853E-12	1.967E-11	1.005E-10	7.970E-10	4.843E-09	2.002E-08	0.000E+00	0.000E+00
Th-230	Po-210	1.000E+00	1.724E-13	1.910E-12	1.337E-11	1.287E-10	8.351E-10	3.549E-09	0.000E+00	0.000E+00
Th-230	ΣDSR(j)		1.753E-06	2.223E-06	3.142E-06	6.161E-06	1.326E-05	2.581E-05	0.000E+00	0.000E+00
Th-232	Th-232	1.000E+00	6.984E-06	6.984E-06	6.984E-06	6.983E-06	6.981E-06	6.973E-06	0.000E+00	0.000E+00
Th-232	Ra-228+D	1.000E+00	3.447E-05	9.756E-05	2.009E-04	4.049E-04	5.221E-04	4.978E-04	0.000E+00	0.000E+00
Th-232	Th-228+D	1.000E+00	6.263E-06	3.826E-05	1.506E-04	5.431E-04	8.344E-04	7.870E-04	0.000E+00	0.000E+00
Th-232	ΣDSR(j)		4.772E-05	1.428E-04	3.585E-04	9.550E-04	1.363E-03	1.292E-03	0.000E+00	0.000E+00
U-234	U-234	1.000E+00	6.060E-07	5.953E-07	5.746E-07	5.076E-07	3.562E-07	1.031E-07	0.000E+00	0.000E+00
U-234	Th-230	1.000E+00	6.782E-12	2.019E-11	4.629E-11	1.307E-10	3.213E-10	6.391E-10	0.000E+00	0.000E+00
U-234	Ra-226+D	1.000E+00	7.093E-13	4.919E-12	2.546E-11	2.112E-10	1.439E-09	7.582E-09	0.000E+00	0.000E+00
U-234	Pb-210+D	1.000E+00	6.414E-18	9.478E-17	1.069E-15	2.511E-14	4.378E-13	5.368E-12	0.000E+00	0.000E+00
U-234	Po-210	1.000E+00	3.269E-19	7.851E-18	1.273E-16	3.871E-15	7.427E-14	9.479E-13	0.000E+00	0.000E+00
U-234	ΣDSR(j)		6.060E-07	5.954E-07	5.747E-07	5.080E-07	3.580E-07	1.113E-07	0.000E+00	0.000E+00
U-235+D	U-235+D	1.000E+00	8.418E-05	8.269E-05	7.979E-05	7.041E-05	4.925E-05	1.399E-05	0.000E+00	0.000E+00
U-235+D	Pa-231	1.000E+00	2.794E-10	8.250E-10	1.858E-09	4.920E-09	9.985E-09	9.296E-09	0.000E+00	0.000E+00
U-235+D	Ac-227+D	1.000E+00	2.683E-11	1.820E-10	8.954E-10	6.232E-09	2.672E-08	3.869E-08	0.000E+00	0.000E+00
U-235+D	ΣDSR(j)		8.418E-05	8.269E-05	7.979E-05	7.042E-05	4.928E-05	1.404E-05	0.000E+00	0.000E+00
U-238	U-238	5.400E-05	2.773E-11	2.724E-11	2.630E-11	2.323E-11	1.630E-11	4.722E-12	0.000E+00	0.000E+00

**Phase II Final Status Survey Report Mallinckrodt
Columbium-Tantalum Plant, Chapter 26**

**CS-RS-RP-009-26
Revision 0**

RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 12:17 Page 23
Summary : SU20 Elevated Area #2 Excavation
File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA2 EXCAVATION.RAD

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

Parent (i)	Product (j)	Thread Fraction	DSR(j,t) At Time in Years (mrem/yr)/(pCi/g)							
			0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-238+D	U-238+D	9.999E-01	1.607E-05	1.578E-05	1.522E-05	1.341E-05	9.335E-06	2.586E-06	0.000E+00	0.000E+00
U-238+D	U-234	9.999E-01	8.564E-13	2.529E-12	5.699E-12	1.511E-11	3.080E-11	2.938E-11	0.000E+00	0.000E+00
U-238+D	Th-230	9.999E-01	6.389E-18	4.428E-17	2.287E-16	1.886E-15	1.265E-14	6.540E-14	0.000E+00	0.000E+00
U-238+D	Ra-226+D	9.999E-01	5.017E-19	7.444E-18	8.475E-17	2.058E-15	3.913E-14	5.874E-13	0.000E+00	0.000E+00
U-238+D	Pb-210+D	9.999E-01	3.635E-24	1.110E-22	2.703E-21	1.871E-19	9.406E-18	3.593E-16	0.000E+00	0.000E+00
U-238+D	Po-210	9.999E-01	1.604E-25	8.077E-24	2.922E-22	2.761E-20	1.570E-18	6.315E-17	0.000E+00	0.000E+00
U-238+D	ΣDSR(j)		1.607E-05	1.578E-05	1.522E-05	1.341E-05	9.335E-06	2.586E-06	0.000E+00	0.000E+00

The DSR includes contributions from associated (half-life ≤ 30 days) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 2.500E+01 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
Ac-227	1.056E+05	1.140E+05	1.327E+05	2.260E+05	1.034E+06	2.144E+08	*7.232E+13	*7.232E+13
Pa-231	8.256E+05	6.769E+05	5.170E+05	3.421E+05	3.121E+05	9.532E+05	*4.723E+10	*4.723E+10
Pb-210	1.802E+07	1.764E+07	1.891E+07	2.502E+07	5.570E+07	9.185E+08	*7.634E+13	*7.634E+13
Ra-226	2.288E+04	2.319E+04	2.384E+04	2.623E+04	3.454E+04	9.266E+04	*9.885E+11	*9.885E+11
Ra-228	3.525E+04	2.937E+04	2.767E+04	5.106E+04	6.965E+05	8.445E+09	*2.726E+14	*2.726E+14
Th-228	3.066E+04	4.408E+04	9.113E+04	1.157E+06	1.652E+09	*8.195E+14	*8.195E+14	*8.195E+14
Th-230	1.426E+07	1.125E+07	7.956E+06	4.058E+06	1.885E+06	9.685E+05	*2.018E+10	*2.018E+10
Th-232	*1.097E+05	*1.097E+05	6.973E+04	2.618E+04	1.834E+04	1.935E+04	*1.097E+05	*1.097E+05
U-234	4.125E+07	4.199E+07	4.350E+07	4.921E+07	6.983E+07	2.245E+08	*6.247E+09	*6.247E+09
U-235	2.970E+05	3.023E+05	3.133E+05	3.550E+05	5.073E+05	1.781E+06	*2.161E+06	*2.161E+06
U-238	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05

*At specific activity limit

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RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 12:17 Page 24

Summary : SU20 Elevated Area #2 Excavation

File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA2 EXCAVATION.RAD

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)
Ac-227	1.910E+00	0.000E+00	2.367E-04	1.056E+05	2.367E-04	1.056E+05
Pa-231	1.910E+00	21.22 ± 0.04	8.348E-05	2.995E+05	3.028E-05	8.256E+05
Pb-210	5.094E+02	0.642 ± 0.001	1.423E-06	1.757E+07	1.387E-06	1.802E+07
Ra-226	5.094E+02	0.000E+00	1.093E-03	2.288E+04	1.093E-03	2.288E+04
Ra-228	2.272E+02	2.440 ± 0.005	9.099E-04	2.748E+04	7.092E-04	3.525E+04
Th-228	2.272E+02	0.000E+00	8.154E-04	3.066E+04	8.154E-04	3.066E+04
Th-230	3.100E+03	144.7 ± 0.3	2.758E-05	9.066E+05	1.753E-06	1.426E+07
Th-232	2.272E+02	39.47 ± 0.08	1.376E-03	1.817E+04	4.772E-05	*1.097E+05
U-234	4.197E+01	0.000E+00	6.060E-07	4.125E+07	6.060E-07	4.125E+07
U-235	1.910E+00	0.000E+00	8.418E-05	2.970E+05	8.418E-05	2.970E+05
U-238	4.197E+01	0.000E+00	1.607E-05	*3.361E+05	1.607E-05	*3.361E+05

*At specific activity limit

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RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 12:17 Page 25
Summary : SU20 Elevated Area #2 Excavation
File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA2 EXCAVATION.RAD

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

Nuclide (j)	Parent (i)	THF (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						
Ac-227	Ac-227	1.000E+00	4.520E-04	4.189E-04	3.598E-04	2.113E-04	4.617E-05	2.227E-07	0.000E+00	0.000E+00						
Ac-227	Pa-231	1.000E+00	7.242E-06	2.084E-05	4.440E-05	9.727E-05	1.235E-04	4.175E-05	0.000E+00	0.000E+00						
Ac-227	U-235	1.000E+00	5.125E-11	3.475E-10	1.710E-09	1.190E-08	5.104E-08	7.390E-08	0.000E+00	0.000E+00						
Ac-227	ΣDOSE(j)		4.592E-04	4.398E-04	4.042E-04	3.086E-04	1.697E-04	4.205E-05	0.000E+00	0.000E+00						
Pa-231	Pa-231	1.000E+00	5.060E-05	4.970E-05	4.795E-05	4.230E-05	2.955E-05	8.341E-06	0.000E+00	0.000E+00						
Pa-231	U-235	1.000E+00	5.337E-10	1.576E-09	3.550E-09	9.397E-09	1.907E-08	1.776E-08	0.000E+00	0.000E+00						
Pa-231	ΣDOSE(j)		5.060E-05	4.970E-05	4.795E-05	4.231E-05	2.957E-05	8.359E-06	0.000E+00	0.000E+00						
Pb-210	Pb-210	1.000E+00	6.432E-04	6.180E-04	5.705E-04	4.311E-04	1.936E-04	1.173E-05	0.000E+00	0.000E+00						
Pb-210	Ra-226	1.000E+00	1.002E-05	2.936E-05	6.503E-05	1.625E-04	2.842E-04	1.883E-04	0.000E+00	0.000E+00						
Pb-210	Th-230	1.000E+00	8.844E-09	6.098E-08	3.115E-07	2.471E-06	1.501E-05	6.205E-05	0.000E+00	0.000E+00						
Pb-210	U-234	1.000E+00	2.692E-16	3.978E-15	4.486E-14	1.054E-12	1.837E-11	2.253E-10	0.000E+00	0.000E+00						
Pb-210	U-238	9.999E-01	1.526E-22	4.658E-21	1.135E-19	7.851E-18	3.948E-16	1.508E-14	0.000E+00	0.000E+00						
Pb-210	ΣDOSE(j)		6.532E-04	6.474E-04	6.358E-04	5.961E-04	4.929E-04	2.621E-04	0.000E+00	0.000E+00						
Po-210	Pb-210	1.000E+00	6.339E-05	1.038E-04	1.028E-04	7.785E-05	3.501E-05	2.133E-06	0.000E+00	0.000E+00						
Po-210	Ra-226	1.000E+00	7.477E-07	3.529E-06	9.895E-06	2.766E-05	5.009E-05	3.372E-05	0.000E+00	0.000E+00						
Po-210	Th-230	1.000E+00	5.345E-10	5.922E-09	4.145E-08	3.988E-07	2.589E-06	1.100E-05	0.000E+00	0.000E+00						
Po-210	U-234	1.000E+00	1.372E-17	3.295E-16	5.344E-15	1.625E-13	3.117E-12	3.978E-11	0.000E+00	0.000E+00						
Po-210	U-238	9.999E-01	6.732E-24	3.390E-22	1.227E-20	1.159E-18	6.588E-17	2.650E-15	0.000E+00	0.000E+00						
Po-210	ΣDOSE(j)		6.414E-05	1.073E-04	1.127E-04	1.059E-04	8.769E-05	4.686E-05	0.000E+00	0.000E+00						
Ra-226	Ra-226	1.000E+00	5.566E-01	5.490E-01	5.342E-01	4.853E-01	3.684E-01	1.372E-01	0.000E+00	0.000E+00						
Ra-226	Th-230	1.000E+00	7.353E-04	2.192E-03	5.043E-03	1.440E-02	3.639E-02	7.526E-02	0.000E+00	0.000E+00						
Ra-226	U-234	1.000E+00	2.977E-11	2.065E-10	1.069E-09	8.866E-09	6.040E-08	3.182E-07	0.000E+00	0.000E+00						
Ra-226	U-238	9.999E-01	2.105E-17	3.124E-16	3.557E-15	8.637E-14	1.642E-12	2.465E-11	0.000E+00	0.000E+00						
Ra-226	ΣDOSE(j)		5.573E-01	5.512E-01	5.392E-01	4.997E-01	4.048E-01	2.125E-01	0.000E+00	0.000E+00						
Ra-228	Ra-228	1.000E+00	1.271E-01	1.112E-01	8.512E-02	3.338E-02	2.297E-03	1.922E-07	0.000E+00	0.000E+00						
Ra-228	Th-232	1.000E+00	7.833E-03	2.217E-02	4.566E-02	9.202E-02	1.186E-01	1.131E-01	0.000E+00	0.000E+00						
Ra-228	ΣDOSE(j)		1.350E-01	1.334E-01	1.308E-01	1.254E-01	1.209E-01	1.131E-01	0.000E+00	0.000E+00						
Th-228	Ra-228	1.000E+00	3.401E-02	8.222E-02	1.202E-01	7.788E-02	5.859E-03	4.805E-07	0.000E+00	0.000E+00						
Th-228	Th-228	1.000E+00	1.853E-01	1.289E-01	6.234E-02	4.908E-03	3.438E-06	3.050E-17	0.000E+00	0.000E+00						
Th-228	Th-232	1.000E+00	1.423E-03	8.695E-03	3.422E-02	1.234E-01	1.896E-01	1.788E-01	0.000E+00	0.000E+00						
Th-228	ΣDOSE(j)		2.207E-01	2.198E-01	2.168E-01	2.062E-01	1.955E-01	1.788E-01	0.000E+00	0.000E+00						
Th-230	Th-230	1.000E+00	4.698E-03	4.698E-03	4.698E-03	4.697E-03	4.694E-03	4.684E-03	0.000E+00	0.000E+00						
Th-230	U-234	1.000E+00	2.846E-10	8.472E-10	1.943E-09	5.485E-09	1.349E-08	2.682E-08	0.000E+00	0.000E+00						
Th-230	U-238	9.999E-01	2.682E-16	1.858E-15	9.600E-15	7.916E-14	5.309E-13	2.745E-12	0.000E+00	0.000E+00						
Th-230	ΣDOSE(j)		4.698E-03	4.698E-03	4.698E-03	4.697E-03	4.694E-03	4.684E-03	0.000E+00	0.000E+00						
Th-232	Th-232	1.000E+00	1.587E-03	1.587E-03	1.587E-03	1.587E-03	1.586E-03	1.585E-03	0.000E+00	0.000E+00						
U-234	U-234	1.000E+00	2.543E-05	2.499E-05	2.412E-05	2.131E-05	1.495E-05	4.328E-06	0.000E+00	0.000E+00						
U-234	U-238	9.999E-01	3.594E-11	1.061E-10	2.392E-10	6.341E-10	1.293E-09	1.233E-09	0.000E+00	0.000E+00						
U-234	ΣDOSE(j)		2.543E-05	2.499E-05	2.412E-05	2.131E-05	1.495E-05	4.329E-06	0.000E+00	0.000E+00						
U-235	U-235	1.000E+00	1.608E-04	1.579E-04	1.524E-04	1.345E-04	9.406E-05	2.673E-05	0.000E+00	0.000E+00						

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Columbium-Tantalum Plant, Chapter 26**

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Revision 0**

RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 12:17 Page 26
Summary : SU20 Elevated Area #2 Excavation
File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA2 EXCAVATION.RAD

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

Nuclide (j)	Parent (i)	THF(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
U-238	U-238	5.400E-05	1.164E-09	1.143E-09	1.104E-09	9.750E-10	6.843E-10	1.982E-10	0.000E+00	0.000E+00
U-238	U-238	9.999E-01	6.744E-04	6.623E-04	6.388E-04	5.629E-04	3.918E-04	1.085E-04	0.000E+00	0.000E+00
U-238	∑DOSE(j)		6.744E-04	6.623E-04	6.388E-04	5.629E-04	3.918E-04	1.085E-04	0.000E+00	0.000E+00

THF(i) is the thread fraction of the parent nuclide.

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Columbium-Tantalum Plant, Chapter 26**

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Revision 0**

RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 12:17 Page 27

Summary : SU20 Elevated Area #2 Excavation

File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA2 EXCAVATION.RAD

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF (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
Ac-227	Ac-227	1.000E+00	1.910E+00	1.771E+00	1.521E+00	8.949E-01	1.964E-01	9.735E-04	2.529E-10	2.261E-33
Ac-227	Pa-231	1.000E+00	0.000E+00	5.803E-02	1.587E-01	3.863E-01	5.074E-01	1.773E-01	5.135E-03	2.100E-08
Ac-227	U-235	1.000E+00	0.000E+00	6.199E-07	5.184E-06	4.480E-05	2.056E-04	3.120E-04	3.082E-05	4.412E-10
Ac-227	ΣS(j):		1.910E+00	1.829E+00	1.680E+00	1.281E+00	7.040E-01	1.786E-01	5.166E-03	2.144E-08
Pa-231	Pa-231	1.000E+00	1.910E+00	1.876E+00	1.811E+00	1.600E+00	1.122E+00	3.245E-01	9.370E-03	3.832E-08
Pa-231	U-235	1.000E+00	0.000E+00	3.970E-05	1.150E-04	3.385E-04	7.126E-04	6.874E-04	5.967E-05	8.194E-10
Pa-231	ΣS(j):		1.910E+00	1.876E+00	1.811E+00	1.600E+00	1.123E+00	3.252E-01	9.430E-03	3.914E-08
Pb-210	Pb-210	1.000E+00	5.094E+02	4.894E+02	4.518E+02	3.416E+02	1.536E+02	9.374E+00	3.174E-03	2.268E-15
Pb-210	Ra-226	1.000E+00	0.000E+00	1.542E+01	4.388E+01	1.218E+02	2.202E+02	1.483E+02	1.160E+01	1.213E-03
Pb-210	Th-230	1.000E+00	0.000E+00	2.051E-02	1.782E-01	1.755E+00	1.139E+01	4.841E+01	7.708E+01	7.811E+01
Pb-210	U-234	1.000E+00	0.000E+00	8.331E-10	2.171E-08	7.119E-07	1.371E-05	1.751E-04	4.994E-04	5.383E-04
Pb-210	U-238	9.999E-01	0.000E+00	5.904E-16	4.616E-14	5.041E-12	2.898E-10	1.167E-08	7.048E-08	8.632E-08
Pb-210	ΣS(j):		5.094E+02	5.049E+02	4.959E+02	4.652E+02	3.852E+02	2.061E+02	8.868E+01	7.811E+01
Po-210	Pb-210	1.000E+00	0.000E+00	4.041E+02	4.389E+02	3.330E+02	1.498E+02	9.138E+00	3.094E-03	2.211E-15
Po-210	Ra-226	1.000E+00	0.000E+00	8.221E+00	3.501E+01	1.116E+02	2.092E+02	1.424E+02	1.115E+01	1.166E-03
Po-210	Th-230	1.000E+00	0.000E+00	8.266E-03	1.219E-01	1.522E+00	1.058E+01	4.602E+01	7.356E+01	7.456E+01
Po-210	U-234	1.000E+00	0.000E+00	2.721E-10	1.309E-08	5.882E-07	1.253E-05	1.657E-04	4.764E-04	5.139E-04
Po-210	U-238	9.999E-01	0.000E+00	1.626E-16	2.493E-14	3.979E-12	2.605E-10	1.099E-08	6.719E-08	8.240E-08
Po-210	ΣS(j):		0.000E+00	4.123E+02	4.740E+02	4.462E+02	3.696E+02	1.975E+02	8.471E+01	7.456E+01
Ra-226	Ra-226	1.000E+00	5.094E+02	5.028E+02	4.898E+02	4.469E+02	3.439E+02	1.375E+02	1.003E+01	1.049E-03
Ra-226	Th-230	1.000E+00	0.000E+00	1.334E+00	3.951E+00	1.259E+01	3.331E+01	7.477E+01	1.000E+02	1.003E+02
Ra-226	U-234	1.000E+00	0.000E+00	8.100E-08	7.142E-07	7.390E-06	5.446E-05	3.151E-04	6.597E-04	6.916E-04
Ra-226	U-238	9.999E-01	0.000E+00	7.640E-14	2.013E-12	6.853E-11	1.458E-09	2.432E-08	9.600E-08	1.109E-07
Ra-226	ΣS(j):		5.094E+02	5.041E+02	4.937E+02	4.595E+02	3.772E+02	2.123E+02	1.100E+02	1.003E+02
Ra-228	Ra-228	1.000E+00	2.272E+02	1.989E+02	1.524E+02	5.998E+01	4.178E+00	3.727E-04	1.002E-15	0.000E+00
Ra-228	Th-232	1.000E+00	0.000E+00	2.565E+01	6.774E+01	1.514E+02	2.018E+02	2.054E+02	2.048E+02	2.026E+02
Ra-228	ΣS(j):		2.272E+02	2.245E+02	2.201E+02	2.113E+02	2.060E+02	2.054E+02	2.048E+02	2.026E+02
Th-228	Ra-228	1.000E+00	0.000E+00	6.440E+01	1.198E+02	8.525E+01	6.600E+00	5.893E-04	1.585E-15	0.000E+00
Th-228	Th-228	1.000E+00	2.272E+02	1.582E+02	7.663E+01	6.066E+00	4.322E-03	4.175E-14	0.000E+00	0.000E+00
Th-228	Th-232	1.000E+00	0.000E+00	4.219E+00	2.789E+01	1.230E+02	1.996E+02	2.054E+02	2.048E+02	2.026E+02
Th-228	ΣS(j):		2.272E+02	2.268E+02	2.243E+02	2.143E+02	2.062E+02	2.054E+02	2.048E+02	2.026E+02
Th-230	Th-230	1.000E+00	3.100E+03	3.100E+03	3.100E+03	3.099E+03	3.098E+03	3.093E+03	3.078E+03	3.027E+03
Th-230	U-234	1.000E+00	0.000E+00	3.745E-04	1.104E-03	3.462E-03	8.790E-03	1.768E-02	2.111E-02	2.086E-02
Th-230	U-238	9.999E-01	0.000E+00	5.292E-10	4.652E-09	4.763E-08	3.409E-07	1.803E-06	3.295E-06	3.345E-06
Th-230	ΣS(j):		3.100E+03	3.100E+03	3.100E+03	3.099E+03	3.098E+03	3.093E+03	3.078E+03	3.027E+03
Th-232	Th-232	1.000E+00	2.272E+02	2.272E+02	2.272E+02	2.272E+02	2.271E+02	2.269E+02	2.262E+02	2.239E+02
U-234	U-234	1.000E+00	4.197E+01	4.123E+01	3.980E+01	3.516E+01	2.467E+01	7.145E+00	2.070E-01	8.576E-07
U-234	U-238	9.999E-01	0.000E+00	1.169E-04	3.385E-04	9.967E-04	2.099E-03	2.026E-03	1.761E-04	2.435E-09
U-234	ΣS(j):		4.197E+01	4.123E+01	3.980E+01	3.516E+01	2.468E+01	7.147E+00	2.072E-01	8.600E-07
U-235	U-235	1.000E+00	1.910E+00	1.876E+00	1.811E+00	1.600E+00	1.123E+00	3.252E-01	9.430E-03	3.914E-08

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Columbium-Tantalum Plant, Chapter 26**

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Revision 0**

RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 12:17 Page 28
Summary : SU20 Elevated Area #2 Excavation
File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA2 EXCAVATION.RAD

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(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
U-238	U-238	5.400E-05	2.266E-03	2.227E-03	2.149E-03	1.899E-03	1.333E-03	3.859E-04	1.119E-05	4.644E-11
U-238	U-238	9.999E-01	4.197E+01	4.123E+01	3.980E+01	3.516E+01	2.468E+01	7.146E+00	2.072E-01	8.600E-07
U-238	ΣS(j):		4.197E+01	4.123E+01	3.980E+01	3.516E+01	2.468E+01	7.147E+00	2.072E-01	8.600E-07

THF(i) is the thread fraction of the parent nuclide.

RESRAD.EXE execution time = 2.35 seconds

APPENDIX D

RESRAD v6.5 Summary Report for Elevated Area #3 Excavation Scenario Model

RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 12:20 Page 1
Summary : SU20 Elevated Area #3 Excavation
File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA3 EXCAVATION.RAD

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Time = 1.000E+00	15
Time = 3.000E+00	16
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Summary : SU20 Elevated Area #3 Excavation

File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA3 EXCAVATION.RAD

Dose Conversion Factor (and Related) Parameter Summary
Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
A-1	DCF's for external ground radiation, (mrem/yr)/(pCi/g)			
A-1	Ac-227 (Source: FGR 12)	4.951E-04	4.951E-04	DCF1(1)
A-1	Ac-228 (Source: FGR 12)	5.978E+00	5.978E+00	DCF1(2)
A-1	At-218 (Source: FGR 12)	5.847E-03	5.847E-03	DCF1(3)
A-1	Bi-210 (Source: FGR 12)	3.606E-03	3.606E-03	DCF1(4)
A-1	Bi-211 (Source: FGR 12)	2.559E-01	2.559E-01	DCF1(5)
A-1	Bi-212 (Source: FGR 12)	1.171E+00	1.171E+00	DCF1(6)
A-1	Bi-214 (Source: FGR 12)	9.808E+00	9.808E+00	DCF1(7)
A-1	Fr-223 (Source: FGR 12)	1.980E-01	1.980E-01	DCF1(8)
A-1	Pa-231 (Source: FGR 12)	1.906E-01	1.906E-01	DCF1(9)
A-1	Pa-234 (Source: FGR 12)	1.155E+01	1.155E+01	DCF1(10)
A-1	Pa-234m (Source: FGR 12)	8.967E-02	8.967E-02	DCF1(11)
A-1	Pb-210 (Source: FGR 12)	2.447E-03	2.447E-03	DCF1(12)
A-1	Pb-211 (Source: FGR 12)	3.064E-01	3.064E-01	DCF1(13)
A-1	Pb-212 (Source: FGR 12)	7.043E-01	7.043E-01	DCF1(14)
A-1	Pb-214 (Source: FGR 12)	1.341E+00	1.341E+00	DCF1(15)
A-1	Po-210 (Source: FGR 12)	5.231E-05	5.231E-05	DCF1(16)
A-1	Po-211 (Source: FGR 12)	4.764E-02	4.764E-02	DCF1(17)
A-1	Po-212 (Source: FGR 12)	0.000E+00	0.000E+00	DCF1(18)
A-1	Po-214 (Source: FGR 12)	5.138E-04	5.138E-04	DCF1(19)
A-1	Po-215 (Source: FGR 12)	1.016E-03	1.016E-03	DCF1(20)
A-1	Po-216 (Source: FGR 12)	1.042E-04	1.042E-04	DCF1(21)
A-1	Po-218 (Source: FGR 12)	5.642E-05	5.642E-05	DCF1(22)
A-1	Ra-223 (Source: FGR 12)	6.034E-01	6.034E-01	DCF1(23)
A-1	Ra-224 (Source: FGR 12)	5.119E-02	5.119E-02	DCF1(24)
A-1	Ra-226 (Source: FGR 12)	3.176E-02	3.176E-02	DCF1(25)
A-1	Ra-228 (Source: FGR 12)	0.000E+00	0.000E+00	DCF1(26)
A-1	Rn-219 (Source: FGR 12)	3.083E-01	3.083E-01	DCF1(27)
A-1	Rn-220 (Source: FGR 12)	2.298E-03	2.298E-03	DCF1(28)
A-1	Rn-222 (Source: FGR 12)	2.354E-03	2.354E-03	DCF1(29)
A-1	Th-227 (Source: FGR 12)	5.212E-01	5.212E-01	DCF1(30)
A-1	Th-228 (Source: FGR 12)	7.940E-03	7.940E-03	DCF1(31)
A-1	Th-230 (Source: FGR 12)	1.209E-03	1.209E-03	DCF1(32)
A-1	Th-231 (Source: FGR 12)	3.643E-02	3.643E-02	DCF1(33)
A-1	Th-232 (Source: FGR 12)	5.212E-04	5.212E-04	DCF1(34)
A-1	Th-234 (Source: FGR 12)	2.410E-02	2.410E-02	DCF1(35)
A-1	Tl-207 (Source: FGR 12)	1.980E-02	1.980E-02	DCF1(36)
A-1	Tl-208 (Source: FGR 12)	2.298E+01	2.298E+01	DCF1(37)
A-1	Tl-210 (Source: no data)	0.000E+00	-2.000E+00	DCF1(38)
A-1	U-234 (Source: FGR 12)	4.017E-04	4.017E-04	DCF1(39)
A-1	U-235 (Source: FGR 12)	7.211E-01	7.211E-01	DCF1(40)
A-1	U-238 (Source: FGR 12)	1.031E-04	1.031E-04	DCF1(41)
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	6.724E+00	6.700E+00	DCF2(1)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(2)
B-1	Pb-210+D	1.380E-02	1.360E-02	DCF2(3)
B-1	Po-210	9.400E-03	9.400E-03	DCF2(4)
B-1	Ra-226+D	8.594E-03	8.580E-03	DCF2(5)
B-1	Ra-228+D	5.078E-03	4.770E-03	DCF2(6)

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Summary : SU20 Elevated Area #3 Excavation

File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA3 EXCAVATION.RAD

Dose Conversion Factor (and Related) Parameter Summary (continued)

Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
B-1	Th-228+D	3.454E-01	3.420E-01	DCF2(7)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(8)
B-1	Th-232	1.640E+00	1.640E+00	DCF2(9)
B-1	U-234	1.320E-01	1.320E-01	DCF2(10)
B-1	U-235+D	1.230E-01	1.230E-01	DCF2(11)
B-1	U-238	1.180E-01	1.180E-01	DCF2(12)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(13)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	1.480E-02	1.410E-02	DCF3(1)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(2)
D-1	Pb-210+D	5.376E-03	5.370E-03	DCF3(3)
D-1	Po-210	1.900E-03	1.900E-03	DCF3(4)
D-1	Ra-226+D	1.321E-03	1.320E-03	DCF3(5)
D-1	Ra-228+D	1.442E-03	1.440E-03	DCF3(6)
D-1	Th-228+D	8.086E-04	3.960E-04	DCF3(7)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(8)
D-1	Th-232	2.730E-03	2.730E-03	DCF3(9)
D-1	U-234	2.830E-04	2.830E-04	DCF3(10)
D-1	U-235+D	2.673E-04	2.660E-04	DCF3(11)
D-1	U-238	2.550E-04	2.550E-04	DCF3(12)
D-1	U-238+D	2.687E-04	2.550E-04	DCF3(13)
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	Po-210 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(4,1)
D-34	Po-210 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(4,2)
D-34	Po-210 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.400E-04	3.400E-04	RTF(4,3)
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(5,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(5,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(5,3)
D-34	Ra-228+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(6,1)
D-34	Ra-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(6,2)
D-34	Ra-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(6,3)
D-34				

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Summary : SU20 Elevated Area #3 Excavation

File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA3 EXCAVATION.RAD

Dose Conversion Factor (and Related) Parameter Summary (continued)

Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
D-34	Th-228+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(7,1)
D-34	Th-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(7,2)
D-34	Th-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(7,3)
D-34				
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(8,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(8,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(8,3)
D-34				
D-34	Th-232 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(9,1)
D-34	Th-232 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(9,2)
D-34	Th-232 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(9,3)
D-34				
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(10,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(10,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(10,3)
D-34				
D-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(11,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(11,2)
D-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(11,3)
D-34				
D-34	U-238 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(12,1)
D-34	U-238 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(12,2)
D-34	U-238 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(12,3)
D-34				
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(13,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(13,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(13,3)
D-5				
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-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	Po-210 , fish	1.000E+02	1.000E+02	BIOFAC(4,1)
D-5	Po-210 , crustacea and mollusks	2.000E+04	2.000E+04	BIOFAC(4,2)
D-5				
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(5,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(5,2)
D-5				
D-5	Ra-228+D , fish	5.000E+01	5.000E+01	BIOFAC(6,1)
D-5	Ra-228+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(6,2)
D-5				
D-5	Th-228+D , fish	1.000E+02	1.000E+02	BIOFAC(7,1)
D-5	Th-228+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(7,2)
D-5				

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Summary : SU20 Elevated Area #3 Excavation

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Dose Conversion Factor (and Related) Parameter Summary (continued)

Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(8,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(8,2)
D-5				
D-5	Th-232 , fish	1.000E+02	1.000E+02	BIOFAC(9,1)
D-5	Th-232 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(9,2)
D-5				
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(10,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(10,2)
D-5				
D-5	U-235D , fish	1.000E+01	1.000E+01	BIOFAC(11,1)
D-5	U-235D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(11,2)
D-5				
D-5	U-238 , fish	1.000E+01	1.000E+01	BIOFAC(12,1)
D-5	U-238 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(12,2)
D-5				
D-5	U-238D , fish	1.000E+01	1.000E+01	BIOFAC(13,1)
D-5	U-238D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(13,2)

#For DCF1(XXX) only, factors are for infinite depth & area. See ETFG table in Ground Pathway of Detailed Report.

*Base Case means Default.Lib w/o Associate Nuclide contributions.

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Summary : SU20 Elevated Area #3 Excavation
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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)	1.000E+00	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	3.000E-01	2.000E+00	---	THICK0
R011	Fraction of contamination that is submerged	0.000E+00	0.000E+00	---	SUBMFRACT
R011	Length parallel to aquifer flow (m)	not used	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	2.500E+01	3.000E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
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): Ac-227	1.900E-01	0.000E+00	---	S1(1)
R012	Initial principal radionuclide (pCi/g): Pa-231	1.900E-01	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g): Pb-210	2.189E+02	0.000E+00	---	S1(3)
R012	Initial principal radionuclide (pCi/g): Ra-226	2.189E+02	0.000E+00	---	S1(5)
R012	Initial principal radionuclide (pCi/g): Ra-228	5.960E+01	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g): Th-228	5.960E+01	0.000E+00	---	S1(7)
R012	Initial principal radionuclide (pCi/g): Th-230	1.300E+03	0.000E+00	---	S1(8)
R012	Initial principal radionuclide (pCi/g): Th-232	5.960E+01	0.000E+00	---	S1(9)
R012	Initial principal radionuclide (pCi/g): U-234	4.240E+00	0.000E+00	---	S1(10)
R012	Initial principal radionuclide (pCi/g): U-235	1.900E-01	0.000E+00	---	S1(11)
R012	Initial principal radionuclide (pCi/g): U-238	4.240E+00	0.000E+00	---	S1(12)
R012	Concentration in groundwater (pCi/L): Ac-227	not used	0.000E+00	---	W1(1)
R012	Concentration in groundwater (pCi/L): Pa-231	not used	0.000E+00	---	W1(2)
R012	Concentration in groundwater (pCi/L): Pb-210	not used	0.000E+00	---	W1(3)
R012	Concentration in groundwater (pCi/L): Ra-226	not used	0.000E+00	---	W1(5)
R012	Concentration in groundwater (pCi/L): Ra-228	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L): Th-228	not used	0.000E+00	---	W1(7)
R012	Concentration in groundwater (pCi/L): Th-230	not used	0.000E+00	---	W1(8)
R012	Concentration in groundwater (pCi/L): Th-232	not used	0.000E+00	---	W1(9)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(10)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W1(11)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(12)
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
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)	1.500E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	---	FCCZ
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	Average annual wind speed (m/sec)	4.000E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID

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Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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)	0.000E+00	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)	not used	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	not used	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	not used	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	not used	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	not used	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	not used	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	not used	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	not used	2.000E-02	---	HGWT
R014	Saturated zone b parameter	not used	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	not used	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	not used	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	not used	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	not used	2.500E+02	---	UW
R015	Number of unsaturated zone strata	not used	1	---	NS
R015	Unsat. zone 1, thickness (m)	not used	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	not used	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	not used	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	not used	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	not used	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	not used	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	not used	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(1)
R016	Unsat. zone 1 (cm**3/g)	not used	2.000E+01	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	not used	2.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.398E-02	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for Pa-231				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(2)
R016	Unsat. zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.770E-02	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(3)
R016	Unsat. zone 1 (cm**3/g)	not used	1.000E+02	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	not used	1.000E+02	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	8.870E-03	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)

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R016	Distribution coefficients for Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	not used	7.000E+01	---	DCNUCU(5,1)
R016	Saturated zone (cm**3/g)	not used	7.000E+01	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.266E-02	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R016	Distribution coefficients for Ra-228				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	not used	7.000E+01	---	DCNUCU(6,1)
R016	Saturated zone (cm**3/g)	not used	7.000E+01	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.266E-02	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
R016	Distribution coefficients for Th-228				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(7)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(7,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.481E-05	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)
R016	Distribution coefficients for Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(8,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.481E-05	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
R016	Distribution coefficients for Th-232				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(9)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(9,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.481E-05	ALEACH(9)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(9)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(10)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(10,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(10)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.770E-02	ALEACH(10)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(10)
R016	Distribution coefficients for U-235				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(11)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(11,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(11)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.770E-02	ALEACH(11)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(11)

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R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(12)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(12,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(12)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.770E-02	ALEACH(12)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(12)
R016	Distribution coefficients for daughter Po-210				
R016	Contaminated zone (cm**3/g)	1.000E+01	1.000E+01	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	not used	1.000E+01	---	DCNUCU(4,1)
R016	Saturated zone (cm**3/g)	not used	1.000E+01	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	8.706E-02	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R017	Inhalation rate (m**3/yr)	1.227E+04	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	3.500E-05	1.000E-04	---	MLINH
R017	Exposure duration	3.000E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	6.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	1.700E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	0.000E+00	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	5.700E-05	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS
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)

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Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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)	3.650E+01	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	not used	1.000E+00	---	FHHW
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	---	FP LANT
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	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	not used	1.000E-04	---	MLFD
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	not used	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	not used	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	not used	7.000E-01	---	YV (1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	not used	1.500E+00	---	YV (2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	---	YV (3)
R19B	Growing Season for Non-Leafy (years)	not used	1.700E-01	---	TE (1)
R19B	Growing Season for Leafy (years)	not used	2.500E-01	---	TE (2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE (3)
R19B	Translocation Factor for Non-Leafy	not used	1.000E-01	---	TIV (1)
R19B	Translocation Factor for Leafy	not used	1.000E+00	---	TIV (2)
R19B	Translocation Factor for Fodder	not used	1.000E+00	---	TIV (3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RDRY (1)
R19B	Dry Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RDRY (2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RDRY (3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RWET (1)
R19B	Wet Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RWET (2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET (3)
R19B	Weathering Removal Constant for Vegetation	not used	2.000E+01	---	WLAM
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	---	C12CC
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL

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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)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	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	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	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	not used	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	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	32	---	---	NPTS
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	1	---	---	KYMAX

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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	active
9 -- radon	suppressed
Find peak pathway doses	active

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Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	1.00 square meters	Ac-227	1.900E-01
Thickness:	0.30 meters	Pa-231	1.900E-01
Cover Depth:	0.00 meters	Pb-210	2.189E+02
		Ra-226	2.189E+02
		Ra-228	5.960E+01
		Th-228	5.960E+01
		Th-230	1.300E+03
		Th-232	5.960E+01
		U-234	4.240E+00
		U-235	1.900E-01
		U-238	4.240E+00

Total Dose TDOSE(t), mrem/yr

Basic Radiation Dose Limit = 2.500E+01 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):	1.734E-02	1.717E-02	1.682E-02	1.572E-02	1.337E-02	8.724E-03	0.000E+00	0.000E+00
M(t):	6.935E-04	6.867E-04	6.728E-04	6.286E-04	5.350E-04	3.490E-04	0.000E+00	0.000E+00

Maximum TDOSE(t): 1.734E-02 mrem/yr at t = 0.000E+00 years

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RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 12:20 Page 14
Summary : SU20 Elevated Area #3 Excavation
File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA3 EXCAVATION.RAD

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.
Ac-227	2.095E-06	0.0001	1.013E-06	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.633E-09	0.0000
Pa-231	2.353E-07	0.0000	2.147E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.243E-09	0.0000
Pb-210	8.268E-06	0.0005	3.322E-06	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.852E-06	0.0002
Ra-226	1.213E-02	0.6994	1.588E-06	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.404E-07	0.0000
Ra-228	2.144E-03	0.1237	2.843E-06	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.829E-07	0.0000
Th-228	2.444E-03	0.1410	1.422E-05	0.0008	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.410E-08	0.0000
Th-230	2.586E-05	0.0015	3.490E-04	0.0201	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.483E-06	0.0001
Th-232	1.234E-04	0.0071	8.061E-05	0.0046	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.495E-07	0.0000
U-234	1.158E-08	0.0000	4.568E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.474E-09	0.0000
U-235	8.498E-07	0.0000	1.908E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.048E-10	0.0000
U-238	3.455E-06	0.0002	4.085E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.349E-09	0.0000
Total	1.688E-02	0.9735	4.537E-04	0.0262	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.607E-06	0.0003

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.
Ac-227	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	3.113E-06	0.0002
Pa-231	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	4.543E-07	0.0000
Pb-210	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	1.444E-05	0.0008
Ra-226	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	1.213E-02	0.6995
Ra-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	2.147E-03	0.1238
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	2.459E-03	0.1418
Th-230	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	3.763E-04	0.0217
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	2.044E-04	0.0118
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	4.709E-07	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	8.690E-07	0.0001
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	3.866E-06	0.0002
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	1.734E-02	1.0000

*Sum of all water independent and dependent pathways.

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RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 12:20 Page 15
Summary : SU20 Elevated Area #3 Excavation
File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA3 EXCAVATION.RAD

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.
Ac-227	1.941E-06	0.0001	9.391E-07	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.222E-09	0.0000
Pa-231	2.947E-07	0.0000	2.417E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.340E-09	0.0000
Pb-210	7.963E-06	0.0005	3.790E-06	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.046E-06	0.0002
Ra-226	1.196E-02	0.6966	1.680E-06	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.246E-07	0.0000
Ra-228	2.567E-03	0.1496	6.518E-06	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.839E-07	0.0000
Th-228	1.700E-03	0.0990	9.896E-06	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.854E-08	0.0000
Th-230	5.681E-05	0.0033	3.490E-04	0.0203	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.485E-06	0.0001
Th-232	4.105E-04	0.0239	8.119E-05	0.0047	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.717E-07	0.0000
U-234	1.138E-08	0.0000	4.488E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.431E-09	0.0000
U-235	8.346E-07	0.0000	1.875E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.030E-10	0.0000
U-238	3.393E-06	0.0002	4.013E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.308E-09	0.0000
Total	1.671E-02	0.9732	4.541E-04	0.0265	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.884E-06	0.0003

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.
Ac-227	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	2.885E-06	0.0002
Pa-231	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	5.408E-07	0.0000
Pb-210	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	1.480E-05	0.0009
Ra-226	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	1.196E-02	0.6967
Ra-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	2.574E-03	0.1499
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	1.710E-03	0.0996
Th-230	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	4.073E-04	0.0237
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	4.920E-04	0.0287
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	4.626E-07	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	8.535E-07	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	3.796E-06	0.0002
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	1.717E-02	1.0000

*Sum of all water independent and dependent pathways.

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Summary : SU20 Elevated Area #3 Excavation
File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA3 EXCAVATION.RAD

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.
Ac-227	1.666E-06	0.0001	8.070E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.487E-09	0.0000
Pa-231	3.967E-07	0.0000	2.878E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.492E-09	0.0000
Pb-210	7.351E-06	0.0004	3.597E-06	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.862E-06	0.0002
Ra-226	1.163E-02	0.6914	1.864E-06	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.879E-07	0.0001
Ra-228	2.719E-03	0.1616	9.401E-06	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.670E-07	0.0000
Th-228	8.219E-04	0.0489	4.795E-06	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.836E-08	0.0000
Th-230	1.174E-04	0.0070	3.490E-04	0.0207	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.489E-06	0.0001
Th-232	1.060E-03	0.0630	8.320E-05	0.0049	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.143E-07	0.0000
U-234	1.098E-08	0.0000	4.332E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.347E-09	0.0000
U-235	8.050E-07	0.0000	1.811E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.965E-11	0.0000
U-238	3.271E-06	0.0002	3.874E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.228E-09	0.0000
Total	1.636E-02	0.9727	4.537E-04	0.0270	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.862E-06	0.0003

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.
Ac-227	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	2.478E-06	0.0001
Pa-231	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	6.889E-07	0.0000
Pb-210	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	1.381E-05	0.0008
Ra-226	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	1.163E-02	0.6915
Ra-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	2.729E-03	0.1622
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	8.267E-04	0.0491
Th-230	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	4.678E-04	0.0278
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	1.144E-03	0.0680
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	4.465E-07	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	8.232E-07	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	3.660E-06	0.0002
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	1.682E-02	1.0000

*Sum of all water independent and dependent pathways.

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RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 12:20 Page 17
Summary : SU20 Elevated Area #3 Excavation
File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA3 EXCAVATION.RAD

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.
Ac-227	9.767E-07	0.0001	4.746E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.639E-09	0.0000
Pa-231	6.177E-07	0.0000	3.847E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.693E-09	0.0000
Pb-210	5.548E-06	0.0004	2.721E-06	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.164E-06	0.0001
Ra-226	1.055E-02	0.6712	2.352E-06	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.328E-06	0.0001
Ra-228	1.469E-03	0.0935	6.084E-06	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.981E-08	0.0000
Th-228	6.462E-05	0.0041	3.795E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.245E-09	0.0000
Th-230	3.156E-04	0.0201	3.489E-04	0.0222	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.509E-06	0.0001
Th-232	2.849E-03	0.1813	9.019E-05	0.0057	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.167E-07	0.0000
U-234	9.737E-09	0.0000	3.828E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.073E-09	0.0000
U-235	7.095E-07	0.0000	1.604E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.868E-11	0.0000
U-238	2.877E-06	0.0002	3.422E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.968E-09	0.0000
Total	1.526E-02	0.9709	4.523E-04	0.0288	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.612E-06	0.0004

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.
Ac-227	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	1.454E-06	0.0001
Pa-231	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	1.007E-06	0.0001
Pb-210	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	1.043E-05	0.0007
Ra-226	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	1.055E-02	0.6715
Ra-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	1.475E-03	0.0939
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	6.500E-05	0.0041
Th-230	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	6.660E-04	0.0424
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	2.940E-03	0.1870
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	3.946E-07	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	7.256E-07	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	3.221E-06	0.0002
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	1.572E-02	1.0000

*Sum of all water independent and dependent pathways.

**Phase II Final Status Survey Report Mallinckrodt
Columbium-Tantalum Plant, Chapter 26**

**CS-RS-RP-009-26
Revision 0**

RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 12:20 Page 18
Summary : SU20 Elevated Area #3 Excavation
File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA3 EXCAVATION.RAD

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.
Ac-227	2.122E-07	0.0000	1.042E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.793E-10	0.0000
Pa-231	6.841E-07	0.0001	3.953E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.990E-09	0.0000
Pb-210	2.482E-06	0.0002	1.224E-06	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.735E-07	0.0001
Ra-226	7.971E-03	0.5960	2.818E-06	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.823E-06	0.0001
Ra-228	1.072E-04	0.0080	4.652E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.805E-09	0.0000
Th-228	4.508E-08	0.0000	2.704E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.600E-12	0.0000
Th-230	7.785E-04	0.0582	3.489E-04	0.0261	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.593E-06	0.0001
Th-232	4.057E-03	0.3033	9.559E-05	0.0071	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.856E-07	0.0000
U-234	7.095E-09	0.0000	2.688E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.456E-09	0.0000
U-235	4.944E-07	0.0000	1.141E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.381E-11	0.0000
U-238	1.993E-06	0.0001	2.402E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.382E-09	0.0000
Total	1.292E-02	0.9660	4.500E-04	0.0336	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.989E-06	0.0004

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.
Ac-227	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	3.170E-07	0.0000
Pa-231	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	1.083E-06	0.0001
Pb-210	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	4.679E-06	0.0003
Ra-226	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	7.976E-03	0.5964
Ra-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	1.077E-04	0.0081
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	4.535E-08	0.0000
Th-230	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	1.129E-03	0.0844
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	4.153E-03	0.3105
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	2.774E-07	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	5.059E-07	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	2.235E-06	0.0002
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	1.337E-02	1.0000

*Sum of all water independent and dependent pathways.

**Phase II Final Status Survey Report Mallinckrodt
Columbium-Tantalum Plant, Chapter 26**

**CS-RS-RP-009-26
Revision 0**

RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 12:20 Page 19

Summary : SU20 Elevated Area #3 Excavation

File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA3 EXCAVATION.RAD

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.
Ac-227	1.003E-09	0.0000	5.164E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.871E-12	0.0000
Pa-231	2.200E-07	0.0000	1.305E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.244E-09	0.0000
Pb-210	1.480E-07	0.0000	7.466E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.939E-08	0.0000
Ra-226	2.920E-03	0.3347	1.607E-06	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.111E-06	0.0001
Ra-228	8.706E-09	0.0000	4.154E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.180E-13	0.0000
Th-228	3.941E-19	0.0000	2.612E-21	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.545E-23	0.0000
Th-230	1.572E-03	0.1802	3.487E-04	0.0400	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.870E-06	0.0002
Th-232	3.781E-03	0.4334	9.591E-05	0.0110	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.902E-07	0.0001
U-234	3.548E-09	0.0000	7.824E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.236E-10	0.0000
U-235	1.387E-07	0.0000	3.491E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.029E-11	0.0000
U-238	5.430E-07	0.0001	6.958E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.002E-10	0.0000
Total	8.274E-03	0.9484	4.466E-04	0.0512	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.632E-06	0.0004

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.
Ac-227	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	1.522E-09	0.0000
Pa-231	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	3.518E-07	0.0000
Pb-210	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	2.820E-07	0.0000
Ra-226	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	2.922E-03	0.3350
Ra-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	8.748E-09	0.0000
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	3.967E-19	0.0000
Th-230	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	1.923E-03	0.2204
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	3.877E-03	0.4444
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	8.221E-08	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	1.422E-07	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	6.130E-07	0.0001
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	8.724E-03	1.0000

*Sum of all water independent and dependent pathways.

**Phase II Final Status Survey Report Mallinckrodt
Columbium-Tantalum Plant, Chapter 26**

**CS-RS-RP-009-26
Revision 0**

RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 12:20 Page 20
Summary : SU20 Elevated Area #3 Excavation
File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA3 EXCAVATION.RAD

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.
Ac-227	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
Pa-231	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
Pb-210	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
Ra-226	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
Ra-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-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-230	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 = 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.
Ac-227	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
Pa-231	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
Pb-210	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
Ra-226	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
Ra-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-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-230	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

*Sum of all water independent and dependent pathways.

**Phase II Final Status Survey Report Mallinckrodt
Columbium-Tantalum Plant, Chapter 26**

**CS-RS-RP-009-26
Revision 0**

RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 12:20 Page 21
Summary : SU20 Elevated Area #3 Excavation
File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA3 EXCAVATION.RAD

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.
Ac-227	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
Pa-231	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
Pb-210	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
Ra-226	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
Ra-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-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-230	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.
Ac-227	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
Pa-231	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
Pb-210	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
Ra-226	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
Ra-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-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-230	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

*Sum of all water independent and dependent pathways.

**Phase II Final Status Survey Report Mallinckrodt
Columbium-Tantalum Plant, Chapter 26**

**CS-RS-RP-009-26
Revision 0**

RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 12:20 Page 22
Summary : SU20 Elevated Area #3 Excavation
File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA3 EXCAVATION.RAD

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

Parent (i)	Product (j)	Thread Fraction	DSR(j,t) At Time in Years (mrem/yr)/(pCi/g)							
			0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Ac-227+D	Ac-227+D	1.000E+00	1.639E-05	1.518E-05	1.304E-05	7.652E-06	1.668E-06	8.009E-09	0.000E+00	0.000E+00
Pa-231	Pa-231	1.000E+00	2.129E-06	2.091E-06	2.017E-06	1.778E-06	1.241E-06	3.499E-07	0.000E+00	0.000E+00
Pa-231	Ac-227+D	1.000E+00	2.625E-07	7.556E-07	1.609E-06	3.522E-06	4.462E-06	1.502E-06	0.000E+00	0.000E+00
Pa-231	ΣDSR(j)		2.391E-06	2.846E-06	3.626E-06	5.301E-06	5.702E-06	1.852E-06	0.000E+00	0.000E+00
Pb-210+D	Pb-210+D	1.000E+00	5.973E-08	5.738E-08	5.296E-08	3.999E-08	1.793E-08	1.078E-09	0.000E+00	0.000E+00
Pb-210+D	Po-210	1.000E+00	6.243E-09	1.022E-08	1.012E-08	7.666E-09	3.446E-09	2.099E-10	0.000E+00	0.000E+00
Pb-210+D	ΣDSR(j)		6.597E-08	6.760E-08	6.308E-08	4.766E-08	2.137E-08	1.288E-09	0.000E+00	0.000E+00
Ra-226+D	Ra-226+D	1.000E+00	5.540E-05	5.463E-05	5.313E-05	4.818E-05	3.640E-05	1.333E-05	0.000E+00	0.000E+00
Ra-226+D	Pb-210+D	1.000E+00	9.303E-10	2.726E-09	6.036E-09	1.507E-08	2.632E-08	1.731E-08	0.000E+00	0.000E+00
Ra-226+D	Po-210	1.000E+00	7.363E-11	3.476E-10	9.743E-10	2.724E-09	4.932E-09	3.319E-09	0.000E+00	0.000E+00
Ra-226+D	ΣDSR(j)		5.540E-05	5.463E-05	5.314E-05	4.820E-05	3.643E-05	1.335E-05	0.000E+00	0.000E+00
Ra-228+D	Ra-228+D	1.000E+00	2.846E-05	2.489E-05	1.904E-05	7.451E-06	5.102E-07	4.192E-11	0.000E+00	0.000E+00
Ra-228+D	Th-228+D	1.000E+00	7.572E-06	1.830E-05	2.675E-05	1.731E-05	1.297E-06	1.049E-10	0.000E+00	0.000E+00
Ra-228+D	ΣDSR(j)		3.603E-05	4.319E-05	4.578E-05	2.476E-05	1.807E-06	1.468E-10	0.000E+00	0.000E+00
Th-228+D	Th-228+D	1.000E+00	4.125E-05	2.869E-05	1.387E-05	1.091E-06	7.610E-10	6.656E-21	0.000E+00	0.000E+00
Th-230	Th-230	1.000E+00	2.774E-07	2.774E-07	2.774E-07	2.774E-07	2.772E-07	2.766E-07	0.000E+00	0.000E+00
Th-230	Ra-226+D	1.000E+00	1.202E-08	3.584E-08	8.241E-08	2.349E-07	5.910E-07	1.201E-06	0.000E+00	0.000E+00
Th-230	Pb-210+D	1.000E+00	1.349E-13	9.303E-13	4.751E-12	3.766E-11	2.284E-10	9.372E-10	0.000E+00	0.000E+00
Th-230	Po-210	1.000E+00	8.648E-15	9.582E-14	6.707E-13	6.453E-12	4.188E-11	1.779E-10	0.000E+00	0.000E+00
Th-230	ΣDSR(j)		2.895E-07	3.133E-07	3.598E-07	5.123E-07	8.684E-07	1.479E-06	0.000E+00	0.000E+00
Th-232	Th-232	1.000E+00	1.360E-06	1.360E-06	1.360E-06	1.359E-06	1.359E-06	1.358E-06	0.000E+00	0.000E+00
Th-232	Ra-228+D	1.000E+00	1.753E-06	4.961E-06	1.021E-05	2.054E-05	2.635E-05	2.467E-05	0.000E+00	0.000E+00
Th-232	Th-228+D	1.000E+00	3.169E-07	1.935E-06	7.615E-06	2.742E-05	4.197E-05	3.903E-05	0.000E+00	0.000E+00
Th-232	ΣDSR(j)		3.429E-06	8.256E-06	1.919E-05	4.932E-05	6.968E-05	6.505E-05	0.000E+00	0.000E+00
U-234	U-234	1.000E+00	1.111E-07	1.091E-07	1.053E-07	9.303E-08	6.528E-08	1.890E-08	0.000E+00	0.000E+00
U-234	Th-230	1.000E+00	1.241E-12	3.695E-12	8.474E-12	2.393E-11	5.883E-11	1.170E-10	0.000E+00	0.000E+00
U-234	Ra-226+D	1.000E+00	3.596E-14	2.493E-13	1.290E-12	1.068E-11	7.244E-11	3.752E-10	0.000E+00	0.000E+00
U-234	Pb-210+D	1.000E+00	3.034E-19	4.482E-18	5.055E-17	1.186E-15	2.065E-14	2.514E-13	0.000E+00	0.000E+00
U-234	Po-210	1.000E+00	1.640E-20	3.938E-19	6.386E-18	1.942E-16	3.725E-15	4.752E-14	0.000E+00	0.000E+00
U-234	ΣDSR(j)		1.111E-07	1.091E-07	1.053E-07	9.306E-08	6.541E-08	1.939E-08	0.000E+00	0.000E+00
U-235+D	U-235+D	1.000E+00	4.574E-06	4.492E-06	4.333E-06	3.818E-06	2.660E-06	7.452E-07	0.000E+00	0.000E+00
U-235+D	Pa-231	1.000E+00	2.245E-11	6.629E-11	1.493E-10	3.950E-10	8.009E-10	7.449E-10	0.000E+00	0.000E+00
U-235+D	Ac-227+D	1.000E+00	1.858E-12	1.260E-11	6.198E-11	4.311E-10	1.844E-09	2.658E-09	0.000E+00	0.000E+00
U-235+D	ΣDSR(j)		4.574E-06	4.492E-06	4.333E-06	3.819E-06	2.663E-06	7.486E-07	0.000E+00	0.000E+00
U-238	U-238	5.400E-05	5.278E-12	5.186E-12	5.005E-12	4.422E-12	3.103E-12	8.987E-13	0.000E+00	0.000E+00

**Phase II Final Status Survey Report Mallinckrodt
Columbium-Tantalum Plant, Chapter 26**

**CS-RS-RP-009-26
Revision 0**

RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 12:20 Page 23
Summary : SU20 Elevated Area #3 Excavation
File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA3 EXCAVATION.RAD

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

Parent (i)	Product (j)	Thread Fraction	DSR(j,t) At Time in Years (mrem/yr)/(pCi/g)							
			0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-238+D	U-238+D	9.999E-01	9.118E-07	8.953E-07	8.632E-07	7.597E-07	5.271E-07	1.446E-07	0.000E+00	0.000E+00
U-238+D	U-234	9.999E-01	1.569E-13	4.635E-13	1.044E-12	2.769E-12	5.644E-12	5.385E-12	0.000E+00	0.000E+00
U-238+D	Th-230	9.999E-01	1.170E-18	8.105E-18	4.187E-17	3.453E-16	2.316E-15	1.197E-14	0.000E+00	0.000E+00
U-238+D	Ra-226+D	9.999E-01	2.543E-20	3.773E-19	4.294E-18	1.041E-16	1.970E-15	2.906E-14	0.000E+00	0.000E+00
U-238+D	Pb-210+D	9.999E-01	1.719E-25	5.249E-24	1.278E-22	8.840E-21	4.436E-19	1.682E-17	0.000E+00	0.000E+00
U-238+D	Po-210	9.999E-01	8.046E-27	4.052E-25	1.466E-23	1.385E-21	7.873E-20	3.166E-18	0.000E+00	0.000E+00
U-238+D	ΣDSR(j)		9.118E-07	8.953E-07	8.632E-07	7.597E-07	5.271E-07	1.446E-07	0.000E+00	0.000E+00

The DSR includes contributions from associated (half-life ≤ 30 days) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 2.500E+01 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
Ac-227	1.526E+06	1.646E+06	1.917E+06	3.267E+06	1.499E+07	3.121E+09	*7.232E+13	*7.232E+13
Pa-231	1.046E+07	8.783E+06	6.895E+06	4.716E+06	4.384E+06	1.350E+07	*4.723E+10	*4.723E+10
Pb-210	3.790E+08	3.698E+08	3.963E+08	5.246E+08	1.170E+09	1.941E+10	*7.634E+13	*7.634E+13
Ra-226	4.513E+05	4.576E+05	4.705E+05	5.186E+05	6.862E+05	1.873E+06	*9.885E+11	*9.885E+11
Ra-228	6.939E+05	5.789E+05	5.461E+05	1.010E+06	1.383E+07	1.703E+11	*2.726E+14	*2.726E+14
Th-228	6.061E+05	8.715E+05	1.802E+06	2.292E+07	3.285E+10	*8.195E+14	*8.195E+14	*8.195E+14
Th-230	8.636E+07	7.980E+07	6.947E+07	4.880E+07	2.879E+07	1.690E+07	*2.018E+10	*2.018E+10
Th-232	*1.097E+05	*1.097E+05	*1.097E+05	*1.097E+05	*1.097E+05	*1.097E+05	*1.097E+05	*1.097E+05
U-234	2.251E+08	2.291E+08	2.374E+08	2.686E+08	3.822E+08	1.289E+09	*6.247E+09	*6.247E+09
U-235	*2.161E+06	*2.161E+06	*2.161E+06	*2.161E+06	*2.161E+06	*2.161E+06	*2.161E+06	*2.161E+06
U-238	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05

*At specific activity limit

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RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 12:20 Page 24

Summary : SU20 Elevated Area #3 Excavation

File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA3 EXCAVATION.RAD

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)
Ac-227	1.900E-01	0.000E+00	1.639E-05	1.526E+06	1.639E-05	1.526E+06
Pa-231	1.900E-01	20.70 ± 0.04	5.970E-06	4.187E+06	2.391E-06	1.046E+07
Pb-210	2.189E+02	0.666 ± 0.001	6.784E-08	3.685E+08	6.597E-08	3.790E+08
Ra-226	2.189E+02	0.000E+00	5.540E-05	4.513E+05	5.540E-05	4.513E+05
Ra-228	5.960E+01	2.429 ± 0.005	4.611E-05	5.421E+05	3.603E-05	6.939E+05
Th-228	5.960E+01	0.000E+00	4.125E-05	6.061E+05	4.125E-05	6.061E+05
Th-230	1.300E+03	140.6 ± 0.3	1.552E-06	1.611E+07	2.895E-07	8.636E+07
Th-232	5.960E+01	37.87 ± 0.08	7.016E-05	*1.097E+05	3.429E-06	*1.097E+05
U-234	4.240E+00	0.000E+00	1.111E-07	2.251E+08	1.111E-07	2.251E+08
U-235	1.900E-01	0.000E+00	4.574E-06	*2.161E+06	4.574E-06	*2.161E+06
U-238	4.240E+00	0.000E+00	9.118E-07	*3.361E+05	9.118E-07	*3.361E+05

*At specific activity limit

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RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 12:20 Page 25
Summary : SU20 Elevated Area #3 Excavation
File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA3 EXCAVATION.RAD

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

Nuclide (j)	Parent (i)	THF (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
Ac-227	Ac-227	1.000E+00	3.113E-06	2.885E-06	2.478E-06	1.454E-06	3.170E-07	1.522E-09	0.000E+00	0.000E+00
Ac-227	Pa-231	1.000E+00	4.988E-08	1.436E-07	3.058E-07	6.693E-07	8.477E-07	2.853E-07	0.000E+00	0.000E+00
Ac-227	U-235	1.000E+00	3.530E-13	2.393E-12	1.178E-11	8.190E-11	3.504E-10	5.050E-10	0.000E+00	0.000E+00
Ac-227	ΣDOSE(j)		3.163E-06	3.029E-06	2.783E-06	2.123E-06	1.165E-06	2.873E-07	0.000E+00	0.000E+00
Pa-231	Pa-231	1.000E+00	4.044E-07	3.972E-07	3.832E-07	3.379E-07	2.357E-07	6.649E-08	0.000E+00	0.000E+00
Pa-231	U-235	1.000E+00	4.266E-12	1.259E-11	2.837E-11	7.506E-11	1.522E-10	1.415E-10	0.000E+00	0.000E+00
Pa-231	ΣDOSE(j)		4.044E-07	3.972E-07	3.832E-07	3.379E-07	2.359E-07	6.663E-08	0.000E+00	0.000E+00
Pb-210	Pb-210	1.000E+00	1.308E-05	1.256E-05	1.159E-05	8.755E-06	3.924E-06	2.361E-07	0.000E+00	0.000E+00
Pb-210	Ra-226	1.000E+00	2.037E-07	5.967E-07	1.322E-06	3.300E-06	5.761E-06	3.789E-06	0.000E+00	0.000E+00
Pb-210	Th-230	1.000E+00	1.754E-10	1.209E-09	6.177E-09	4.896E-08	2.969E-07	1.218E-06	0.000E+00	0.000E+00
Pb-210	U-234	1.000E+00	1.286E-18	1.901E-17	2.143E-16	5.030E-15	8.754E-14	1.066E-12	0.000E+00	0.000E+00
Pb-210	U-238	9.999E-01	7.290E-25	2.225E-23	5.420E-22	3.748E-20	1.881E-18	7.133E-17	0.000E+00	0.000E+00
Pb-210	ΣDOSE(j)		1.328E-05	1.316E-05	1.292E-05	1.210E-05	9.983E-06	5.244E-06	0.000E+00	0.000E+00
Po-210	Pb-210	1.000E+00	1.367E-06	2.238E-06	2.216E-06	1.678E-06	7.545E-07	4.596E-08	0.000E+00	0.000E+00
Po-210	Ra-226	1.000E+00	1.612E-08	7.609E-08	2.133E-07	5.963E-07	1.080E-06	7.265E-07	0.000E+00	0.000E+00
Po-210	Th-230	1.000E+00	1.124E-11	1.246E-10	8.719E-10	8.389E-09	5.445E-08	2.313E-07	0.000E+00	0.000E+00
Po-210	U-234	1.000E+00	6.953E-20	1.670E-18	2.708E-17	8.232E-16	1.579E-14	2.015E-13	0.000E+00	0.000E+00
Po-210	U-238	9.999E-01	3.412E-26	1.718E-24	6.215E-23	5.872E-21	3.338E-19	1.342E-17	0.000E+00	0.000E+00
Po-210	ΣDOSE(j)		1.383E-06	2.314E-06	2.431E-06	2.283E-06	1.889E-06	1.004E-06	0.000E+00	0.000E+00
Ra-226	Ra-226	1.000E+00	1.213E-02	1.196E-02	1.163E-02	1.055E-02	7.969E-03	2.918E-03	0.000E+00	0.000E+00
Ra-226	Th-230	1.000E+00	1.563E-05	4.659E-05	1.071E-04	3.054E-04	7.682E-04	1.562E-03	0.000E+00	0.000E+00
Ra-226	U-234	1.000E+00	1.525E-13	1.057E-12	5.469E-12	4.530E-11	3.071E-10	1.591E-09	0.000E+00	0.000E+00
Ra-226	U-238	9.999E-01	1.078E-19	1.600E-18	1.820E-17	4.413E-16	8.352E-15	1.232E-13	0.000E+00	0.000E+00
Ra-226	ΣDOSE(j)		1.214E-02	1.201E-02	1.174E-02	1.085E-02	8.737E-03	4.479E-03	0.000E+00	0.000E+00
Ra-228	Ra-228	1.000E+00	1.696E-03	1.483E-03	1.135E-03	4.441E-04	3.041E-05	2.498E-09	0.000E+00	0.000E+00
Ra-228	Th-232	1.000E+00	1.045E-04	2.957E-04	6.086E-04	1.224E-03	1.571E-03	1.470E-03	0.000E+00	0.000E+00
Ra-228	ΣDOSE(j)		1.800E-03	1.779E-03	1.743E-03	1.668E-03	1.601E-03	1.470E-03	0.000E+00	0.000E+00
Th-228	Ra-228	1.000E+00	4.513E-04	1.091E-03	1.594E-03	1.031E-03	7.729E-05	6.250E-09	0.000E+00	0.000E+00
Th-228	Th-228	1.000E+00	2.459E-03	1.710E-03	8.267E-04	6.500E-05	4.535E-08	3.967E-19	0.000E+00	0.000E+00
Th-228	Th-232	1.000E+00	1.888E-05	1.153E-04	4.539E-04	1.634E-03	2.501E-03	2.326E-03	0.000E+00	0.000E+00
Th-228	ΣDOSE(j)		2.929E-03	2.916E-03	2.875E-03	2.731E-03	2.579E-03	2.326E-03	0.000E+00	0.000E+00
Th-230	Th-230	1.000E+00	3.607E-04	3.607E-04	3.607E-04	3.606E-04	3.604E-04	3.596E-04	0.000E+00	0.000E+00
Th-230	U-234	1.000E+00	5.264E-12	1.567E-11	3.593E-11	1.014E-10	2.494E-10	4.962E-10	0.000E+00	0.000E+00
Th-230	U-238	9.999E-01	4.959E-18	3.437E-17	1.775E-16	1.464E-15	9.819E-15	5.077E-14	0.000E+00	0.000E+00
Th-230	ΣDOSE(j)		3.607E-04	3.607E-04	3.607E-04	3.606E-04	3.604E-04	3.596E-04	0.000E+00	0.000E+00
Th-232	Th-232	1.000E+00	8.104E-05	8.104E-05	8.103E-05	8.102E-05	8.100E-05	8.091E-05	0.000E+00	0.000E+00
U-234	U-234	1.000E+00	4.709E-07	4.626E-07	4.465E-07	3.944E-07	2.768E-07	8.013E-08	0.000E+00	0.000E+00
U-234	U-238	9.999E-01	6.654E-13	1.965E-12	4.428E-12	1.174E-11	2.393E-11	2.283E-11	0.000E+00	0.000E+00
U-234	ΣDOSE(j)		4.709E-07	4.626E-07	4.465E-07	3.944E-07	2.768E-07	8.015E-08	0.000E+00	0.000E+00
U-235	U-235	1.000E+00	8.690E-07	8.535E-07	8.232E-07	7.254E-07	5.054E-07	1.416E-07	0.000E+00	0.000E+00

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**CS-RS-RP-009-26
Revision 0**

RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 12:20 Page 26
Summary : SU20 Elevated Area #3 Excavation
File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA3 EXCAVATION.RAD

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

Nuclide (j)	Parent (i)	THF(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
U-238	U-238	5.400E-05	2.238E-11	2.199E-11	2.122E-11	1.875E-11	1.316E-11	3.811E-12	0.000E+00	0.000E+00
U-238	U-238	9.999E-01	3.866E-06	3.796E-06	3.660E-06	3.221E-06	2.235E-06	6.130E-07	0.000E+00	0.000E+00
U-238	∑DOSE(j)		3.866E-06	3.796E-06	3.660E-06	3.221E-06	2.235E-06	6.130E-07	0.000E+00	0.000E+00

THF(i) is the thread fraction of the parent nuclide.

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RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 12:20 Page 27

Summary : SU20 Elevated Area #3 Excavation

File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA3 EXCAVATION.RAD

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF (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
Ac-227	Ac-227	1.000E+00	1.900E-01	1.761E-01	1.513E-01	8.902E-02	1.954E-02	9.684E-05	2.516E-11	2.249E-34
Ac-227	Pa-231	1.000E+00	0.000E+00	5.773E-03	1.579E-02	3.843E-02	5.047E-02	1.764E-02	5.108E-04	2.089E-09
Ac-227	U-235	1.000E+00	0.000E+00	6.167E-08	5.157E-07	4.457E-06	2.046E-05	3.104E-05	3.065E-06	4.389E-11
Ac-227	ΣS(j):		1.900E-01	1.819E-01	1.671E-01	1.275E-01	7.003E-02	1.777E-02	5.139E-04	2.133E-09
Pa-231	Pa-231	1.000E+00	1.900E-01	1.867E-01	1.802E-01	1.591E-01	1.116E-01	3.228E-02	9.321E-04	3.812E-09
Pa-231	U-235	1.000E+00	0.000E+00	3.950E-06	1.144E-05	3.367E-05	7.089E-05	6.838E-05	5.935E-06	8.151E-11
Pa-231	ΣS(j):		1.900E-01	1.867E-01	1.802E-01	1.592E-01	1.117E-01	3.235E-02	9.380E-04	3.893E-09
Pb-210	Pb-210	1.000E+00	2.189E+02	2.103E+02	1.942E+02	1.468E+02	6.603E+01	4.029E+00	1.364E-03	9.748E-16
Pb-210	Ra-226	1.000E+00	0.000E+00	6.627E+00	1.886E+01	5.235E+01	9.463E+01	6.374E+01	4.985E+00	5.215E-04
Pb-210	Th-230	1.000E+00	0.000E+00	8.599E-03	7.473E-02	7.359E-01	4.775E+00	2.030E+01	3.232E+01	3.275E+01
Pb-210	U-234	1.000E+00	0.000E+00	8.416E-11	2.194E-09	7.192E-08	1.385E-06	1.769E-05	5.045E-05	5.439E-05
Pb-210	U-238	9.999E-01	0.000E+00	5.964E-17	4.664E-15	5.093E-13	2.927E-11	1.178E-09	7.120E-09	8.720E-09
Pb-210	ΣS(j):		2.189E+02	2.170E+02	2.131E+02	1.999E+02	1.654E+02	8.807E+01	3.731E+01	3.275E+01
Po-210	Pb-210	1.000E+00	0.000E+00	1.737E+02	1.886E+02	1.431E+02	6.437E+01	3.927E+00	1.330E-03	9.503E-16
Po-210	Ra-226	1.000E+00	0.000E+00	3.533E+00	1.504E+01	4.798E+01	8.991E+01	6.120E+01	4.791E+00	5.012E-04
Po-210	Th-230	1.000E+00	0.000E+00	3.466E-03	5.114E-02	6.380E-01	4.438E+00	1.930E+01	3.085E+01	3.127E+01
Po-210	U-234	1.000E+00	0.000E+00	2.749E-11	1.323E-09	5.942E-08	1.266E-06	1.674E-05	4.813E-05	5.192E-05
Po-210	U-238	9.999E-01	0.000E+00	1.642E-17	2.518E-15	4.020E-13	2.631E-11	1.110E-09	6.788E-09	8.324E-09
Po-210	ΣS(j):		0.000E+00	1.772E+02	2.037E+02	1.917E+02	1.587E+02	8.442E+01	3.564E+01	3.127E+01
Ra-226	Ra-226	1.000E+00	2.189E+02	2.161E+02	2.105E+02	1.921E+02	1.478E+02	5.911E+01	4.309E+00	4.506E-04
Ra-226	Th-230	1.000E+00	0.000E+00	5.595E-01	1.657E+00	5.278E+00	1.397E+01	3.135E+01	4.194E+01	4.208E+01
Ra-226	U-234	1.000E+00	0.000E+00	8.183E-09	7.215E-08	7.466E-07	5.502E-06	3.183E-05	6.664E-05	6.986E-05
Ra-226	U-238	9.999E-01	0.000E+00	7.718E-15	2.034E-13	6.923E-12	1.473E-10	2.457E-09	9.698E-09	1.120E-08
Ra-226	ΣS(j):		2.189E+02	2.166E+02	2.121E+02	1.973E+02	1.618E+02	9.046E+01	4.624E+01	4.208E+01
Ra-228	Ra-228	1.000E+00	5.960E+01	5.217E+01	3.997E+01	1.573E+01	1.096E+00	9.775E-05	2.629E-16	0.000E+00
Ra-228	Th-232	1.000E+00	0.000E+00	6.727E+00	1.777E+01	3.970E+01	5.293E+01	5.386E+01	5.370E+01	5.315E+01
Ra-228	ΣS(j):		5.960E+01	5.889E+01	5.773E+01	5.543E+01	5.402E+01	5.386E+01	5.370E+01	5.315E+01
Th-228	Ra-228	1.000E+00	0.000E+00	1.689E+01	3.142E+01	2.236E+01	1.731E+00	1.546E-04	4.158E-16	0.000E+00
Th-228	Th-228	1.000E+00	5.960E+01	4.148E+01	2.010E+01	1.591E+00	1.134E-03	1.095E-14	0.000E+00	0.000E+00
Th-228	Th-232	1.000E+00	0.000E+00	1.106E+00	7.315E+00	3.226E+01	5.235E+01	5.386E+01	5.370E+01	5.315E+01
Th-228	ΣS(j):		5.960E+01	5.948E+01	5.883E+01	5.621E+01	5.408E+01	5.386E+01	5.370E+01	5.315E+01
Th-230	Th-230	1.000E+00	1.300E+03	1.300E+03	1.300E+03	1.300E+03	1.299E+03	1.297E+03	1.291E+03	1.269E+03
Th-230	U-234	1.000E+00	0.000E+00	3.783E-05	1.115E-04	3.498E-04	8.880E-04	1.786E-03	2.133E-03	2.108E-03
Th-230	U-238	9.999E-01	0.000E+00	5.346E-11	4.700E-10	4.811E-09	3.444E-08	1.822E-07	3.329E-07	3.380E-07
Th-230	ΣS(j):		1.300E+03	1.300E+03	1.300E+03	1.300E+03	1.299E+03	1.297E+03	1.291E+03	1.269E+03
Th-232	Th-232	1.000E+00	5.960E+01	5.960E+01	5.960E+01	5.959E+01	5.957E+01	5.951E+01	5.934E+01	5.872E+01
U-234	U-234	1.000E+00	4.240E+00	4.166E+00	4.021E+00	3.552E+00	2.493E+00	7.218E-01	2.092E-02	8.664E-08
U-234	U-238	9.999E-01	0.000E+00	1.181E-05	3.419E-05	1.007E-04	2.120E-04	2.046E-04	1.779E-05	2.459E-10
U-234	ΣS(j):		4.240E+00	4.166E+00	4.021E+00	3.552E+00	2.493E+00	7.220E-01	2.093E-02	8.688E-08
U-235	U-235	1.000E+00	1.900E-01	1.867E-01	1.802E-01	1.592E-01	1.117E-01	3.235E-02	9.380E-04	3.893E-09

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Revision 0**

RESRAD, Version 6.5 T½ Limit = 30 days 09/17/2013 12:20 Page 28
Summary : SU20 Elevated Area #3 Excavation
File : C:\RESRAD_FAMILY\RESRAD\USERFILES\SU20 EA3 EXCAVATION.RAD

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(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
U-238	U-238	5.400E-05	2.290E-04	2.249E-04	2.171E-04	1.918E-04	1.346E-04	3.899E-05	1.130E-06	4.692E-12
U-238	U-238	9.999E-01	4.240E+00	4.165E+00	4.020E+00	3.552E+00	2.493E+00	7.219E-01	2.093E-02	8.688E-08
U-238	ΣS(j):		4.240E+00	4.166E+00	4.021E+00	3.552E+00	2.493E+00	7.220E-01	2.093E-02	8.688E-08

THF(i) is the thread fraction of the parent nuclide.

RESRAD.EXE execution time = 2.18 seconds