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ABSTRACT

In 1988, a comprehensive radiological survey was performed in designated portions of Building T009 and surrounding areas at the Santa Susana Field Laboratories (SSFL). The results of the survey showed a few isolated areas of contamination inside the building, but at levels that were all well below any applicable regulatory limits, including some low levels of fission products, ^{238}U, ^{235}U, and ^{232}Th in a sludge sample from an inactive hold-up tank. The hold-up tank and associated drain lines were removed in late 1989 through early 1990. As part of this effort, an indication-only gamma survey was conducted, and extensive soil samples were collected from the drain line trenches for later analysis. As no above-normal gamma measurements were observed in the indication-only survey, the trenches were backfilled and resurfaced.

This report provides further corroborative results from subsequent gamma spectrometric analyses of the soil samples. The data show no measurable radionuclide activity above normal background levels at the SSFL. Based on these results, and the 1988 survey, it is concluded that residual radionuclide activity in all surveyed areas in and around Building T009 is well below applicable limits. Therefore, these areas meet the requirements of DOE Order 5400.5, "Radiation Protection of the Public and Environment" (February 1990), for release without radiological restrictions.

RESERVED FOR PROPRIETARY/LEGAL NOTICES

CONTENTS

TABLES

FIGURES

1.0 BACKGROUND AND SUMMARY

Building T009 is located in Area IV of Rockwell International's Santa Susana Field Laboratories (SSFL), and was originally designated the Critical Experiments Building. From the late 1950s until the early 1970s, this building supported nuclear reactor programs for the U.S. Department of Energy's (DOE) predecessor agencies. Primarily, these included two critical experiments: the sodium graphite reactor (SGR) and the organic moderated reactor (OMR).

As shown in Figure 1, the SGR was located in the eastern part of the building and the OMR was located in the western part. In the late 1960s, the SGR and OMR programs were terminated and all materials from the two critical assemblies were subsequently removed and transferred to other laboratories or disposed of at authorized sites in the early 1970s. At that time, the building was re-designated the Engineering Development Facility. The SGR side is currently being used for in-service inspection (ISI) activities for nuclear power plants involving equipment contaminated with low levels of radioactivity.

Although no major contamination incidents are known to have occurred in Building T009, it was general practice at Atomics International to clean up any small contamination incidents that may have occurred to original "clean" conditions. Nevertheless, in 1988 a comprehensive radiological survey (Ref. 1) was conducted on the OMR side as part of a broad radiological survey plan for the SSFL (Ref. 2), with the intent of preparing the OMR side of the building for release without radiological restrictions. The SGR side was not included because of the ongoing ISI work.

The 1988 survey included total and removable alpha/beta radioactivity measurements on the building interior, examination of sludge from sink clean-outs, shower drains, etc., including sludge from the inactive SGR hold-up tank and pit, and ambient gamma exposure measurements outside the building on the northwest side. The results of the survey showed that a few locations inside the facility were very slightly contaminated, but at levels far below any regulatory limits. No radioactivity was observed in the drain-line sludge samples; however, analysis of sludge inside the SGR hold-up tank indicated slight contamination with fission products, ^{238}U, ^{232}Th, and possibly ^{235}U. The report concluded that further investigation of the area was not required, but recommended Health Physics supervision, and collection and examination of radiological data in the vicinity of the drain lines, if the hold-up tank were removed for disposal.

Subsequent to the 1988 survey report, the SGR hold-up tank and associated drain system were removed in late 1989 and early 1990 (Ref. 3) for disposal at an authorized site. As part of this effort, numerous soil samples were collected from areas immediately adjacent to the removed drain lines for subsequent gamma spectrometric analysis. The results of the analyses of these soil samples for residual radioactivity are discussed in this Safety Review Report and showed no measurable radionuclide activity above normal background levels at the SSFL.

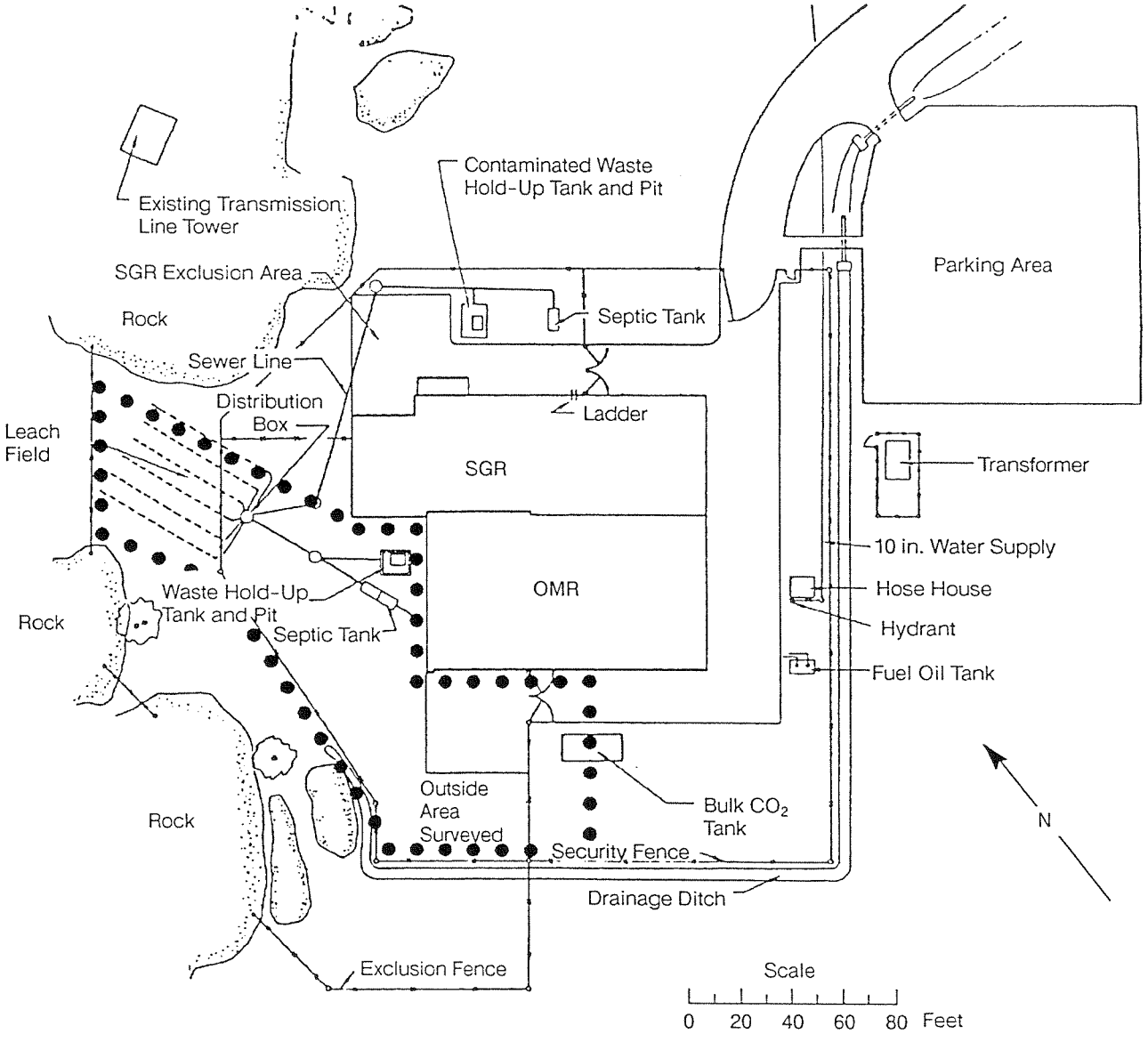

Figure 1. Plot Plan of Building T009 During Critical Assembly Operations

2.0 SCOPE

The scope of the present effort was to (1) present the results of analyses of the soil samples collected during the removal of the SGR hold-up tank and associated drain lines, (2) statistically analyze the data and compare these with available background data for the SSFL to determine if the surveyed areas are free of radioactive contamination, and thus may be released without radiological restrictions, and (3) have all material relevant to the Building T009 decontamination assembled and archived in a permanent file at the SSFL.

3.0 SOIL ANALYSIS RESULTS AND DISCUSSION

3.1 SOIL SAMPLE COLLECTION

Removal of the inactive SGR hold-up tank and drain lines was performed in late 1989 and early 1990 (Ref. 3). All work was performed in accordance with a detailed work procedure (Ref. 4). As part of this effort, 199 two-pound soil samples were randomly taken from soil areas immediately adjacent to the removed drain lines, both outside the facility, and from sections underneath Building T009. A complete description of the areas surveyed is given in Ref. 3.

During soil removal, an indication-only survey for residual contamination was conducted on the drain line trenches using a Ludlum Model 12S Micro-R meter, and a Ludlum Model 12 countrate meter with a thin-window pancake probe. No indication of radioactive contamination was observed during this survey, and the drain line trenches were subsequently backfilled and resurfaced.

3.2 SOIL ANALYSIS DATA

Gamma spectrometry was performed on the 199 two-pound soil samples using a Canberra Series 80 gamma spectrometer. A generic description of the spectrometer and its calibration is given in Ref. 5. The resulting spectrometry data were analyzed using the in-house spreadsheet code MCASOIL. MCASOIL converts the multichannel analyzer (MCA) output from the gamma spectrometer (i.e., quantity of isotope for each peak analyzed) in μCi, to concentrations of selected isotopes, and total derived alpha and beta activities (both in pCi/g). These calculational procedures are also described in Ref. 5.

Spectrometric data from the 199 soil samples were examined for concentration of the naturally occurring isotopes ^{238}U, ^{232}Th, ^{235}U, and ^{40}K, and the man-made isotopes ^{137}Cs, ^{134}Cs, and ^{60}Co. Mean and standard deviations for the activity concentrations of these isotopes are summarized in Table 1; the complete MCASOIL output listing is given in Appendix A. As indicated in Appendix A, except for two isolated data points for ^{137}Cs (Sample Nos. 124 and G6), no measurable activity was observed for the man-made nuclides ^{137}Cs, ^{134}Cs, or ^{60}Co in any soil sample. The two isolated data points for ^{137}Cs are very low (0.15 and 0.18 pCi/g), and are close to the detection limit of the MCA system for ^{137}Cs of ~0.1 to 0.2 pCi/g. These values of 0.15 and 0.18 pCi/g are also more than an order of magnitude lower than the 2.6 pCi/g of ^{137}Cs found in the SGR hold-up tank sludge sample during the 1988 survey (Ref. 1).

Table 1. Summary of Gamma Spectrometry Data for All 199 T009 Drain Line Soil Samples

Radionuclide	Mean Value[a] (pCi/g)	Standard Deviation[b] (pCi/g)
Naturally occurring		
^{238}U	0.64	0.24
^{235}U	0.02	0.03
^{232}Th	0.97	0.36
^{40}K	15.3	5.6
Man-made		
^{137}Cs	0.0[c]	0.0
^{134}Cs	0.0	0.0
^{60}Co	0.0	0.0

[a]Mean value of 199 soil data values (Appendix A).

[b]Standard deviation (1σ) of distribution.

[c]Mean value includes two data points with values of 0.15 and 0.18 pCi/g, which were above the cutoff limit for the measuring equipment (see text).

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3.3 COMPARISON WITH BACKGROUND RADIONUCLIDE ACTIVITY LEVELS AT THE SSFL

Because radionuclide activity, including the fission product ^{137}Cs, was observed in the inactive SGR hold-up tank sludge sample, it is instructive to examine the radionuclide data in Table 1 to determine if the measured activities are consistent with naturally occurring radioactivity levels at the SSFL. This will verify that no unobserved leaks occurred in the drain line system during its operation that may have contaminated the surrounding soil.

Background radionuclide activity is present at the SSFL, and elsewhere, as a result of several naturally occurring radionuclides and also from the man-made nuclide ^{137}Cs from radioactive fallout during the period of atmospheric nuclear weapons testing. Background values for radionuclide activity at the SSFL were independently measured as part of an Area IV survey by Groundwater Resources Consultants (GRC), Inc. between July and October 1988 (Ref. 6). Measured background values for ^{238}U, ^{235}U, ^{232}Th, ^{137}Cs, and ^{40}K from the survey are summarized in Table 2. The activity values in Table 2 are an average of data from three representative soil samples taken during the GRC survey.

Comparing the data in Tables 1 and 2 indicates that in each case the radionuclide values measured in the Building T009 soil are consistent although somewhat lower than the corresponding GRC values. The zero average ^{137}Cs value for the T009 soil samples in Table 1 may be attributed to that fact that the soil was taken from around the buried drain lines, and thus was underground and largely unaffected from any fallout. The measured ratio of ^{235}U to ^{238}U in the drain line soil is also consistent, within uncertainties, with the GRC measured ratio, and the expected naturally occurring activity ratio of 0.045 (Ref. 7) for these two isotopes.

Thus, the data show no increased residual activity either from the ^{137}Cs fission product, from the ^{238}U and ^{235}U fuel element isotopes, or from ^{232}Th, which could have potentially contaminated the soil in the vicinity of the drain lines.

Although the comparison of the data in Tables 1 and 2 indicates that there is no residual radionuclide activity from ^{137}Cs, ^{238}U, or ^{235}U in the Building T009 drain line soil, the data do indicate some small systematic differences in the T009 data and the corresponding background data determined by GRC. Figures 2, 3, and 4 show the ratio of ^{238}U, ^{232}Th, and ^{235}U with respect to the naturally occurring ^{40}K data, for each of the 199 soil samples plotted against the cumulative gaussian probability. The value of this type of graphical display is that it permits the identification of individual data points significantly outside the range expected for the distribution. For a perfectly "normal" (gaussian) distribution, the data values would fall on a straight line, with the mean value

Table 2. Summary of Background Soil Radionuclide Activity at the SSFL

Isotope	Mean Value[a] (pCi/g)	Standard Deviation[b] (pCig)
Naturally occurring		
^{238}U	1.1	0.3
^{235}U	0.04	0.02
^{232}Th	1.7	0.3
^{40}K	22	1
Man-made		
^{137}Cs	0.07	0.05

Note: Data from Groundwater Resources Consultants (GRC) Report 8640M-77 (Ref. 6)

[a]Average of data from three representative soil samples.

[b]Standard deviation (1σ) of distribution.

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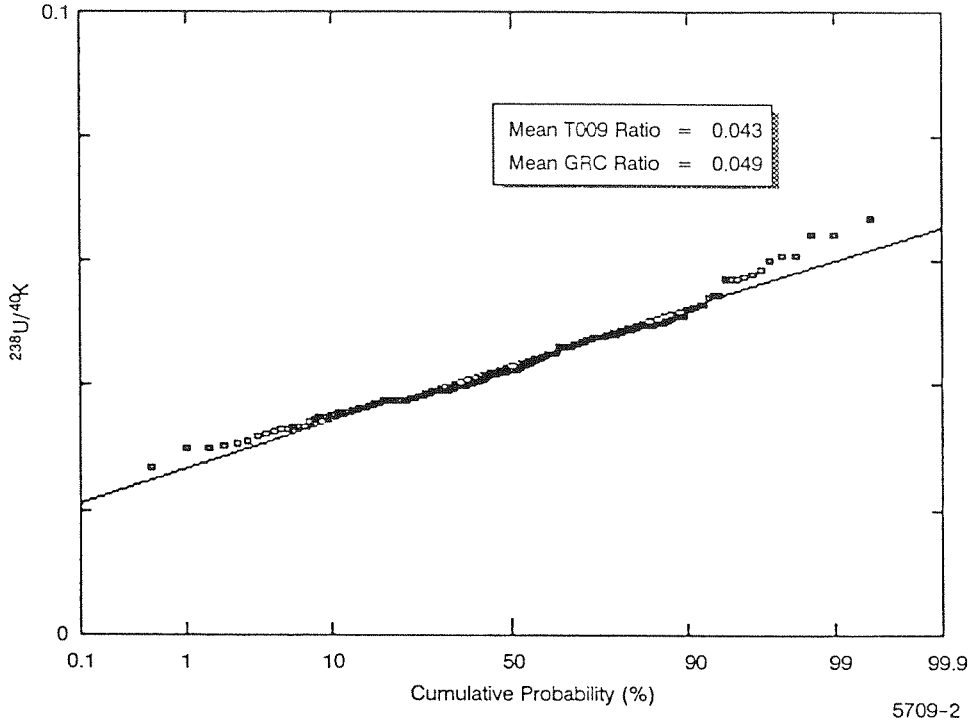

Figure 2. Measured $^{238}U/^{40}K$ Ratio in T009 Drain Line Soil

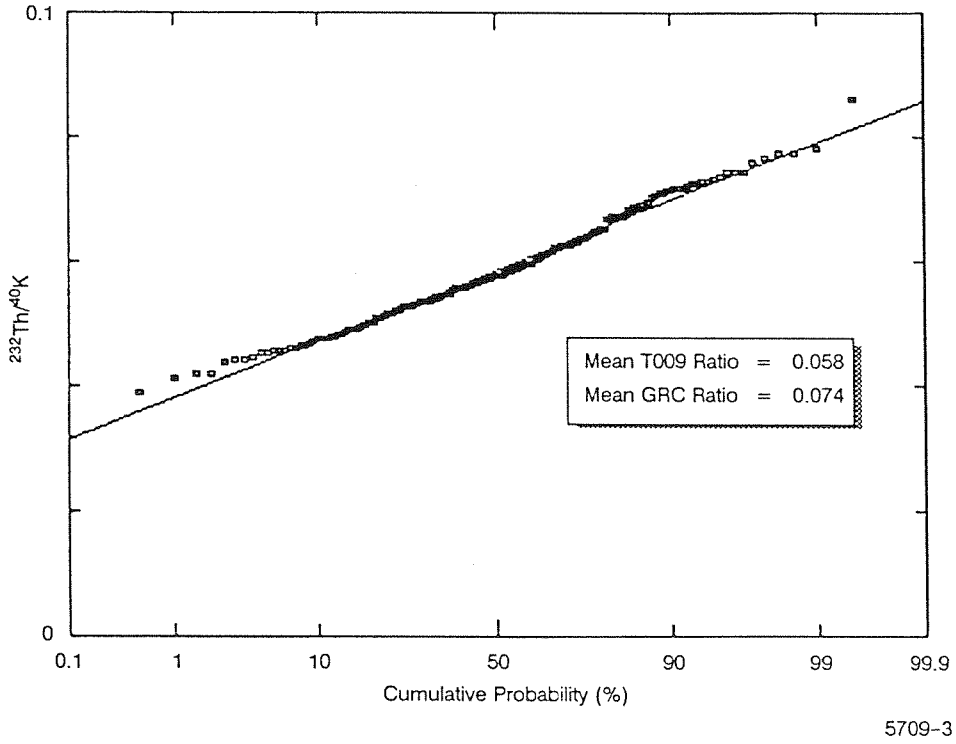

Figure 3. Measured $^{232}Th/^{40}K$ Ratio in T009 Drain Line Soil

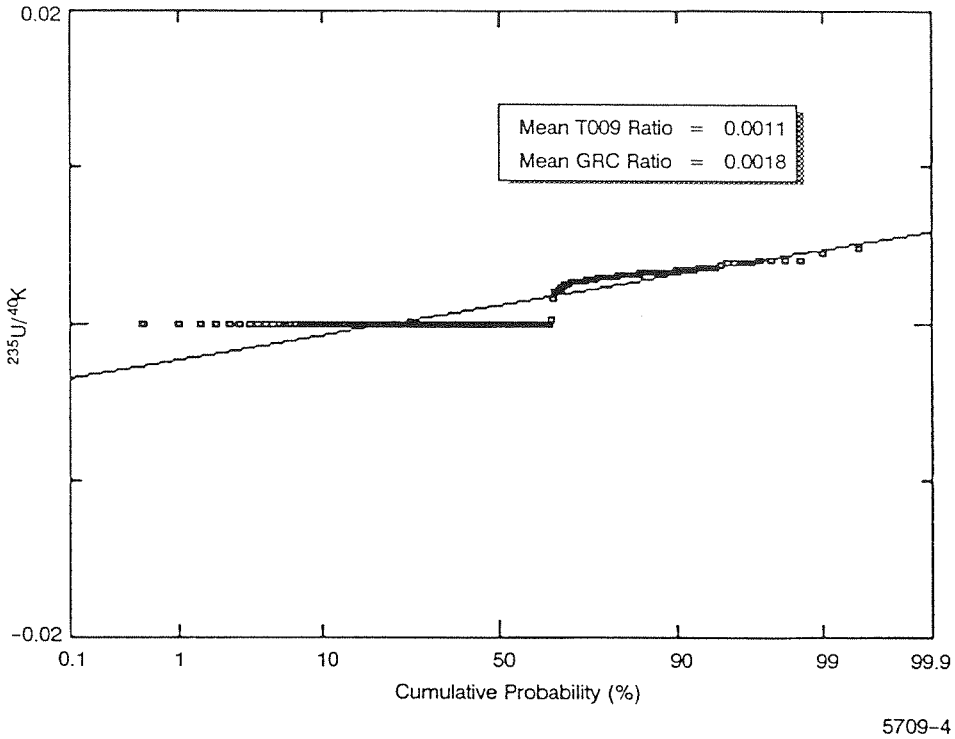

Figure 4. Measured $^{235}U/^{40}K$ Ratio in T009 Drain Line Soil

occurring at the 50% point on the probability axis. For comparison, the mean ratio values for the T009 data and the GRC data are also indicated inside each figure.

Figures 2 and 3 show distributions which are closely gaussian, with no outliers. The distribution in Figure 4, for ^{235}U, also shows no outliers but it is slightly skewed due to a large number of "zero" measurements. The mean isotope ratios obtained from the Building T009 data, although being similar to the corresponding GRC values, are nonetheless consistently lower. These comparisons, therefore, suggest that there are some small energy-dependent sensitivity and/or calibration differences between the Canberra instrument used at the SSFL and the analysis system used by GRC Inc. These differences, however, have no effect on the overall conclusions reached from the data.

4.0 CONCLUSIONS

In accordance with the recommendations of the Building T009 radiological survey, the inactive SGR hold-up tank and associated drain line system were removed under Health Physics supervision for disposal at an authorized site. As part of this work, extensive soil samples were taken for subsequent gamma spectrometric analysis and the results were compared with background radionuclide activity levels at the SSFL. These analyses are reported here, and the following conclusions are drawn.

4.1 SPECIFIC CONCLUSIONS

1. No residual levels of man-made radionuclides were observed in the T009 drain line soil.

2. Measured naturally occurring radionuclide activity in the Building T009 drain line soil was comparable to (although slightly lower than) normal background levels measured independently in nearby soils at the SSFL.

3. The slightly lower T009 soil activity results compared to normal background levels are attributed to small variations in the sensitivity and/or calibration of the SSFL analysis system.

4.2 OVERALL CONCLUSIONS

1. Based on the results of the analyses reported here, the Building T009 drain line soil is free of any residual radioactive contamination.

2. Based on the results of the 1988 radiological survey of Building T009, the OMR side (interior western side) and the outside northwestern areas surveyed are acceptably free of residual radioactive contamination.

3. The interior western side and the exterior northwestern side are suitable for release for use without radiological restrictions.

5.0 REFERENCES

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2. Badger, F. H., and Tuttle, R. J., "Radiological Survey Plan for SSFL," 154SRR000001, Rocketdyne Division, Rockwell International, September 25, 1985.

3. Klein, A., "Building T009 Drain System Removal," N001TI000329, Rocketdyne Division, Rockwell International, August 22, 1990.

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5. Chapman, J. A., "Radiological Survey of the Source and Special Nuclear Material Storage Vault - Bldg T64," GEN-ZR-0005, Energy Technology Engineering Center, Rockwell International, August 19, 1988.

6. "Investigation of Naturally Occurring Radionuclides in Rock, Soils and Groundwater - Santa Susana Field Laboratory, Ventura County, California," 8640M-77, Groundwater Resources Consultants, Inc., June 1, 1990.

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APPENDIX A

DERIVED ALPHA, BETA, AND RADIONUCLIDE DATA FROM BUILDING T009 DRAIN LINE SOIL

During removal of the SGR hold-up tank and associated drain line system from Building T009, 199 two-pound samples were collected from the soil surrounding the drain lines. In each case, samples ranging in mass from ~700 to 900 g were analyzed using a Canberra system as described in Ref. 2. Following analysis, the results were input to the MCASOIL spreadsheet, which calculated derived quantities for total alpha and total beta, and derived activities for selected man-made and naturally occurring radionuclides. A zero value in the data tables indicates that no photopeaks were detected above the detection limit of the Canberra multichannel analyzer. For ^{137}Cs, this detection limit was ~0.1 to 0.2 pCi/g for the counting times used for the analyses.

Table A–1. Gamma Spectrometry Data from Drain Line Soil Samples
(Sheet 1 of 6)

	39	40	41	42	43	44	45	46	47	48	49	50
1	BUILDING T009 DRAIN LINE SOIL SAMPLES											
2	(Samples Analyzed: 1/11/90 TO 1/18/90)											
3	Excel File:	009SOIL.XLS										
4												
5			picocuries per gram of each radionuclide									
6					186 keV	185.6 keV						
7			U-238	Th-232	U-235	U-235	K-40	Cs-137	Cs-134	Co-60	Derived Alpha	Derived Beta
8					(from	(from					pCi/g	pCi/g
9					Ra-226)	U-238)						
10												
11	Sample	Mass	c32*1e6/	c33*1e6/	c34*1e6/	c41*.045	c35*1e6/	c36*1e6/	c37*1e6/	c38*1e6/	8*c41+6*c42	6*c41+4*c42+4*
12	Description	(grams)	c2	c2	c2		c2	c2	c2	c2	+7*c43	c43+sum(c44:48)
13												
14	SOIL 1	708.2	0.74	1.11	0.04	0.03	16.50	0.00	0.00	0.00	12.88	25.58
15	SOIL 2	584.9	0.63	1.15	0.00	0.03	16.76	0.00	0.00	0.00	11.89	25.14
16	SOIL 3	494.8	0.73	1.13	0.00	0.03	19.48	0.00	0.00	0.00	12.59	28.39
17	SOIL 4	630.4	0.65	1.09	0.00	0.03	17.39	0.00	0.00	0.00	11.75	25.69
18	SOIL 4 DUPLICATE	698.0	0.67	0.79	0.04	0.03	13.85	0.00	0.00	0.00	10.41	21.24
19	SOIL 5	659.2	0.67	1.05	0.00	0.03	18.31	0.00	0.00	0.00	11.62	26.53
20	SOIL 6	649.4	0.84	1.06	0.05	0.04	17.01	0.00	0.00	0.00	13.48	26.56
21	SOIL 7	628.7	0.87	1.09	0.06	0.04	17.57	0.00	0.00	0.00	13.93	27.44
22	SOIL 8	659.1	0.62	1.19	0.00	0.03	16.34	0.00	0.00	0.00	12.11	24.85
23	SOIL 9	639.4	0.69	1.07	0.00	0.03	16.50	0.00	0.00	0.00	11.92	24.93
24	SOIL 10	670.1	0.73	0.74	0.04	0.03	17.68	0.00	0.00	0.00	10.60	25.24
25	SOIL 11	776.4	0.53	0.74	0.00	0.02	14.19	0.00	0.00	0.00	8.64	20.32
26	SOIL 12	699.7	0.71	0.95	0.00	0.03	16.10	0.00	0.00	0.00	11.34	24.17
27	SOIL 12 DUPLICATE	716.1	0.55	0.87	0.00	0.02	15.08	0.00	0.00	0.00	9.65	21.91
28	SOIL 13	717.0	0.74	0.98	0.05	0.03	15.41	0.00	0.00	0.00	12.15	24.00
29	SOIL 14	724.7	0.59	0.89	0.00	0.03	16.69	0.00	0.00	0.00	10.08	23.84
30	SOIL 15	739.9	0.55	0.97	0.00	0.02	14.48	0.00	0.00	0.00	10.28	21.73
31	SOIL 16	627.4	0.97	1.10	0.00	0.04	16.77	0.00	0.00	0.00	14.32	27.00
32	SOIL 17	558.4	1.01	1.01	0.07	0.05	17.71	0.00	0.00	0.00	14.57	28.09
33	SOIL 18	665.7	0.62	1.07	0.00	0.03	16.51	0.00	0.00	0.00	11.37	24.53
34	SOIL 19	730.3	0.58	0.75	0.00	0.03	13.39	0.00	0.00	0.00	9.18	19.92
35	SOIL 30	741.5	0.82	0.82	0.05	0.04	15.16	0.00	0.00	0.00	11.79	23.57
36	SOIL 31	785.2	0.62	0.81	0.00	0.03	13.89	0.00	0.00	0.00	9.85	20.91

Table A–1. Gamma Spectrometry Data from Drain Line Soil Samples
(Sheet 2 of 6)

	39	40	41	42	43	44	45	46	47	48	49	50
37	SOIL 32	782.7	0.73	0.81	0.06	0.03	15.14	0.00	0.00	0.00	11.15	23.05
38	SOIL 33	785.8	0.57	0.80	0.00	0.03	13.81	0.00	0.00	0.00	9.35	20.45
39	SOIL 34	726.3	0.48	0.69	0.00	0.02	14.68	0.00	0.00	0.00	7.95	20.32
40	SOIL 35	724.2	0.58	0.79	0.00	0.03	14.64	0.00	0.00	0.00	9.36	21.30
41	SOIL 36	691.3	0.49	0.79	0.00	0.02	14.14	0.00	0.00	0.00	8.62	20.23
42	SOIL 37	772.7	0.54	0.71	0.00	0.02	13.33	0.00	0.00	0.00	8.56	19.42
43	SOIL 38	725.2	0.56	0.89	0.00	0.03	14.97	0.00	0.00	0.00	9.77	21.88
44	SOIL 39	728.9	0.64	0.70	0.00	0.03	14.97	0.00	0.00	0.00	9.29	21.62
45	SOIL 40	738.9	0.70	0.77	0.05	0.03	14.50	0.00	0.00	0.00	10.65	22.06
46	SOIL 41	713.5	0.65	0.63	0.00	0.03	14.98	0.00	0.00	0.00	8.99	21.43
47	SOIL 52	819.6	0.71	1.04	0.04	0.03	14.97	0.00	0.00	0.00	12.18	23.57
48	SOIL 53	704.9	0.59	1.16	0.00	0.03	16.87	0.00	0.00	0.00	11.70	25.09
49	SOIL 54	761.1	0.58	0.86	0.00	0.03	15.59	0.00	0.00	0.00	9.85	22.58
50	SOIL 55	661.3	0.66	1.01	0.00	0.03	15.71	0.00	0.00	0.00	11.34	23.74
51	SOIL 56	776.0	0.68	1.09	0.04	0.03	15.05	0.00	0.00	0.00	12.24	23.66
52	SOIL 57	818.2	0.92	1.11	0.04	0.04	15.28	0.00	0.00	0.00	14.25	25.41
53	SOIL 58	677.2	0.76	1.06	0.04	0.03	15.80	0.00	0.00	0.00	12.67	24.76
54	SOIL 58 DUPLICATE	693.2	0.58	1.03	0.00	0.03	13.80	0.00	0.00	0.00	10.83	21.44
55	SOIL 59A	640.8	0.90	1.15	0.06	0.04	15.79	0.00	0.00	0.00	14.52	26.07
56	SOIL 60A	808.6	0.60	0.99	0.04	0.03	15.09	0.00	0.00	0.00	11.00	22.83
57	SOIL 62	705.4	0.55	0.84	0.00	0.02	18.43	0.00	0.00	0.00	9.44	25.11
58	SOIL 63	739.0	0.67	1.01	0.00	0.03	14.29	0.00	0.00	0.00	11.42	22.38
59	SOIL 64	690.5	0.73	0.79	0.05	0.03	15.79	0.00	0.00	0.00	10.89	23.54
60	SOIL 65	752.3	0.67	0.87	0.04	0.03	17.03	0.00	0.00	0.00	10.83	24.70
61	SOIL 70	613.0	0.66	1.09	0.00	0.03	17.37	0.00	0.00	0.00	11.80	25.71
62	SOIL 71	678.5	0.81	0.87	0.05	0.04	16.89	0.00	0.00	0.00	12.05	25.47
63	SOIL 72	665.2	0.70	1.00	0.00	0.03	17.03	0.00	0.00	0.00	11.60	25.26
64	SOIL 73	650.7	0.68	0.94	0.00	0.03	16.81	0.00	0.00	0.00	11.07	24.67
65	SOIL 74	774.0	0.52	0.82	0.00	0.02	15.02	0.00	0.00	0.00	9.12	21.47
66	SOIL 75	710.0	0.58	0.96	0.00	0.03	17.55	0.00	0.00	0.00	10.44	24.93
67	SOIL 76	679.5	0.92	1.18	0.06	0.04	13.73	0.00	0.00	0.00	14.85	24.24
68	SOIL 77	717.9	0.71	1.13	0.05	0.03	15.17	0.00	0.00	0.00	12.82	24.19
69	SOIL 78	612.4	0.80	1.09	0.06	0.04	17.41	0.00	0.00	0.00	13.37	26.85
70	SOIL 79	636.1	0.88	1.03	0.05	0.04	17.70	0.00	0.00	0.00	13.64	27.38
71	SOIL 80	771.2	0.57	0.73	0.00	0.03	15.14	0.00	0.00	0.00	8.93	21.50
72	SOIL 80 DUPLICATE	641.3	0.74	1.18	0.06	0.03	18.46	0.00	0.00	0.00	13.35	27.85

Table A-1. Gamma Spectrometry Data from Drain Line Soil Samples
(Sheet 3 of 6)

	39	40	41	42	43	44	45	46	47	48	49	50
73	SOIL 81	792.7	0.61	0.76	0.00	0.03	14.42	0.00	0.00	0.00	9.46	21.17
74	SOIL 82	811.9	0.54	0.68	0.00	0.02	14.62	0.00	0.00	0.00	8.43	20.63
75	SOIL 83	789.6	0.61	0.68	0.00	0.03	14.55	0.00	0.00	0.00	8.95	20.95
76	SOIL 84	774.1	0.57	0.81	0.00	0.03	13.97	0.00	0.00	0.00	9.41	20.65
77	SOIL 85	800.7	0.69	0.66	0.05	0.03	14.58	0.00	0.00	0.00	9.81	21.59
78	SOIL 86	804.3	0.58	0.80	0.00	0.03	14.32	0.00	0.00	0.00	9.45	21.03
79	SOIL 87	815.7	0.63	0.84	0.00	0.03	14.91	0.00	0.00	0.00	10.14	22.12
80	SOIL 88	823.2	0.55	0.73	0.00	0.02	14.22	0.00	0.00	0.00	8.77	20.46
81	SOIL 89	792.0	0.56	0.92	0.00	0.03	15.36	0.00	0.00	0.00	9.95	22.39
82	SOIL 90	778.8	0.82	0.77	0.06	0.04	14.04	0.00	0.00	0.00	11.60	22.32
83	SOIL 91	782.6	0.41	0.81	0.00	0.02	15.08	0.00	0.00	0.00	8.11	20.77
84	SOIL 99	772.4	0.48	0.72	0.00	0.02	15.75	0.00	0.00	0.00	8.15	21.52
85	SOIL 100	603.9	0.60	0.97	0.00	0.03	15.89	0.00	0.00	0.00	10.60	23.38
86	SOIL 101	717.4	0.45	0.73	0.00	0.02	13.43	0.00	0.00	0.00	7.97	19.06
87	SOIL 102	736.9	0.53	0.90	0.00	0.02	14.33	0.00	0.00	0.00	9.64	21.13
88	SOIL 103	776.0	0.62	0.55	0.00	0.03	11.32	0.00	0.00	0.00	8.26	17.26
89	SOIL 104	766.2	0.62	0.76	0.04	0.03	13.90	0.00	0.00	0.00	9.80	20.85
90	SOIL 105	725.2	0.49	0.78	0.00	0.02	13.24	0.00	0.00	0.00	8.58	19.31
91	SOIL 106	624.8	0.80	0.81	0.06	0.04	15.67	0.00	0.00	0.00	11.71	24.01
92	SOIL 120	816.1	0.49	0.77	0.00	0.02	14.81	0.00	0.00	0.00	8.49	20.81
93	SOIL 121	765.9	0.54	0.81	0.00	0.02	14.47	0.00	0.00	0.00	9.19	20.99
94	SOIL 122	797.2	0.59	0.92	0.00	0.03	13.55	0.00	0.00	0.00	10.21	20.77
95	SOIL 123	736.6	0.58	0.96	0.03	0.03	13.94	0.00	0.00	0.00	10.65	21.43
96	SOIL 124	774.7	0.54	0.81	0.00	0.02	11.40	0.15	0.00	0.00	9.20	18.07
97	SOIL 125	774.0	0.63	0.85	0.00	0.03	13.58	0.00	0.00	0.00	10.10	20.76
98	SOIL 126	779.9	0.51	0.79	0.00	0.02	10.28	0.00	0.00	0.00	8.85	16.54
99	SOIL 150	698.9	0.52	0.96	0.00	0.02	15.73	0.00	0.00	0.00	9.90	22.69
100	SOIL 151	623.2	0.76	1.10	0.05	0.03	16.34	0.00	0.00	0.00	13.02	25.52
101	SOIL 152	672.7	0.82	1.13	0.00	0.04	14.48	0.00	0.00	0.00	13.37	23.98
102	SOIL 153	691.5	0.82	1.07	0.05	0.04	14.30	0.00	0.00	0.00	13.33	23.73
103	SOIL 154	707.8	0.87	1.08	0.06	0.04	14.30	0.00	0.00	0.00	13.88	24.13
104	SOIL 155	724.5	0.68	0.82	0.04	0.03	13.71	0.00	0.00	0.00	10.62	21.25
105	SOIL 156	705.2	0.51	0.88	0.00	0.02	12.32	0.00	0.00	0.00	9.39	18.94
106	SOIL 160	816.8	0.47	0.70	0.00	0.02	11.59	0.00	0.00	0.00	8.02	17.28
107	SOIL 161	758.8	0.54	1.11	0.00	0.02	15.75	0.00	0.00	0.00	11.00	23.46
108	SOIL 162	739.7	0.53	0.85	0.03	0.02	13.38	0.00	0.00	0.00	9.53	20.09

Table A-1. Gamma Spectrometry Data from Drain Line Soil Samples
(Sheet 4 of 6)

	39	40	41	42	43	44	45	46	47	48	49	50
109	SOIL 1000	800.7	0.54	0.62	0.04	0.02	10.49	0.00	0.00	0.00	8.26	16.35
110	SOIL 1001	756.6	0.67	0.68	0.00	0.03	14.14	0.00	0.00	0.00	9.49	20.95
111	SOIL 1002	807.5	0.52	0.65	0.00	0.02	14.90	0.00	0.00	0.00	8.12	20.69
112	SOIL G1	667.4	0.59	0.88	0.00	0.03	15.93	0.00	0.00	0.00	10.03	23.04
113	SOIL G2	680.9	0.61	0.86	0.00	0.03	15.78	0.00	0.00	0.00	10.04	22.90
114	SOIL G3	631.7	0.62	0.73	0.00	0.03	15.96	0.00	0.00	0.00	9.38	22.65
115	SOIL G5	573.6	0.95	0.97	0.06	0.04	18.05	0.00	0.00	0.00	13.88	27.94
116	SOIL G6	747.8	0.47	0.62	0.00	0.02	10.01	0.18	0.00	0.00	7.49	15.52
117	SOIL G7	692.2	0.61	0.80	0.00	0.03	15.44	0.00	0.00	0.00	9.71	22.35
118	SOIL G9	700.1	0.58	0.73	0.00	0.03	14.99	0.00	0.00	0.00	9.02	21.42
119	SOIL G10	677.7	0.56	0.94	0.00	0.03	15.69	0.00	0.00	0.00	10.06	22.79
120	SOIL G11	717.2	0.68	0.75	0.04	0.03	15.36	0.00	0.00	0.00	10.22	22.63
121	SOIL G13	678.9	0.65	0.86	0.03	0.03	16.35	0.00	0.00	0.00	10.54	23.82
122	SOIL G14	670.2	0.73	0.75	0.00	0.03	14.01	0.00	0.00	0.00	10.30	21.39
123	SOIL G15	689.4	0.55	0.73	0.00	0.02	14.14	0.00	0.00	0.00	8.78	20.38
124	SOIL G30	759.5	0.67	0.95	0.00	0.03	13.22	0.00	0.00	0.00	11.00	21.03
125	SOIL G31	644.4	0.83	1.36	0.05	0.04	19.15	0.00	0.00	0.00	15.14	29.79
126	SOIL G32	729.1	0.56	0.95	0.00	0.03	17.57	0.00	0.00	0.00	10.16	24.75
127	SOIL G33	603.6	0.81	1.13	0.00	0.04	17.56	0.00	0.00	0.00	13.26	26.97
128	SOIL G34	719.9	0.80	1.00	0.04	0.04	13.13	0.00	0.00	0.00	12.71	22.15
129	SOIL G35	686.2	0.78	1.10	0.05	0.03	15.94	0.00	0.00	0.00	13.19	25.25
130	SOIL G36	660.7	0.67	0.85	0.00	0.03	13.95	0.00	0.00	0.00	10.44	21.38
131	SOIL G37	696.6	0.72	0.90	0.05	0.03	15.16	0.00	0.00	0.00	11.53	23.32
132	SOIL G39	653.6	0.58	1.14	0.00	0.03	14.76	0.00	0.00	0.00	11.48	22.82
133	SOIL G40	750.8	0.58	0.99	0.00	0.03	14.00	0.00	0.00	0.00	10.58	21.47
134	SOIL G41	738.0	0.80	0.94	0.05	0.04	16.59	0.00	0.00	0.00	12.43	25.42
135	SOIL G42	643.8	0.56	0.95	0.00	0.03	17.72	0.00	0.00	0.00	10.21	24.93
136	SOIL G42	831.9	0.64	0.77	0.02	0.03	15.14	0.00	0.00	0.00	9.89	22.17
137	SOIL G43	767.0	0.71	0.90	0.00	0.03	15.12	0.00	0.00	0.00	11.07	23.00
138	SOIL G44	727.0	0.83	0.97	0.06	0.04	15.65	0.00	0.00	0.00	12.87	24.78
139	SOIL G44 DUPLICATE	768.2	0.62	0.86	0.00	0.03	15.31	0.00	0.00	0.00	10.11	22.49
140	SOIL G45	748.3	0.61	0.78	0.00	0.03	13.66	0.00	0.00	0.00	9.54	20.45
141	SOIL G45 DUPLICATE	814.3	0.72	0.86	0.00	0.03	15.43	0.00	0.00	0.00	10.91	23.21
142	SOIL G46	681.8	0.59	0.92	0.05	0.03	14.15	0.00	0.00	0.00	10.60	21.61
143	SOIL G46 DUPLICATE	806.2	0.74	0.82	0.05	0.03	14.66	0.00	0.00	0.00	11.15	22.59
144	SOIL G47	667.2	0.89	0.82	0.06	0.04	17.80	0.00	0.00	0.00	12.44	26.68

Table A–1. Gamma Spectrometry Data from Drain Line Soil Samples
(Sheet 5 of 6)

	39	40	41	42	43	44	45	46	47	48	49	50
145	SOIL G47 DUPLICATE	606.4	0.60	0.83	0.00	0.03	17.34	0.00	0.00	0.00	9.77	24.28
146	SOIL G48	768.1	0.68	0.72	0.05	0.03	15.57	0.00	0.00	0.00	10.07	22.74
147	SOIL G49	644.3	0.57	0.91	0.00	0.03	16.12	0.00	0.00	0.00	10.03	23.21
148	SOIL G50	601.5	0.80	1.06	0.06	0.04	18.09	0.00	0.00	0.00	13.20	27.42
149	SOIL G50 (60000 SECOND	601.5	0.72	1.01	0.04	0.03	16.30	0.00	0.00	0.00	12.11	24.86
150	SOIL G51	646.6	0.60	1.08	0.00	0.03	18.11	0.00	0.00	0.00	11.32	26.08
151	SOIL G52	734.3	0.55	0.97	0.00	0.02	13.99	0.00	0.00	0.00	10.16	21.15
152	SOIL G53	711.4	0.66	0.68	0.00	0.03	14.33	0.00	0.00	0.00	9.39	21.06
153	SOIL G60	676.6	0.49	0.91	0.00	0.02	15.98	0.00	0.00	0.00	9.34	22.56
154	SOIL G61	705.5	0.50	0.81	0.00	0.02	13.45	0.00	0.00	0.00	8.90	19.74
155	SOIL G62	701.0	0.58	0.74	0.04	0.03	14.50	0.00	0.00	0.00	9.30	21.08
156	SOIL G63	754.2	0.53	0.69	0.00	0.02	14.55	0.00	0.00	0.00	8.40	20.53
157	SOIL G64	666.9	0.52	0.65	0.00	0.02	14.63	0.00	0.00	0.00	8.06	20.37
158	SOIL G65	689.0	0.43	0.65	0.00	0.02	14.36	0.00	0.00	0.00	7.30	19.53
159	SOIL G66	710.0	0.63	0.68	0.00	0.03	13.63	0.00	0.00	0.00	9.11	20.15
160	SOIL G70	790.2	0.50	0.78	0.00	0.02	13.51	0.00	0.00	0.00	8.72	19.68
161	SOIL G71	795.4	0.65	0.81	0.00	0.03	15.43	0.00	0.00	0.00	10.04	22.58
162	SOIL G72	777.1	0.59	0.76	0.00	0.03	15.15	0.00	0.00	0.00	9.28	21.76
163	SOIL G73	784.8	0.72	0.79	0.05	0.03	13.85	0.00	0.00	0.00	10.80	21.53
164	SOIL G74	798.6	0.64	0.87	0.04	0.03	13.03	0.00	0.00	0.00	10.69	20.58
165	SOIL G75	777.5	0.59	0.68	0.00	0.03	15.38	0.00	0.00	0.00	8.76	21.64
166	SOIL G78	761.1	0.56	0.80	0.00	0.03	12.49	0.00	0.00	0.00	9.25	19.05
167	SOIL G79	769.9	0.50	0.75	0.00	0.02	13.00	0.00	0.00	0.00	8.48	19.02
168	SOIL G80	792.3	0.51	0.75	0.00	0.02	12.77	0.00	0.00	0.00	8.58	18.85
169	SOIL G80 DUPLICATE	789.6	0.64	0.78	0.04	0.03	14.79	0.00	0.00	0.00	10.10	21.95
170	SOIL G81	738.8	0.59	0.77	0.00	0.03	14.86	0.00	0.00	0.00	9.30	21.47
171	SOIL G82	785.2	0.60	0.72	0.04	0.03	14.49	0.00	0.00	0.00	9.43	21.18
172	SOIL G83	767.5	0.70	0.79	0.04	0.03	14.74	0.00	0.00	0.00	10.61	22.28
173	SOIL G84	801.8	0.65	0.86	0.00	0.03	13.99	0.00	0.00	0.00	10.35	21.35
174	SOIL G85	818.7	0.74	0.62	0.04	0.03	15.10	0.00	0.00	0.00	9.93	22.23
175	SOIL G87	756.2	0.73	0.71	0.00	0.03	14.78	0.00	0.00	0.00	10.04	21.99
176	SOIL G88	785.2	0.74	0.72	0.05	0.03	11.55	0.00	0.00	0.00	10.61	19.13
177	SOIL G88 DUPLICATE	805.3	0.64	0.68	0.04	0.03	13.95	0.00	0.00	0.00	9.55	20.74
178	SOIL G89	809.1	0.60	0.73	0.00	0.03	14.75	0.00	0.00	0.00	9.14	21.26
179	SOIL G90	768.6	0.53	0.69	0.00	0.02	13.94	0.00	0.00	0.00	8.41	19.93
180	SOIL G91	853.7	0.68	0.77	0.00	0.03	14.39	0.00	0.00	0.00	10.08	21.60

Table A–1. Gamma Spectrometry Data from Drain Line Soil Samples
(Sheet 6 of 6)

	39	40	41	42	43	44	45	46	47	48	49	50
181	SOIL G92	787.7	0.69	0.85	0.04	0.03	14.62	0.00	0.00	0.00	10.89	22.34
182	SOIL G99	751.0	0.56	0.81	0.00	0.03	13.15	0.00	0.00	0.00	9.33	19.77
183	SOIL G100	778.8	0.56	0.72	0.00	0.03	11.40	0.00	0.00	0.00	8.85	17.71
184	SOIL G101	813.4	0.57	0.67	0.00	0.03	12.60	0.00	0.00	0.00	8.55	18.70
185	SOIL G102	793.6	0.56	0.78	0.00	0.03	14.68	0.00	0.00	0.00	9.13	21.16
186	SOIL G103	788.3	0.61	0.73	0.04	0.03	12.06	0.00	0.00	0.00	9.52	18.81
187	SOIL G104	722.9	0.58	0.87	0.00	0.03	12.61	0.00	0.00	0.00	9.89	19.62
188	SOIL G105	757.3	0.45	0.84	0.00	0.02	11.72	0.00	0.00	0.00	8.67	17.83
189	SOIL G106	777.4	0.64	0.69	0.05	0.03	12.74	0.00	0.00	0.00	9.58	19.55
190	SOIL G120	828.9	0.52	0.86	0.00	0.02	13.24	0.00	0.00	0.00	9.28	19.79
191	SOIL G121	781.9	0.64	0.95	0.04	0.03	13.93	0.00	0.00	0.00	11.13	21.77
192	SOIL G122	798.2	0.55	0.91	0.00	0.02	14.46	0.00	0.00	0.00	9.81	21.39
193	SOIL G123	791.6	0.49	0.73	0.00	0.02	11.88	0.00	0.00	0.00	8.32	17.78
194	SOIL G124	780.2	0.62	0.98	0.00	0.03	13.76	0.00	0.00	0.00	10.84	21.42
195	SOIL G125	809.4	0.55	1.00	0.00	0.02	13.76	0.00	0.00	0.00	10.42	21.10
196	SOIL G126	783.4	0.67	0.94	0.04	0.03	12.74	0.00	0.00	0.00	11.23	20.68
197	SOIL G150	700.7	0.61	0.75	0.04	0.03	16.97	0.00	0.00	0.00	9.63	23.80
198	SOIL G151	767.0	0.64	0.68	0.04	0.03	11.76	0.00	0.00	0.00	9.46	18.50
199	SOIL G152	741.6	0.56	0.61	0.00	0.03	15.60	0.00	0.00	0.00	8.11	21.40
200	SOIL G153	768.5	0.66	0.75	0.04	0.03	13.30	0.00	0.00	0.00	9.98	20.39
201	SOIL G154	783.9	0.60	0.75	0.00	0.03	13.46	0.00	0.00	0.00	9.28	20.08
202	SOIL G155	796.2	0.48	0.88	0.00	0.02	14.04	0.00	0.00	0.00	9.12	20.46
203	SOIL G156	785.2	0.66	0.81	0.00	0.03	13.77	0.00	0.00	0.00	10.16	21.02
204	SOIL G160	735.9	0.51	0.50	0.03	0.02	10.54	0.00	0.00	0.00	7.30	15.75
205	SOIL G161	765.3	0.53	0.79	0.00	0.02	13.70	0.00	0.00	0.00	8.98	20.07
206	SOIL G162	799.1	0.64	0.90	0.00	0.03	14.87	0.00	0.00	0.00	10.53	22.34
207	SOIL G1000	786.0	0.73	0.83	0.05	0.03	11.42	0.00	0.00	0.00	11.15	19.34
208	SOIL G1001	748.3	0.65	0.91	0.00	0.03	13.66	0.00	0.00	0.00	10.68	21.24
209	SOIL G1002	838.3	0.54	0.74	0.00	0.02	15.04	0.00	0.00	0.00	8.81	21.30
210	SOIL H1	728.7	0.77	0.94	0.00	0.03	18.99	0.00	0.00	0.00	11.81	27.41
211	SOIL H2	666.2	0.55	1.10	0.00	0.02	17.53	0.00	0.00	0.00	10.99	25.24
212	SOIL H3	697.8	0.67	1.00	0.00	0.03	14.95	0.00	0.00	0.00	11.33	22.98

APPENDIX B.

LIST OF ITEMS IN THE BUILDING T009 DECOMMISSIONING FILE

The following is a list of the documents on the decommissioning of the OMR side of Building T009 and the surrounding northwestern outside area. The documents are archived in Building T100 of Rockwell International's Santa Susana Field Laboratory (SSFL).

1. Chapman, J. A., "Radiological Survey of Building T009," GEN-ZR-0014, Rocketdyne Division, Energy Technology Engineering Center, Rockwell International, August 26, 1988.

    - Radiological survey report on the OMR side of SSFL Building T009 (interior) and on the exterior area northwest of the facility. The results of the survey showed a few areas inside the building that were slightly contaminated, but with levels far below any regulatory limits. No elevated gamma exposure rates were observed. The report recommended that no further investigation was required, and that the areas surveyed were acceptable for unrestricted release. It was further recommended that removal of the inactive SGR hold-up tank be done under Health Physics supervision.

2. Parker, D.C., "SGR Liquid Drain Line System Removal, Building T009," 195DWP000001, Rocketdyne Division, Rockwell International, October 10, 1989.

    - Report describes the procedures used to remove the SGR hold-up tank and associated drain line system from Building T009.

3. Klein, A., "Building T009 Drain System Removal," N001TI000329, Rocketdyne Division, Rockwell International, August 22, 1990.

    - Report describes the removal of the SGR hold-up tank and associated drain line system. Indication-only gamma surveys of the drain line trenches showed no radioactivity above background. Almost 200 soil samples were collected from the trenches for subsequent MCA analysis.

4. Gamma Mass Spectrometric Analysis (MCA) printouts and corresponding MCASOIL spreadsheets corresponding to data from the 199 soil samples taken during removal of the SGR hold-up tank and associated drain line system.

5. Oliver, B. M., and Subbaraman, G., "Final Decontamination and Radiological Survey Report of Portions of Building T009," N704SRR990032, Rocketdyne Division, Rockwell International, December 1990.