Phase II Final Status Survey Report
Mallinckrodt Columbium-Tantalum Plant

St. Louis, Missouri

Chapter 20

Project No. 137131 **Revision 0**

Prepared by:
Energy*Solutions*, LLC
Commercial Projects
1009 Commerce Park Drive, Suite 100
Oak Ridge, TN 37830

Authored By:	Timothy J. Bauer, Health Physicist	9/11/2013 Date
Reviewed By:	Joseph D. Jacobsen, Senior Health Physicist	9/11/2013 Date
Reviewed By:	Mark Cambra, P.E., Project Manager	09/11/2013 Date
Approved By:	Arthur J. Palmer, CHP, PMP, Director, Health Physics & Radiological Engineering	9/12/2013 Date

[X] Non-Proprietary	[X] New
[ ] Proprietary	[ ] Title Change
[ ] Restricted Information	[ ] Revision
[ ] Safeguards Information	[ ] Rewrite
[ ] Sensitive Security Information	[ ] Cancellation

Effective Date 9/13/2013

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

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
DCGL	derived concentration guideline level
DP	decommissioning plan
DQO	data quality objectives
EMC	elevated measurement comparison
FSS	Final Status Survey
FSSR	Final Status Survey Report
ft	feet
GWS	gamma walk-over survey
m^2	square meters
MARSSIM	Multi-Agency Radiation and Site Investigation Manual (NUREG-1575)
MDC	minimum detectable concentration
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

20.0 RESULTS SUMMARY FOR PLANT 5 SUBSURFACE SU14

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 SU14 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 April 2012. The SU14 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.

20.1 OVERVIEW

SU14 is a Class 1 survey unit located in the north central portion of C-T Plant 5. The survey unit is approximately 227 square meters (m^2) in size, which is less than the size limit of 3,000 m^2 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 20-1 shows the location of SU14 within the Plant 5 area.

Figure 20-2 is a photograph of SU14 that was taken during the FSS, following remediation. The survey unit is bounded on the north by Destrehan Street, on the west by SU04, and on the south by SU15. The 7th Street roadway lies immediately east of SU14. Soil and related debris were removed from the area to an excavated depth range of approximately 5 to 13 feet (ft) below grade surface (bgs). The remediation of SU14 involved removing a portion of a concrete structure at the west end of the survey unit. The concrete structure extended the length of the west side of SU14. Contaminated soil was removed from the remaining section of the concrete structure by a combination of mechanical means and power washing.

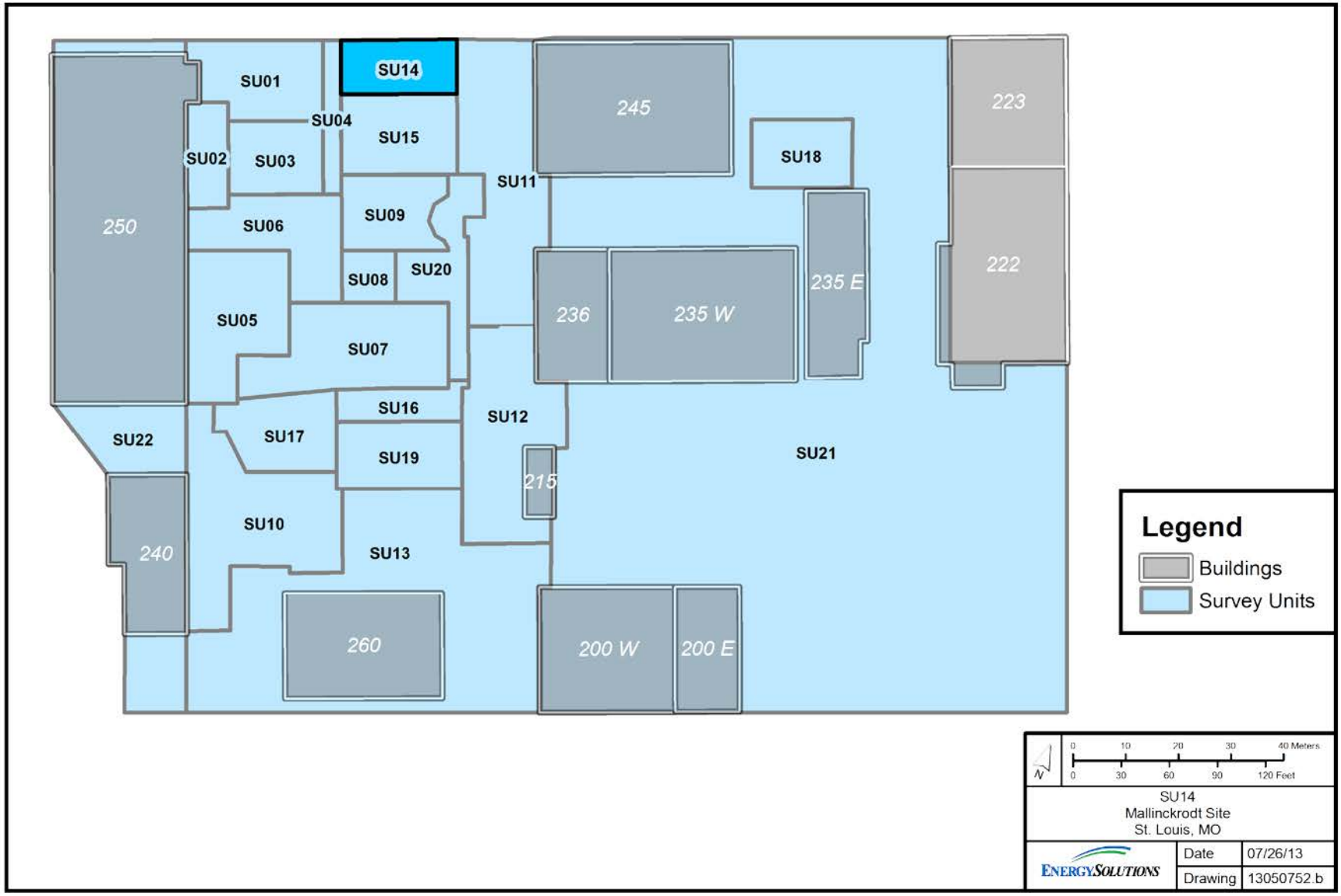


Figure 20-1 Location of Subsurface SU14 in C-T Plant 5

Figure 20-2 Photograph Looking North Towards SU14

20.2 REMEDIAL ACTION AND RADIOLOGICAL SAMPLING SUMMARY

Extensive post-remediation soil sampling, shown in Figure 20-3, was performed by AECOM after GWS indicated successful remediation. The soil sampling demonstrated that the survey unit was ready for FSS. Table 20-1 provides the results for 23 post-remediation samples. In addition, a soil sample (3677) collected beneath the concrete structure verified contaminated soil does not extend beneath it, which exhibited a gross sum of fractions (SOF) value of 0.12.

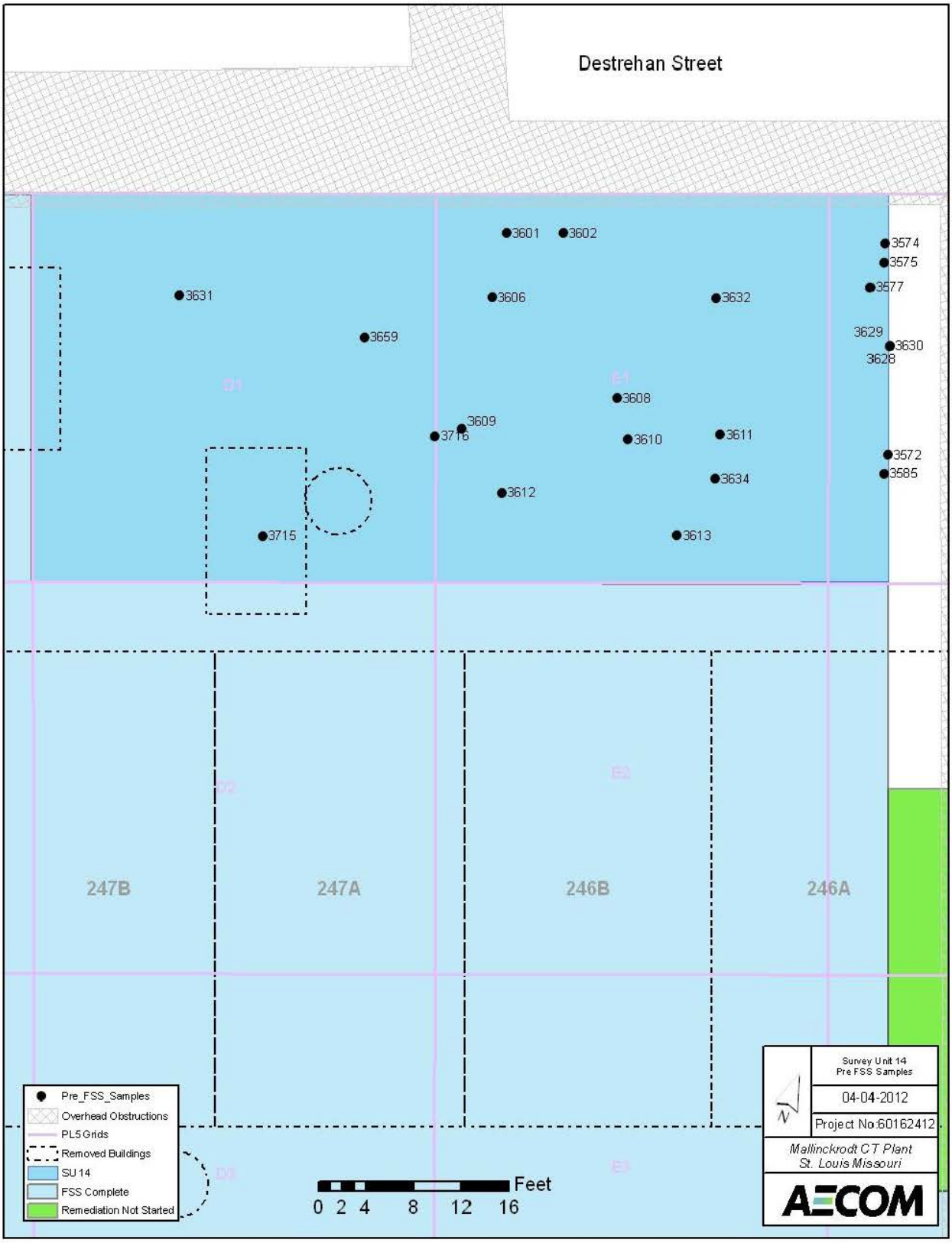


Figure 20-3 Post-Remediation Soil Sampling Locations

Table 20-1 Post-Remediation Sampling Analytical Results

Sample ID	Collection Date	On-Site Results			
		Concentration (pCi/g)			Gross SOF
		^{232}Th	^{226}Ra	^{238}U	
3572	3/7/2012	1.50	2.93	1.59	0.17
3574	3/7/2012	1.80	7.54	8.38	0.35
3575	3/7/2012	3.07	10.04	14.93	0.49
3577	3/7/2012	1.52	11.23	19.75	0.47
3585	3/8/2012	1.19	2.04	3.99	0.13
3601	3/12/2012	0.50	10.35	2.87	0.38
3602	3/12/2012	0.37	4.40	7.50	0.18
3606	3/12/2012	1.17	12.43	26.21	0.51
3608	3/12/2012	1.98	10.33	13.17	0.45
3609	3/12/2012	1.34	17.39	23.69	0.68
3610	3/13/2012	0.00	11.98	7.76	0.42
3611	3/13/2012	1.13	3.19	2.87	0.16
3612	3/13/2012	1.29	3.78	3.51	0.19
3613	3/13/2012	1.43	3.64	3.82	0.19
3628	3/14/2012	1.47	5.03	4.83	0.24
3629	3/14/2012	-0.48	4.02	3.37	0.14
3630	3/14/2012	0.34	7.20	7.75	0.27
3631	3/20/2012	2.28	10.42	21.12	0.48
3632	3/20/2012	1.26	10.18	19.03	0.43
3634	3/20/2012	2.72	9.68	4.26	0.45
3659	3/27/2012	0.26	11.42	1.81	0.40
3715	4/4/2012	2.29	18.37	13.16	0.74
3716	4/4/2012	1.51	3.12	5.78	0.18

20.3 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.

20.3.1 Gamma Scans

A gamma walk-over survey (GWS) was performed over 100% of the excavated area to locate radiation anomalies that might indicate areas with elevated residual radioactivity where further data collection (i.e., biased soil sampling) was warranted.

20.3.2 Soil Sampling

Soil samples to be used for the statistical test were collected at a frequency and at representative locations throughout SU14 such that a statistically sound conclusion regarding the radiological condition of the survey unit could be developed. Additional biased soil samples were also collected at locations of elevated residual radioactivity identified by GWS. Figure 20-4 provides

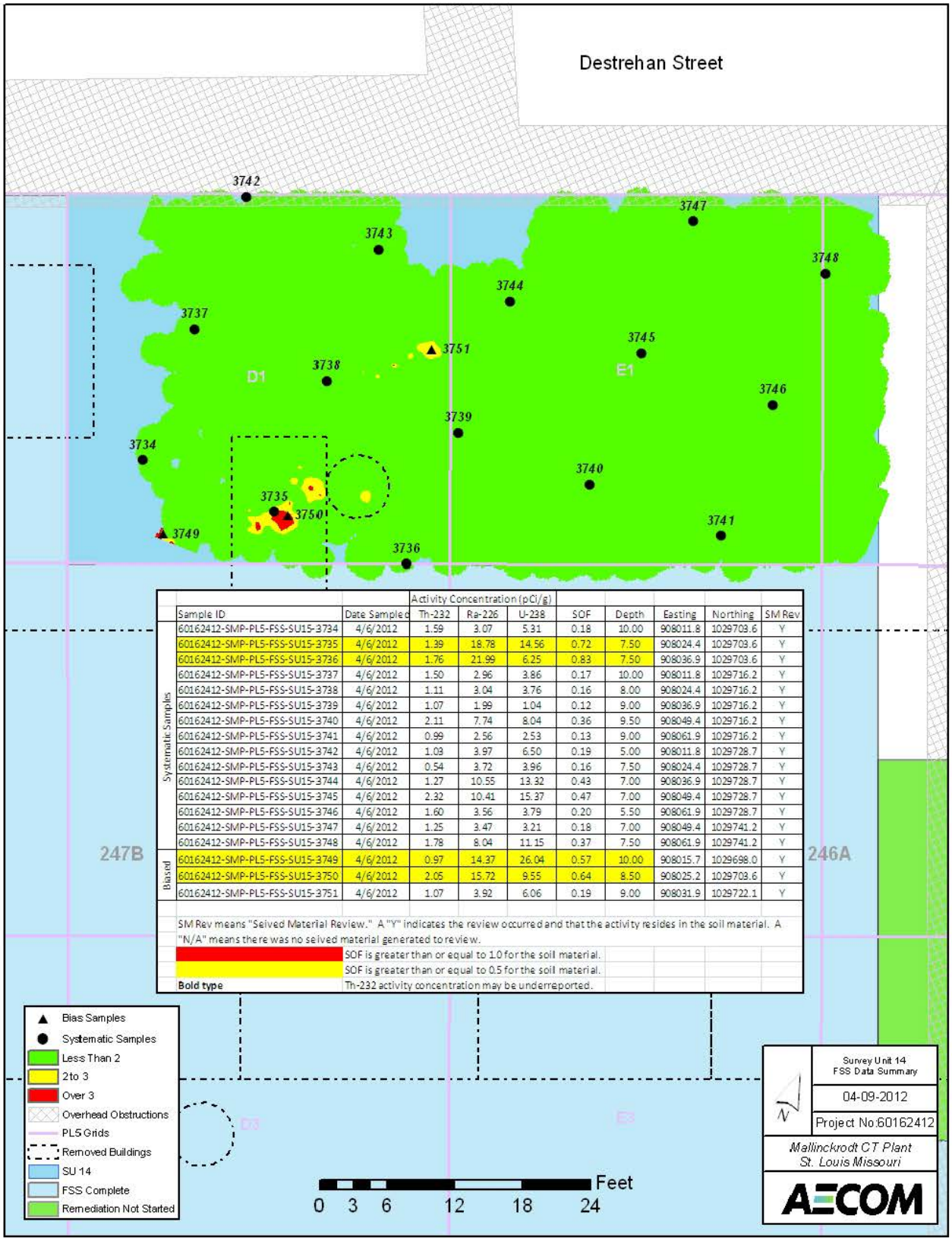
the GWS results and soil sampling locations. A total of 18 (15 systematic and 3 GWS biased) soil samples were collected over the areal footprint SU14.

All soil samples were analyzed on site via gamma spectroscopy analysis. Table 20-2 provides the sample results and summary statistics for the 15 systematic samples. Table 20-3 provides the sample results for the 3 GWS biased samples.

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 SOF values—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.



	Sample ID	Date Sampled	Activity Concentration (pCi/g) Th-232	Ra-226	U-238	SOF	Depth	Easting	Northing	SM Rev
Systematic Samples	60162412-SMP-PLS-FSS-SU15-3734	4/6/2012	1.59	3.07	5.31	0.18	10.00	908011.8	1029703.6	Y
	60162412-SMP-PLS-FSS-SU15-3735	4/6/2012	1.39	18.78	14.56	0.72	7.50	908024.4	1029703.6	Y
	60162412-SMP-PLS-FSS-SU15-3736	4/6/2012	1.76	21.99	6.25	0.83	7.50	908036.9	1029703.6	Y
	60162412-SMP-PLS-FSS-SU15-3737	4/6/2012	1.50	2.96	3.86	0.17	10.00	908011.8	1029716.2	Y
	60162412-SMP-PLS-FSS-SU15-3738	4/6/2012	1.11	3.04	3.76	0.16	8.00	908024.4	1029716.2	Y
	60162412-SMP-PLS-FSS-SU15-3739	4/6/2012	1.07	1.99	1.04	0.12	9.00	908036.9	1029716.2	Y
	60162412-SMP-PLS-FSS-SU15-3740	4/6/2012	2.11	7.74	8.04	0.36	9.50	908049.4	1029716.2	Y
	60162412-SMP-PLS-FSS-SU15-3741	4/6/2012	0.99	2.56	2.53	0.13	9.00	908061.9	1029716.2	Y
	60162412-SMP-PLS-FSS-SU15-3742	4/6/2012	1.03	3.97	6.50	0.19	5.00	908011.8	1029728.7	Y
	60162412-SMP-PLS-FSS-SU15-3743	4/6/2012	0.54	3.72	3.96	0.16	7.50	908024.4	1029728.7	Y
	60162412-SMP-PLS-FSS-SU15-3744	4/6/2012	1.27	10.55	13.32	0.43	7.00	908036.9	1029728.7	Y
	60162412-SMP-PLS-FSS-SU15-3745	4/6/2012	2.32	10.41	15.37	0.47	7.00	908049.4	1029728.7	Y
	60162412-SMP-PLS-FSS-SU15-3746	4/6/2012	1.60	3.56	3.79	0.20	5.50	908061.9	1029728.7	Y
	60162412-SMP-PLS-FSS-SU15-3747	4/6/2012	1.25	3.47	3.21	0.18	7.00	908049.4	1029741.2	Y
	60162412-SMP-PLS-FSS-SU15-3748	4/6/2012	1.78	8.04	11.15	0.37	7.50	908061.9	1029741.2	Y
Biased	60162412-SMP-PLS-FSS-SU15-3749	4/6/2012	0.97	14.37	26.04	0.57	10.00	908015.7	1029698.0	Y
	60162412-SMP-PLS-FSS-SU15-3750	4/6/2012	2.05	15.72	9.55	0.64	8.50	908025.2	1029703.6	Y
	60162412-SMP-PLS-FSS-SU15-3751	4/6/2012	1.07	3.92	6.06	0.19	9.00	908031.9	1029722.1	Y

SM Rev means "Seived Material Review." A "Y" indicates the review occurred and that the activity resides in the soil material. A "N/A" means there was no seived material generated to review.

SOF is greater than or equal to 1.0 for the soil material.

SOF is greater than or equal to 0.5 for the soil material.

Bold type Th-232 activity concentration may be underreported.

Figure 20-4 GWS and Soil Sampling Locations

Table 20-2 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					^{232}Th			^{226}Ra			^{238}U					
		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	Gross	Net [c]	
3734	10	1.59	0.29	0.10	3.07	1.21	0.87	5.31	1.52	0.86	0.18	0.03	2.00	0.34	0.23	2.29	0.30	0.07	2.70	0.34	0.07	0.17	0.03	1.08
3735	7.5	1.39	0.28	0.14	18.78	2.50	1.39	14.56	2.24	1.24	**0.72**	**0.57**	1.64	0.49	0.44	10.70	1.30	0.11	12.20	1.50	0.13	0.45	0.30	1.60
3736	7.5	1.76	0.39	0.19	21.99	2.47	1.33	6.25	1.86	1.25	**0.83**	**0.68**	2.69	0.61	0.55	20.60	2.40	0.14	22.40	2.60	0.17	**0.84**	**0.70**	0.98
3737	10	1.50	0.26	0.05	2.96	0.97	0.68	3.86	1.28	0.76	0.17	0.02	1.40	0.38	0.32	1.34	0.21	0.09	1.47	0.21	0.09	0.11	0.00	1.59
3738	8	1.11	0.22	0.09	3.04	0.97	0.65	3.76	1.24	0.76	0.15	0.02	1.34	0.27	0.23	1.48	0.21	0.07	1.70	0.23	0.07	0.11	0.00	1.42
3739	9	1.07	0.23	0.08	1.99	0.69	0.46	1.04	0.73	0.52	0.11	0.00	1.13	0.21	0.16	1.19	0.17	0.05	1.31	0.16	0.05	0.09	0.00	1.27
3740	9.5	2.11	0.40	0.08	7.74	1.71	1.09	8.04	1.87	1.06	0.36	0.22	2.20	0.39	0.29	5.39	0.73	0.09	6.11	0.73	0.08	0.28	0.14	1.28
3741	9	0.99	0.23	0.06	2.56	0.97	0.67	2.53	1.10	0.68	0.13	0.00	1.69	0.31	0.22	2.33	0.32	0.08	2.73	0.33	0.07	0.15	0.02	0.86
3742	5	1.03	0.25	0.11	3.97	1.28	0.89	6.50	1.47	0.82	0.19	0.05	1.37	0.41	0.37	2.78	0.36	0.10	2.89	0.37	0.10	0.16	0.01	1.20
3743	7.5	0.54	0.17	0.05	3.72	1.04	0.70	3.96	1.31	0.81	0.15	0.04	0.80	0.31	0.34	3.17	0.40	0.09	3.36	0.42	0.11	0.15	0.02	1.06
3744	7	1.27	0.25	0.10	10.55	1.65	1.01	13.32	2.00	1.01	0.43	0.29	1.50	0.37	0.30	4.90	0.60	0.09	5.59	0.65	0.09	0.24	0.09	1.82
3745	7	2.32	0.36	0.10	10.41	1.96	1.30	15.37	1.93	0.99	0.47	0.33	3.12	0.50	0.30	5.21	0.65	0.09	5.84	0.70	0.09	0.32	0.17	1.50
3746	5.5	1.60	0.32	0.06	3.56	1.05	0.70	3.79	1.41	0.82	0.19	0.05	1.46	0.34	0.24	1.56	0.21	0.06	1.57	0.21	0.07	0.12	0.01	1.66
3747	7	1.25	0.19	0.09	3.47	1.03	0.70	3.21	1.08	0.68	0.17	0.03	1.15	0.33	0.23	2.20	0.27	0.07	2.32	0.31	0.07	0.13	0.00	1.38
3748	7.5	1.78	0.50	0.07	8.04	2.19	1.30	11.15	2.51	1.22	0.36	0.22	1.48	0.56	0.56	1.51	0.32	0.17	1.65	0.30	0.16	0.12	0.01	3.15
Summary Statistics																								
Count:		15			15			15			15	15	15			15			15			15	15	15
Average:		1.42			7.06			6.84			0.31	0.17	1.66			4.44			4.92			0.23	0.10	1.46
Median:		1.39			3.72			5.31			0.19	0.05	1.48			2.33			2.73			0.15	0.02	1.38
Standard Dev.:		0.46			6.13			4.62			0.22	0.22	0.61			5.12			5.62			0.20	0.19	0.54
Minimum:		0.54			1.99			1.04			0.11	0.00	0.80			1.19			1.31			0.09	0.00	0.86
Maximum:		2.32			21.99			15.37			**0.83**	**0.68**	3.12			20.60			22.40			**0.84**	**0.70**	3.15
Range:		1.78			19.99			14.33			0.72	0.68	2.32			19.41			21.09			0.75	0.70	2.29

[a] Off-site laboratory results as reported by TestAmerica after sufficient in-growth time to reach ^{226}Ra progeny equilibrium.
[b] **Bolded orange** SOF values indicate a result >0.5 but ≤1.
[c] Calculated as discussed in Section 20.3.2.

Table 20-3 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					^{232}Th			^{226}Ra			^{238}U					
		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	Gross	Net [c]	
GWS Biased Samples																							
3749	10	0.97	0.23	0.13	14.37	2.44	1.60	26.04	2.92	1.37	**0.57**	0.43	1.43	0.31	0.31	7.31	0.89	0.09	8.05	0.96	0.10	0.32	0.17	1.77
3750	8.5	2.05	0.35	0.03	15.72	1.99	1.05	9.55	2.13	1.24	**0.63**	0.49	2.60	0.62	0.46	11.60	1.40	0.12	12.90	1.50	0.13	**0.52**	0.38	1.22
3751	9	1.07	0.27	0.09	3.92	1.16	0.80	6.06	1.43	0.79	0.19	0.05	1.28	0.28	0.27	2.23	0.28	0.07	2.73	0.35	0.07	0.13	0.00	1.40

[a] Off-site laboratory results as reported by TestAmerica after sufficient in-growth time to reach ^{226}Ra progeny equilibrium.
[b] **Bolded orange** SOF values indicate a result >0.5 but ≤1.
[b] Calculated as discussed in Section 20.3.2.

20.3.3 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 SU14: BH-039. Table 20-4 provides the data for this location. The results indicate that beyond the excavation extent, additional subsurface contamination is not reasonably expected. Therefore, in accordance with Page 14-22 of the C-T Phase II DP, FSS core sampling or measurements were not performed.

Table 20-4 Characterization Borehole Results

Location ID	Sample Depth (ft)	Activity Concentration (pCi/g) [a]			SOF [b]	
		^{232}Th	^{226}Ra	^{238}U	Gross	Net [c]
BH-039	0.4 - 2	1.20	21.10	29.70	**0.81**	**0.67**
	2 - 4	0.86	3.93	*4.12*	0.18	0.05
	4 - 5	0.80	5.56	5.39	0.23	0.11
	6 - 7	0.91	3.70	3.46	0.17	0.04
	8 - 9	1.00	5.00	3.00	0.22	0.09
	17 - 18	1.30	1.00	1.60	0.09	0.00
	30 - 31	1.40	0.96	1.30	0.09	0.00

[a] Italicized results indicate <MDC.
[b] **Bolded orange** SOF values indicate a result >0.5.
[c] Calculated as discussed in Section 20.3.2.

20.4 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.

20.4.1 Elevated Area Evaluation

There were no elevated areas identified in SU14.

20.4.2 Data Set Screening Analysis

Table 20-5 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 20-5 Screening Tests Results

Screening Test	Test Value	Conclusion
Min/Max	0.82	PASS
Low Level	N/A	Not applicable; Class 1 survey unit
$DCGL_W$	N/A	Not applicable; Min/Max < 1
EMC Limit	N/A	Not applicable; No elevated areas

20.4.2.1 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 3736 with a gross SOF of 0.84 (from Table 20-2) 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 0.82. Because the test value was less than one, no further computations are required, i.e., $DCGL_W$ screening and Wilcoxon Rank Sum (WRS) tests.

20.4.2.2 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.

20.4.2.3 $DCGL_W$

In accordance with Page 14-28 of the C-T Phase II DP and because the Min/Max test value was less than one, the $DCGL_W$ screening test was not applicable to this survey unit.

20.4.2.4 EMC Limit

In accordance with Page 14-28 of the C-T Phase II DP, the elevated measurement comparison (EMC) Limit screening test was not applicable to this survey unit because no elevated areas were identified.

20.4.3 WRS Test

In accordance with Page 14-29 of the C-T Phase II DP and because the Min/Max test value was less than one, the WRS Test was not required to demonstrate compliance.

20.4.4 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 20-6 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 20-6 Retrospective Analysis

Parameter	*A Priori* 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	0.23
Spatial Variability (standard deviation)	1/6 x DCGL = 0.17	0.20
Type I Error (false positive)	0.05	0.05
Type II Error (false negative)	0.05	0.05
Relative Shift	3	3.8
Calculated N/2 Sample Size	15 [a]	9
Actual N/2 Sample Size	--	15

[a] The *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.

20.5 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. Only one deviation was 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.

20.6 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. No violations were identified. No findings of significance were identified.

20.7 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 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. SOF > 1.0) were appropriately investigated and the $DCGL_{EMC}$ properly applied.

All the applicable screening tests passed, the retrospective analysis found that the survey design objectives were met, and additional subsurface contamination was not reasonably suspected. SU14 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.

20.8 REFERENCES

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