

21G-17-0051  
GOV-01-55-06  
ACF-17-0048

February 15, 2017

Director, Office of Nuclear Material Safety and Safeguards  
U.S. Nuclear Regulatory Commission  
Attention: Document Control Desk  
Washington, DC 20555

Reference:

- 1) Docket No. 70-143; SNM License 124
- 2) Letter from B. Marie Moore to NRC, Submittal of North Site Decommissioning Plan, Revision 3, (21G-06-0049) dated May 2, 2006
- 3) Letter from NRC to B. Marie Moore, Nuclear Fuel Services, Inc., Acknowledgement and Acceptance of Revision 3 to North Site Decommissioning Plan (TAC L31949), dated May 18, 2006
- 4) Letter from R. J. Freudenberger to NRC, Final Status Survey Final Report for Survey Units 4, 6, 7, 12, 16, 17, & 18, (21G-16-0076) dated July 28, 2016
- 5) Letter from NRC to R. J. Freudenberger, Accept for Review of Final Status Survey Report for Survey Units 4, 6, 7, 12, 16, 17, and 18 (Cost Activity Code L33421), dated December 15, 2016
- 6) Letter from NRC to R. J. Freudenberger, Request for Additional Information Concerning Final Status Survey Report (Cost Activity Code L33421), dated January 19, 2017

**Subject: Response to Request for Additional Information Concerning Final Status Survey Report for Survey Units 4, 6, 7, 12, 16, 17, and 18**

As requested in Reference 6, Nuclear Fuel Services, Inc. (NFS) hereby submits its response to your request for additional information concerning the Final Status Survey Report for Survey Units 4, 6, 7, 12, 16, 17, and 18 (Reference 4). NFS will revise and resubmit the report upon NRC acceptance of NFS' responses.

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21G-17-0051  
GOV-01-55-06  
ACF-17-0048

If you or your staff have any questions, require additional information, or wish to discuss this, please contact me, or Mr. Scott Morie, Decommissioning Environmental Unit Manager, at (423) 735-5616. Please reference our unique document identification number (21G-17-0051) in any correspondence concerning this letter.

Sincerely,

**NUCLEAR FUEL SERVICES, INC.**



Richard J. Freudenberger, Director  
Safety and Safeguards

CSM/pdj

Attachment: **Response to Request for Additional Information- Nuclear Fuel Services, Inc. Final Status Survey Report, Subsurface Soil Characterization and FSS Project, Survey Units 4, 6, 7, 12, 16, 17, and 18**

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21G-17-0051  
GOV-01-55-06  
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**Attachment**

**Response to Request for Additional Information- Nuclear Fuel Services, Inc.  
Final Status Survey Report, Subsurface Soil Characterization and  
FSS Project, Survey Units 4, 6, 7, 12, 16, 17, and 18**

**17 pages to follow**

## **RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION- NUCLEAR FUEL SERVICES, INC.**

### **FINAL STATUS SURVEY REPORT, SUBSURFACE SOIL CHARACTERIZATION and FSS PROJECT, SURVEY UNITS 4, 6, 7, 12, 16, 17, AND 18**

#### **1. Final Status Survey Results for Surface Soils**

##### **Request:**

Provide results of the *surface* final status survey for Survey Units (SUs) 4, 6, 7, 12, 16, 17 and 18 or the basis for determining why surface soil surveys are not needed.

##### **Basis:**

In some areas of the North Site, soils have been or will be excavated and clean backfill may be applied over the excavated areas. In such cases, soils at the surface at the time of final status survey (FSS) may be considered or treated as subsurface soils, because after backfill the soils will be subsurface and therefore the subsurface criteria would be applicable. Thus, at the time of FSS, some areas may only have soils that will be considered "subsurface." In the following, the terms surface and subsurface generally refer to the eventual location of the soil, after any backfilling that has been committed to by Nuclear Fuel Services, Inc. (NFS).

As discussed in the NFS Decommissioning Plan (DP) (Revision 3, dated May 2, 2006), Section 5.1, a *surface* final FSS will be performed for the North Site. As discussed in the (DP), Appendix B, Section 1, the FSS for *subsurface* soils only applies to impacted subsurface soils deeper than 15 centimeters. The U.S. Nuclear Regulatory Commission (NRC) staff understands this to mean that when surface soils (0-15 cm in depth) and subsurface soils (depth greater than 15 cm) are both present at the time of FSS, both the surface and subsurface FSSs are to be performed. Survey Units 4, 6, 7, 12, 16, 17 and 18 contain surface soils, so it appears to NRC staff that a surface FSS should have been performed. However, the final status survey report (FSSR) for SUs 4, 6, 7, 12, 16, 17 and 18 does not provide results of the surface FSS for these SUs.

The surface FSS would include gamma scans of the surface soils as well as soil samples or in situ gamma spectroscopy measurements, as described in Chapter 5 of the DP. The NRC staff understanding is that these measurements are important to addressing potential exposures to material as they are being left on the site. The NRC staff understanding is that the subsurface FSS are important to addressing potential exposures that might occur if subsurface soils are disturbed (in particular, if subsurface soils are excavated and brought to the surface). Thus, the two FSSs (for surface soils and for subsurface soils) address two different aspects of the overall demonstration that the area is suitable for unrestricted use.

This information is required to verify compliance with the NFS North Site DP.

## **RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION- NUCLEAR FUEL SERVICES, INC.**

### **FINAL STATUS SURVEY REPORT, SUBSURFACE SOIL CHARACTERIZATION and FSS PROJECT, SURVEY UNITS 4, 6, 7, 12, 16, 17, AND 18**

#### **NFS RESPONSE:**

NFS acknowledges that some areas in Survey Units 4, 6, 7, 12, 16, 17, & 18 may have pre-remediation soils that remain intact on the existing surface following the subsurface FSS. Surface soils are defined as soils within 15 cm below the final grade as delineated by the NFS Drainage Plan. NFS further acknowledges that survey units that contain such intact surface soils may require a surface FSS to satisfy the DP and to follow the precedent established in the FSS for Survey Units 1 and 2 at the North Site. NFS has assessed the potential for intact surface soils in SUs 4, 6, 7, 12, 16, 17, & 18 to remain on the surface following backfill operations on an individual survey unit basis, the results of which are presented herein.

#### **Survey Unit 4**

The elevation differential in Survey Unit 4 between the top of the corehole (i.e. surface) at time of sampling relative to the final grade as shown in the Drainage Plan is presented in Table 1-1 (Page 1-5). The only corehole location within Survey Unit 4 where the surface at the time of sampling was within 15 cm of the Drainage Plan final grade was at Corehole 61. Corehole 61 is the western-most corehole location in the survey unit (Survey Units 4, 6, 7, 12, 16, 17, & 18 FSS Report [FSS Report], Figure 2-13), with a measured elevation 3 cm above the Drainage Plan final grade.

Areas of Survey Unit 4 had been remediated in 2009 prior to the subsurface soil FSS sampling activities. Part of the remedial activities included the placement of clean backfill that is known to be free from radioactive contamination following excavation. The geologic soil boring log for Corehole 61 (included in Appendix D of the FSS Report) indicates that the area around Corehole 61 was covered with backfill material from the surface to a depth of ~1.22 m (4 ft). This indicates that the surface of the final grade is clean fill known to be free of radioactive material to a depth of ~1.19 m below the Drainage Plan final grade. Thus, there is virtually no potential for the presence of original soils within the top 15 cm of soil in Survey Unit 4 and a surface FSS is not necessary to satisfy the requirements of the DP.

#### **Survey Unit 6**

The elevation differential in Survey Unit 6 between the top of the corehole (i.e. surface) at time of sampling relative to the final grade as shown in the Drainage Plan is presented in Table 1-2 (Page 1-5). The only corehole locations within Survey Unit 6 where the surface at the time of sampling was within 15 cm of the Drainage Plan final grade were Coreholes 750, 751, and 755. Coreholes 750, 751, and 755 are located in the southwest corner of the survey unit (FSS Report, Figure 2-16), with measured elevations below the final grade of the Drainage Plan of 12 cm, 9 cm, and 14 cm, respectively.

Similar to Survey Unit 4, areas of Survey Unit 6 had been previously remediated in 2009. However, contrary to Survey Unit 4, the geologic soil boring logs collected during the subsurface soil FSS do not definitively support the conclusion that the entire area around Coreholes 750, 751, and 755 was covered with clean backfill. This indicates that there is a potential for soils now present on the surface to remain intact within 15 cm of the final grade. Therefore, NFS elects to perform a surface FSS in Survey Unit 6 to confirm that the surface

## **RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION- NUCLEAR FUEL SERVICES, INC.**

### **FINAL STATUS SURVEY REPORT; SUBSURFACE SOIL CHARACTERIZATION and FSS PROJECT, SURVEY UNITS 4, 6, 7, 12, 16, 17, AND 18**

soils satisfy the requirements of the DP.

#### **Survey Unit 7**

The elevation differential in Survey Unit 7 between the top of the corehole (i.e. surface) at time of sampling relative to the final grade as shown in the Drainage Plan is presented in Table 1-3 (Page 1-6). The elevation of the majority of the coreholes within Survey Unit 7 at the time of sampling was within 15 cm below the surface of the final grade, or higher. Similar to Survey Units 4 and 6, most of Survey Unit 7 was remediated and covered with clean backfill to varying depth. However, given the high number of corehole locations in Survey Unit 7 where the grade at time of sampling was within 15 cm of the final grade, coupled with the varying depth of clean backfill across the survey unit, there is a reasonable potential for soils now present on the surface to remain intact within 15 cm of the final grade in Survey Unit 7. Therefore, NFS elects to perform a surface FSS in Survey Unit 7 to confirm that the surface soils satisfy the requirements of the DP.

#### **Survey Unit 12**

The elevation differential in Survey Unit 12 between the top of the corehole (i.e. surface) at time of sampling relative to the final grade as shown in the Drainage Plan is presented in Table 1-4 (Page 1-6). The elevation at the time of sampling was greater than 15 cm below final grade throughout Survey Unit 12. Thus, there is virtually no potential for the presence of original soils within 15 cm of the final grade in Survey Unit 12 and a surface FSS is not necessary to satisfy the requirements of the DP.

#### **Survey Unit 16**

The elevation differential in Survey Unit 16 between the top of the corehole (i.e. surface) at time of sampling relative to the final grade as shown in the Drainage Plan is presented in Table 1-5 (Page 1-7). The elevation at the time of sampling was greater than 15 cm below final grade throughout Survey Unit 16. Thus, there is virtually no potential for the presence of original soils within 15 cm of the final grade in Survey Unit 16 and a surface FSS is not necessary to satisfy the requirements of the DP.

#### **Survey Unit 17**

The elevation differential in Survey Unit 17 between the top of the corehole (i.e. surface) at time of sampling relative to the final grade as shown in the Drainage Plan is presented in Table 1-6 (Page 1-8). The only corehole location within Survey Unit 17 where the surface at the time of sampling was within 15 cm of the Drainage Plan final grade was at Corehole B614. Corehole B614 is located in the southeast corner of the survey unit, with a measured elevation 6 cm below the Drainage Plan final grade. As described in Appendix H.1 of the FSS Report, Corehole B614 was a supplemental corehole drilled in the immediate vicinity of the planned Corehole 0614, which is located in the southeastern corner of Survey Unit 17 (FSS Report, Figure 2-32).

Survey Unit 17 underwent remedial activities, including excavation of contaminated soils, prior to the subsurface soil FSS activities conducted between March and June 2011. Subsequent to the FSS sampling campaign, much of Survey Unit 17 was covered with clean backfill in preparation of implementation of the Drainage Plan. Following backfilling

## **RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION- NUCLEAR FUEL SERVICES, INC.**

### **FINAL STATUS SURVEY REPORT, SUBSURFACE SOIL CHARACTERIZATION and FSS PROJECT, SURVEY UNITS 4, 6, 7, 12, 16, 17, AND 18**

operations, evaluation of the subsurface sample results collected from Survey Unit 17 indicated the potential for concentrations of radionuclides in excess of the applicable Sub-Surface DCGLs in the immediate vicinity of Sample ID 0614-A.

Appendix H.1 of the FSS Report describes the additional characterization that was conducted to determine the areal extent of the contamination within the grid cell represented by Sample ID 0614-A. The additional characterization resulted in four supplemental coreholes, A614, B614, C614, and D614, which were drilled and sampled in August 2011.

The geologic soil boring log for Corehole B614 (included in Appendix D of the FSS Report) indicates that the area around Corehole B614 was covered with clean backfill to a depth of ~2.29 m (7.5 ft). This indicates that the surface of the final grade is clean fill known to be free of radioactive material to a depth of ~2.35 m. Thus, there is virtually no potential for the presence of original soils within 15 cm of the final grade in Survey Unit 17 and a surface FSS is not necessary to satisfy the requirements of the DP.

#### **Survey Unit 18**

The elevation differential in Survey Unit 18 between the top of the corehole (i.e. surface) at time of sampling relative to the final grade as shown in the Drainage Plan is presented in Table 1-7 (Page 1-8). The elevation at the time of sampling was greater than 15 cm below final grade throughout Survey Unit 18. Thus, there is virtually no potential for the presence of original soils within 15 cm of the final grade in Survey Unit 18 and a surface FSS is not necessary to satisfy the requirements of the DP.

#### **NFS Response Summary**

The assessment of the potential for intact surface soils in Survey Units 4, 6, 7, 12, 16, 17, & 18 indicates that there is virtually no potential for the presence of such soils in Survey Units 4, 12, 16, 17, & 18. NFS concludes that a surface soil survey is not required to demonstrate compliance with the DP for these survey units. An additional appendix (Appendix I) will be added to the subsurface soil FSS Report to summarize the assessment of the potential for original soils remaining intact in the surface (less than 15 cm below final grade) of SUs 4, 12, 16, 17, & 18.

The assessment further indicates that, in Survey Units 6 & 7, there is a reasonable potential that original, intact soils remain on or near the surface (within 15 cm of the finished surface grade) after the Drainage Plan was implemented. NFS has elected to conduct a surface FSS in Survey Units 6 & 7 to satisfy the DP and to follow the precedent established in the FSS for Survey Units 1 and 2 at the North Site. The surface FSS will include gamma scans of the surface soils as well as soil samples or in-situ gamma spectroscopy measurements, as described in Chapter 5 of the DP. The results of the surface soil FSS for Survey Units 6 & 7 will be submitted as an addendum to the subsurface soil FSS Report.



**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION- NUCLEAR FUEL SERVICES, INC.**  
**FINAL STATUS SURVEY REPORT, SUBSURFACE SOIL CHARACTERIZATION and FSS PROJECT,**  
**SURVEY UNITS 4, 6, 7, 12, 16, 17, AND 18**

**Table 1-1- Elevation Differential between Time of Sampling  
and Final Grade, Survey Unit 4**

Corehole ID	Ground Surface Elevation		Elevation Difference	
	At Time of Sampling	Finished Grade	Feet	Meters
50	1640.60	1641.94	1.34	0.41
51	1641.50	1642.18	0.68	0.21
52	1641.10	1643.60	2.50	0.76
53	1637.60	1643.08	5.48	1.67
54	1631.20	1642.75	11.55	3.52
55	1632.90	1643.44	10.54	3.21
56	1635.10	1644.00	8.90	2.71
57	1640.70	1644.64	3.94	1.20
58	1638.30	1644.64	6.34	1.93
59	1636.20	1644.49	8.29	2.53
60	1638.70	1644.03	5.33	1.62
61	1642.70	1642.61	-0.09	-0.03
62	1631.20	1643.66	12.46	3.80
63	1631.00	1644.36	13.36	4.07
64	1642.00	1645.18	3.18	0.97
65	1641.60	1645.19	3.59	1.09
66	1635.00	1645.92	10.92	3.33
67	1636.70	1645.72	9.02	2.75
68	1638.50	1645.38	6.88	2.10
69	1639.50	1645.10	5.60	1.71
70	1632.40	1644.18	11.78	3.59
71	1642.10	1645.33	3.23	0.99
72	1637.20	1645.74	8.54	2.60
73	1634.60	1646.69	12.09	3.69
74	1635.40	1647.11	11.71	3.57
75	1636.70	1646.77	10.07	3.07
76	1638.70	1646.62	7.92	2.41
77	1635.30	1645.96	10.66	3.25
78	1634.30	1646.90	12.60	3.84
79	1633.80	1647.30	13.50	4.11
80	1637.20	1648.29	11.09	3.38
81	1634.70	1645.23	10.53	3.21
82	1635.20	1646.04	10.84	3.30
83	1635.40	1646.87	11.47	3.50
84	1636.90	1647.71	10.81	3.29
85	1634.80	1644.28	9.48	2.89
86	1634.70	1645.17	10.47	3.19
87	1635.00	1645.98	10.98	3.35
88	1636.70	1646.80	10.10	3.08
89	1635.10	1643.45	8.35	2.55
90	1634.70	1644.52	9.82	2.99
Coordinate System: US State Plane 1983, Zone Tennessee 4100 Datum NAD 1983 (Conus), Units US Survey Feet				
Indicates Sample was Collected Less Than 15 cm bgs of Final Grade				

**Table 1-2- Elevation Differential between Time of Sampling  
and Final Grade, Survey Unit 6**

Corehole ID	Ground Surface Elevation		Elevation Difference	
	At Time of Sampling	Finished Grade	Feet	Meters
750	1641.80	1642.19	0.39	0.12
751	1642.10	1642.38	0.28	0.09
752	1635.80	1642.86	7.06	2.15
753	1632.10	1643.25	11.15	3.40
754	1632.50	1643.63	11.13	3.39
755	1641.80	1642.27	0.47	0.14
756	1635.90	1642.76	6.86	2.09
757	1633.50	1643.13	9.63	2.94
758	1632.30	1643.52	11.22	3.42
759	1633.20	1643.96	10.76	3.28
760	1633.00	1644.28	11.28	3.44
761	1639.80	1644.82	5.02	1.53
762	1641.90	1645.10	3.20	0.97
763	1635.40	1643.00	7.60	2.32
764	1634.00	1643.42	9.42	2.87
765	1633.90	1643.73	9.83	3.00
766	1633.30	1644.17	10.87	3.31
767	1639.70	1644.70	5.00	1.52
768	1641.60	1644.95	3.35	1.02
769	1642.20	1645.18	2.98	0.91
770	1634.70	1643.77	9.07	2.76
771	1634.50	1643.98	9.48	2.89
772	1638.70	1644.42	5.72	1.74
773	1640.90	1644.81	3.91	1.19
774	1641.60	1645.00	3.40	1.04
775	1635.70	1645.19	9.49	2.89
776	1637.60	1644.26	6.66	2.03
777	1640.20	1644.50	4.30	1.31
778	1640.10	1644.75	4.65	1.42
779	1637.20	1644.97	7.77	2.37
780	1636.70	1645.15	8.45	2.58
781	1642.80	1643.62	0.82	0.25
782	1637.80	1643.88	6.08	1.85
783	1638.20	1644.15	5.95	1.81
784	1637.40	1644.34	6.94	2.12
785	1636.40	1644.60	8.20	2.50
786	1635.50	1644.87	9.37	2.86
787	1640.50	1643.00	2.50	0.76
788	1640.20	1643.21	3.01	0.92
789	1638.80	1643.49	4.69	1.43
790	1637.20	1643.73	6.53	1.99
791	1636.90	1643.95	7.05	2.15
792	1636.80	1644.26	7.46	2.27
793	1635.80	1644.55	8.75	2.67
794	1640.50	1642.30	1.80	0.55
795	1640.00	1642.57	2.57	0.78
796	1638.90	1642.84	3.94	1.20
797	1638.70	1643.32	4.62	1.41
798	1637.10	1643.55	6.45	1.97
799	1636.90	1643.90	7.00	2.13
800	1638.00	1641.51	3.51	1.07
801	1640.50	1642.05	1.55	0.47
802	1638.90	1642.99	4.09	1.25
803	1637.50	1643.24	5.74	1.75
804	1638.10	1643.56	5.46	1.66
805	1639.00	1642.93	3.93	1.20
806	1638.00	1643.21	5.21	1.59
807	1640.10	1642.56	2.46	0.75
808	1637.90	1642.81	4.91	1.50
809	1639.00	1642.31	3.31	1.01
Coordinate System: US State Plane 1983, Zone Tennessee 4100 Datum NAD 1983 (Conus), Units US Survey Feet				
Indicates Sample was Collected Less Than 15 cm bgs of Final Grade				



**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION- NUCLEAR FUEL SERVICES, INC.**  
**FINAL STATUS SURVEY REPORT, SUBSURFACE SOIL CHARACTERIZATION and FSS PROJECT,**  
**SURVEY UNITS 4, 6, 7, 12, 16, 17, AND 18**

**Table 1-3- Elevation Differential between Time of Sampling and Final Grade, Survey Unit 7**

Corehole ID	Ground Surface Elevation		Elevation Difference	
	At Time of Sampling	Finished Grade	Feet	Meters
7001	1643.00	1642.62	-0.38	-0.12
7002	1643.60	1643.13	-0.47	-0.14
7003	1639.50	1637.52	-1.98	-0.60
7004	1642.20	1642.37	0.17	0.05
7005	1642.70	1642.94	0.24	0.07
7006	1637.90	1640.02	2.12	0.65
7007	1637.60	1640.81	3.21	0.98
7008	1642.40	1642.55	0.15	0.05
7009	1636.90	1638.21	1.31	0.40
7010	1638.00	1638.00	0.00	0.00
7011	1639.40	1639.46	0.06	0.02
7012	1642.00	1642.37	0.37	0.11
7013	1645.80	1646.00	0.20	0.06
7014	1636.60	1639.00	2.40	0.73
7015	1636.90	1637.55	0.65	0.20
7016	1638.70	1638.89	0.19	0.06
7017	1639.60	1639.92	0.32	0.10
7018	1642.60	1642.06	-0.54	-0.16
7019	1644.50	1644.46	-0.04	-0.01
7020	1645.00	1644.67	-0.33	-0.10
7021	1644.90	1644.70	-0.20	-0.06
7022	1645.20	1645.24	0.04	0.01
7023	1636.60	1639.93	3.33	1.01
7024	1637.90	1637.64	-0.26	-0.08
7025	1637.10	1637.00	-0.10	-0.03
7026	1637.50	1637.40	-0.10	-0.03
7027	1638.20	1638.65	0.45	0.14
7028	1639.80	1639.67	-0.13	-0.04
7029	1635.70	1640.10	4.40	1.34
7030	1637.30	1639.31	2.01	0.61
7031	1636.20	1636.46	0.26	0.08
7032	1637.40	1637.00	-0.40	-0.12
Coordinate System: US State Plane 1983, Zone Tennessee 4100 Datum NAD 1983 (Conus), Units US Survey Feet				
Indicates Sample was Collected Less Than 15 cm bgs of Final Grade				

**Table 1-4- Elevation Differential between Time of Sampling and Final Grade, Survey Unit 12**

Corehole ID	Ground Surface Elevation		Elevation Difference	
	At Time of Sampling	Finished Grade	Feet	Meters
292	1631.5	1641.66	10.16	3.10
293	1632.6	1642.03	9.43	2.88
294	1633.7	1642.24	8.54	2.60
295	1637.3	1642.46	5.16	1.57
296	1634.3	1642.77	8.47	2.58
297	1628.3	1639.89	11.59	3.53
298	1630.1	1640.44	10.34	3.15
299	1631.1	1640.77	9.67	2.95
300	1631.1	1641.21	10.11	3.08
301	1631.6	1641.62	10.02	3.06
302	1633.6	1642.14	8.54	2.60
303	1634.7	1642.42	7.72	2.35
304	1635.7	1642.64	6.94	2.12
305	1627.7	1639.12	11.42	3.48
306	1628.1	1639.33	11.23	3.42
307	1629.0	1639.54	10.54	3.21
308	1630.0	1639.80	9.80	2.99
309	1630.6	1639.98	9.38	2.86
310	1631.2	1640.69	9.49	2.89
311	1631.5	1640.88	9.38	2.86
312	1633.2	1641.21	8.01	2.44
313	1636.5	1641.95	5.45	1.66
314	1627.8	1638.48	10.68	3.26
315	1628.5	1638.72	10.22	3.11
316	1628.9	1638.90	10.00	3.05
317	1629.0	1639.13	10.13	3.09
318	1629.5	1639.34	9.84	3.00
319	1630.1	1639.57	9.47	2.89
320	1630.8	1639.80	9.00	2.74
321	1631.4	1640.07	8.67	2.64
322	1633.0	1640.59	7.59	2.31
323	1630.1	1638.06	7.96	2.43
324	1629.8	1638.22	8.42	2.57
325	1629.6	1638.48	8.88	2.71
326	1629.7	1638.71	9.01	2.75
327	1629.8	1639.01	9.21	2.81
328	1630.1	1639.16	9.06	2.76
329	1630.7	1639.40	8.70	2.65
330	1631.7	1639.66	7.96	2.43
331	1629.6	1637.84	8.24	2.51
332	1629.8	1638.10	8.30	2.53
333	1629.7	1638.30	8.60	2.62
334	1629.7	1638.53	8.83	2.69
335	1630.4	1638.77	8.37	2.55
336	1631.2	1639.00	7.80	2.38
337	1629.9	1637.73	7.83	2.39
338	1629.6	1637.91	8.31	2.53
339	1630.1	1638.13	8.03	2.45
340	1631.0	1638.36	7.36	2.24
341	1629.2	1637.37	8.17	2.49
342	1630.0	1637.48	7.48	2.28
343	1630.3	1637.73	7.43	2.26
344	1630.9	1636.33	5.43	1.66
Coordinate System: US State Plane 1983, Zone Tennessee 4100 Datum NAD 1983 (Conus), Units US Survey Feet				



**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION- NUCLEAR FUEL SERVICES, INC.**  
**FINAL STATUS SURVEY REPORT, SUBSURFACE SOIL CHARACTERIZATION and FSS PROJECT,**  
**SURVEY UNITS 4, 6, 7, 12, 16, 17, AND 18**

*Table 1-5- Elevation Differential between Time of Sampling and Final Grade, Survey Unit 16*

Corehole ID	Ground Surface Elevation		Elevation Difference	
	At Time of Sampling	Finished Grade	Feet	Meters
384	1631.10	1639.82	8.72	2.66
385	1631.00	1639.81	8.81	2.69
386	1631.00	1639.73	8.73	2.66
387	1631.20	1639.66	8.46	2.58
388	1629.70	1639.80	10.10	3.08
389	1629.80	1639.81	10.21	3.11
390	1630.40	1639.70	9.30	2.83
391	1630.80	1639.60	8.80	2.68
392	1631.20	1639.53	8.33	2.54
393	1629.40	1639.81	10.41	3.17
394	1629.70	1639.74	10.04	3.06
395	1629.90	1639.65	9.75	2.97
396	1629.90	1639.55	9.65	2.94
397	1629.90	1639.81	9.91	3.02
398	1629.80	1639.72	9.92	3.02
399	1629.70	1639.63	9.93	3.03
400	1629.70	1639.55	9.85	3.00
401	1629.40	1639.83	10.43	3.18
402	1629.40	1639.81	10.41	3.17
403	1630.00	1639.68	9.68	2.95
404	1629.90	1639.57	9.67	2.95
405	1629.80	1639.55	9.75	2.97
406	1629.80	1639.78	10.18	3.10
407	1629.80	1639.76	10.16	3.10
408	1629.80	1639.67	9.87	3.01
409	1630.10	1639.58	9.48	2.89
410	1630.20	1639.48	9.28	2.83
411	1629.70	1639.82	10.12	3.08
412	1629.60	1639.70	10.10	3.08
413	1629.90	1639.60	9.70	2.96
414	1630.20	1639.50	9.30	2.83
415	1630.50	1639.50	9.00	2.74
416	1628.00	1639.79	11.79	3.59
417	1628.80	1639.76	10.96	3.34
418	1629.20	1639.68	10.48	3.19
419	1629.90	1639.59	9.69	2.95
420	1630.10	1639.51	9.41	2.87
421	1627.00	1639.78	12.78	3.90
422	1628.20	1639.73	11.53	3.51
423	1628.70	1639.64	10.94	3.33
424	1628.90	1639.57	10.67	3.25
425	1629.40	1639.56	10.16	3.10
426	1627.50	1639.83	12.33	3.76
427	1627.30	1639.77	12.47	3.80
428	1627.50	1639.70	12.20	3.72
429	1627.40	1639.61	12.21	3.72
430	1628.20	1639.53	11.33	3.45
431	1628.60	1639.50	10.90	3.32
432	1626.90	1639.83	12.93	3.94
433	1627.80	1639.79	11.99	3.65
434	1627.00	1639.69	12.69	3.87
435	1627.30	1639.60	12.30	3.75
436	1628.00	1639.49	11.49	3.50
437	1627.90	1639.46	11.56	3.52
438	1626.70	1639.80	13.10	3.99
439	1626.50	1639.71	13.21	4.03
440	1627.70	1639.61	11.91	3.63
441	1628.10	1639.53	11.43	3.48
442	1628.10	1639.47	11.37	3.47
443	1628.70	1639.41	10.71	3.26
444	1626.30	1639.79	13.49	4.11
445	1626.40	1639.75	13.35	4.07
446	1626.10	1639.67	13.57	4.14
447	1626.70	1639.59	12.89	3.93
448	1627.30	1639.49	12.19	3.72
449	1628.50	1639.41	10.91	3.33
450	1626.70	1639.79	13.09	3.99
451	1626.50	1639.78	13.28	4.05
452	1628.10	1639.67	13.57	4.14
453	1627.00	1639.59	12.59	3.84
454	1628.60	1639.42	10.82	3.30
455	1628.70	1639.37	10.67	3.25
456	1628.70	1639.76	13.06	3.98
457	1626.60	1639.72	13.12	4.00
458	1626.70	1639.63	12.93	3.94
459	1627.60	1639.52	11.92	3.63
460	1628.50	1639.44	10.94	3.33
461	1629.20	1639.37	10.17	3.10
462	1626.60	1640.03	13.43	4.09
463	1627.00	1639.90	12.90	3.93
464	1626.70	1639.69	12.99	3.96
465	1626.70	1639.61	12.91	3.93
466	1627.20	1639.50	12.30	3.75
467	1628.40	1639.42	11.02	3.36
468	1629.20	1639.35	10.15	3.09
469	1626.50	1640.25	13.75	4.19
470	1626.90	1640.23	13.33	4.06
471	1626.50	1639.98	13.48	4.11
472	1626.50	1639.81	13.31	4.06
473	1627.30	1639.56	12.26	3.74
474	1628.30	1639.37	11.07	3.37
475	1628.90	1639.28	10.38	3.16
476	1628.20	1640.25	12.05	3.67
477	1627.40	1640.39	12.99	3.96
478	1627.10	1640.37	13.27	4.04
479	1627.00	1640.16	13.16	4.01
480	1627.10	1639.97	12.87	3.92
481	1628.70	1639.72	11.02	3.36
482	1628.60	1639.50	10.90	3.32
483	1628.70	1639.99	11.29	3.44
484	1628.10	1640.16	12.06	3.68
485	1628.40	1640.35	11.95	3.64
486	1628.70	1640.51	11.81	3.60
487	1628.20	1640.55	12.35	3.76
488	1628.40	1640.43	12.03	3.67
489	1629.30	1640.21	10.91	3.33
490	1628.00	1640.01	12.01	3.66
491	1628.70	1639.83	11.13	3.39
492	1628.00	1639.99	11.99	3.65
493	1628.00	1640.24	12.24	3.73
494	1628.40	1640.46	12.06	3.68
495	1628.40	1640.66	12.26	3.74
496	1629.10	1640.71	11.61	3.54
497	1629.20	1640.58	11.38	3.47
498	1629.30	1640.43	11.13	3.39
499	1628.40	1639.58	11.18	3.41
500	1628.20	1639.78	11.58	3.53
501	1627.80	1640.10	12.30	3.75
502	1628.10	1640.41	12.31	3.75
503	1628.00	1640.67	12.67	3.86
504	1628.70	1640.85	12.15	3.70
505	1629.70	1640.87	11.17	3.40
506	1627.80	1639.29	11.49	3.50
507	1627.70	1639.39	11.69	3.56
508	1628.00	1639.71	11.71	3.57
509	1628.10	1639.98	11.88	3.62
510	1628.20	1640.22	12.02	3.66
511	1628.10	1640.57	12.47	3.80
512	1628.90	1640.84	11.94	3.64
513	1628.90	1641.07	12.17	3.71
514	1628.70	1641.20	12.50	3.81
515	1628.40	1639.05	10.65	3.25
516	1628.10	1639.25	11.15	3.40
517	1627.90	1639.51	11.61	3.54
518	1627.90	1639.82	11.92	3.63
519	1627.80	1640.09	12.29	3.75
520	1627.90	1640.36	12.46	3.80
521	1627.90	1640.65	12.75	3.89
522	1628.70	1640.92	12.22	3.72
523	1628.60	1641.12	12.52	3.82
524	1629.10	1641.32	12.22	3.72
525	1630.70	1637.75	7.05	2.15
526	1630.90	1639.09	8.19	2.50
527	1630.20	1639.36	9.16	2.79
528	1628.00	1639.65	11.65	3.55
529	1627.90	1639.86	11.96	3.65
530	1627.70	1640.22	12.52	3.82
531	1627.90	1640.49	12.59	3.84
532	1628.00	1640.79	12.79	3.90
533	1628.20	1641.04	12.84	3.91
534	1628.80	1641.27	12.47	3.80
535	1630.30	1639.23	8.93	2.72
536	1629.10	1639.51	10.41	3.17
537	1628.80	1639.80	11.00	3.35
538	1628.00	1640.09	12.09	3.69
539	1627.90	1640.34	12.44	3.79
540	1627.90	1640.59	12.69	3.87
541	1627.60	1640.87	13.27	4.04
542	1628.10	1641.14	13.04	3.97
543	1629.50	1639.63	10.13	3.09
544	1627.80	1639.92	12.12	3.69
545	1627.70	1640.17	12.47	3.80
546	1627.40	1640.50	13.10	3.99
547	1627.80	1640.74	12.94	3.94
548	1627.80	1640.98	13.18	4.02
549	1628.50	1641.24	12.74	3.88
550	1628.00	1639.77	11.77	3.59
551	1627.30	1640.06	12.76	3.89
552	1626.90	1640.31	13.41	4.09
553	1625.80	1640.59	14.79	4.51
554	1628.60	1640.88	12.28	3.74
555	1628.40	1641.14	12.74	3.88
556	1629.00	1641.30	12.30	3.75
557	1628.10	1640.17	12.07	3.68
558	1627.10	1640.42	13.32	4.06
559	1629.00	1640.54	11.54	3.52
560	1628.70	1640.73	12.03	3.67
561	1628.60	1640.98	12.38	3.77
Coordinate System: US State Plane ne Tennessee 41000 Datum NAD 1983 (Conus), Units US Survey Feet				



**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION- NUCLEAR FUEL SERVICES, INC.**  
**FINAL STATUS SURVEY REPORT, SUBSURFACE SOIL CHARACTERIZATION and FSS PROJECT,**  
**SURVEY UNITS 4, 6, 7, 12, 16, 17, AND 18**

*Table 1-6- Elevation Differential between Time of Sampling  
and Final Grade, Survey Unit 17*

Corehole ID	Ground Surface Elevation		Elevation Difference	
	At Time of Sampling	Finished Grade	Feet	Meters
612	1634.90	1640.00	5.10	1.55
613	1635.47	1640.00	4.53	1.38
614	1635.18	1639.92	4.74	1.45
615	1635.00	1639.92	4.92	1.50
616	1635.31	1639.75	4.44	1.35
617	1634.48	1639.44	4.96	1.51
618	1635.37	1639.42	4.05	1.24
619	1633.54	1639.30	5.76	1.76
620	1634.50	1639.22	4.72	1.44
621	1632.84	1639.37	6.53	1.99
622	1634.35	1639.11	4.76	1.45
623	1632.65	1639.29	6.64	2.02
624	1632.41	1639.11	6.70	2.04
625	1632.55	1639.42	6.87	2.09
626	1632.62	1639.10	6.48	1.97
627	1632.88	1639.00	6.12	1.87
628	1633.44	1639.10	5.66	1.73
629	1633.33	1639.33	6.00	1.83
630	1632.67	1639.01	6.34	1.93
631	1633.01	1639.10	6.09	1.86
632	1632.99	1639.62	6.63	2.02
633	1632.66	1639.33	6.67	2.03
634	1632.90	1640.66	7.76	2.37
635	1632.54	1640.22	7.68	2.34
636	1632.47	1639.90	7.43	2.26
637	1632.54	1641.14	8.60	2.62
638	1631.72	1640.93	9.21	2.81
639	1632.35	1642.04	9.69	2.95
640	1631.02	1641.82	10.80	3.29
641	1632.91	1642.58	9.67	2.95
642	1632.66	1642.50	9.84	3.00
643	1629.60	1642.38	12.78	3.90
644	1631.80	1642.22	10.62	3.24
645	1633.21	1642.49	9.28	2.83
646	1631.80	1642.86	11.06	3.37
647	1631.11	1642.98	11.87	3.62
648	1631.25	1642.82	11.57	3.53
649	1631.72	1642.62	10.90	3.32
650	1631.90	1642.47	10.57	3.22
651	1632.74	1642.20	9.46	2.88
652	1632.57	1642.45	9.88	3.01
653	1633.19	1642.70	9.51	2.90
654	1632.66	1642.90	10.24	3.12
655	1631.65	1643.00	11.35	3.46
656	1632.88	1642.89	10.01	3.05
657	1634.44	1642.72	8.28	2.52
658	1629.65	1641.13	11.48	3.50
659	1631.62	1641.60	9.98	3.04
660	1631.29	1642.03	10.74	3.27
661	1632.36	1642.25	9.89	3.01
662	1633.03	1642.46	9.43	2.87
663	1633.03	1642.74	9.71	2.96
664	1633.85	1642.95	9.10	2.77
665	1635.03	1643.00	7.97	2.43
666	1635.28	1642.98	7.70	2.35
667	1635.45	1642.78	7.33	2.23
668	1635.05	1643.00	7.95	2.42
A614	1639.10	1639.90	0.80	0.24
B614	1639.60	1639.81	0.21	0.06
C614	1639.40	1639.97	0.57	0.17
D614	1639.20	1640.00	0.80	0.24
Coordinate System: US State Plane 1983, Zone Tennessee 4100 Datum NAD 1983 (Conus), Units US Survey Feet				
Indicates Sample was Collected Less Than 15 cm bgs of Final Grade				

*Table 1-7- Elevation Differential between Time of Sampling  
and Final Grade, Survey Unit 18*

Corehole ID	Ground Surface Elevation		Elevation Difference	
	At Time of Sampling	Finished Grade	Feet	Meters
669	1632.79	1639.13	6.34	1.93
670	1633.15	1639.26	6.11	1.86
671	1633.11	1639.60	6.49	1.98
672	1634.73	1639.73	5.00	1.52
673	1632.81	1639.29	6.48	1.98
674	1633.52	1639.55	6.03	1.84
675	1633.54	1639.94	6.40	1.95
676	1634.89	1640.26	5.37	1.64
677	1634.80	1640.27	5.47	1.67
678	1632.81	1639.89	7.08	2.16
679	1633.58	1639.74	6.16	1.88
680	1634.38	1639.95	5.57	1.70
681	1634.65	1640.27	5.62	1.71
682	1635.44	1640.60	5.16	1.57
683	1635.14	1640.94	5.80	1.77
684	1630.67	1641.18	10.51	3.20
685	1630.49	1640.92	10.43	3.18
686	1632.87	1640.67	7.80	2.38
687	1634.06	1640.32	6.26	1.91
688	1634.20	1640.25	6.05	1.84
689	1634.95	1640.58	5.63	1.72
690	1634.85	1640.93	6.08	1.85
691	1631.36	1641.87	10.51	3.20
692	1632.13	1641.49	9.36	2.85
693	1633.68	1641.05	7.37	2.25
694	1634.54	1641.00	6.46	1.97
695	1635.06	1641.00	5.94	1.81
696	1635.32	1641.25	5.93	1.81
697	1635.66	1641.58	5.92	1.80
698	1631.82	1642.16	10.34	3.15
699	1634.41	1641.96	7.55	2.30
700	1634.58	1641.70	7.12	2.17
701	1635.23	1641.41	6.18	1.88
702	1635.42	1641.54	6.12	1.86
703	1636.00	1641.91	5.91	1.80
704	1633.96	1642.47	8.51	2.59
705	1634.61	1642.35	7.74	2.36
706	1635.30	1642.13	6.83	2.08
707	1635.70	1642.00	6.30	1.92
708	1634.87	1642.72	7.85	2.39
709	1636.00	1642.52	6.52	1.99
W672	1633.70	1639.49	5.79	1.76
S672	1634.50	1639.67	5.17	1.57
E672	1635.60	1640.00	4.40	1.34
N672	1635.30	1639.81	4.51	1.37
Coordinate System: US State Plane 1983, Zone Tennessee 4100 Datum NAD 1983 (Conus), Units US Survey Feet				

**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION NUCLEAR FUEL SERVICES, INC.**

**FINAL STATUS SURVEY REPORT ON SUBSURFACE SOIL CHARACTERIZATION,  
SURVEY UNITS 4, 6, 7, 12, 16, 17, AND 18 OF THE NORTH SITE**

**2. Number of Survey Unit Coreholes**

**Request:**

Provide results of the determination and basis of the appropriate number of coreholes (corehole density) for SUs 6, 17, and 18.

**Basis:**

In review of the NFS FSSR of Subsurface Soil Characterization and FSS Project Revision 0, dated April 2016, NRC Staff noted that the highest 90<sup>th</sup> percentile and maximum concentrations observed exceeded the corresponding permissible surface soil Derived Concentration Guideline Level in SU 6. This is indicated by the 90<sup>th</sup> percentile and maximum concentration values intersecting the volume factor curves, which indicates the need to adjust corehole density to account for the possibility of localized anomalies in the subsurface soil. For SU 6, this resulted in a corehole density of 1.0 m<sup>2</sup> or 3,101 coreholes for the 3,101 m<sup>2</sup> survey area.

Based on Section 4.3 of the Characterization Plan (MACTEC 2007), a corehole sampling density of 50 m<sup>2</sup> was selected resulting in 60 corehole samples for the 3,101 m<sup>2</sup> survey area. The NFS FSSR states that Section 5.3.3.2 of MARSSIM (NRC 2000) defines a typical reference system spacing for open land areas as 10 meters (100 m<sup>2</sup>). The reference system spacing was reduced by two to 50 m<sup>2</sup> (or 1 corehole every 7 m) by NFS due to surface scanning not being applicable to subsurface soil characterization and known hot spots. This approach was described by NFS as "conservative" for determining corehole sampling density. NFS utilized the Visual Sample Plan code hotspot function to locate the 60 planned corehole locations.

It is not clear that the basis for selecting 60 coreholes vs. the calculated corehole density of 3,101 coreholes is justified as a "conservative approach" in determining the acceptability of a SU for unrestricted release.

This information is required to verify compliance with the NFS North Site DP and demonstration that a SU is suitable for unrestricted use.

## **RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION NUCLEAR FUEL SERVICES, INC.**

### **FINAL STATUS SURVEY REPORT ON SUBSURFACE SOIL CHARACTERIZATION, SURVEY UNITS 4, 6, 7, 12, 16, 17, AND 18 OF THE NORTH SITE**

#### **NFS RESPONSE**

The final designs of Survey Units 6, 17, and 18 were ultimately determined in 2006 using professional judgment relying on the consideration of three mathematical points; the corehole frequency determined using "historical data", the corehole frequency of the neighboring survey units sharing similar historical properties, and areal frequency as suggested by the MARSSIM (USNRC 2000) to evaluate areas of elevated radioactivity for open land areas. Because surface scanning is not applicable for subsurface soil characterization and known elevated concentrations of residual radioactivity existed in these areas in the past, an alternative approach was taken. In Survey Units 6, 17, and 18 the reference system spacing area identified in MARSSIM (100 m<sup>2</sup>) was reduced by a factor of two, resulting in a reference system spacing surface area of 50 m<sup>2</sup> (approximately every 7 meters). The subsequent information in this response provides further justification that the selected corehole frequencies for Survey Units 6, 17, and 18 are appropriate.

#### **Compilation of Historical Datasets**

As described in the FSS Report and the 2007 Characterization Plan, the historical dataset that NFS provided to contractor MACTEC (now Amec Foster Wheeler) in 2006 contained 23,429 sample data points. Of these 23,429 samples, MACTEC utilized 19,107 samples during the design of the Characterization Plan. MACTEC removed 4,322 analytical samples from the dataset because they were located within 3 ft below the original ground surface of previously excavated areas, and thus predate the post-excavation radiological conditions in those areas. The expunged data were deemed irrelevant to the radiological conditions of the North Site.

Survey Unit 6 underwent additional remediation in October of 2009. Field records indicate that the survey unit was excavated down ~0.5 to 2.0 m with volumetric sampling occurring throughout and at the conclusion of the excavation process. However, the post-remedial action sample results from the 2009 remedial actions were not included in the 2006 dataset.

Survey Unit 17 underwent additional remediation in June and July of 2009. Field records indicate that the survey unit was excavated down ~2.0 m with volumetric sampling occurring throughout and at the conclusion of the excavation process. However, the post-remedial action sample results from the 2009 remedial actions were not included in the 2006 dataset.

Survey Unit 18 underwent additional remediation in June of 2009. Field records indicate that the survey unit was excavated down ~2.0 m with volumetric sampling occurring throughout and at the conclusion of the excavation process. However, the post-remedial action sample results from the 2009 remedial actions were not included in the 2006 dataset.

NFS provided a supplemental dataset (referred to as the "2009 dataset" throughout the remainder of this Response to RAI) to Amec Foster Wheeler that included 22 new pre-Subsurface Soil FSS (historical) analytical sample results located within Survey Unit 6, 30 new pre-Subsurface Soil FSS (historical) analytical sample results located within Survey Unit 17, and 22 new pre-Subsurface Soil FSS (historical) analytical sample results located within Survey Unit 18. The 2009 dataset is comprised of analytical results from volumetric samples collected in June, July, and October 2009 following the additional remedial activities in Survey Units 6, 17, and 18. The 2009 dataset is representative of radiological conditions of the site at the time of FSS activities and is considered the relevant historical dataset for use in designing the FSS and demonstrating compliance and acceptability with

**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION NUCLEAR FUEL SERVICES, INC.**  
**FINAL STATUS SURVEY REPORT ON SUBSURFACE SOIL CHARACTERIZATION,  
SURVEY UNITS 4, 6, 7, 12, 16, 17, AND 18 OF THE NORTH SITE**

the sampling density criteria for Survey Units 6, 17, and 18.

The selected corehole spacing (one corehole every 50 m<sup>2</sup>) was reevaluated using the 2009 dataset for Survey Units 6, 17, and 18 and the final design criteria as outlined in Section 2.6.2 of the FSS Report. To reevaluate the Survey Unit 6, 17, and 18 corehole designs, the 2009 post-remediation sample results were plotted into SADA to verify their locations within the survey units. Next, the 2009 dataset was inputted into the Subsurface Soil DCGL calculators as the historical dataset, replacing the 2006 dataset. This test was performed to determine what the resultant corehole spacing would have been, if the post-remediation data had been available and used during the original survey design. This evaluation confirmed the suitability of the survey design for Survey Unit 6, 17, and 18. It affirmed that corehole spacing prescribed in the designs (one corehole every 50 m<sup>2</sup>) was far more densely spaced than would be reasonably required to assess the dose consequences of locally elevated pockets of residual radioactivity in the survey units. Using the 2009 dataset, the Subsurface Soil DCGL calculators conclude that the *Minimum Areal Sample Frequency required to Satisfy DCGL<sub>EMC</sub> 90<sup>th</sup> Percentile* is 999 m<sup>2</sup> (the default maximum size of the Subsurface Soil DCGL calculators) and that the *Minimum Areal Sample Frequency required to Satisfy DCGL<sub>EMC</sub> Observed Maximum* is 999 m<sup>2</sup> for all three survey units.

The 2006 dataset of Survey Units 6, 17, and 18, Appendix A.2, A.6, and A.7, respectively, will be replaced in their entirety with the post-remediation dataset, shown in Table 2-2, Table 2-4, and Table 2-6, respectively. Additional survey unit-specific information is provided in the following sections.

## **RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION NUCLEAR FUEL SERVICES, INC.**

### **FINAL STATUS SURVEY REPORT ON SUBSURFACE SOIL CHARACTERIZATION, SURVEY UNITS 4, 6, 7, 12, 16, 17, AND 18 OF THE NORTH SITE**

#### **Survey Unit 6**

The 2006 dataset included sparsely distributed data within the Survey Unit 6 boundary with only 11 individual sample IDs, dating back before 2006, and well before the 2009 remediation. Based on the findings described in this response it is evident that a single data point from the 2006 dataset remained relevant to the radiological conditions at the time of the subsurface FSS in Survey Unit 6. Thus, the post-remedial action samples collected in 2009, along with the single sample from the 2006 dataset, should be considered the relevant Survey Unit 6 Historical Dataset for the purposes of subsurface soil FSS design.

*Table 2-1 Survey Unit 6, 2006 Dataset (Pre-Remediation)*

<b>Sample ID</b>	<b>Sample Depth (meter bgs)</b>
09-S6-021	0.15
09-S6-022	0.61
09-S6-023	1.07
511-F5-1	0.15
513-F5-1	0.15
551-F1-1	0.15
551-F1-2	0.46
553-F5-1	0.15
592-F5-1	0.15
593-D3-1	0.15
593-D3-2	0.46

As explained above, Survey Unit 6 was excavated to a depth of ~0.5 to 2.0 m during remedial activities conducted in 2009. Mapping the 2006 pre-remediation samples to the depths listed in Table 2-1 and plotting them against the post-remediation contour map demonstrates that the soils represented by these samples, except for those represented by Sample ID 09-S6-023, were removed in 2009 and disposed of as part of NFS' approved soil remediation activities. Therefore, only Sample ID 09-S6-023 is considered relevant to the post-remediation conditions.

At the conclusion of excavation in 2009, volumetric samples were collected from the remediated surface of Survey Unit 6. The results of these samples, along with Sample ID 09-S6-023, are presented in Table 2-2. This post-remediation dataset is representative of the radiological conditions of Survey Unit 6 at the time of the subsurface FSS, and is the relevant Survey Unit 6 Historical Dataset which confirms that the selected corehole density for the subsurface FSS (50 m<sup>2</sup>) is appropriate.



**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION NUCLEAR FUEL SERVICES, INC.****FINAL STATUS SURVEY REPORT ON SUBSURFACE SOIL CHARACTERIZATION,  
SURVEY UNITS 4, 6, 7, 12, 16, 17, AND 18 OF THE NORTH SITE***Table 2-2 Survey Unit 6, 2009 Dataset (Post-Remediation)*

Sample ID	Date Collected	Sample Depth Below Pre-Excavation Surface (meters)	Analytical Results (pCi/g)		
			Am-241	Th-232	U-235
OP-1085	10/13/2009	1	-1.081	1.970	2.504
OP-1086	10/13/2009	1	-1.425	3.153	3.051
OP-1087	10/13/2009	1	-0.309	2.239	0.964
OP-1088	10/13/2009	1	-1.245	1.054	0.372
OP-1089	10/13/2009	1	-3.223	1.101	6.680
OP-1090	10/14/2009	0.5	-0.026	3.316	2.632
OP-1091	10/14/2009	1	0.320	1.572	0.242
OP-1092	10/14/2009	1	-2.181	2.284	2.847
OP-1093	10/14/2009	0.5	0.277	3.991	2.079
OP-1094	10/14/2009	1	-0.771	3.865	1.779
OP-1095	10/14/2009	0.5	0.145	2.329	0.589
OP-1096	10/14/2009	1	0.028	1.745	1.020
OP-1097	10/14/2009	0.5	0.148	5.674	1.867
OP-1098	10/14/2009	0.5	-0.260	1.961	0.979
OP-1099	10/14/2009	1	0.347	1.923	0.676
OP-1103	10/15/2009	2	0.463	2.034	0.367
OP-1104	10/15/2009	2	-0.656	1.368	0.502
OP-1110	10/28/2009	2	-0.142	2.039	0.415
OP-1111	10/28/2009	2	-0.571	1.080	0.118
OP-1112	10/28/2009	2	-0.614	2.098	-0.069
OP-1113	10/28/2009	2	-1.354	1.889	0.218
OP-1114	10/28/2009	2	-0.438	2.275	0.302
09-S6-0232	Pre-2006	1.1	0.01	1	0.3

**Survey Unit 17**

The 2006 dataset included data for 104 individual sample IDs within the Survey Unit 17 boundary, dating back before 2006, and well before the 2009 remediation. Based on the findings described in this response it is evident that none of the 2006 dataset results remain relevant to the radiological conditions at the time of subsurface soil FSS in Survey Unit 17, and that the post-remedial action samples collected in 2009 should be considered the relevant Survey Unit 17 Historical Dataset for purposes of subsurface soil FSS design.

As explained above, Survey Unit 17 was excavated to a depth of ~2.0 m during remedial activities conducted in 2009. Mapping the 2006 pre-remediation samples to the depths listed in Table 2-3 and plotting them against the post-remediation contour map demonstrates that the soils represented by these samples were removed in 2009 and disposed of as part of NFS' approved soil remediation activities.

**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION NUCLEAR FUEL SERVICES, INC.****FINAL STATUS SURVEY REPORT ON SUBSURFACE SOIL CHARACTERIZATION,  
SURVEY UNITS 4, 6, 7, 12, 16, 17, AND 18 OF THE NORTH SITE****Table 2-3 Survey Unit 17, 2006 Dataset (Pre-Remediation)**

<b>Sample ID</b>	<b>Sample Depth (meter bgs)</b>
02-S-122	0.15
02-S-123	0.46
02-S-124	0.76
02-S-131	0.15
02-S-132	0.46
02-S-133	0.91
02-S-134	0.15
02-S-135	0.46
02-S-136	0.76
705-C1-1	0.15
705-C1-2	0.46
706-C1-1	0.15
706-C1-2	0.46
706-C1-3	0.76
743-C8-1	0.15
743-C8-2	0.46
743-C8-3	0.76
744-C2-1	0.15
744-C2-2	0.46
744-C2-3	0.76
744-I8-1	0.15
744-I8-2	0.46
744-I8-3	0.76
745-B1-1	0.15
745-B1-2	0.46
745-B1-3	0.76
781-B4-1	0.15
781-B4-2	0.46
781-B4-3	0.76
781-B4-4	1.07
782-C2-1	0.15
782-C2-2	0.46
782-C2-3	0.76
782-I8-1	0.15
782-I8-2	0.46
782-I8-3	0.76
783-C2-1	0.15
783-C2-2	0.46
783-C2-3	0.76
783-I8-1	0.15
783-I8-2	0.46
783-I8-3	0.76
820-D5-2	0.46
820-D5-3	0.76
820-F8-1	0.15
821-D2-1	0.15
821-D2-2	0.46
822-C4-1	0.15
822-C4-2	0.46
822-C4-3	0.76
822-J2-1	0.15
822-J2-2	0.46

<b>Sample ID</b>	<b>Sample Depth (meter bgs)</b>
822-J2-3	0.76
859-H3-1	0.15
859-H3-2	0.46
859-H3-3	0.76
860-H5-1	0.15
860-H5-2	0.46
860-H5-3	0.76
864-C2-1	0.15
864-C2-2	0.46
864-C2-3	0.76
864-C2-4	1.07
899-E4-1	0.15
899-E4-2	0.46
899-E4-3	0.76
902-C1-1	0.15
902-C1-2	0.46
902-F8-1	0.15
902-F8-2	0.46
902-F8-3	0.76
902-F8-4	1.07
903-C2-1	0.15
903-C2-2	0.46
903-C2-3	0.76
903-J7-1	0.15
903-J7-2	0.46
903-J7-3	0.76
903-J7-4	1.07
935-I2-1	0.15
935-I2-2	0.46
935-I2-3	0.76
937-E5-1	0.15
937-E5-2	0.46
937-E5-3	0.76
940-J7-1	0.15
940-J7-2	0.46
941-C2-1	0.15
941-C2-2	0.46
941-C2-3	0.76
941-I7-1	0.15
941-I7-2	0.46
941-I7-3	0.76
942-H2-1	0.15
942-H2-2	0.46
943-G3-1	0.15
943-G3-2	0.46
945-D3-1	0.15
945-D3-2	0.46
946-C2-1	0.15
946-C2-2	0.46
946-C2-3	0.76
AOC5-SD-009	0.15
AOC5-SD-010,D	0.15

**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION NUCLEAR FUEL SERVICES, INC.****FINAL STATUS SURVEY REPORT ON SUBSURFACE SOIL CHARACTERIZATION,  
SURVEY UNITS 4, 6, 7, 12, 16, 17, AND 18 OF THE NORTH SITE**

At the conclusion of excavation in 2009, volumetric samples were collected from the remediated surface of Survey Unit 17. The results of these samples are presented in Table 2-4. This 2009 dataset is representative of the radiological conditions of Survey Unit 17 at the time of the subsurface FSS, and is the relevant Survey Unit 17 Historical Dataset which confirms that the selected corehole density for the subsurface FSS (50 m<sup>2</sup>) is appropriate.

*Table 2-4 Survey Unit 17, 2009 Dataset (Post-Remediation)*

Sample ID	Date Collected	Sample Depth Below Pre-Excavation Surface (meters)	Analytical Results (pCi/g)		
			Am-241	Th-232	U-235
OP-1016	06/19/2009	2	0.385	2.467	1.262
OP-1017	06/19/2009	2	0.398	5.075	1.961
OP-1018	06/19/2009	2	0.155	7.197	2.759
OP-1019	06/19/2008	2	2.289	4.506	1.230
OP-1020	06/19/2009	2	1.133	2.319	1.055
OP-1021	06/19/2009	2	-0.047	2.662	0.857
OP-1022	06/19/2009	2	0.659	1.942	0.499
OP-1023	06/22/2009	2	-0.288	1.613	0.599
OP-1024	06/22/2009	2	0.431	1.642	0.497
OP-1025	06/22/2009	2	0.854	2.209	0.848
OP-1026	06/22/2009	2	0.726	6.024	1.738
OP-1027	06/22/2009	2	0.891	3.028	0.887
OP-1028	06/22/2009	2	0.427	1.700	0.440
OP-1029	06/22/2009	2	0.562	1.329	0.165
OP-1030	06/22/2009	2	-0.208	2.132	0.616
OP-1031	06/23/2009	2	-0.201	2.069	1.931
OP-1032	06/23/2009	2	0.071	1.558	0.108
OP-1033	06/23/2009	2	0.240	1.304	0.584
OP-1034	06/23/2009	2	0.745	3.536	0.694
OP-1035	06/23/2009	2	0.558	4.022	1.043
OP-1036	06/23/2009	2	1.228	3.487	0.544
OP-1037	06/23/2009	2	0.884	4.934	1.870
OP-1038	06/23/2009	2	0.124	5.580	1.717
OP-1039	06/23/2009	2	0.093	1.242	0.607
OP-1041	06/24/2009	2	-0.041	5.044	2.538
OP-1042	06/24/2009	2	0.525	4.156	2.178
OP-1043	06/24/2009	2	0.674	2.536	2.247
OP-1044	07/01/2009	2	-0.455	2.252	5.047
OP-1045	07/01/2009	2	-0.679	6.055	5.966
OP-1046	07/01/2009	2	-0.492	5.929	6.425

**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION NUCLEAR FUEL SERVICES, INC.****FINAL STATUS SURVEY REPORT ON SUBSURFACE SOIL CHARACTERIZATION,  
SURVEY UNITS 4, 6, 7, 12, 16, 17, AND 18 OF THE NORTH SITE****Survey Unit 18**

The 2006 dataset included data for 72 individual sample IDs within the Survey Unit 18 boundary, dating back before 2006, and well before the 2009 remediation. Based on the findings described in this response it is evident that none of the 2006 dataset results remain relevant to the radiological conditions at the time of subsurface FSS in Survey Unit 18 and that the post-remedial action samples collected in 2009 should be considered the relevant Survey Unit 18 Historical Dataset for purposes of subsurface soil FSS design.

As explained above, Survey Unit 18 was excavated to a depth of ~2.0 m during remedial activities conducted in 2009. Mapping the 2006 pre-remediation samples to the depths listed in Table 2-5 and plotting them against the post-remediation contour map demonstrates that the soils represented by these samples were removed in 2009 and disposed of as part of NFS' approved soil remediation activities.

*Table 2-5 Survey Unit 18, 2006 Dataset (Pre-Remediation)*

Sample ID	Sample Depth (meter bgs)
860-B8-1	0.15
860-B8-2	0.46
860-B8-3	0.76
861-C2-1	0.15
861-C2-2	0.46
861-C2-3	0.76
861-I2-1	0.15
899-J9-1	0.15
899-J9-2	0.46
899-J9-3	0.76
861-G6-2	0.46
861-G6-3	0.76
823-E2-1	0.15
862-B3-1	0.15
862-B3-2	0.46
862-B3-3	0.76
862-B3-4	1.07
823-G2-2	0.46
823-G2-3	0.76
823-G2-4	1.07
900-I8-1	0.15
900-I8-2	0.46
900-I8-3	0.76
823-H8-1	0.15
823-H8-2	0.46
823-H8-3	0.76
823-H8-4	1.07
784-I2-1	0.15
784-I2-2	0.46
784-I2-3	0.76
784-I2-4	1.07
824-F2-1	0.15
824-F2-2	0.46
824-F2-3	0.76
824-F2-4	1.07
745-B1-1	0.15

Sample ID	Sample Depth (meter bgs)
745-B1-2	0.46
745-B1-3	0.76
784-C8-1	0.15
784-C8-2	0.46
784-C8-3	0.76
784-C8-4	1.07
863-E2-1	0.15
863-E2-2	0.46
863-E2-3	0.76
863-E2-4	1.07
901-I8-1	0.15
901-I8-2	0.46
901-I8-3	0.76
901-I8-4	1.07
785-C2-1	0.15
785-C2-2	0.46
785-C2-3	0.76
785-C2-4	1.07
785-C2-5	1.37
824-H9-1	0.15
825-I1-1	0.15
745-H8-1	0.15
745-H8-2	0.46
786-C2-1	0.15
746-H1-1	0.15
746-H1-2	0.46
785-I8-1	0.15
865-B1-1	0.15
865-B1-2	0.46
865-B1-3	0.76
865-B1-4	1.07
746-G6-1	0.15
746-G6-2	0.46
786-I8-1	0.15
747-I2-1	0.15
747-B8-1	0.15

**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION NUCLEAR FUEL SERVICES, INC.****FINAL STATUS SURVEY REPORT ON SUBSURFACE SOIL CHARACTERIZATION,  
SURVEY UNITS 4, 6, 7, 12, 16, 17, AND 18 OF THE NORTH SITE**

At the conclusion of excavation in 2009, volumetric samples were collected from the remediated surface of Survey Unit 18. The results of these samples are presented in Table 2-6. This 2009 dataset is representative of the radiological conditions of Survey Unit 18 at the time of the subsurface FSS, and is the relevant Survey Unit 18 Historical Dataset which confirms that the selected corehole density for the subsurface FSS (50 m<sup>2</sup>) is appropriate.

*Table 2-6 Survey Unit 18, 2009 Dataset (Post-Remediation)*

Sample ID	Date Collected	Sample Depth Below Pre-Excavation Surface (meters)	Analytical Results (pCi/g)		
			Am-241	Th-232	U-235
OP-900B	06/10/2009	2	0.242	2.068	0.880
OP-901B	06/10/2009	2	-0.167	1.558	0.872
OP-902B	06/10/2009	2	0.092	2.501	2.901
OP-903B	06/10/2009	2	-0.126	1.489	1.462
OP-904B	06/10/2009	2	-0.053	1.570	1.412
OP-905B	06/10/2009	2	-0.483	1.338	0.185
OP-906B	06/10/2009	2	0.316	1.203	0.700
OP-907B	06/10/2009	2	0.160	1.208	1.587
OP-908B	06/10/2009	2	0.228	3.082	2.642
OP-909B	06/10/2009	2	-0.459	0.571	0.367
OP-1000	06/12/2009	2	1.413	3.932	31.917
OP-1001	06/12/2009	2	1.394	3.577	1.952
OP-1002	06/12/2009	2	0.626	1.022	0.472
OP-1003	06/12/2009	2	0.268	2.061	0.874
OP-1004	06/12/2009	2	0.298	4.289	2.486
OP-1005	06/12/2009	2	-0.355	2.907	1.520
OP-1006	06/12/2009	2	0.543	4.609	3.058
OP-1007	06/12/2009	2	0.808	5.528	0.736
OP-1008	06/12/2009	2	-0.099	3.313	1.580
OP-1009	06/12/2009	2	0.170	3.867	1.165
OP-1010	06/18/2009	2	0.318	3.004	0.420
OP-1011	06/18/2009	2	-0.082	2.901	0.453