

**SAFETY EVALUATION REPORT  
NUCLEAR FUEL SERVICES, INC. NORTH SITE  
FINAL STATUS SURVEY REPORT FOR SURVEY UNITS 4, 6, 7, 12, 16, 17 AND 18**

1. Introduction

By letter dated October 27, 2016, and supplemented by letters dated February 15 and August 30, 2017, Nuclear Fuel Services, Inc. (NFS) submitted the Final Status Survey (FSS) Report for Survey Units 4, 6, 7, 12, 16, 17, and 18 located at the North Site area. Nuclear Fuel Services requested confirmation that these survey units are suitable for unrestricted release in accordance with Title 10 of the *Code of Federal Regulations (10 CFR)* Part 20, Subpart E.

2. Background

The NFS North Site Decommissioning Plan (DP) was approved in Amendment 27 to Materials License SNM-124, dated June 19, 2001, and supplemented by information provided to satisfy Safety Condition S-47. One product of the DP was a FSS, to be performed after an area has been fully characterized and remediation has been completed.

The FSS design is an iterative process that requires appropriate site classification based on the potential radionuclide concentration levels relative to the derived concentration guideline levels (DCGLs), and incorporates a process to ensure the quality of the data obtained. In Amendment 69 to Materials License SNM-124, dated February 15, 2006, the U.S. Nuclear Regulatory Commission (NRC) approved a revised method to derive subsurface (greater than 15 cm below the ground surface) soil DCGLs and a method to perform subsurface FSSs. These DCGLs were derived to demonstrate compliance with the 25 mrem/year dose criterion for unrestricted release of the area in accordance with 10 CFR Part 20, Subpart E.

In the approval of Amendment 69, the NRC staff concluded that the subsurface FSS Plan, as described in the revised Appendix B to Chapter 5 of the DP was adequate to perform FSS for subsurface soils in the North Site area for demonstrating compliance with the radiological criteria for license termination.

3. Scope of the Staff Evaluation

This staff evaluation addresses only the subsurface soils FSS for Survey Units 4, 6, 7, 12, 16, 17, and 18. Staff will review and evaluate the results of the surface soil FSS for Survey Units 4, 6, 7, 12, 16, 17, and 18 upon submittal to NRC.

4. Subsurface Final Status Survey Results

4.1. Determination of Number of Coreholes for Survey Units 6, 17, and 18

4.1.1. Evaluation

An important issue for the survey design for the subsurface FSS is the number of coreholes (boreholes) for subsurface soils needed in each survey unit. During its review, NRC staff noted that the highest 90<sup>th</sup> percentile and maximum concentrations observed exceeded the corresponding permissible surface soil DCGL in Survey Unit 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.

Nuclear Fuel Services revised Sections 2.7.2, 2.11.2, and 2.12.2 of the FSS report to reflect an alternative sampling density determination for Survey Units 6, 17, and 18. The historical datasets for Survey Units 6, 17, and 18 were replaced in Appendices A.2, A.6, and A.7 respectively to include post-remediation measurements. These 2009 datasets included 22 new historical measurements within Survey Unit 6, 30 new historical measurements within Survey Unit 17, and 22 new historical measurements within Survey Unit 18. The 2009 post-remediation datasets for Survey Units 6, 17, and 18 represent the radiological status of Survey Units 6, 17, and 18 at the time of FSS performance.

Guidance to determine the corehole density was found in MARSSIM (NRC 2000). MARSSIM recommends, in Section 5.3.3.2, Characterization Surveys, Land Area Surveys, that "A typical reference system spacing for open land areas is 10 meters (100 m<sup>2</sup>)". This spacing is somewhat arbitrary and is chosen to facilitate determining survey unit locations and evaluating areas of elevated radioactivity." Surface scanning is generally not applicable for subsurface soil characterization. Elevated concentrations of residual radioactivity are known to exist in these areas, so an alternative approach is utilized. The reference system spacing area identified in MARSSIM (100 m<sup>2</sup>) is reduced by a factor of two, resulting in a reference system spacing surface area of 50 m<sup>2</sup> (approximately every 7 m). Nuclear Fuel Service's judgment was that a spacing of 50 m<sup>2</sup> was appropriate, given all considerations. The staff reevaluated the revised historical dataset, and agrees that the 2006 historical data used to determine the original spacing is not representative of the post-remediation conditions in Survey Units 6, 17, and 18. The staff concludes that the choice to set spacing at an area of 50 m<sup>2</sup> is reasonable and acceptable for Survey Units 6, 17, and 18. The staff finds that the submitted determination of coreholes is reasonable and acceptable for Survey Units 4, 7, 12, and 16.

#### 4.1.2. Findings

The staff finds that the determination of the number of coreholes is adequate for Survey Units 4, 6, 7, 12, 16, 17, and 18. The historical data sets from 2006 for survey units 6, 17, and 18 were replaced with post-remediation datasets from 2009.

### 4.2. Survey Unit Demarcation

#### 4.2.1 Evaluation

The DP discusses survey unit demarcation in Section 2.7 of Chapter 5, Appendix B. Nuclear Fuel Services states that survey units are laterally demarcated using the same concepts and criteria described in the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM). Section 4.6 of the MARSSIM (NRC, 2000) discusses identifying survey units. MARSSIM indicates that a goal is to distribute survey data points relatively uniformly among areas of similar contamination potential. MARSSIM recommends that sites be divided into survey units that share a common history or other characteristics, or are naturally distinguishable from other portions of the site. MARSSIM also suggests a maximum area for a Class 1 land survey unit of 2000 m<sup>2</sup>.

The staff reviewed the licensee's demarcation of the survey units. Section 2.3 of the FSS Report describes the process NFS used to demarcate survey units; here, the licensee indicates that historical knowledge and the historical sampling data were considered in the demarcation. Sections 2.6 through 2.12 of the FSS Report describe the survey units.

#### 4.2.2 Findings

The staff finds that the licensee has adequately determined the demarcation of Survey Units 4, 6, 7, 12, 16, 17, and 18.

#### 4.3. Survey Unit Size

##### 4.3.1 Evaluation

Staff evaluated the survey unit size for Survey Units 4, 6, 7, 12, 16, 17, and 18. Section 4.6 of the MARSSIM (NRC, 2000) discusses survey unit size based on classification, exposure pathway modeling assumptions, and site-specific assumptions. Survey unit size is important to ensure each survey unit is assigned an adequate number of sample data points to comparison to the DCGLs.

##### 4.3.2 Findings

The staff finds that the licensee has adequately determined the size of Survey Units 4, 6, 7, 12, 16, 17, and 18. The size of each survey unit is adequate to meet the plan in the DP and ensure that an adequate number of sample data points is assigned to each survey unit.

#### 4.4. Surrogate Ratios and Hard to Detect (HTD) Radionuclides

##### 4.4.1 Evaluation

Staff evaluated the use of surrogate ratios and hard to detect radionuclides for Survey Units 4, 6, 7, 12, 16, 17, and 18. During the review of a previous FSS Report, NFS committed to determine surrogate ratios to estimate inferred HTD radionuclides as specified in the DP and evaluate contributions to dose from direct measurements of HTD radionuclides in future FSSs as discussed in a September 11, 2012 meeting with NRC staff.

##### 4.4.2 Findings

The staff finds that overall, the approach to surrogates and results of the surrogate evaluations are acceptable for Survey Units 4, 6, 7, 12, 16, 17, and 18. For these survey units, the Staff concludes that the data indicate that the dose contribution from the HTD radionuclides is insignificant. The staff also concludes that the number of analyses for HTD radionuclides (i.e., 10 percent of all samples) is sufficient.

#### 4.5. Demonstration of Compliance with Derived Concentration Guideline Levels (DCGLs)

##### 4.5.1 Evaluation

Staff evaluated whether derived concentration guideline levels for Survey Units 4, 6, 7, 12, 16, 17, and 18 were consistent with the DP. NFS provided an analysis of the sample results for compliance with the subsurface DCGLs in Chapter 5 of the FSS Report. Nuclear Fuel Services calculated the sum of the fractions (SOF) values for each sample in the survey units and provides a histogram summary of the SOF values in Section 5.1 of the FSS Report. If all individual samples from a survey unit have an SOF (relative to the surface DCGL) no greater than 1, then the survey unit passes the respective DCGLs. The SOF statistical summaries are provided in Table 5-79 through Table 5-87 in the FSS. The projected doses for Survey Units 4, 6, 7, 12, 16, 17, and 18 meet the requirements for unrestricted release.

#### 4.5.2 Findings

The staff finds that the results of the subsurface soil survey demonstrate that the subsurface residual radioactivity in Survey Units 4, 6, 7, 12, 16, 17, and 18 are within the release criteria.

#### 4.6. Survey Unit Re-contamination and Disturbance

##### 4.6.1 Evaluation

The licensee is requesting “confirmation that these survey units will be suitable for unrestricted release in accordance with 10 CFR, Part 20, Subpart E”. In their DP, the licensee discusses how re-contamination of decommissioned areas is prevented. When any type of site release is requested for an area that has completed an FSS, the potential for re-contamination or other disturbance of the survey unit areas must be considered.

#### 5. Conclusion

Since NFS has not provided the results of the surface soil FSS for Survey Units 4, 6, 7, 12, 16, 17, and 18, the staff does not confirm at this time that those survey units are suitable for unrestricted release. For the subsurface soils, the staff finds that the FSSs for Survey Units 4, 6, 7, 12, 16, 17, and 18 were performed in a manner that is consistent with the subsurface FSS Plan in the DP.

#### 6. Recommendations

The staff recommends confirming that the subsurface soils of Survey Units 4, 6, 7, 12, 16, 17, and 18 are be suitable for unrestricted release.

#### Principal Contributor:

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