

June 15, 2010

Mr. Mark P. Elliott, Director  
Quality, Safety and Safeguards  
Nuclear Fuel Services, Inc.  
P.O. Box 337, MS 123  
Erwin, TN 37650

SUBJECT: PARTIAL CONFIRMATION OF FINAL STATUS SURVEY REPORT FOR SURVEY  
UNITS 1, 3, AND 10 (TAC L32879)

Dear Mr. Elliott:

We have completed our review of the Final Status Survey Report for Survey Units (SU) 1, 3, and 10, submitted by letter dated July 8, 2009, and supplemented by letter dated December 31, 2009, and a conference call on January 27, 2010. Based on this review, only the following partial confirmation can be provided that the SUs are suitable for unrestricted use:

- The final status survey of SU-1 was inconsistent with the approved decommissioning plan. Specifically, the survey failed to address surface soils. Therefore, SU-1 is not confirmed to be suitable for unrestricted use. However, the survey of subsurface soils was consistent with the decommissioning plan, and we confirm that the subsurface soils in SU-1 are suitable for unrestricted use.
- The final status survey of SU-3 was consistent with the decommissioning plan. Specifically, the subsurface soils were confirmed suitable for unrestricted use, and there are no surface soils because the area will be backfilled with clean soil. Therefore, we confirm that the soil in SU-3 is suitable for unrestricted release pending confirmation of the backfill.
- The final status survey of SU-10 was consistent with the decommissioning plan. Specifically, the subsurface soils were confirmed suitable for unrestricted use and there are no surface soils because the area will be backfilled with clean soil. Therefore, we confirm that the soil in SU-10 is suitable for unrestricted release pending confirmation of the backfill.

We note that Nuclear Fuel Services, Inc. (NFS) must address the potential for recontamination of the areas if substantial time passes before a request for release of this site. In addition, we note that this evaluation applies only to soil contamination and that evaluation of other media should be performed separately.

In your letter dated December 31, 2009, you proposed changing the decommissioning plan to delete the surface survey provisions in Chapter 5 and rely on the subsurface provisions in Appendix B. Your letter failed to demonstrate that the subsurface provisions would perform as well as the surface survey provisions in detecting surface contamination. Therefore, the change is disapproved.

We acknowledge that we confirmed SU-11 suitable for unrestricted use by letter dated September 24, 2008 (ML082670680). However, the concern regarding failure to perform a surface survey applies to SU-11 also. Therefore, a surface survey of SU-11 should be addressed in any request to release the area for unrestricted use.

A safety evaluation report of our review is enclosed.

TAC L32879 is closed as a result of this action.

In accordance with Title 10 of the *Code of Federal Regulations* 2.390 of the U.S. Nuclear Regulatory Commission's (NRC's) "Rules of Practice," a copy of this letter and its enclosure will be available electronically for public inspection in the NRC Public Document Room or from the Agencywide Documents Access and Management System (ADAMS). ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html> (the Public Electronic Reading Room).

If you have any questions concerning this letter, contact me at (301) 492-3123 or via email to [Kevin.Ramsey@nrc.gov](mailto:Kevin.Ramsey@nrc.gov).

Sincerely,

**/RA/**

Kevin M. Ramsey, Project Manager  
Fuel Manufacturing Branch  
Fuel Facility Licensing Directorate  
Division of Fuel Cycle Safety  
and Safeguards  
Office of Nuclear Material Safety  
and Safeguards

Docket No.: 70-143  
License No.: SNM-124

Enclosure: Safety Evaluation Report

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**/RA/**

Kevin M. Ramsey, Project Manager  
 Fuel Manufacturing Branch  
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**\*via email**

<b>OFC</b>	FMB	FMB	FSME/RDB	FMB
<b>NAME</b>	KRamsey	LAllen	BWatson*	PHabighorst
<b>DATE</b>	6/10/10	6/14/10	6/14/10	6/15/10

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**Safety Evaluation Report  
Nuclear Fuel Services, Inc. North Site  
Final Status Survey Report  
Subsurface Soil Characterization and Final Status Survey Project,  
Survey Units 1, 3, and 10**

1.0 INTRODUCTION

1.1 Background

The Nuclear Fuel Services, Inc. (NFS) North Site Decommissioning Plan (DP) was approved via 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 Final Status Survey (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 Title 10 of the Code of Federal Regulation (10 CFR) Part 20, Subpart E.

In terms of the health physics and surveying aspects, the NRC staff concluded that the subsurface FSS Plan, as described in the revised Appendix B to Chapter 5 of the DP (dated December 14, 2005) was adequate to perform FSS for subsurface soils in the North Site area for demonstrating compliance with the radiological criteria for license termination.

As described in the NRC staff's safety evaluation, approving Amendment 69, the subsurface approach proposed by the licensee is site specific, and is applicable only to the North Site area of the NFS site. Because of this, potential application to other areas or other sites must be considered carefully by licensees and by the NRC staff. Also, because of the above considerations, and because the proposed approach is one not applied to NRC-licensed facilities previously, the NRC staff will carefully evaluate the results of these surveys as presented in the eventual FSS Reports.

1.2 Request for Action

By letter dated July 8, 2009, NFS submitted the FSS Report for Survey Units (SU) 1, 3, and 10 of the subsurface soil characterization and FSS Project of the NFS North Site Area. NFS requested confirmation that these SUs will be suitable for unrestricted release in accordance with 10 CFR Part 20, Subpart E. Direct comparison of a single SU, out of many SUs that cover the whole North Site Area, to the unrestricted use criteria of Subpart E is generally inappropriate. In this evaluation, the NRC staff compares results of the FSS for SUs 1, 3, and 10 to the NFS DP, which shows how NFS plans to meet the requirements of Part 20, Subpart E for the entire North Site area.

## 2.0 EVALUATION

The NRC staff reviewed the FSS Report for SUs 1, 3, and 10 submitted by NFS. The NRC staff identified two issues requiring additional information from NFS, and the NRC staff sent a request for additional information (RAI), dated December 3, 2009. NFS responded to the RAI with additional information, dated December 31, 2009. The issues raised by the NRC staff are summarized below, along with other issues evaluated.

### 2.1 Applicable Requirements

While the focus of Amendment 69 was the subsurface FSS approach, the NFS DP provides plans for both surface soil and subsurface soil FSSs. Therefore, this NRC staff evaluation addresses both surface and subsurface soil FSSs. The licensee's FSS Plan is provided in the North Site DP, Revision 3, which was submitted to the NRC staff May 2, 2006, and approved by letter from NRC dated May 18, 2006. The surface soils FSS Plan is provided in Chapter 5, and the subsurface FSS Plan is provided in Appendix B of the DP.

### 2.2 Surface Final Status Survey

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 excavation surface at the time of 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 other cases, surface soils exist at the time of the FSS. 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 NFS.

As discussed in the NFS DP, Section 5.1, a *surface* 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 (cm). The 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 1, 3, and 10 appear to contain surface soils, so it appeared to NRC staff that a surface FSS should have been performed. However, the FSS Report for SUs 1, 3, and 10 does not provide results of any surface FSS for these SUs. The NRC staff notes that when the subsurface methodology was approved as an acceptable alternative for *subsurface* soils, NRC staff did not approve any modification of the DP commitment to perform *surface* FSSs.

The NRC staff requested additional information from NFS (in the RAI of December 3, 2009) on this issue. In its response to the RAI, NFS stated that the subsurface methodology (of Appendix B of the DP) addresses both surface and subsurface soils. Further, NFS proposed to revise the DP to entirely remove the surface FSS methodology of Chapter 5 and replace it with the subsurface methodology of Appendix B. The NRC staff acknowledges that the subsurface methodology partially addresses surface soils, because the subsurface methodology employs soil samples taken from the top surface of the soil column. However, the uppermost soil samples of the subsurface methodology are samples composited in depth to 1 meter (i.e., 0-1 meter samples) so that this top layer of samples would be representative of the uppermost 1 meter of the soil column. One meter is a much greater thickness than the 15 cm's thickness definition for surface soils.

As indicated in the RAI, the NRC staff considers that surface (0-15 cm) measurements are important to addressing potential exposures to material as they are being left on the site, while the subsurface measurements 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). The significant exposure pathways for surface soils are different from the significant pathways for subsurface soils. Thus, the two FSSs (for surface soils and for subsurface soils) address two different aspects of the overall demonstration that an area is suitable for unrestricted use. These two different aspects rely on different dose assessment models (in fact, NFS's DP provides for a completely different conceptual model for subsurface soils than that used for surface soils and NFS has a methodology for determining subsurface DCGLs that differ from the surface DCGLs). In its response to the RAI, NFS did not provide any discussion of how the dose modeling for the subsurface methodology would be applicable to surface soils.

As also indicated in the RAI, 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. In its response to the RAI, NFS stated that the *subsurface* methodology accommodates the FSS scan survey objective to ensure that significant amounts of radioactivity discretely deposited within the SU on the surface do not go undetected. A major reason for implementing the subsurface methodology was that subsurface locations scan surveys are not possible; this reason is not relevant for surface soils, where scan surveys are relatively straightforward to implement. However, NFS did not provide a demonstration that the subsurface methodology would perform as well as scan surveys in detecting such potential elevated areas on the surface. The NRC staff, therefore, concludes that NFS has not provided sufficient justification that the subsurface methodology would perform acceptably for surface soils. For this reason, and because NFS has not addressed the concern about differing dose modeling for surface and subsurface soils, the NRC staff concludes that NFS's justifications are insufficient; and surface soil FSSs must still be performed for SUs where surface soils will be present. The NRC staff also concludes that the proposed revision to the DP is insufficiently justified and is unacceptable.

In a January 27, 2010, telephone call between NFS and NRC staff (documented by NRC staff in a summary, ADAMS Accession Number ML100280989), NFS stated that there is a backfill plan for SU 3 and 10, so the existing soil will be covered. NFS stated that SU 1 will not be backfilled. The NRC staff acknowledges that if an SU would be backfilled, such that surface soils essentially do not exist, a surface FSS is not necessary. Therefore, the NRC staff concludes that FSSs of surface soils are unnecessary for SU 3 and 10. However, NFS needs to provide an FSS for surface soils for SU 1.

## 2.3 Subsurface Final Status Survey Results

### 2.3.1 Survey Unit Demarcation and Use of Historical Site Assessment Information

The NRC staff reviewed NFS's demarcation of the survey units. Section 2.3 of the FSS Report describes the process NFS used to demarcate survey units. In part, this section indicates that historical knowledge was used as one factor in the demarcation. However, while the FSS Report described the historical sampling data that was considered, it was unclear what historical knowledge about operations or activities was considered. Sections 2.6, 2.7, and 2.8 of the FSS Report state that SUs 1, 3, and 10 all comprise portions of the former radiological burial grounds in the North Site. The sections also state that remedial activities had not been conducted in the SUs. Section 1.4 of the FSS Report describes the historical site assessment (HSA) for the

North Site, mentions the burial ground, and states that “the contents and locations of most disposal pits are well documented.” There is no citation provided for this statement. Figure 2-2 in the DP shows locations of trenches within the radiological burial ground (RBG) area, but no citation to the source of the information is provided. The NRC staff reviewed the North Site Characterization Report - Revision 1, which was Attachment 2 to a letter from NFS dated July 30, 1999. Appendix D of the characterization report is a geophysical survey report, providing results of geophysical surveys performed in the RBG area. Conclusions from that report included that the trenches found through the geophysical survey closely corresponded to locations shown in a sketch provided by NFS. In addition, some trenches shown in the NFS sketch could not be located by the geophysical survey; but those trenches are still shown in the drawing (Figure 2-2) in the DP. The NRC staff concludes that it is unlikely that burial trenches were in the areas of SUs 1, 3, and 10 and concludes that the use of HSA information and demarcation of these survey units are acceptable.

### 2.3.2 Size of Survey Units

Chapter 5 of the DP (which is the surface soils FSS Plan) states that Class 1 areas will be approximately 2,000 square meters. Appendix B of the DP—which addresses the subsurface FSS Plan—indicates that, laterally, survey unit demarcation will follow the concepts and criteria described in Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM). The MARSSIM concepts include a maximum area for a Class 1 survey unit of 2,000 square meters. Chapter 5 of the DP also shows a drawing of area classifications. From that drawing, it appears to the NRC staff that part of SU 10 was considered a Class 1 area. However, Section 2.8 of the FSS Report states that SU 10 has an area of 3,511 square meters, which is greater than 2,000 square meters. To the NRC staff, this appeared inconsistent with the provisions of the DP.

The NRC staff requested additional information from NFS (in the RAI of December 3, 2009) on this issue. In its response to the RAI, NFS provided a discussion of why the subsurface FSS approach does not rely on the area of a survey unit and thus that the area limitations (e.g., 2,000 square meters for Class 1 areas) are not relevant for the subsurface FSS approach. The NRC staff agrees with the discussion to the extent that it applies to the subsurface methodology and concludes that the limitation of SU size is not necessary for the subsurface methodology.

NFS also stated that its commitment to limit SU size to around 2,000 square meters for Class 1 areas is associated with the old FSS methodology (i.e., Chapter 5 of the DP, which is for surface FSS), which NFS proposes to entirely eliminate from the DP. NFS states that its commitment to limit Class 1 survey units to around 2,000 square miles in size will be removed. As discussed in Section 2.2 above, the NRC staff does not approve NFS’s proposal to replace the surface FSS method of Chapter 5 (of the DP) with the subsurface FSS methodology. Thus, the NRC staff does not approve NFS’s proposal to remove its commitment to limit Class 1 survey units to around 2,000 square meters.

### 2.3.3 Determination of Number of Coreholes for Survey Unit

An important issue for the overall survey design for the subsurface FSS is the determination of the number of coreholes (boreholes) for each survey unit. The FSS Plan in the DP specifies that sum-of-fraction (SOF) values (which are sums of ratios of concentration to DCGL for all radionuclides) would be used in determining the number of coreholes. For these three SUs, NFS used the SOF values to determine the corehole density based on the statistical test of the DCGL<sub>w</sub>. For these SUs, the reasonable maximum concentrations and expected maximum concentrations did not exceed the DCGLs or four times the DCGLs, respectively. Thus, the



evaluation of adjusting corehole density to demonstrate compliance with local area DCGLs determined that no adjustment was necessary. In addition, NFS performed post-FSS verifications of the necessary corehole density (Section 5.8 of the FSS Report). These post-FSS verifications showed that the corehole density was sufficient. The NRC staff concludes that the determinations of the number of coreholes is acceptable.

#### 2.3.4 Surrogate Ratios from Characterization and from FSS Results

Surrogate ratios based on historical characterization data are used in the survey design, specifically as part of the potential adjustment of corehole density to satisfy criteria for local area DCGLs. NFS committed to compare surrogate ratios obtained from the FSS results to surrogate ratios determined based on the historical data to verify that the planning of the FSS was appropriate. NFS provides that comparison in Section 5.7 of the FSS Report. The comparison indicated that some of the surrogate ratios based on historical data were non-conservative when compared to ratios developed from the FSS data. NFS performed additional evaluations to verify that the FSS design were appropriate (i.e., not impacted by the non-conservative ratios). The NRC staff concludes that these additional evaluations are appropriate—and, therefore, that the use of surrogate ratios for the design of the FSSs were acceptable.

#### 2.3.5 FSS Results and Demonstration of Compliance with DCGLs

NFS provides an analysis of the sample results for compliance with the subsurface DCGLs in Chapter 5 of the FSS Report. NFS calculated the SOF values for each sample in the SUs and provides a histogram summary of the SOF values in Section 5.1 of the FSS Report. NFS stated that since each sample SOF value is less than or equal to one, the survey units pass (the null hypothesis that residual radioactivity in the SU exceeds the  $DCGL_w$  is rejected) and that no further compliance tests are necessary in this case. The NRC staff agrees with this and concludes that the results of the subsurface survey demonstrate, with reasonable assurance, that the subsurface residual radioactivity in SUs 1, 3, and 10 are within the criteria.

#### 2.4 Potential for Re-contamination and Disturbance

The NRC staff notes that NFS is not requesting a partial site release of SUs 1, 3, and 10 at this time. Activities continue in other parts of the North Site area. Thus, there is potential for SUs 1, 3, and 10 to be re-contaminated from other activities on the NFS North Site. The staff notes that the DP discusses preventing re-contamination of decommissioned areas. When partial site release is requested, the potential for re-contamination or other disturbance of the SU areas must be considered.

#### 2.5 Only Soil Contamination is Addressed

The NRC staff notes that the FSS Report for SUs 1, 3, and 10—and this present safety evaluation report—only address contamination in subsurface soils. If evaluation of contamination of other media is needed prior to partial site release, that must be done separately.

### 3.0 CONCLUSION

The NRC staff's review of the FSS Report and NFS's response to RAIs determined that the FSS for SU 1 was performed inconsistent with the FSS Plans in the DP. Specifically, the FSS did not

address surface soils. Therefore, the NRC staff disapproves confirming that SU 1 would be suitable for unrestricted release. Before such confirmation can be approved by the NRC staff, NFS must address the surface FSS of SU 1.

NFS proposed to revise its DP to entirely remove the surface FSS methodology of Chapter 5 and replace it with the subsurface methodology of Appendix B. The NRC staff disapproves the proposed revision to the DP.

The NRC staff acknowledges that in its earlier review of the FSS Report for SU 11 (confirmation letter dated September 24, 2008), the NRC staff did not raise a concern about the lack of a surface FSS. However, the NRC staff concludes that the concern is applicable to SU 11, because NFS did not perform a surface survey for that SU. Before NRC staff will approve partial site release of the North Site area, NFS must address the surface FSS for SU 11.

Similarly, NFS must address FSS of surface soils for the remainder of the North Site. In cases where SUs are to be backfilled, FSSs of surface soils are unnecessary. However, when partial site release is requested, NFS must verify that such backfill has been accomplished.

For the *subsurface* soils, the NRC staff concludes that the FSSs for SUs 1, 3, and 10 were performed consistent with the subsurface FSS Plan in the DP.

Thus, the NRC staff approves confirming that the *surface and subsurface* soils of SU 3 and 10 will be suitable for unrestricted release, subject to the caveats described in Sections 2.4 and 2.5. For SU 1, the NRC staff approves confirming that the *subsurface* soils will be suitable for unrestricted release, subject to the same caveats.

PRINCIPAL CONTRIBUTORS:

Duane Schmidt, FSME  
Kevin Ramsey, NMSS