

**SAFETY EVALUATION REPORT  
NUCLEAR FUEL SERVICES, INC. – BLENDED LOW ENRICHED URANIUM FACILITY  
RADIOLOGICAL SURVEY REPORT FOR THE LAND AREA OF THE BLENDED LOW  
ENRICHED URANIUM FACILITY AT THE NUCLEAR FUEL SERVICES SITE**

**1. Introduction**

By letter dated April 23, 2018 (Accession No. ML18128A284), and supplemented by letter dated September 21, 2018 (Accession No. ML18276A081), Nuclear Fuel Services, Inc, (NFS) submitted a Final Status Survey Report for the Blended Low Enriched Uranium (BLEU) facility. NFS requested confirmation that these survey units are suitable for unrestricted use in accordance with Title 10 of the *Code of Federal Regulations (10 CFR)*, Section 20.1402, Radiological Criteria for Unrestricted Use, in order to remove financial assurance requirements in place for the former BLEU facility.

**2. Background**

The BLEU facility converted low enriched uranyl nitrate liquid from the NFS plant site and the Savannah River Site into uranium oxide powder for shipment to an off-site fuel fabrication facility. Nuclear Fuel Services identified the potential contaminants as U-232, U-233, U-234, U-235, U-236, and U-238. Other radiological contaminants such as plutonium, americium, technetium, and other fission products were identified with activity fractions below 0.0001. The BLEU facility covers approximately 5.16 acres which is now a cleared soil area.

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 Final Status Survey (FSS) that is 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.

Nuclear Fuel Services has stated there is no intent to request a site release for the land area of the former BLEU facility at this time. However, NFS has requested confirmation that the former BLEU facility is suitable for unrestricted release in accordance with 10 CFR 20.1402, to remove the financial assurance requirements in place for the former BLEU facility. The radiological criteria for unrestricted use in 10 CFR 20.1402 states:

A site will be considered acceptable for unrestricted use if the residual radioactivity that is distinguishable from background radiation results in a TEDE [total effective dose equivalent] to an average member of the critical group that does not exceed 25 mrem (0.25 mSv) per year, including that from groundwater sources of drinking water, and the residual radioactivity has been reduced to levels that are as low as reasonably achievable (ALARA). Determination of the levels which are ALARA must take into account consideration of any detriments, such as deaths from transportation accidents, expected to potentially result from decontamination and waste disposal.

### 3. Scope of the Staff Evaluation

This Staff review addressed the approach for performing and evaluating the FSS of the land area of the former BLEU facility site and the results of that survey. The licensee has stated that the survey was based on guidance and recommendations of the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) to provide a graded survey approach, based on contamination potential, while instilling a high level of confidence that significant concentrations of residual uranium contamination, if any, were identified and evaluated.

In response to NRC's request for additional information (Accession No. ML18207A349), NFS determined that an alternative approach was necessary and appropriate to demonstrate that the scan survey measurement capability for U-238 was sufficient to meet the radiological release criteria for unrestricted use in accordance with 10 CFR 20.1402.

### 4. Potential Contaminants and Site Criteria

#### 4.1 Evaluation

Nuclear Fuel Services proposed using the approved DCGLs from the North Site DP, Rev. 3 as the alternate approach. Nuclear Fuel Services has revised Table 1 of the FSS to include the NFS North Site DCGLs that meet the 25 mrem/year release criteria of 10 CFR 20.1402 as follows:

Uranium Isotope	Concentration (pCi/g)	Source Document	Document Table
U-232	1.96	NUREG/CR-5512	Table 6.91
U-233/234	642	North Site DP, Rev. 3	Table 1-1
U-235/U-236	74	North Site DP, Rev. 3	Table 1-1
U-238	306	North Site DP, Rev. 3	Table 1-1

A DCGL<sub>MOD</sub> for U-235/U-236 was derived to account for U-234 during scan surveys.

$$DCGL_{MOD} = 1/[(1/74) + ((0.5170/642))] = 38 \text{ pCi/g (U-235/U-236)}$$

Where: 74 = DCGL for U-235/U-236 (pCi/g)  
0.5170 = U-233/234 fractional contribution in BLEU FSS samples  
0.0650 = U-235/U-236 fractional contribution in BLEU FSS samples  
642 = U-233/234 DCGL (pCi/g)

The scan sensitivity for U-235/U-236 was established as 7.2 pCi/g in the BLEU facility FSS. This scan sensitivity is about 20% of the DCGL<sub>MOD</sub>(U-235/U-236) of 38 pCi/g.

#### 4.2 Findings

The NRC staff finds that the alternate approach adequately identified the potential radiological contaminants and their respective release concentration values equivalent to 25 mrem/year because the physical, chemical, and groundwater characteristics used in the approved North Site DP, Rev. 3, RESRAD model are similar to the former BLEU facility. Therefore, these values are acceptable to the Staff. Also, the Staff finds that the scan sensitivity of 7.2 pCi/g is acceptable for detecting concentrations below the DCGL<sub>MOD</sub> (U-235/U-236) of 38 pCi/g.

## **5. Survey Approach**

### 5.1 Evaluation

Nuclear Fuel Services states that the survey approach was prepared in accordance with the guidelines and recommendations presented in MARSSIM. The survey approach incorporated the use of Data Quality Objectives and Data Quality Assessment with a quality assurance / quality control program.

Nuclear Fuel Services established three land area survey units to evaluate the radiological status of the cleared soil area of the BLEU facility. This was based on the historical use and radiological monitoring records for the facility. The feed line trench was designated as a Class 1 survey unit due to a known minor spill. The process buildings footprint was designated a Class 2 survey unit due to the low potential for contamination. The remainder of the site was designated a Class 3 survey unit due to little or no potential for contamination.

The NRC staff has evaluated survey unit size and number of sample data points needed to determine the radiological status of the BLEU facility. 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 for comparison to the DCGLs.

### 5.2 Findings

The NRC staff finds that NFS has adequately determined the size of survey units in accordance with MARSSIM. 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.

## **6. Data Evaluation and Survey Results**

### 6.1 Evaluation

Surface scans were performed using a Model 44-10 with 2" sodium iodide gamma scintillation detector approximately 5 centimeters or less from the surface. Scan data were recorded for count rate and GPS coordinates every 2 seconds. Static measurements were performed with a Bicron microrem meter at 1 meter above the surface. Isotopic uranium soil analyses were performed by a National Environmental Laboratory Accreditation Program (NELAP) certified and International Standards Organization (ISO) certified laboratory, Eberline Services in Oak Ridge, Tennessee.

Surface scans, direct measurements, and soil analyses results were compared to approved concentration limits for the radionuclides of concern; U-232, U-233/234, U-235/U-236, and U-238. The Sum Of Fractions (SOFs) were calculated for uranium for each survey unit. All SOF values are required to be less than unity. Soil sample uranium concentrations for U-232, U-233/234, U-235/U-236, and U-238 from Survey Units A, B,

and C are presented in revised Tables 11, 12, and 13. The sample results (pCi/g) and corresponding SOF values are listed for each sample within each survey unit.

Gamma scans conducted in surveys units A, B, and C identified no locations with elevated surface gamma count rates. Soil sample analytical results for U-232, U-233/234, U-235/U-236, and U-238 were well below their respective DCGL concentrations listed in the revised Table 1 of the FSS. The SOF values for survey units A, B, and C were well below unity (1.0) and did not utilize background subtraction from the analytical sample concentration results.

## 6.2 Findings

Instrumentation selected and utilized for surface scans and direct measurements is acceptable to the Staff since their detection sensitivity is sufficiently below the detection limits. The methodology for conducting isotopic uranium soil analyses and data evaluation is acceptable for results from the NELAP and ISO certified laboratory. Therefore the NRC staff finds that the NFS data evaluation and survey results of the BLEU facility FSS are acceptable.

## 7. Conclusion

A final radiological survey was conducted for the land area of the former BLEU facility at the NFS Site. Nuclear Fuel Services requested confirmation that the three survey units for the land area of the NFS former BLEU facility meet the radiological criteria for unrestricted use in accordance with 10 CFR 20.1402, Radiological Criteria for Unrestricted Use, in order to remove financial assurance requirements in place for the former BLEU facility. The Staff confirmed that the three survey units are suitable for unrestricted use, provided there are no future commercial operations or impacts from other areas on the three survey units. A final confirmatory FSS survey is required prior to NFS requesting the official release of the former BLEU facility land area from the license.

### Principal Contributor:

Stephen Giebel, NMSS/DUWP