



UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
612 EAST LAMAR BLVD, SUITE 400
ARLINGTON, TEXAS 76011-4125

December 21, 2010

John H. Ellis, President
Sequoyah Fuels Corporation
P.O. Box 610
Gore, Oklahoma 74435

SUBJECT: NRC INSPECTION REPORT 040-08027/10-003

Dear Mr. Ellis:

This refers to the inspection conducted on November 3-4, 2010, at your Sequoyah Fuels Corporation site located near Gore, Oklahoma. This inspection was an examination of activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your license. Within these areas, the inspection consisted of selected examination of procedures and representative records, observations of activities, and interviews with personnel. The enclosed report presents the results of this inspection.

During the inspection, the NRC collected a number of soil samples that were analyzed by Oak Ridge Institute for Science and Education (ORISE) on behalf of the NRC. We received the soil sample results from ORISE on November 30, 2010. In addition, we received your split-sample results on December 17, 2010. We subsequently presented the final inspection results to your staff by telephone on December 20, 2010. In summary, the inspector determined that you were conducting decommissioning activities in compliance with regulatory and license requirements.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response, should you choose to provide one, will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (ADAMS), accessible from the NRC's Web site at <http://www.nrc.gov/reading-rm/adams.html>. To the extent possible, your response should not include any personal privacy, proprietary, or safeguards information so that it can be made available to the Public without redaction.

Should you have any questions concerning this inspection, please contact Mr. Robert Evans, Senior Health Physicist, at (817) 860-8234 or the undersigned at (817) 860-8191.

Sincerely,

/RA/

D. Blair Spitzberg, PhD, Chief
Repository and Spent Fuel Safety Branch

Docket: 040-08027
License: SUB-1010

Enclosure:

NRC Inspection Report 040-08027/10-003

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Category A	<input type="checkbox"/> Non-publicly Available	<input type="checkbox"/> Sensitive		
KEYWORD:		Sensitive:		
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U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

Docket: 040-08027

License: SUB-1010

Report: 040-08027/10-003

Licensee: Sequoyah Fuels Corporation

Location: P.O. Box 610
Gore, Oklahoma

Dates: November 3-4, 2010

Inspector: Robert Evans, PE, CHP, Senior Health Physicist
Repository and Spent Fuel Safety Branch

Accompanied By: Martha Poston Brown, Health Physicist
Nuclear Materials Safety Branch A

Approved by: D. Blair Spitzberg, PhD, Chief
Repository and Spent Fuel Safety Branch

Attachment: Supplemental Inspection Information

ENCLOSURE

EXECUTIVE SUMMARY

Sequoyah Fuels Corporation NRC Inspection Report 040-08027/10-003

This inspection was a non-routine, announced inspection of decommissioning activities being conducted at the Sequoyah Fuels Corporation site. Overall, the licensee was conducting decommissioning activities in accordance with the NRC-approved Reclamation Plan.

Decommissioning Inspection Procedure for Materials Licensees

- The licensee conducted demonstration surveys to confirm that the remediated portions of the Phase I and Phase II disposal cell footprints met the soil criteria established in the Reclamation Plan. The inspector verified that the licensee's survey results were below the criteria established in the Reclamation Plan (Section 1.2.a).
- The inspector conducted a confirmatory survey of the Phase II footprint area to independently determine if this area had been effectively decommissioned by the licensee. The inspector's survey results suggest that the area had been effectively decommissioned (Section 1.2.b).
- The inspector also conducted a confirmatory survey of a former burial pit to independently confirm if the area had been effectively decommissioned. The results of this second confirmatory survey indicate that the licensee had effectively decommissioned this area of the site (Section 1.2.c).
- Finally, the inspector collected a sample of the tornado berm material to determine if this material contained radioactivity in excess of the soil criteria presented in the Reclamation Plan. The soil sample results indicate that the tornado berm soil contains radioactivity in concentrations well below the cleanup limits specified in the Reclamation Plan (Section 1.2.d).

Report Details

Summary of Plant Status

At the time of the inspection, the licensee was conducting site decommissioning in accordance with the NRC-approved Reclamation Plan. The licensee plans to dismantle and remove systems and equipment, demolish structures, remove and treat sludges and sediments, remediate contaminated soils, and treat wastewater. Most of the residual waste material will be placed into an onsite disposal cell for permanent disposal. The disposal cell will be constructed in phases. The disposal cell was originally designed for a capacity of 8.3 million cubic feet of waste material, although the cell can be modified to accommodate 5 to 11 million cubic feet of material.

During the inspection, the licensee was placing waste material into Phase I of the onsite disposal cell. The Phase I area consists of the north-eastern portion of the cell and is approximately 11,400 square meters in size. The licensee began placing material into this portion of the disposal cell during June 2010. The disposed material included pond residue containing calcium fluoride, contaminated soil from the Phase II footprint, and solid wastes from Burial Area No. 1. Pond 2 sediment will be the next material placed into the Phase I disposal cell.

The Phase II area includes the north-western portion of the cell and is approximately 18,600 square meters in size. The Phase II footprint encompasses the former emergency basin and north ditch areas. At the time of the inspection, the Phase II footprint had been cleared and radiologically surveyed by the licensee. The survey was conducted to demonstrate that the area met the cleanup criteria established in the Reclamation Plan. The demonstration survey included measurement of ambient gamma radiation levels and collection of random and biased soil samples. The soil samples were analyzed in-situ using x-ray fluorescence and were submitted for analysis at an offsite laboratory. Soil samples were collected at 37 different locations, and some of the samples were collected at depth to determine the extent of sub-surface contamination.

After the Phase II footprint area has been confirmed to meet the radiological criteria established in the Reclamation Plan, the licensee plans to backfill the area to meet the level and grade requirements for construction of the base of the Phase II disposal cell. Most of the contaminated equipment and components located immediately south of the disposal cell will be added to the Phase II portion of the disposal cell. The contaminated equipment will have to be cleared from this area to support future reclamation work including demolition of site structures.

The licensee still possessed approximately 11,000 tons of de-watered raffinate sludge. The sludge was being stored in bags for possible transfer to an out of state uranium mill for processing as alternate feed material. If the licensee is unable to transfer the material, the NRC-approved Reclamation Plan allows the licensee to dispose of the raffinate sludge in the onsite disposal cell.

1 Decommissioning Inspection Procedure for Materials Licensees (87104)

1.1 Inspection Scope

The purpose of the inspection was to determine if licensed decommissioning activities were being conducted in accordance with the NRC-approved Reclamation Plan.

1.2 Observations and Findings

a. Review of Demonstration Survey Results

License Condition 51 stipulates that the site will be decommissioned in accordance with the guidance provided in the Reclamation Plan dated January 4, 2008, as amended. At the time of the inspection, the disposal cell was being constructed in phases. Before construction begins, the licensee has to demonstrate that the ground surface meets certain radiological characteristics. The Reclamation Plan provides the acceptance criteria for the residual radioactive contamination of the soils situated underneath the footprint of the disposal cell.

In accordance with the Reclamation Plan, if these soils contain natural uranium in concentrations greater than 570 picocuries per gram (pCi/g), then these soils have to be excavated and placed into the disposal cell. This concentration was designated as the derived concentration guideline level (DCGL) in the Reclamation Plan. The Reclamation Plan also specifies a cleanup/action level of 100 pCi/g to support the concept of As Low As Reasonably Achievable (ALARA) during excavation activities. Following the excavation of contaminated soils, the Reclamation Plan stipulates that a demonstration survey be conducted to confirm that the DCGL has been satisfied.

The licensee conducted the demonstration survey for the Phase I footprint during 2009. These survey results were submitted to the NRC by letter dated October 5, 2009. Although the survey was not a final status survey, the licensee conducted the survey using the general criteria for Class 3 areas as described in NUREG-1575, "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)." The results of this survey were reviewed during the NRC's November 2009 inspection.

After the Phase I footprint demonstration survey was submitted to the NRC, the licensee conducted additional remediation of the edges of the Phase I footprint. These additional survey results were subsequently added to the Phase I demonstration survey report. The inspector reviewed these additional survey results during this inspection. The results indicate that all soil sample results were less than the DCGL of 570 pCi/g.

The inspector also reviewed the preliminary Phase II demonstration survey results. The preliminary results suggest that the Phase II footprint meets the criteria established in the Reclamation Plan, with one exception. Based on the licensee's in-situ x-ray fluoroscopy results, one soil sample result exceeded the 570 pCi/g acceptance criteria. After the conclusion of this onsite inspection, the licensee conducted additional cleanup in this area, and the licensee resurveyed the area to verify that the area met the DCGL. Because the licensee's Phase II demonstration survey report was incomplete during the inspection, this report will be reviewed during a future inspection.

b. Confirmatory Survey of Phase II Footprint Area

The inspector conducted a confirmatory survey of the Phase II footprint. The purpose of the survey was to confirm that the area met the acceptance criteria established in the Reclamation Plan. The survey included measurement of ambient gamma exposure rates and collection of soil samples. The gamma scan was conducted using a Ludlum Model 19 survey meter (NRC number 015540, calibration due date of 04/08/11,

calibrated to radium-226). The ambient gamma exposure rates were measured, in part, to identify any area that exhibited radiation above background levels for soil sampling.

Prior to conducting the gamma scan, the inspector measured ambient background levels, in part, to establish an action level for this survey meter. The background measurements were collected outside of the restricted area in the yard adjacent to the administrative building. The inspector measured an average background level of 12 microRoentgens per hour ($\mu\text{R/hr}$). The licensee's action level for gamma radiation exposure rates was three times the background level. The NRC's action level was 36 $\mu\text{R/hr}$, or three times the background level, for this survey meter.

The inspector conducted surface scans of the Phase II footprint and adjacent areas. All areas within the Phase II footprint and adjacent areas were less than the action level, with one exception. One area in the southwestern corner of the Phase II footprint was measured at 42 $\mu\text{R/hr}$. The licensee's demonstration survey revealed similar elevated measurements in this area. The licensee concluded that this elevated exposure rate was the result of radiation "shine" from contaminated equipment and structures located south of the Phase II footprint area. This contaminated equipment is scheduled to be removed and placed into Phase II of the disposal cell at a later date.

The inspector collected three soil samples from the Phase II footprint area. Sample NRC-3 was collected from a natural drainage ditch in the western portion of the Phase II footprint. Sample NRC-4 was collected at the southern end of the Phase II footprint, in the general vicinity of the highest gamma exposure rate (42 $\mu\text{R/hr}$). Finally, sample NRC-5 was collected from the eastern side of the Phase II footprint. This area was previously identified by the licensee as containing radioactive material that may exceed the DCGL.

The NRC's soil samples were submitted to Oak Ridge Institute for Science and Education (ORISE) for analysis. The licensee split the samples with the inspector, and the licensee submitted its samples to an offsite contract laboratory for analysis. The NRC's samples were analyzed by gamma spectroscopy for determination of total uranium concentrations. The samples were also analyzed for thorium-230 and radium-226 concentrations to ensure that these radionuclides did not exceed the respective action levels presented in the Reclamation Plan. The NRC's sample results, and the licensee's split sample results, are presented below:

Phase II Footprint Split Soil Sample Results

Location	Total Uranium, pCi/g		Thorium-230, pCi/g		Radium-226, pCi/g	
	NRC	SFC	NRC	SFC	NRC	SFC
NRC-3 Loc. HA928	44.8 ± 2.9	79.2	56.3 ± 5.9	86.7 ± 1.97	1.39 ± 0.10	2.12 ± 0.500
NRC-4 Loc. HA916	64.7 ± 3.2	43.4	5.9 ± 2.0	5.58 ± 0.529	0.92 ± 0.07	0.984 ± 0.336
NRC-5 Loc. HA946	460 ± 20	340	167 ± 14	137 ± 4.679	2.22 ± 0.15	3.77 ± 0.534
NRC-5 Resample		1.8		1.86 ± 0.301		0.683 ± 0.221

Based on its preliminary demonstration survey results, the license elected to conduct additional remediation of Location HA946, the area where sample NRC-5 was collected.

The licensee conducted this additional cleanup immediately after the onsite inspection. The licensee then resurveyed and re-sampled the soil in the area. The licensee's resample results are presented in the table above.

The inspector compared the total uranium concentrations to the NRC-approved DCGL (570 pCi/g). None of the sample results exceeded the DCGL. However, elevated concentrations of thorium-230 were identified in samples NRC-3 and NRC-5. The Reclamation Plan specifies a thorium-230 DCGL of 66 pCi/g, and a cleanup level of 14 pCi/g. The inspector discussed these sample results with the licensee and with NRC staff in the NRC's program office. In summary, the NRC staff concluded that the Reclamation Plan does not specify a cleanup criteria or DCGL for thorium-230 in areas under the footprint of the disposal cell. Therefore, the licensee did not have to sample for thorium-230 and did not have to conduct remediation for this radionuclide within the footprint of the disposal cell.

According to the NRC's program office, the NRC staff considers the footprint of a disposal cell to be the area underlying the engineered barrier system components (liner and cover) that provides adequate protection against the spread of contamination. In other words, the footprint is that area that is adequately protected by the engineered barrier system. Since locations NRC-3 and NRC-5 fell within the footprint of the disposal cell, the licensee does not have to remediate thorium-230 contaminated soils in the disposal cell footprint area. As noted above, the licensee elected to conduct additional remediation in the vicinity of NRC-5 to ensure that the uranium limits were not exceeded.

Sample NRC-4 was collected in the area where the highest ambient gamma radiation measurement was observed. The sample result for NRC-4 indicated that the uranium concentration was below both the DCGL and the cleanup criteria. The inspector concluded that the elevated gamma exposure rate was attributable to contaminated equipment located just south of the Phase II footprint area.

Finally, the inspector noted that the NRC's sample results were similar, but not always identical, to the licensee's laboratory results. Since all sample results were generally comparable and since all sample results were less than the NRC-approved DCGL, the variations in the two sets of sample results were not significant regulatory concerns.

In summary, the areas within the Phase II disposal cell footprint that were sampled by the inspector met the DCGL and cleanup criteria established in the Reclamation Plan for uranium. The inspector concluded that the Phase II footprint had been effectively remediated by the licensee.

c. Confirmatory Survey of Burial Area No. 1

During the inspection, the inspector also conducted a confirmatory survey of the former Burial Area No. 1. This area had been previously excavated by the licensee, and the waste material had been placed into the disposal cell. Burial Area No. 1 was located immediately north of the Phase II footprint area and is about 2,200 square meters in size. The confirmatory survey was conducted, in part, to ensure that the area met the DCGLs specified in the Reclamation Plan for areas located outside of the footprint of the disposal cell. The licensee planned to refill the excavated pit with clean backfill material in the near future.

The inspector measured the ambient gamma exposure rates within Burial Area No. 1. With a background level of 12 µR/hr, the ambient gamma exposure rates in this area ranged from background levels to about 20 µR/hr. All areas within the former burial area were less than the action level of three times the background level (36 µR/hr).

Since Burial Area No. 1 was located outside of the disposal cell footprint, the licensee conducted a final status survey of this area using the guidance provided in the Reclamation Plan. The sampling grid was established in accordance with MARSSIM guidance. The licensee's final status survey included systematic soil sampling. The licensee collected 22 soil samples for offsite analysis. At the time of the onsite inspection, these soil sample results were not available. These sample results will be reviewed during a future inspection.

The inspector collected two soil samples from areas that exhibited slightly elevated uranium concentrations during the performance of the licensee's survey. Location 891 was situated on the northwestern wall of the burial area, while Location 905 was situated on the southwestern wall. These two samples were submitted to ORISE for analysis. The samples were split with the licensee, and the licensee's samples were analyzed by an offsite contract laboratory:

Burial Area No. 1 Split Soil Sample Results

Location	Total Uranium, pCi/g		Thorium-230, pCi/g		Radium-226, pCi/g	
	NRC	SFC	NRC*	SFC	NRC	SFC
NRC-1 Location 891	51.2 ± 2.9	43.7	-32.5 ± 6.7	0.70 ± 0.248	1.00 ± 0.07	1.01 ± 0.338
NRC-2 Location 905	58.4 ± 2.9	43.0	-7.1 ± 5.3	1.52 ± 0.311	1.02 ± 0.07	0.391 ± 0.237

* The NRC's thorium-230 sample results are statistically negative concentrations due to the force fit routine of the gamma spectroscopy system software

Both sample results were less than the uranium concentration DCGL of 570 pCi/g and the cleanup level of 100 pCi/g specified in the Reclamation Plan. The thorium-230 and radium-226 concentrations were essentially at background levels. In summary, the NRC's confirmatory survey results suggest that the licensee had effectively remediated the former Burial Area No. 1 to less than the limits specified in the Reclamation Plan.

d. Soil Sampling of Tornado Berm

The Reclamation Plan allows the licensee to use soil from the tornado berm for reuse as disposal cell cover subsurface material. The tornado berm was located at the southwestern corner of the yellowcake pad within the restricted area. During the inspection, the licensee was excavating soil from the tornado berm. The excavated soil was being reused for construction of Phase I of the disposal cell.

Since the licensee was reusing soil located from within the restricted area, the inspector elected to collect one soil sample from the tornado berm. The sample was collected to confirm that the soil did not contain uranium in excess of the cleanup action level specified in the Reclamation Plan. The soil sample was collected from the southwestern corner of the tornado berm. The sample was split with the licensee:

Tornado Berm Split Soil Sample Results

Location	Total Uranium, pCi/g		Thorium-230, pCi/g		Radium-226, pCi/g	
	NRC	SFC	NRC	SFC	NRC	SFC
NRC-6 Tornado Berm	13.8 ± 1.6	16.4	-0.4 ± 5.6	1.79 ± 0.302	0.77 ± 0.07	0.626 ± 0.176

The sample results indicate that the tornado berm soil did not contain uranium in concentrations greater than the action level (100 pCi/g); therefore, the soil could be used as construction material for the disposal cell.

1.3 Conclusions

Overall, the licensee was conducting decommissioning activities in accordance with the NRC-approved Reclamation Plan. The licensee conducted demonstration surveys to confirm that the remediated portions of the Phase I and Phase II disposal cell footprints met the criteria established in the Reclamation Plan. The inspector verified that the licensee's survey results were below the criteria established in the Reclamation Plan.

The inspector conducted a confirmatory survey of the Phase II footprint area to independently determine if this area had been effectively decommissioned by the licensee. The inspector's survey results suggest that the area had been effectively decommissioned.

The inspector also conducted a confirmatory survey of a former burial pit to independently confirm if the area had been effectively decommissioned. The results of this second confirmatory survey indicate that the licensee had effectively decommissioned this area of the site.

Finally, the inspector collected a sample of the tornado berm material to determine if this material contained radioactivity in excess of the soil criteria presented in the Reclamation Plan. The soil sample results indicate that the tornado berm soil contains radioactivity in concentrations well below the cleanup limits specified in the Reclamation Plan.

2 **Exit Meeting**

The inspector reviewed the scope and findings of the inspection during an exit meeting that was conducted at the conclusion of the onsite inspection on November 4, 2010. The inspector presented the final inspection findings to the licensee on December 20, 2010, following the receipt of the soil sample results from both ORISE and the licensee on December 17, 2010. During the inspection, the licensee did not identify any information reviewed by the inspector as proprietary.

SUPPLEMENTAL INSPECTION INFORMATION

PARTIAL LIST OF PERSONS CONTACTED

John Ellis, President
Scott Munson, Environmental Manager
Billy Reid, Quality Assurance
Rob Miller, Contractor

INSPECTION PROCEDURES USED

IP 87104 Decommissioning Inspection Procedure for Materials Licensees

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

None

Closed

None

Discussed

None

LIST OF ACRONYMS

CFR	Code of Federal Regulations
DCGL	derived concentration guideline level
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual (NUREG-1575)
µR/hr	microRoentgens per hour
IP	NRC Inspection Procedure
ORISE	Oak Ridge Institute for Science and Education
pCi/g	picocuries per gram