

January 8, 2010

Mr. David L. Kudsin
President
Nuclear Fuel Services, Inc.
P.O. Box 337, MS 123
Erwin, TN 37650

SUBJECT: INSPECTION REPORT NO. 70-143/2009-207

Dear Mr. Kudsin:

The U.S. Nuclear Regulatory Commission (NRC) conducted a routine announced criticality safety inspection at your facility in Erwin, Tennessee, from December 7-10, 2009. The purpose of the inspection was to determine whether activities involving licensed materials were conducted safely and in accordance with NRC requirements. Inspection observations were discussed with your management and staff throughout this inspection and at the exit meeting which was held on December 10, 2009.

The inspection, which is described in the enclosure, focused on the most hazardous activities and plant conditions; the most important controls relied on for safety and their analytical basis; and the principal management measures for ensuring controls are available and reliable to perform their functions relied on for safety. The inspection consisted of analytical basis review, selective review of related procedures and records, examinations of relevant nuclear criticality safety (NCS)-related equipment, interviews with NCS engineers and plant personnel, and facility walkdowns to observe plant conditions and activities related to safety basis assumptions and related NCS controls. Throughout this inspection, observations were discussed with your managers and staff.

In accordance with Title 10 of the *Code of Federal Regulations* 2.390 of NRC's "Rules of Practice," a copy of this letter and the enclosure will be available in the public electronic reading room of the NRC's AgencyWide Documents Access and Management System (ADAMS). ADAMS is accessible from the NRC web site at <http://www.nrc.gov/reading-rm/adams.html>.

If you have any questions concerning this report, please contact Thomas Marenchin, of my staff, at (301) 492-3209.

Sincerely,

R/A

Patricia A. Silva, Chief
Technical Support Branch
Division of Fuel Cycle Safety
and Safeguards
Office of Nuclear Material Safety
and Safeguards

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

Enclosure: Inspection Report 70-143/2009-207

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**U.S. NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS**

Docket No.: 70-143

License No.: SNM-124

Report No.: 70-143/2009-207

Licensee: Nuclear Fuel Services, Inc.

Location: Erwin, Tennessee

Inspection Dates: December 7-10, 2009

Inspector: Thomas Marenchin, Criticality Safety Inspector
Christopher Tripp, Criticality Safety Inspector

Approved by: Patricia A. Silva, Chief
Technical Support Branch
Division of Fuel Cycle Safety
and Safeguards
Office of Nuclear Material Safety
and Safeguards

Enclosure

EXECUTIVE SUMMARY

Nuclear Fuel Services, Inc. NRC Inspection Report No. 70-143/2009-207

Introduction

Staff of the U.S. Nuclear Regulatory Commission (NRC) performed a routine and announced nuclear criticality safety (NCS) inspection of Nuclear Fuel Services, Inc. (NFS) license number SNM-124, in Erwin, Tennessee, facility from December 7-10, 2009. The inspection included an on-site review of the licensee's programs involving the NCS program; inspections, audits, and investigations; plant operations; NCS event review and follow-up; and open items. The inspection focused on risk-significant fissile material processing activities including the blended low-enriched uranium processing facility (BPF), and high-enriched uranium (HEU) fuel fabrication.

Results

- No safety concerns were noted regarding implementation of the NCS program. One inspector follow-up item (IFI) was identified regarding the applicability of, and compliance with, license requirements for fixed neutron absorbers.
- No safety concerns were noted regarding the licensee's NCS inspections, audits, and investigations.
- No safety concerns were identified during a review of recent licensee investigation of internal events.
- An IFI regarding submission of an amendment request to clarify license requirements regarding the modeling of reflection was closed, based on an amendment request issued December 10, 2009.

REPORT DETAILS

1.0 Plant Status

NFS license number SNM-124, produces uranium oxides from low-enriched uranium (LEU) liquid, conducts routine ammonia recovery process and liquid waste treatment at its Erwin, Tennessee site. During the inspection, NFS was performing routine fuel fabrication, parts of the BPF was shutdown, and CD Line area was shutdown.

2.0 Nuclear Criticality Safety Program (IP 88015, 88016)

a. Inspection Scope

The inspectors reviewed Nuclear Criticality Safety Evaluations (NCSEs) to determine that criticality safety of risk-significant operations was assured through engineered and human controls with adequate safety margin and preparation and review by qualified staff. The inspectors reviewed selected aspects of the following documents:

- NCS-07-01, "Control Flowdown and Field Verification for CDL [commercial development line] Process Ventilation System," Revision 2, dated September 4, 2009
- NFS-HS-CL-04, "Nuclear Criticality Safety Configuration Control Requirements," Revision 2, dated October 11, 2004
- 54X-09-0001, "Nuclear Criticality Safety Evaluation for the HEPA [high-efficiency particulate air] Filtered Balance Enclosure (IAC 760)," Revision 0, dated May 26, 2009
- 54T-09-0058, "Nuclear Criticality Safety Evaluation for the Blended Low Enriched Uranium Preparation Facility U-Aluminum Dissolution," Revision 11, dated July 23, 2009
- 54T-09-0066, "Nuclear Criticality Safety Evaluation for Sublimation Station Number 1&2 and the Cylinder Test and Overpack Station," Revision 3, dated August 20, 2009
- 54T-09-0068, "Nuclear Criticality Safety Evaluation for Sublimation Station Number 1&2 and the Cylinder Test and Overpack Station," Revision 4, dated August 28, 2009
- 54T-09-0057, "Nuclear Criticality Safety Evaluation for CDL Tray Dissolution System," Revision 1, dated July 20, 2009
- 53T-09-0074, "Heating Chamber Enclosure Ventilation Design," Revision 3, dated October 12, 2009
- 54T-09-0073, "Nuclear Criticality Safety Evaluation for the BPF ETR/GETR/MTR/HFIR Fuel Element Size Reduction Enclosure," Revision 0, dated October 15, 2009
- 54T-09-0065, "Nuclear Criticality Safety Evaluation for the CDL Process Ventilation System," Revision 2, dated August 27, 2009
- 54T-09-0006, "BPF Glass Columns," dated February 6, 2009

b. Observations and Findings

The inspectors reviewed new and revised analyses since the last criticality safety inspection, to ensure that facility changes were being performed safely and in accordance with regulatory requirements. The inspectors determined that in general NCSEs were performed by qualified NCS engineers; that independent reviews of the evaluations were completed by qualified NCS engineers; that subcriticality of operations was assured through appropriate limits on controlled parameters; and that double contingency was assured for each credible accident sequence leading to criticality by

means of appropriate engineered and procedural controls. NCS analyses and supporting calculations demonstrated an adequate basis for criticality safety for the processes reviewed.

With regard to specific NCSEs, the inspectors questioned why the NCSE for Sublimation Stations 1 & 2 was revised twice within a week, and determined that these revisions were for unrelated changes made as part of initial start-up of this new operation. The inspectors noted that in several NCSEs, the licensee took credit for initiating and enabling events such as the rate of buildup on a HEPA filter, the amount of material that would be released from a UF₆ cylinder during a leak, etc. For some of these initiating and enabling events, the basis was not apparent from a review of the NCSE and associated documentation. However, in all cases, the inspectors were able to determine that the underlying assumptions were conservative and reasonable. In addition, the inspectors reviewed new operations that had not yet been field verified, such as the design of portable favorable geometry columns for reagent addition to the BPF solvent extraction process, and the design of the saw for size reduction of MTR fuel. The inspectors determined, based on the established controls, that these operations would also be conducted safely and in accordance with regulatory requirements.

The inspectors noted, in their review of the revised BPF U-Aluminum Dissolution NCSE, that the licensee stated it was no longer required to perform inspections of borosilicate glass columns in this area, allowing the columns to be reclassified as configuration controlled equipment (CCE) rather than safety-related equipment. The inspectors reviewed the memorandum that justified this, dated February 6, 2009. The BPF processes still place reliance on the borosilicate glass, but no longer require an annual inspection of the glass thickness based on examinations of inspection data taken from 2006 to 2009, consisting of 220 tests with 3520 individual glass thickness measurements (taken at many different axial and radial locations along and around each column). The inspectors reviewed this data and the licensee's evaluation thereof, and concluded that the data did adequately demonstrate there was no measurable thinning of the glass over this time, justifying their reclassification as CCE. However, the inspectors noted that Section 4.2.1.9 of the License Application, "Fixed Neutron Absorbers," states:

The use of a neutron absorber as a criticality controlled parameter is acceptable if the following criteria are met...

Procedures are established to verify the presence and continuing effectiveness of fixed neutron absorbers before use and periodically thereafter.

Controls are exercised to maintain the continued presence and the intended distribution and concentration of fixed neutron absorbers.

The inspectors questioned how these requirements would be met if the required glass thickness inspections were discontinued. The licensee stated that it believed it was allowed to discontinue the inspections, but that there was no documented basis for doing so. The licensee had issued Problem Identification, Resolution, and Corrective System (PIRCS) 7419 on May 25, 2006, with an action to "generate basis documents for glass columns to address fixed neutron absorber requirements in license." Subsequent to this, the due date had been extended several times, from May 1, 2007, to October 1, 2007, to October 1, 2009, and finally to October 1, 2010. The licensee stated that it was uncertain whether Section 4.2.1.9 even applied to the glass columns, noting that: (1) the

most significant effect (in terms of system reactivity) of glass thinning was increasing fissile dimensions, not reducing neutron absorption; and (2) there was considerable margin in both glass thickness and boron loading, such that only ~50% of the boron was needed to maintain k_{eff} below the upper subcritical limit. The licensee also stated that, as part of license renewal, it had submitted changes to Section 4.2.1.9 of the license application, which state that controls are to be exercised to maintain the continued effectiveness of absorbers "as necessary." However, this is not the version of the application currently in effect.

The inspectors determined that the stated specifications for the borosilicate glass (i.e., in the U-Aluminum Dissolution NCSE) include NCS limits on the B_2O_3 content and ^{10}B enrichment, as well as the glass thickness. Therefore, it appears that reliance is being placed on both the inner diameter and the material properties of the glass columns, even if only partial credit for boron is needed to demonstrate subcriticality, which would mean that this section of the application does apply. The inspectors determined, however, that the failure to do inspections has at most minor safety significance, because of the large margin inherent in facility calculations, and because the licensee's inspection data convincingly demonstrate the lack of any measurable thinning of the glass over time. In fact, there is not foreseeable credible mechanism that could reduce the glass thickness by the 50% required to exceed the upper subcritical limit. Therefore, there is no safety concern with the discontinuation of glass column inspections (as long as current chemical conditions in this area are maintained). The licensee has committed that it would complete its evaluation of the applicability of License Application Section 4.2.1.9, and justifies how it is meeting the license requirements, by June 30, 2010. Demonstration of applicability of, and compliance with, License Application Section 4.2.1.9 will be tracked as **IFI 70-143/2009-207-01**.

c. Conclusions

No safety concerns were noted regarding the NCS program. An IFI was identified regarding the compliance with license requirements for the use of fixed neutron absorbers.

3.0 Nuclear Criticality Safety Inspections, Audits, and Investigations (IP 88015)

a. Inspection Scope

The inspector reviewed results of the most recent NCS audits to assure that appropriate issues were identified and resolved. The inspector reviewed selected aspects of the following documents:

- NCS-2009-01, "NCS Audit of the NCSE for Area F," dated January 13, 2009
- NCS-2009-18, "NCS Audit of the NCSE for Area 700 of the Production Fuel Facility," dated July 17, 2009
- NCS-2009-19, "NCS Audit of the NCSE for the Oxide Conversion Building Portable HEPA Filter Unit," dated July 21, 2009
- NCS-2009-20, "NCS Audit of the NCSE for the Tube Cleaning Room of the Production Fuel Facility," dated July 21, 2009
- NCS-2009-21, "NCS Audit of the NCSE for the 110B and 131 Labs," dated July 28, 2009

- NCS-2009-22, "NCS Audit of the NCSE for the Waste Drum Storage and the Bechtel Jacobs Shipping Package Storage Areas," dated July 31, 2009
- NCS-2009-23, "NCS Audit of the NCSA [nuclear criticality safety analysis] for Prevention of Inadvertent Uranium Solution Backflow from Recovery Areas to the Unfavorable Geometry Equipment in the Plant Air Supply System," dated August 21, 2009
- NCS-2009-24, "NCS Audit of the NCSE for Building 100 NDA-Lab," dated August 26, 2009
- NCS-2009-25, "NCS Audit of the Fuel Production Process NCSA Spilled Materials," dated August 27, 2009
- NCS-2009-26, "NCS Audit of the NCSE for the Waste Water Treatment Facility," dated September 1, 2009
- NCS-2009-27, "NCS Audit of the NCSE for Caustic Receipt Tank-26," dated September 1, 2009
- NCS-2009-28, "NCS Audit of the NCSE for the Building 300 Warehouse and Building 310 Warehouse," dated October 13, 2009
- NCS-2009-29, "NCS Audit of the NCSE for the Oxide Conversion Building HEPA Filter Reduction Enclosure," dated October 14, 2009
- NCS-2009-30, "NCS Audit of 300 Complex and 105 Laboratory Exhaust Ventilation Systems," dated October 27, 2009
- NFS-HS-A-16, "Safety Audits and Inspections," Revision 11, dated June 19, 2009.
- NFS-NCS-AUDITWG, "Nuclear Criticality Safety Audit Writer's Guide," Revision 2, dated November 9, 2006

b. Observations and Findings

The inspectors observed that the licensee NCS audits were conducted in accordance with written procedures. The inspectors noted that the audits were performed by NCS engineers who reviewed open NCS issues from previous audits; reviewed the adequacy of control implementation; reviewed plant operations for compliance with license requirements, procedures, and postings; and examined equipment and operations to determine that past evaluations remained adequate. Any deficiencies identified within NCSEs and operating procedures were appropriately captured in the licensee's corrective action program and resolved in a timely manner. The inspectors had no safety concerns regarding the identification, assignment and tracking of corrective actions.

c. Conclusions

No safety concerns were noted regarding the licensee's NCS inspections, audits, and investigations.

4.0 Nuclear Criticality Safety Event Review and Follow-up (IP 88015, 88016)

a. Inspection Scope

The inspectors reviewed the licensee's response to internally-reported events. The inspectors reviewed the progress of investigations and interviewed licensee staff regarding immediate and long-term corrective actions. The inspectors reviewed selected aspects of the following documents:

- PIRCS #20981 dated September 10, 2009
- PIRCS #20902 dated September 17, 2009
- PIRCS #21117 dated September 28, 2009
- PIRCS #21438 dated October 12, 2009
- PIRCS #21269 dated October 3, 2009
- PIRCS #21296 dated October 5, 2009
- PIRCS #21297 dated October 5, 2009
- PIRCS #21677 dated October 27, 2009
- PIRCS #21990 dated November 12, 2009
- PIRCS #22081 dated November 17, 2009
- PIRCS #22154 dated November 20, 2009
- PIRCS #22128 dated November 19, 2009

b. Observations and Findings

The inspectors reviewed selected licensee internally-reported events. The inspectors observed that internal events were investigated in accordance with written procedures and appropriate corrective actions were assigned. The inspectors had no safety concerns regarding licensee reporting, investigation, and correction of internal NCS related events.

c. Conclusions

No safety concerns were identified during a review of recent licensee investigation of internal events.

5.0 Plant Activities (IP 88015, 88016)

a. Inspection Scope

The inspectors performed plant walkdowns to review activities in progress and to determine whether risk-significant fissile material operations were being conducted safely and in accordance with regulatory requirements. The inspectors interviewed operations staff and NCS engineers both before and during walkdowns. The inspectors reviewed selected aspects of the following documents prior to performing the walkdowns:

- NCS-07-01, "Control Flowdown and Field Verification for CDL Process Ventilation System," Revision 2, dated September 4, 2009
- NFS-HS-CL-04, "Nuclear Criticality Safety Configuration Control Requirements," Revision 2, dated October 11, 2004
- PIRCS #22422 dated December 12, 2009

b. Observations and Findings

The inspectors verified that controls identified in NCS analyses were installed or implemented and were adequate to ensure safety. The inspectors also verified that safety was maintained for observed facility operations. The cognizant NCS engineers were knowledgeable and interacted regularly with operators on the process floors. The

inspector verified the adequacy of management measures for assuring the continued availability, reliability, and capability of safety-significant controls relied upon by the licensee for controlling criticality risks.

During a walkdown of Area 800 the inspectors identified some 2 liter contains and 1 liter contains that were stored in the corner of the area. The containers had some type of liquid in them but not all of them were marked with the contents of the container and some of the containers were not marked "No SNM Allowed." NFS-HS-CL-04 states in part, "Favorable containers that are not being used to contain SNM are permitted provided they are labeled as to their contents and with the words "No SNM Allowed." The area supervisor and NCS staff walked down the area and identified that the containers contained the chemical that is used in Area 800. They also identified two containers that did not have the appropriate contents label and "No SNM Allow" label. The containers were subsequently marked with the appropriate labels and a problem report was generated (PIRCS #22422). The inspectors determined that the operations in the area do not generate SNM solutions and that none of the containers that were being stored in the area contained SNM. The inspectors considered the risk significance of this failure to follow procedure NFS-HS-CL-04 to be minor because of the operations in the area and that no SNM was in the containers. This failure constitutes a violation of minor significance and is not subject to formal enforcement.

c. Conclusions

No safety concerns were identified during plant walkdowns.

6.0 Open Item Review

IFI 70-143/2009-202-01

This concerned the licensee's planned submission of an amendment request to clarify license requirements regarding modeling of reflection in criticality calculations, as it had committed to do in a previous inspection. The licensee subsequently submitted an amendment request, but later withdrew it. In a previous inspection, the licensee had stated its intention to resubmit with more justification by the end of 2009. Following the inspection, on December 15, 2009, the licensee resubmitted its amendment request, which will be reviewed by licensing staff. Accordingly, this issue is now closed.

7.0 Exit Meeting

The inspectors presented the inspection results to members of the licensee's management and staff during an exit meeting on December 10, 2009. The licensee acknowledged and understood the findings as presented.

SUPPLEMENTARY INFORMATION

1.0 List of Items Opened, Closed, and Discussed

Items Opened

IFI 70-143/2009-207-01 Tracks the licensee's demonstration of applicability of, and compliance with, License Application Section 4.2.1.9.

Items Closed

IFI 70-143/2009-202-01 Tracks the licensee's submission of an amendment request to clarify the license requirements regarding modeling of reflection.

Items Discussed

None

2.0 Inspection Procedures Used

IP 88015 Nuclear Criticality Safety Program
IP 88016 Nuclear Criticality Safety Evaluations and Analyses

3.0 Key Points of Contact

Nuclear Fuel Services, Inc.

C. Athon	Director, Applied Technology
R. Bond	Senior Project Director
N. Brown	Engineer, NCS
R. Droke	Director, Licensing
M. Eakin	Engineer, NCS
T. Finan	KAPL Resident
D. Gardner	Licensing
D. Kudsin	NFS President
C. Lewis	Engineer, NCS
B. Moore	Director, Safety and Regulatory
R. Nelson	Safety and Regulatory
S. Sanders	Training Manager
R. Shackelford	Manager, NCS
A. Vaughan	Director, Fuel Production
L. Willis	Engineer
D. Wise	Director, Fuel Operations

NRC

G. Hopper	Inspector, NRC Region II
G. Smith	Senior Resident Inspector, NRC Region II
T. Marenchin	Criticality Safety Inspector, NRC Headquarters
C. Tripp	Criticality Safety Inspector, NRC Headquarters

All attended the exit meeting on December 10, 2009.

4.0 List of Acronyms and Abbreviations

BPF	BLEU preparation facility
CCE	configuration-controlled equipment
CDL	Commercial Development Line
HEPA	high-efficiency particulate air (filter)
HFIR	high-flux isotope reactor
HEU	high-enriched uranium
IFI	inspection follow-up item
IP	inspection procedure
MTR	Materials Test Reactor
NCS	nuclear criticality safety
NCSA	nuclear criticality safety analysis
NCSE	nuclear criticality safety evaluation
NFS	Nuclear Fuel Services, Inc. (licensee)
PIRCS	Problem Identification, Resolution, and Corrective System
SNM	special nuclear material