

May 2, 2011

Mr. Joseph G. Henry
President
Nuclear Fuel Services, Inc.
P.O. Box 337, MS 123
Erwin, TN 37650

SUBJECT: INSPECTION REPORT NO. 70-143/2011-202

Dear Mr. Henry:

The U.S. Nuclear Regulatory Commission (NRC) conducted a routine announced criticality safety inspection at your facility in Erwin, Tennessee, from April 4-8, 2011. 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 April 8, 2011.

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>.

J. Henry

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If you have any questions concerning this report, please contact Dennis Morey, of my staff, at 301-492-3112.

Sincerely,

/RA/ T. Marenchin for

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 70-143/2011-202

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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.: 70-143/2011-202

Licensee: Nuclear Fuel Services, Inc.

Location: Erwin, Tennessee

Inspection Dates: April 4-8, 2011

Inspector: Dennis Morey, Senior Criticality Safety Inspector
Christian Fisher, 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. 70-143/2011-202

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 April 4-8, 2011. The inspection included an on-site review of the licensee programs involving the NCS program, NCS audits, internal NCS event review and follow-up, criticality alarm system, plant operations, and open items. The inspection focused on risk-significant fissile material processing activities including the commercial development line (CDL), blended low-enriched uranium processing facility (BPF), high-enriched uranium (HEU) fuel fabrication and the Waste Water Treatment Facility (WWTF).

Results

- No safety concerns were identified regarding implementation of the NCS program.
- No safety concerns were identified regarding the licensee's NCS audits.
- No safety concerns were identified regarding the licensee's internal NCS event review and follow-up.
- No safety concerns were identified regarding the licensee's criticality alarm system.
- No safety concerns were identified regarding the licensee's plant operations.

REPORT DETAILS

1.0 Plant Status

NFS License Number SNM-124, produces uranium oxides from low-enriched uranium liquid, conducts routine ammonia recovery process and liquid waste treatment at its Erwin, Tennessee site. During the inspection, NFS was performing routine fuel fabrication and downblending operations and part of the CDL 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:

- NFS-HS-A-68, "ISA [Integrated Safety Analysis] Risk Assessment Procedure," Revision 4, dated October 2007
- NFS-HS-A-79, "Identification and Control of Items Relied on For Safety [IROFS] Procedure," Revision 7, dated November 2010
- NFS-HS-CL-10, "Nuclear Criticality Safety Fuel Manufacturing Facility," Revision 25, dated January 2011
- 54X-06-0017, "Nuclear Criticality Safety Evaluation for Area F of the Uranium Recovery Facility," " 3, dated October 2009
- 54T-09-0018, "NCSE for the CDL Column Dissolution System," Revision 0, dated April 3, 2009
- 54T-10-0032, "NCSE for BPF Liquid Waste Discard System," Revision 6, dated October 19, 2010
- 54T-10-0033, "NCSE for WWTF Caustic Receipt Tank-26," "Revision 1, dated November 16, 2010
- 54T-10-0036, "NCSE for CDL Vent and Tap Station," Revision 0, dated January 4, 2011
- 54T-10-0037, "NCSE for Sublimation Stations 1 and 2 and the Cylinder Test and Overpack Station," Revision 5, dated February 10, 2011
- 54T-10-0038, "NCSE for Sublimation Station 3, the Heel removal Station and the NaF Alumina Traps," Revision 5, dated February 10, 2011
- 54T-10-0039, "NCSE for the CDL Process Ventilation System," Revision 4, dated January 2011
- 54T-11-0001, "NCSE for CDL Interaction Analysis," Revision 2, dated January 25 2011
- 54X-11-001, "Control Flowdown and Field Verification Checklist for Area F of the Uranium Recovery Facility Revision 3 of NCSE Issued on October 1, 2009," Revision 2, dated March 2011
- Problem Identification, Resolution and Correction System [PIRCS] Identification Number 29424, dated April 7, 2011
- 71T-10-0150, "Uranium Accumulation on Filters 1V01, 1V02, and 1V03, Revision 0, dated September 29, 2011

b. Observations and Findings

The inspectors determined that NCSEs were performed by qualified NCS engineers, that independent reviews of the evaluations were completed by qualified NCS engineers, that subcriticality of the systems and operations was assured through appropriate limits on controlled parameters, and that double contingency was assured for each credible accident sequence leading to inadvertent criticality. The inspectors determined that NCS controls for equipment and processes assured the safety of the operations. NCS analyses and supporting calculations demonstrated adequate identification and control of NCS hazards to assure operations within subcritical limits.

During review of the NCSE for Area F, the inspectors reviewed several accident sequences and the IROFS associated with those sequences. The internal procedure for conducting ISA Risk Assessment, NFS-HS-A-68, states that in some complex scenarios, there may be factors that are not failures but are enabling events (e.g., an enabling event cannot be a failure). The inspectors noted that, for accident sequence 4.1.12, one of the enabling events to the sequence was also an IROFS failure credited for the same sequence. Combining an enabling event and an IROFS failure in an accident sequence is contrary to procedure NFS-HS-A-68. The inspectors determined that there were other IROFS in place for the accident sequence and that the licensee still met the performance requirements with other IROFS credited in accident sequence 4.1.12. Although this issue should be corrected, it constitutes a violation of minor significance that is not subject to enforcement action in accordance with Section 2.2.2 of the Enforcement Policy.

The inspectors notified the licensee regarding accident sequence 4.1.12 and the issue was entered as a minor violation into the licensee Problem Identification, Resolution, and Correction System (PIRCS) under identification number 29424, dated April 7, 2011. The licensee identified two different corrective actions to address the minor violation. First, that it would update accident sequence 4.1.12 by July 29, 2011, to eliminate double counting. Second, that it would provide a briefing to all NCS engineers on the use of enabling events by April 29, 2011. The licensee's commitment to have both of the corrective actions under PIRCS 29424 finished by July 29, 2011, will be tracked as **Inspector Follow-up Item (IFI) 70-143/2011-202-01**.

c. Conclusions

No safety concerns were identified regarding implementation of the NCS program.

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

a. Inspection Scope

The inspectors reviewed results of the most recent NCS audits to assure that appropriate issues were identified and resolved. The inspectors also accompanied a NCS engineer as they finished an audit in Area E and began an audit in Area 800. The inspectors reviewed selected aspects of the following documents:

- NCS-AUDITWG, "Nuclear Criticality Safety Audit Writer's Guide," Revision 2, dated November 2006
- NFS-HS-A-16, "Safety Audits and Inspections," Revision 12, dated March 2011

- 21T-11-0015, "Third Nuclear Criticality Safety Audit of the Nuclear Safety Evaluation for the Dissolution of Uranium Metal and High Enriched Uranium Storage Columns," dated January 2011
- 21T-11-0215, "Nuclear Criticality Safety Audit of the Nuclear Criticality Safety Evaluation for Area 300/400 of the Fuel Production Facility (Fourth Audit)," dated March 2011
- 21T-11-0229, "Nuclear Criticality Safety Audit of the NCSE for Area 500 and Area 400 Discard Columns of the Production Fuel Facility, Fourth Audit," dated March 2011
- 21T-11-0236, "Nuclear Criticality Safety Audit of the Nuclear Criticality Safety Evaluation for OCB [Oxide Conversion Building] Ventilation, Third Audit," dated March 2011
- 21T-11-0267, "Nuclear Criticality Safety Audit of the Nuclear Criticality Safety Evaluation for the Prevention of Inadvertent Solution Backflow from the Production Fuel Facility to Unfavorable Geometry Equipment of the Nitrogen Supply system (Sixth Audit)," dated March 2011
- 54X-09-002, "Nuclear Criticality Safety Evaluation for Area E of the Uranium Recovery Facility," Revision 6, dated March 2009
- 54X-09-003, "Control Flowdown and Field Verification Checklist for Area E," Revision 6, dated March 2009
- 54T-04-0127, "Risk Index and IROFS Summary for Area E of the Uranium Recovery Facility," Revision 3, dated October 2004
- 21T-08-0839, "Nuclear Criticality Safety Audit of the Nuclear Criticality Safety Evaluation for Area E of the Uranium Recovery Facility," Revision 5, dated January 2009

b. Observations and Findings

The inspectors observed that the licensee's 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 corrective action program and resolved in a timely manner. The inspectors observed a NCS engineer follow up on a non-NCS item identified during the audit by an operator. The inspectors had no safety concerns regarding the identification, assignment and tracking of corrective actions.

c. Conclusions

No safety concerns were identified regarding the licensee's NCS audits.

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

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:

- NFS-GH-922, "The NFS Problem Identification, Resolution and Correction System (PIRCS)," Revision 11, dated January 2011
- PIRCS Identification Number 27935, dated December 15, 2010
- PIRCS Identification Number 28140, dated January 4, 2011
- PIRCS Identification Number 28164, dated January 6, 2011
- PIRCS Identification Number 28210, dated January 10, 2011
- PIRCS Identification Number 28221, dated January 11, 2011
- PIRCS Identification Number 28432, dated January 22, 2011
- PIRCS Identification Number 28616, dated February 7, 2011
- PIRCS Identification Number 28558, dated February 2, 2011
- PIRCS Identification Number 28936, dated March 1, 2011
- PRICS Identification Number 29087, dated March 10, 2011
- PIRCS Identification Number 29223, dated March 22, 2011
- PIRCS Identification Number 29284, dated March 29, 2011
- PIRCS Identification Number 29307, dated March 30, 2011
- PIRCS Identification Number 29363, dated April 5, 2011
- 54T-09-0017, "NCSE for the Blended Low Enriched Uranium Preparation Facility Solvent Extraction," Revision 10, dated April 2009
- 53T-09-0022, "Processing of Flouride Bearing Solutions in Glass SX [Solvent Extraction] Columns," Revision 0, dated March 2009
- 54X-07-0022, "NCSE for Area 800 of the Production Fuel Facility," Revision 8, dated March 2008
- 54X-08-0002, "NCSE for area LA," Revision 3, dated January 2008

b. Observations and Findings

The inspectors reviewed selected licensee internally reported events and selected NCSEs associated with the 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 Criticality Alarm Systems (IP 88017)

a. Inspection Scope

The inspectors reviewed documentation of criticality accident alarm detector coverage, interviewed engineering staff, and performed facility walkdowns to determine the adequacy of the licensee's criticality alarm system.

b. Observations and Findings

The inspectors reviewed recent hardware and software upgrades to the licensee's criticality alarm system. The inspectors determined that the licensee had upgraded their criticality accident alarm system equipment to give the ability to visually determine which detector pair had alarmed. This change was expected to improve criticality alarm response. The inspectors reviewed newly installed equipment and discussed the upgrade with the responsible engineering manager.

c. Conclusions

No safety concerns were identified during a review of the licensee's criticality accident alarm system.

6.0 Plant Activities (IP 88015)

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:

- Drawing 301-M4100-D, "CDL Layout," Revision B, dated March 9, 2011
- Drawing 301-F2035-D, "CDL Process Block Diagram," Revision A, dated May 25, 2010
- Drawing 301-F0203-D, "UF₆ Sublimation Station 1," Revision V, March 9, 2011
- Drawing 301-F-0204-D, UF₆ Sublimation Station 2," Revision U, dated March 9, 2011
- Drawing 301-F-0205-D, "UF₆ Sublimation Station 3," Revision S, dated March 9, 2011
- Drawing 301-F-0255-D, "Ammonia Pre-scrubber NOx Stage 1 Scrubber and Blowdown Tank," Revision I, dated September 7, 2010
- Drawing 301-F-0256-D, "NOx Pre-scrubber System Stages 2 and 3," Revision I, dated September 2, 2010
- Drawing 301-F-0257-D, "Main Scrubber" Revision G, dated April 22, 2010
- Drawing 301-F-0270-D, "CDL Vent and Tap Station," Revision A, dated March 3, 2011

b. Observations and Findings

The inspectors performed walkdowns in the CDL, BPF, HEU fuel fabrication and the WWTF. 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 inspectors 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.

c. Conclusions

No safety concerns were identified during plant walkdowns.

7.0 Open Item Review

IFI 70-143/2010-206-01

This item concerns the commitment to provide a schedule during this NCS inspection for the completion of specific NCSEs that cover Reagents and Utilities. These are two general NCSEs that the licensee is working to split up into more specific analyses. During this inspection the licensee gave a schedule to have the remaining four NCSEs for Area A, B, C, and GHJ, completed by June 30, 2012. The NCSEs are tracked in PIRCS by the licensee under the following four identification numbers all dated April 7, 2011; 15185, 15186, 15187, and 15188. This schedule closes this IFI. The licensee's commitment to update NCSEs for Area A, B, C, and GHJ by June 30, 2012, will be tracked as **IFI 70-143/2011-202-02**.

8.0 Exit Meeting

The inspectors presented the inspection results to members of the licensee's management and staff during an exit meeting on April 8, 2011. The licensee acknowledged and understood the findings as presented.

SUPPLEMENTARY INFORMATION

1.0 List of Items Opened, Closed, and Discussed

Items Opened

- IFI 70-143/2011-202-01** Tracks the licensee's commitment to have both of the corrective actions with PIRCS 29424 finished by July 29, 2011.
- IFI 70-143/2011-202-02** Tracks the licensee's commitment to update NCSEs for Area A, B, C, and GHJ by June 30, 2012.

Items Closed

- IFI 70-143/2010-206-01** Tracks the licensee's commitment to provide a schedule during the next NCS inspection for completion of its specific NCSEs that cover Reagents and Utilities.

Items Discussed

None

2.0 Inspection Procedures Used

- IP 88015 Nuclear Criticality Safety Program
IP 88016 Nuclear Criticality Safety Evaluations and Analyses
IP 88017 Criticality Alarm Systems

3.0 Key Points of Contact

Nuclear Fuel Services, Inc.

- *J. Henry President
*R. Shackelford Manager, Nuclear Safety & Licensing
*N. Brown Nuclear Criticality Safety Manger
*J. Wheeler Licensing & ISA Manager
*C. Reed Operations Director
*D. Lee Licensing Specialist
M. Moore Senior Regulatory Adviser
R. Maurer Engineer, NCS
M. Elliott Director, Safety & Security

NRC

- *D. Morey Senior Criticality Safety Inspector, NRC Headquarters
*C. Fisher Criticality Safety Inspector, NRC Headquarters
*M. Chitty NFS Resident Inspector, Region II

* Attended the exit meeting on April 8, 2011.

4.0 List of Acronyms and Abbreviations

ADAMS	Agencywide Documents Access and Management System
BPF	blended low-enriched uranium preparation facility
CDL	Commercial Development Line
HEU	high-enriched uranium
IFI	inspector follow-up item
IP	inspection procedure
IROFS	items relied on for safety
ISA	integrated safety analysis
NCS	nuclear criticality safety
NCSE	nuclear criticality safety evaluation
NFS	Nuclear Fuel Services, Inc. (licensee)
OCB	Oxide Conversion Building
PIRCS	Problem Identification, Resolution, and Correction System
SNM	Special Nuclear Material
SX	Solvent Extraction
WWTF	Waste Water Treatment Facility