

January 6, 2011

Mr. Dave Amerine
President
Nuclear Fuel Services, Inc.
P.O. Box 337, MS 123
Erwin, TN 37650

SUBJECT: INSPECTION REPORT NO. 70-143/2010-206

Dear Mr. Amerine:

The U.S. Nuclear Regulatory Commission (NRC) conducted a routine announced criticality safety inspection at your facility in Erwin, Tennessee, from December 6-9, 2010. 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 9, 2010.

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,

/RA/

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 70-143/2010-206

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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.: 70-143/2010-206

Licensee: Nuclear Fuel Services, Inc.

Location: Erwin, Tennessee

Inspection Dates: December 6-9, 2010

Inspector: Thomas Marenchin, Criticality Safety Inspector
Christopher Tripp, Senior Criticality Safety Inspector
Thomas Briley, Nuclear Engineer

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. 70-143/2010-206

Introduction

Staff of the U.S. Nuclear Regulatory Commission (NRC) performed a routine and announced nuclear criticality safety (NCS) inspection of the Nuclear Fuel Services, Inc. (NFS) License Number SNM-124, Erwin, Tennessee, facility from December 6-9, 2010. 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, and plant operations. 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

- A minor violation was identified during review of NCS safety evaluation auditor training and qualifications.
- No safety concerns were identified regarding implementation of the NCS program
- No safety concerns were identified regarding the licensee's NCS training 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 conducts high-enriched uranium (HEU) fuel fabrication, downblending, uranium recovery, waste processing, and decommissioning operations at its Erwin, Tennessee site. During the inspection, NFS was performing routine fuel fabrication, downblending, maintenance, and construction activities, and the commercial development line (CDL) area was shutdown.

2.0 Nuclear Criticality Safety Program (IP 88015, 88016)

a. Inspection Scope

The inspectors reviewed new and revised Nuclear Criticality Safety Evaluations (NCSEs) and procedures 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:

- 54T-10-0030, "Nuclear Criticality Safety Evaluation for the Blended Low Enriched Uranium Preparation Facility U-Aluminum Dissolution," Revision 13, October 2010
- 54T-10-0015, "Nuclear Criticality Safety Evaluation for 301 RFS Calciner Furnace," Revision 0, July 2010
- 54T-09-0075, "Nuclear Criticality Safety Evaluation for the CDL Process Ventilation System," Revision 3, July 2010
- NFS-GH-89, "Hearing Conservation," Revision 0, dated December 17, 2010
- NFS-GH-913, "Nuclear Criticality Safety program," Revision 2, dated February 27, 2004
- NFS-HS-A-58, "Nuclear Criticality Safety Evaluations," Revision 11, dated March 27, 2009
- NFS-HS-E-04, "Fire Reporting and Response," Revision 32, dated October 25, 2010
- NFS-HS-E-13, "Emergency Take Cover," Revision 4, dated March 31, 2010
- SYS-50-05, "NCS Nuclear Criticality Safety Policy," Revision 2, dated April 17, 2009

b. Observations and Findings

The inspectors reviewed the revised NCSE for the BPF U-Aluminum dissolution process. The NCSE was revised in response to an event on September 27, 2010, in which a larger amount of caustic build-up was discovered outside the bowl (on the inside of the centrifuge jacket and underside of the centrifuge lid) than had been analyzed. This resulted in reportable Event #46284 and internal PIRCS #26883. The licensee determined by sampling and nondestructive assay (NDA) that there was an elevated mass on each of the four area centrifuges, but the maximum buildup was 46 g ²³⁵U, much less than a minimum critical mass. The licensee had also determined that the apparent causes of the unanticipated buildup were: (1) running the centrifuges at high speed without any solution flow; and (2) a redesign of the centrifuge drains that allowed greater air flow across the outer surface of the centrifuge bowl. The revised NCSE included calculations that showed that a bounding amount of uranium-bearing material

on the inside of the centrifuge jacket would remain subcritical. The licensee also modified the drains back to a design with a water seal, and instituted new controls limiting the amount of time the centrifuge could be operated without solution being added and requiring periodic shutdown and inspection. The inspectors reviewed the new calculations, additional controls, and drain modifications and concluded they appeared adequate to prevent recurrence. The inspectors also reviewed and walked down a new NCSE for the Reliable Fuel Supply (RFS) calciner, and reviewed modifications to the CDL process ventilation system NCSE to address backflow of scrubber solution into enclosures and revised risk indexing so that a single missed NDA scan would not result in failure to meet the performance requirements.

The inspectors determined that NCSEs were performed by qualified NCS engineers, independent reviews of the evaluations were completed by qualified NCS engineers, 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.

c. Conclusions

No safety concerns were identified regarding the NCS program.

3.0 Nuclear Criticality Safety Training (IP 88015)

a. Inspection Scope

The inspectors reviewed the content of NCS training for general workers and for fissile material handlers. The inspectors evaluated the effectiveness of the licensee NCS training through interviews with both categories of workers. The inspectors also interviewed licensee training management. The inspectors reviewed selected aspects of the following documents:

- NFS-HS-A-49, "Training Requirements for Safety Professionals," Revision 1, dated May 29, 2009
- NFS-HS-A-16, "Safety Audits and Inspections," Revision 11, dated June 19, 2009
- NFS-TN-008, "NFS Training Procedure," Revision 10, dated June 28, 2010
- NCS 2009-05, "Nuclear Criticality Safety Audit of the Nuclear Criticality Safety Evaluation for Area 800 of the Production Fuel Facility," Revision 8, dated March 5, 2009
- NCS 2009-09, "Nuclear Criticality Safety Audit for the Nuclear Criticality Evaluation Six-Inch Diameter Column Leaks," Revision 0, dated April 9, 2009
- NCS 2009-17, "Nuclear Criticality Safety Audit for the Nuclear Criticality Evaluation for the Building 306 Main Vault," dated June 18, 2009
- NCS 2009-18, "Nuclear Criticality Safety Audit for the Nuclear Criticality Evaluation Area 700 of the Production Facility," Revision 4, dated July 17, 2009
- NCS 2009-30, "Nuclear Criticality Safety Audit: 300 Complex and 105 Laboratories Exhaust Ventilation Systems, Fifth Audit," dated October 27, 2009

- PIRCS [Problem Identification Resolution, and Corrective System] #24859, dated May 28, 2010
- PIRCS #18515, dated May 1, 2009
- PIRCS #26597, dated September 9, 2010

b. Observations and Findings

The inspectors reviewed the NCS training, which is a separate module in the general employee safety training. The inspectors determined that the training effectively identified NCS controlled parameters and facility NCS controls related to those parameters. The inspectors noted that the most important NCS controls were clearly identified and emphasized in the training materials.

The inspectors reviewed several NCS safety evaluation audits to determine that the NCS auditors were appropriately trained and qualified. The inspectors identified one individual who had performed several NCS safety evaluation audits who did not have the necessary management signoffs as required in plant procedure NFS-HS-A-49. The inspectors concluded that the issue was of minor safety significance as the individual no longer works for the company and did take all of the required NCS safety evaluation audit training. Although this issue must be corrected, it constitutes a violation of minor significance and is not subject to enforcement action in accordance with Section 2.2.2 of the Enforcement Policy.

c. Conclusions

A minor violation was identified during review of NCS safety evaluation auditor training and qualifications. No safety concerns were identified regarding the licensee NCS training 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 reviewed selected aspects of the following documents:

- NCS-2010-27, "NCS Audit of the NCSE for Handling Fissionable Materials in Portable Containers," Revision 0, dated August 23, 2010
- NCS-2010-28, "NCS Audit of the NCSE for Enclosure 8901," Revision 0, dated August 23, 2010
- NCS-2010-29, "NCS Audit of the NCSE for Enclosure 5901," Revision 0, dated August 27, 2010
- NCS-2010-30, "NCS Audit of the NCSE for Recovery Reagents," Revision 0, dated August 31, 2010
- NCS-2010-31, "NCS Audit of the NCSE for Enclosures 0804, 1901, 2901, and 3901," Revision 0, dated September 21, 2010
- NCS-2010-33, "NCS Audit of the NCSE for Enclosures 6901," Revision 0, dated September 21, 2010

- NCS-07-01, "NCSE for Cart and Rack use in CDL," Revision 1, dated September 2010

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'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.

The inspectors observed in the audit NCS-2010-30 that the licensee had observed in pervious audits that the facility has two general NCSEs that cover Reagents and Utilities in the facility. These are two general NCSEs that the licensee is working to split up into more specific analyses. Due to time constraints the licensee is unable to do all of the specific NCSEs at one time. The licensee has decided to perform the specific NCSEs as they fit into its schedule. The inspectors determined that, because of the way the licensee has determined to revise its general NCSEs in pieces, until all of the specific NCSEs are completed, there are two NCSEs covering some areas. The specific NCSEs contain the new and revised controls. The inspectors determined that the licensee has controls in place and so there is not a safety concern from revising the NCSEs this way, but this is not a good practice. The licensee's management committed to have a schedule for completing the last three specific NCSEs that will cover Reagents and Utilities. The licensee's commitment to provide a schedule during the next NCS inspection for the completion of their specific NCSEs that cover Reagents and Utilities will be tracked as **Inspector Follow-up Item (IFI) 70-143/2010-206-01**

c. Conclusions

No safety concerns were identified regarding the licensee NCS audits.

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

a. Inspection Scope

The inspectors reviewed the licensee 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 #27604, dated November 17, 2010
- PIRCS #27695, dated November 29, 2010
- PIRCS #27696, dated November 29, 2010
- PIRCS #27708, dated November 29, 2010
- PIRCS #27709, dated November 30, 2010

- PIRCS #27712, dated November 30, 2010

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 Criticality Alarm Systems (IP 88017)

a. Inspection Scope

The inspectors reviewed selected maintenance and calibration records and interviewed engineering staff to the adequacy of the licensee criticality alarm system. The licensee indicated that no new detector placement had occurred and no new coverage analyses had been performed.

b. Observations and Findings

The inspectors reviewed selected licensee internally-reported events and discussed them with engineering staff that dealt with the criticality alarm system, to determine that appropriate corrective actions had been performed. One of the internal events (PIRCS #27276) involved an employee concern about evacuating in inclement weather, and the other (PIRCS #27039) involved a routine hardware failure. The inspectors also reviewed the most recent sealed source inventory, indicating initial and current measured activity levels (as of August 1, 2010), and calibration reports for the four detectors that failed calibration tests this year. The licensee took appropriate corrective action with regard to these detectors (replacing or repairing the units). The inspectors also observed several operating detectors in the facility. The inspectors determined that the licensee's maintenance and testing of the criticality alarm system was appropriate.

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.

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

c. Conclusions

No safety concerns were identified during plant walkdowns.

8.0 Exit Meeting

The inspectors presented the inspection results to members of the licensee's management and staff during an exit meeting on December 9, 2010. The licensee acknowledged and understood the findings as presented.

SUPPLEMENTARY INFORMATION

1.0 List of Items Opened, Closed, and Discussed

Items Opened

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

Items Closed

None

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.

N. Brown Engineer, NCS
T. Coates Manager, Electrical & Instrumentation Engineering
R. Dailey Director, Operations
G. Darter Director, Project Management
R. Droke Senior Regulatory Advisor
J. Hughes Engineer, Quality
D. Lee Licensing Specialist
R. Maurer Engineer, NCS
B. Rice Engineer, NCS
L. Sanders Engineer, NCS
S. Sanders Manager, Training
R. Shackelford Manager, Nuclear Safety & Licensing
S. Skiles Engineer, NCS
J. Wheeler Manager, Licensing & ISA

NRC

T. Marenchin Criticality Safety Inspector, NRC Headquarters
C. Tripp Senior Criticality Safety Inspector
T. Briley Nuclear Engineer

All attended the exit meeting on December 9, 2010.

4.0 List of Acronyms and Abbreviations

ADU	ammonium diuranate
BPF	BLEU preparation facility
CDL	commercial development line
HEU	high-enriched uranium
IP	inspection procedure
LEU	low-enriched uranium
NCS	nuclear criticality safety
NCSE	nuclear criticality safety evaluation
NDA	nondestructive assay
NFS	Nuclear Fuel Services, Inc. (licensee)
PIRCS	Problem Identification, Resolution, and Corrective System
RFS	Reliable Fuel Supply
SNM	Special Nuclear Material