May 1, 2009

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

SUBJECT: INSPECTION REPORT NO. 70-143/2009-202

Dear Mr. Kudsin:

The U.S. Nuclear Regulatory Commission (NRC) conducted a routine announced criticality safety inspection at your facility in Erwin, Tennessee, from April 6-9, 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 April 9, 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 10 CFR 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 Agency-Wide 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 70-143/2009-202

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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.:	70-143/2009-202
Licensee:	Nuclear Fuel Services, Inc.
Location:	Erwin, TN
Inspection Dates:	April 6-9, 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. 70-143/2009-202

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), Erwin, Tennessee, facility from April 6-9, 2009. The inspection included an on-site review of the licensee's NCS program, NCS program administrative procedures, NCS-related audits, NCS-related internal event review and follow-up, the facility criticality accident alarm system, plant operation, and open item review. 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 the NCS program.
- No safety concerns were identified regarding the licensee's NCS inspections, audits, and investigations.
- No safety concerns were identified during a review of recent licensee investigation of internal events.
- No safety concerns were identified regarding the licensee's criticality accident alarm system coverage of fissile material operations.
- No safety concerns were identified during plant walkdowns.

REPORT DETAILS

1.0 Plant Status

NFS conducts HEU fuel fabrication, downblending, uranium recovery, waste processing, remediation, and decommissioning operations at its Erwin, Tennessee site. During the inspection, NFS was performing routine fuel fabrication, downblending, maintenance, and construction activities and was completing installation and testing of process equipment in the CD Line area.

2.0 Nuclear Criticality Safety Program (IP 88015, 88016)

a. Inspection Scope

The inspector 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:

- 54T-08-0010, Nuclear Criticality Safety Evaluation BLEU [blended low-enriched uranium] Preparation Facility Downblending," Revision 8, dated February 19, 2008
- 54T-08-0017, "Nuclear Criticality Safety Evaluation for the Blended Low Enriched Uranium Preparation Facility Solvent Extraction," Revision 7, dated March 2008
- 54T-08-0036, "Nuclear Criticality Safety Evaluation for BPF Liquid Waste Discard System," Revision 5, dated July 2008
- 54T-08-0014, "Nuclear Criticality Safety Evaluation of Lab B in Building 110 for the Transfer, Testing, and Disposition of BPF U Metal," Revision 0, dated January 12, 2009
- 54T-08-0048, "Nuclear Criticality Safety Evaluation of the Waste Drum Storage and the Bottle and Cylinder Storage Racks on the East Side of Building 306 East," Revision 1, dated February 3, 2009
- 54T-09-0019, "Nuclear Criticality Safety Evaluation for the Uranium Metal Sampling and the Uranium Metal Shear System," Revision 4, dated March 17, 2009
- 54X-09-0002, "Nuclear Criticality Safety Evaluation for Area E of Uranium Recovery Facility," Revision 6, dated March 18, 2009

b. Observations and Findings

The inspectors walked down several facility gloveboxes, including the glovebox in the CD Line process where the drain height deficiency was originally noticed. Several gloveboxes in the CD Line were having their depth mapped on a 6-inch by 6-inch grid by filling them with water during the course of the inspection. These gloveboxes had not been placed into service yet and therefore no Special Nuclear Material had been placed in them. The inspectors noted that the overall drain height was approximately 1/8" above the bottom of the glovebox, and that no significant deviation from flatness was observable to the naked eye. The licensee stated that it had measured a deviation of up to ½" in some cases, but that it was only over a small area in the glovebox. Based on the observed height of the drain lip and the small localized deviation from flatness, the

inspectors determined that the deviation had minor safety significance. The inspectors further noted that most of the gloveboxes were equipped with two inch diameter drain holes, and that the drain lines were transparent and filled with water. Blockages in the drain lines would most likely be observable as either a discoloration in the water or a cessation of the usual trembling of the water meniscus (gloveboxes are under negative pressure). The licensee also stated that it did periodic surveillance to detect blocked drain lines. Therefore the inspectors determined that exceeding the subcritical solution height in a glovebox would be extremely unlikely.

The inspectors reviewed the recently revised NCSE 54X-09-0002, to determine how much margin there was before criticality was possible. The licensee stated that, prior to being modified, the lips of its drains were designed to be approximately above the ½" bottom of the glovebox. With localized deviations from flatness up to ½", the maximum solution height was estimated to be 1". The licensee stated that its calculations for gloveboxes in this area demonstrated subcriticality with solution up to 2.6" deep. This would exceed the maximum volume that could credibly be fed to the glovebox.

The inspectors reviewed the sensitivity calculations for k_{eff} as a function of solution height, and determined that these results showed a large amount of margin to criticality. However, the inspectors noted that the licensee had originally modeled one glovebox with 12" of full water reflection, but as the solution depth increased, reduced the external reflection to 4". The calculations showed that the glovebox would be subcritical ($k_{eff} + 2\sigma < 0.95$) with a solution height of 2.6" with 4" external reflection. However, the glovebox would just be subcritical with a solution height of 1", if 12" external reflection were assumed. The NCSE did not provide any explanation of why less than full water reflection was assumed in the case with 2.6" of solution. The licensee stated that the glovebox integrity acted as a positive reflection control, but it was not clear to the inspectors how this could limit reflection conditions outside the glovebox. The licensee further stated that the license allows it to assume 4-inch thick water blocks to simulate personnel around equipment (i.e., "slabmen"), and that assuming a tight-fitting 4-inch thick water reflector all around the sides and top of the glovebox is clearly more conservative than this. The inspectors discussed the license requirements with the licensee's personnel and determined that they appear to require full water reflection whenever reflection is not controlled, and that use of the "slabmen" only appears to be allowed in the context of using nominal reflection (when a 1" tight-fitting water reflector is too conservative). The inspectors further noted that an unresolved item (**URI 70-143/2007-207-01**) on another aspect of modeling reflection was previously opened, which was closed based on the licensee's commitment to submit an amendment request to clarify the license commitments regarding reflection. The licensee did submit an amendment request to clarify the license requirements related to modeling of reflection, but subsequently withdrew it. During the course of this inspection, the licensee committed to re-submit its amendment request with more justification than was previously done, by the end of 2009. The submission of an amendment request to clarify the license requirements regarding modeling of reflection will be tracked as **Inspection Follow-Up Item (IFI) 70-143/2009-202-01.**

Because of the margin in the height of solution needed for criticality, the lack of spills in the affected gloveboxes, and the presence of redundant transparent drains, with all their attendant surveillance, the inspectors determined that the likelihood of criticality, and the

safety significance of the glovebox drain issue, was very low. The licensee's failure to adequately control the configuration of gloveboxes as required in the criticality evaluations is considered a violation of minor significance and will not be subject to formal enforcement action.

c. Conclusions

No safety concerns were noted regarding 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 reviewed selected aspects of the following documents:

- NCS-2009-01, "Nuclear Criticality Safety Audit for Area F," dated January 13, 2009
- NCS-2009-02, "Nuclear Criticality Safety Audit for OCB [Oxide Conversion Building] Natural Uranium and Scrap Uranium Dissolution," dated February 2, 2009
- NCS-2009-03, "Nuclear Criticality Safety Audit for OCB Product and Utility Pail Storage," dated February 3, 2009
- NCS-2009-04, "Nuclear Criticality Safety Audit for Area 800," dated March 2, 2009
- NCS-2009-05, "Nuclear Criticality Safety Audit for 105 Lab Sample Storage Rockets," dated March 10, 2009
- NCS-2009-06, "Nuclear Criticality Safety Audit for Area 500 and 400 Discard Column," dated March 12, 2009
- NFS-HS-A-16, "Safety Audits and Inspections," Revision 10, dated July 31, 2007

b. Observations and Findings

The inspectors reviewed the above audits conducted since the previous inspection, and determined that there were no observations or findings in many of the audits. The audit 2009-01 did have an observation concerning outdated NCSE documentation, but the inspectors determined that the licensee took appropriate corrective action. Audits 2009-03 and 2009-05 noted that several previously opened Problem Identification, Resolution and Corrective System (PIRCS) remained open. The inspectors reviewed a sampling of these (PIRCS 8379 and 9206) and determined that they were mainly documentation concerns, as all safety controls were maintained, and that resolution in the corrective action program was pending. The inspectors reviewed the audit checklist and determined that they were thorough and covered all aspects of engineered and administrative control flowdown. No safety concerns were identified.

c. Conclusions

No safety concerns were identified regarding the licensee's NCS inspections, audits, and investigations. Issues were appropriately tracked and resolved in the licensee's PIRCS program.

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 the licensee's staff regarding immediate and long-term corrective actions. The inspectors reviewed selected aspects of the following documents:

- PIRCS Item170801 – Cheesecloth Observed in an Unapproved Container, dated January 29, 2009
- PIRCS Item17092 – NCS Identified an Unfavourable Geometry Container, dated January 30, 2009
- PIRCS Item17387 – SLC [station limit card] was found with its view Obstructed, dated February 19, 2009
- PIRCS Item17646 – Enclosure did not have a SLC, dated March 9, 2009
- PIRCS Item 18119 – Mass Limit of Container Exceeded, dated April 3, 2009
- PIRCS Item18209 – NCS Spacing Requirement, dated April 9, 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 the licensee's 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 Accident Alarm System (IP 88017)

a. Inspection Scope

The inspectors reviewed documentation of Criticality Accident Alarm System (CAAS) coverage, interviewed engineering and maintenance staff, and performed facility walkdowns to determine the adequacy of the licensee's CAAS. The inspectors reviewed selected aspects of the following documents:

- 21T-08-0449, "The NFS Problem Identification, Resolution, and Correction System (PIRCS)," Revision 8, dated August 25, 2008
- PIRCS Item16715 – Criticality Alarm Reading High During Calibration, dated January 1, 2009
- PIRCS Item17559 – Auxiliary Criticality Panel Trouble, dated March 1, 2009
- PIRCS Item17636 – Criticality Alarm Low Count Failure, dated March 6, 2009
- PIRCS Item17896 – Criticality System Alarm Error Message, dated March 22, 2009
- PIRCS Item17953 – Criticality Alarm Low Count Failure, dated March 30, 2009

b. Observations and Findings

The inspectors verified that the licensee's internal reportable events dealing with the criticality accident alarm detectors. The inspector observed that corrective actions were taken to prevent recurrence of the events. The inspector had no safety concerns regarding the licensee's criticality accident alarm system.

c. Conclusions

No safety concerns were identified regarding the licensee's criticality accident alarm system coverage of fissile material operations.

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. Before and during walkdowns, the inspectors interviewed operations staff and NCS engineers.

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.

7.0 Open Item Review

IFI 70-143/2008-208-01

This item tracked the licensee's corrective actions to justify the basis for independence when crediting repeated failures of a single items relied on for safety (IROFS), as part of the double contingency discussion in NCSEs. During this inspection, the inspectors reviewed the changes to NFS procedure NFS-HS-A-58, "Nuclear Criticality Safety Evaluations," Revision 11, dated March 27, 2009. Revision to this procedure was part of the corrective action for PIRCS 16531 (December 11, 2008). The inspectors verified that the licensee had added a requirement to justify the basis for independence when crediting repeated failures of a single IROFS, but did not provide any more specific guidance on how this is to be done. No new or revised NCSEs have been developed since the current revision of this procedure has gone into effect. Because of the lack of specific guidance in the procedure, or any examples to provide assurance that this requirement will be implemented correctly, this item will remain open until inspectors can review its implementation.

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 9, 2009. The licensee acknowledged and understood the findings as presented.

SUPPLEMENTARY INFORMATION

1.0 List of Items Opened, Closed, and Discussed

Items Opened

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

Items Closed

None

Items Discussed

IFI 70-143/2008-208-01	Tracks the licensee's corrective actions to justify the basis for independence when crediting repeated failures of a single IROFS as part of double contingency discussion in NCSEs.

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, Engineering Section
R. Droke	Director, Licensing / Safety
T. Finan	KAPL Resident
D. Gardner	Licensing
N. Kenner	Director, Human Performance
D. Kudsin	President
J. Miller	Licensing/Compliance
M. Moore	Director, Safety and Regulatory
R. Shackelford	Manager, NCS
S. Sanders	Manager, Training
M. Tester	Senior Manager, Radiological Control
A. Vaughan	Director, Fuel Production
J. Wheeler	Manager, Licensing & Integrated Safety Analysis

NRC

S. Burris	Senior Resident Inspector, NRC Region II
G. Smith	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 April 9, 2009.

4.0 List of Acronyms and Abbreviations

BLEU	blended low-enriched uranium
BPF	blended low-enriched uranium processing facility
CAAS	Criticality Accident Alarm System
HEU	high-enriched uranium
IP	inspection procedure
IROFS	items relied on for safety
NCS	nuclear criticality safety
NCSE	nuclear criticality safety evaluation
NFS	Nuclear Fuel Services, Inc. (licensee)
OCB	Oxide Conversion Building
PIRCS	Problem Identification, Resolution, and Corrective System
SLC	station limit card
URI	unresolved item