August 27, 2007

Mr. Dwight B. Ferguson, President
and Chief Executive Officer
Nuclear Fuel Services, Inc.
P.O. Box 337, MS 123
Erwin, TN 37650

SUBJECT: INSPECTION REPORT NO. 70-143/2007-205

Dear Mr. Ferguson:

The U.S. Nuclear Regulatory Commission (NRC) conducted a routine announced criticality safety inspection at your facility in Erwin, Tennessee, from August 6 - 10, 2007. 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 August 10, 2007.

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 capable, 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.

[redacted]

[redacted]

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

Sincerely,

/RA/

Deborah A. Jackson, Chief
Technical Support Branch
Division of Fuel Cycle Safety
and Safeguards

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

Enclosure: Inspection Report 70-143/2007-205

[redacted]

[redacted]

[redacted]

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

Sincerely,

/RA/

Deborah A. Jackson, Chief
Technical Support Branch
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and Safeguards

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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.:	70-143/2007-205
Licensee:	Nuclear Fuel Services, Inc.
Location:	Erwin, TN
Inspection Dates:	August 6 - 10, 2007
Inspectors:	Tamara Powell, Criticality Safety Inspector Thomas Marenchin, Criticality Safety Inspector
Approved by:	Deborah A. Jackson, Chief Technical Support Branch Division of Fuel Cycle Safety and Safeguards, NMSS

Enclosure

[redacted]

EXECUTIVE SUMMARY

Nuclear Fuel Services, Inc.
NRC Inspection Report No. 70-143/2007-205

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 August 6 - 10, 2007. The inspection included an on-site review of the licensee programs involving the NCS program, inspections, audits, and investigations, plant operations, NCS event review and follow-up, and open items. The licensee programs were acceptably directed toward the protection of public health and safety and in compliance with NRC regulatory requirements. The inspection focused on risk-significant [redacted] material processing activities including the blended low-enriched uranium (BLEU) Oxide Conversion Building (OCB), the BLEU Uranyl Nitrate Building (UNB), and the BLEU Effluent Processing Building (EPB).

Results

- The NCS program was adequate for maintaining acceptable levels of safety.
- The licensee NCS audits were adequate for maintaining acceptable levels of safety.
- No safety concerns were identified during a review of recent licensee investigation of internal events.
- Plant operations involving [redacted] materials were conducted safely and in accordance with written procedures.
- No safety concerns were noted regarding licensee NCS evaluations.
- Licensee criticality accident alarm detectors provided adequate coverage of [redacted] operations to reliably detect the minimum accident of concern.

REPORT DETAILS

1.0 Plant Status

Nuclear Fuel Services, Inc. (NFS) conducts [redacted] downblending, uranium recovery, waste processing, and decommissioning operations at its Erwin, Tennessee site. During the inspection, NFS was performing routine fuel fabrication and maintenance operations.

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:

- 21T-04-0123, "ISA [Integrated Safety Analysis] Risk Assessment Procedure," Revision 3, dated March 24, 2004
- 21T-05-1758, "Verification and Validation of Nuclear Criticality Safety Analysis Codes," Revision 4, dated October 5, 2005
- 21T-06-1874, "Nuclear Criticality Safety Posting Procedure," Revision 1, dated October 18, 2006
- 21T-07-0331, "Identification and Control of Items Relied on for Safety (IROFS) Procedure," Revision 2, dated May 21, 2007
- 21T-07-0397, "Items Relied on for Safety (IROFS) and Safety-Related Equipment (SRE)[redacted]," Revision 3, dated June 25, 2007
- 54T-07-0029, "Control Flowdown and Field Verification [redacted]," Revision 4, dated July 27, 2007

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.

c. Conclusions

The NCS program was adequate for maintaining acceptable levels of safety.

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:

- NFS-HS-A-16, "Safety Audits and Inspections," Revision 10, dated July 31, 2007
- 21T-07-0313, NCS-2007-08, "NCS Audit of the Nuclear Criticality Safety [redacted] (Fourth Audit)," dated April 11, 2007
- 21T-07-0329, NCS-2007-09, "NCS Audit of the NCSE [redacted] (First Audit)," dated March 30, 2007
- 21T-07-0330, NCS-2007-10, "NCS Audit of the BLEU Complex UNB (Second Audit)," dated April 2, 2007
- 21T-07-0359, NCS-2007-11, "Fourth NCS Audit of the NCSE [redacted]," dated May 2, 2007
- 21T-07-0363, NCS-2007-12, "NCS Audit of the Waste Water Treatment Facility (Fourth Audit)," dated May 2, 2007
- 21T-07-0368, NCS-2007-13, "NCS Audit of the NCSE [redacted]," dated May 16, 2007
- 21T-07-0369, NCS-2007-14, "Third NCS Audit of the NCSE [redacted]," dated May 10, 2007
- 21T-07-0412, NCS-2007-15, "Fourth NCS Audit [redacted] Nuclear Criticality Safety Analysis - Spilled Materials," dated June 5, 2007
- 21T-07-1009, NCS-2007-16, "NCS Audit of the NCSE [redacted]," dated July 4, 2007
- 21T-07-1363, NCS-2007-17, "NCS Audit of the Nuclear Criticality Safety Analysis [redacted]," dated July 11, 2007
- 21T-07-1382, NCS-2007-19, "NCS Audit for the NCSE for the OCB's HEPA [High-Efficiency Particulate Air] Filer Reduction Enclosure, Revision 0, First Audit," dated July 31, 2007

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 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

The licensee NCS audits were adequate for maintaining acceptable levels of safety.

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

a. Inspection Scope

The inspectors reviewed the licensee response to an NCS-related reportable event. 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:

- 21T-07-0014, "The NFS Problem Identification, Resolution, and Corrections System (PIRCS)," Revision 7, dated March 13, 2007
- PIRCS Problem ID 9833, dated May 7, 2007
- PIRCS Problem ID 10145, dated June 12, 2007
- PIRCS Problem ID 10165, dated June 13, 2007
- PIRCS Problem ID 10181, dated June 14, 2007
- PIRCS Problem ID 10197, dated June 15, 2007
- PIRCS Problem ID 10328, dated June 28, 2007
- PIRCS Problem ID 10369, dated July 3, 2007
- PIRCS Problem ID 10390, dated July 9, 2007
- PIRCS Problem ID 10569, dated August 1, 2007
- PIRCS Problem ID 10587, dated August 2, 2007

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.

[redacted]

5.0 Plant Activities (IP 88015)

a. Inspection Scope

The inspectors performed plant walkdowns to review activities in progress and to determine whether risk-significant [redacted] 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:

- 21T-06-1874, "Nuclear Criticality Safety Posting Procedure," Revision 1, dated October 18, 2006
- 21T-07-0331, "Identification and Control of Items Relied on for Safety (IROFS) Procedure," Revision 2, dated May 21, 2007
- 54T-07-0015, "Nuclear Criticality Safety Evaluation [redacted]," Revision 3, dated May 2, 2007
- 54T-07-0029, "Control Flowdown and Field Verification [redacted]," Revision 4, dated July 27, 2007
- 54X-07-0006, "[redacted]," Revision 1, dated February 6, 2007

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 had good interfaces with operators on the process floors. No issues were identified during these walkdowns. 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 to acceptable levels.

c. Conclusions

Plant operations involving [redacted] materials were conducted safely and in accordance with written procedures.

6.0 Nuclear Criticality Safety Evaluations and Analyses (IP 88016)

a. Inspection Scope

The inspectors reviewed NCS analyses to determine that criticality safety of risk-significant operations was ensured through engineered and administrative controls with

[redacted]

adequate safety margin including preparation and review by qualified staff. The inspectors accompanied NCS and other technical staff on walkdowns of NCS controls in selected plant areas. The inspectors review selected aspects of the following documents:

- 54T-05-0036, "Validation [redacted]," Revision 1, dated September 2005
- 21T-06-0561, "Nuclear Criticality Safety Evaluations (NCSE)," Revision 10, dated February 17, 2006
- 54T-07-0015, "NCSE [redacted] Revision 3, dated May 2, 2007
- 54T-07-0017, "Addendum 4 to Rev. 0 of the NCSE [redacted]" Revision 0, dated May 16, 2007
- 54T-07-0020, "NCSE [redacted] Revision 4, dated May 24, 2007
- 54T-07-0005, "NCSE [redacted] Revision 1, dated February 5, 2007
- 54X-06-0022, "NCSE [redacted] Facility," Revision 1, dated January 21, 2007

b. Observations and Findings

The inspectors reviewed NCS Approvals, NCS Evaluations, and supporting calculations for new, changed, and other selected operations. Within the selected aspects reviewed, the inspectors determined that the analyses 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 identified a weakness in the documentation of IROFS in 54T-07-0015. In the NCSE the licensee had identified three enclosures that have [redacted] spacer barrier installed in the inside of the enclosure to keep material away from the wall of the enclosure. [redacted] spacer barrier was intended to be documented as an IROFS for all three enclosures but was only documented for one of the enclosures. All three spacer barriers were verified and implemented as if there were IROFS. The licensee updated the NCSE, 54T-07-0015, and ISA table, 21T-07-0397, to identify all the spacer barriers for the three enclosures as IROFS. The inspectors determined that NCS controls for equipment and processes assured the safety of the operations. Nuclear criticality safety analyses and supporting calculations demonstrated adequate identification and control of NCS hazards to assure operations within subcritical limits.

c. Conclusions

No safety concerns were noted regarding licensee NCS evaluations.

7.0 Criticality Alarm Systems (IP 88017)

a. Inspection Scope

The inspectors reviewed documentation of criticality accident alarm detector coverage, interviewed engineering and maintenance staff, and performed facility walkdowns to determine the adequacy of the licensee criticality alarm system. The inspectors reviewed selected aspects of the following documents:

- 21T-07-0185, "Operation and Testing of the [redacted] System," Revision 25, dated February 28, 2007
- PIRCS Problem ID 10181, dated June 14, 2007
- PIRCS Problem ID 10197, dated June 15, 2007
- PIRCS Problem ID 10328, dated June 28, 2007

b. Observations and Findings

The inspectors verified that the licensee's placement of criticality accident alarm detectors has been established in accordance with the criteria described in 10 CFR 70.24. The inspectors reviewed criticality accident alarm system placement calculations to determine the adequacy of models, assumptions, and results and visually inspected detector configuration.

c. Conclusions

Licensee criticality accident alarm detectors provided adequate coverage of [redacted] operations to reliably detect the minimum accident of concern.

8.0 Open Item Followup

IFI 70-143/2005-205-02, 2005-205-04, and 2005-205-08

These items track licensee commitments to clarify facility validation. The inspectors discussed the licensee's actions to address the various validation-related issues. The licensee expects that with the issuance of American Nuclear Standards Institute/American Nuclear Society (ANSI/ANS) 8.24, "Validation of Neutron Transport Methods for Nuclear Criticality Safety Calculations," and the NRC's Fuel Cycle Safety and Safeguards Interim Staff Guidance-10, "Justification for Minimum Margin of Subcriticality for Safety," that they are now in a position to have these validation reports updated by the end of the year. When the validations reports are updated to address the commitments they will be reviewed as part of the normal inspection and will no longer be tracked as IFIs. These items are closed.

IFI 70-143/2005-205-09

This item tracks the licensee's resolution of inconsistencies between the validation reports and the procedure, and correcting the methods used to verify adequacy of the margin (HEU operation validations 54T-04-0043 and WRS-97-001). During this inspection, the inspectors reviewed the updated validation report, 54T-05-0036, and procedure, 21T-05-1758. Both the validation report and the procedure had been updated to remove the inconsistencies between them and the methods used to verify adequacy of the margin had been clarified. This item is closed.

IFI 70-143/2005-208-02

This item tracks licensee actions to amend Safety Condition S-9 of the license to eliminate references to ANSI/ANS series standards and clarify the meaning of "published experimental data." During this inspection the licensee indicated that work on this open item has not begun yet. This item remains open.

URI 70-143/2006-205-03

This item tracks splitting a downblending accident sequence into additional sequences. During this inspection, the licensee provided documentation clarifying the licensee position on the URI. The inspectors reviewed the position paper, BPF ISA and the NCSE for the process. The inspectors determined that in this case, splitting the downblending accident sequence into two sequences did not create a new accident sequence because the original sequence bounded any means of transferring additional solution. The inspectors also noted that the criticality controls did not change. This item is closed.

IFI 70-143/2007-202-02

This item tracks commitment to clarify license commitments regarding calculation of effective neutron multiplication factor (k_{eff}) and the use of positive bias. During this inspection the licensee indicated that work on this open item has not begun yet. This item remains open.

9.0 Exit Meeting

The inspectors presented the inspection results to members of the licensee's management and staff during an exit meeting on August 10, 2007. The licensee acknowledged and understood the findings as presented.

[redacted]

SUPPLEMENTARY INFORMATION

1.0 List of Items Opened, Closed, and Discussed

Items Opened

None

Items Closed

IFI 70-143/2005-205-02	Tracks determination of appropriate experimental uncertainties and the reason for the observed spread in effective neutron multiplication factor (k_{eff}) (BLEU validations 54T-03-0053 and 54T-03-0009)
IFI 70-143/2005-205-04	Tracks specification of which materials cover which portions of the area of applicability (AOA) in BLEU validation reports (BLEU validations 54T-03-0054 and 54T-03-0009)
IFI 70-143/2005-205-08	Tracks the licensee's determination of the appropriate bounds of the defined AOA in the validation reports covering HEU operations (HEU operation validations 54T-04-0043 and WRS-97-001)
IFI 70-143/2005-205-09	Tracks the licensee's resolution of inconsistencies between the validation reports and the procedure, and correcting the methods used to verify adequacy of the margin (HEU operation validations 54T-04-0043 and WRS-97-001)
URI 70-143/2006-205-03	Tracks splitting a downblending accident sequence into additional sequences

Items Discussed

IFI 70-143/2005-208-02	Tracks licensee actions to amend Safety Condition S-9 of the license to eliminate references to American Nuclear Standards Institute/American Nuclear Society (ANSI/ANS) series standards and clarify the meaning of "published experimental data"
IFI 70-143/2007-202-02	Tracks commitment to clarify license commitments regarding calculation of k_{eff} and the use of positive bias

Attachment

[redacted]

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, E&I Section
*R. Crowe	Manager, Corrective Actions Program
*L. Davis	Admin, Security Training
*R. Droke	Director, Licensing / Safety
*D. Ferguson	CEO
*T. Lindstrom	Executive Vice President, HEU Operations
*R. Mauer	Engineer, NCS
*M. McKeehan	Manager, Transportation and Waste
*B. Moore	Vice President, Safety and Regulatory
*J. Nagy	Senior Licensing and Regulatory Compliance Officer
*R. Shackelford	Manager, NCS
*M. Shope	Manager, Quality Assurance
*J. Taylor	Manager, Security Training
*A. Vaughan	Director, Fuel Production
*J. Wheeler	Manager, Licensing and ISA
*N. Willis	Manager, Security Compliance

NRC

*S. Burris	Senior Resident Inspector, NRC Region II
*G. Smith	Resident Inspector, NRC Region II
*O. Smith	Physical Security Inspector, NRC Region II
*T. Powell	Criticality Safety Inspector, NRC Headquarters
*T. Marenchin	Criticality Safety Inspector, NRC Headquarters

*Attended the exit meeting on August 10, 2007.

4.0 List of Acronyms and Abbreviations

ANSI/ANS	American Nuclear Standards Institute/American Nuclear Society
AOA	area of applicability
BLEU	blended low-enriched uranium
EPB	Effluent Processing Building
HEPA	high-efficiency particulate air
HEU	high-enriched uranium
IFI	inspector followup item
IP	inspection procedure

IROFS	item relied on for safety
ISA	integrated safety analysis
k_{eff}	effective neutron multiplication factor
NCS	nuclear criticality safety
NCSE	nuclear criticality safety evaluation
NDA	non-destructive analysis
NFS	Nuclear Fuel Services, Inc. (licensee)
OCB	Oxide Conversion Building
PIRCS	Problem Identification, Resolution, and Corrective System
SRE	Safety Related Equipment
UNB	Uranyl Nitrate Building
URI	unresolved item