April 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. 70-143/2007-202

Dear Mr. Ferguson:

The U.S. Nuclear Regulatory Commission (NRC) conducted a routine announced criticality safety inspection at your facility in Erwin, Tennessee, from March 26 - 30, 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 March 30, 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 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.

D. B. Ferguson

If you have any questions concerning this report, please contact Tamara Powell, of my staff, at (301) 415-5095.

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Sincerely,

/RA/

Melanie A. Galloway, Chief Technical Support Branch Division of Fuel Cycle Safety and Safeguards, NMSS

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

Enclosure: Inspection Report 70-143/2007-202

D. B. Ferguson

If you have any questions concerning this report, please contact Tamara Powell, of my staff, at (301) 415-5095.

Sincerely,

/RA/

Melanie A. Galloway, Chief Technical Support Branch Division of Fuel Cycle Safety and Safeguards, NMSS

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

Enclosure: Inspection Report 70-143/2007-202

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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.:	70-143/2007-202
Licensee:	Nuclear Fuel Services, Inc.
Location:	Erwin, TN
Inspection Dates:	March 26 - 30, 2007
Inspectors:	Tamara Powell, Criticality Safety Inspector Thomas Marenchin, Criticality Safety Inspector
Approved by:	Melanie A. Galloway, Chief Technical Support Branch Division of Fuel Cycle Safety and Safeguards, NMSS

Enclosure

EXECUTIVE SUMMARY

Nuclear Fuel Services, Inc. NRC Inspection Report No. 70-143/2007-202

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 March 26 - 30, 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 material processing activities including the **MCCB**, 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 Integrated Safety Analysis (ISA) and items relied on for safety (IROFS) were adequate for maintaining acceptable levels of safety.
- The licensee NCS audits were adequate for maintaining acceptable levels of safety.
- Plant operations involving **materials** were conducted safely and in accordance with written procedures.
- An unresolved item was identified regarding the adequacy of management measures applied to the new module installed in the in-line monitor system (ILMS) to ensure that the system is able to perform its safety function when needed.

REPORT DETAILS

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1.0 Plant Status

Nuclear Fuel Services, Inc. (NFS) conducts

operations at its Erwin, Tennessee site. During the inspection, NFS was performing routine fuel fabrication and maintenance operations.

2.0 Nuclear Criticality Safety Program (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-06-2004, "Evaluation of Normality (Validation Data)," Revision 0, dated December 5, 2006 21T-06-2025, "Evaluation ," dated December 18, 2006 54T-06-0047, "Nuclear Criticality Safety Evaluation Revision 10, dated November 13, 2006 54T-06-0050, "Nuclear Criticality Safety Evaluation for BPF Revision 2, dated December 12, 2006 54T-06-0052, "Control Flowdown and Field Verification for BPF Revision 4, dated December 12, 2006 54T-07-0004, "Nuclear Criticality Safety Evaluation for the Blended Low Enriched. Uranium Preparation Facility ," Revision 10, dated February 22, 2007 54T-07-0005, "Control Flowdown and Field Verification for BPF Revision 8, dated February 26, 2007 54T-07-0008, "Control Flowdown and Field Verification for the BPF ", Revision 8, dated February 27, 2007 NFS-HS-A-21, "Operation and Testing of the Alarm Systems," Revision 25, dated February 28, 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.

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c. <u>Conclusions</u>

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

3.0 Review of Integrated Safety Analysis and Items Relied on for Safety (IP 88015)

a. <u>Inspection Scope</u>

The inspectors reviewed the facility ISA to determine that appropriate criticality safety accident sequences were identified and controlled consistent with approved criticality safety analysis. The inspectors reviewed several NCS-related passive engineered controls identified as IROFS to determine that performance requirements were met for selected accident sequences. During walkdowns, the inspectors evaluated the effectiveness of the IROFS to assure adequate subcritical margin for normal and credible abnormal conditions. The inspectors reviewed selected aspects of the following documents:

- 21T-06-0561, NFS-HS-A-58, "Nuclear Criticality Safety Evaluations," Revision 10, dated February 17, 2006
- 21T-06-1046, NFS-HS-A-62, "Implementation of Nuclear Criticality Safety Evaluations," Revision 4, dated April 4, 2006
- 21T-06-1465, NFS-NCSE-NCSAEG, "Nuclear Criticality Safety Evaluation/Analysis Writer's Guide," Revision 7, dated June 9, 2006
- 21T-07-0007, NFS-GH-43, "Safety-Related Equipment Control Program," Revision 14, dated March 3, 2007
- JKW-06-008, "General Items Relied on for Safety (IROFS) and Safety Related Equipment (SRE) Revision 21, dated February 21, 2007

b. Observations and Findings

The inspectors reviewed selected ISA accident sequences related to NCS and established that the accident sequences and controls corresponded with approved facility criticality safety analyses. The inspectors reviewed ISA accident sequences involving uranium analyzers declared as IROFS in the OCB system. The inspectors noted that the licensee had identified appropriate accident sequences and had declared appropriate engineered features as IROFS.

c. Conclusions

The ISA and IROFS were adequate for maintaining acceptable levels of safety.

4.0 Inspections, Audits, and Investigations (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:

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November 27, 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 corrective action program and resolved in a timely manner. The inspectors had no concerns regarding the identification, assignment and tracking of corrective actions. No safety concerns were noted.

c. <u>Conclusions</u>

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

5.0 Plant Activities (88015)

a. Inspection Scope

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

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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. <u>Conclusions</u>

Plant operations involving **materials** were conducted safely and in accordance with written procedures.

6.0 Nuclear Criticality Safety Event Review and Follow-up (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:

- 21G-07-0018, "30-Day Written Notification of Event (NRC Event No. 43090)," dated February 6, 2007
- PIRCS [Problem Identification, Resolution, and Correction System] Problem ID 9016
- 54T-07-0010, "Nuclear Criticality Safety Evaluation for BPF Liquid Waste Discard System," Revision 4, dated March 20, 2007
- Control Flowdown and Field Verification for BPF Liquid Waste Discards," Revision 3, dated March 20, 2007
- NFS-GH-56, "Management Measures Identification and Implementation for IROFS," Revision 3, dated August 2, 2004
- NFS-GH-43, "Safety-Related Equipment Control Program," dated June 28, 2005
 - SRE Test," dated July 15, 2006

b. Observations and Findings

On January 11, 2007, the licensee notified the NRC of an event involving the **Second** condensate ILMS. During the routine 6-month calibration of the ILMS, the licensee observed that the calibration could not be completed and that the spectrum appeared to have wide, short peaks which were not normal. In response, the licensee shut down the condensate discard system, entered a report into its PIRCS, and notified the NRC. The in-line monitor is identified as an active engineered IROFS in the ISA, and the failure of this IROFS left only one IROFS in place. The probable cause of the event was a partial failure of the voltage supply on the multi-channel analyzer (MCA) board. The licensee replaced the MCA board and re-tested and re-calibrated the system. The inspectors noted that the licensee contacted the manufacturer of the ILMS, which indicated that a failure of this type was not anticipated for the ILMS. The licensee's corrective actions included adding a module that would alarm if the system voltage was not within its operating range.

The inspectors noted that SRE testing of the ILMS did not include testing of the new module. The licensee indicated that the module was tested to be operable prior to installation, but there were no plans in place to test the module further. Appropriate management measures are required to be applied to all IROFS. Functional testing of the new module appears to be an appropriate management measure to ensure continued operability. The review of the licensee's management measures applied to the new module of the ILMS to ensure that the ILMS is able to perform is safety function when needed is **Unresolved Item (URI) 70-143/2007-202-01**.

c. Conclusions

An unresolved item was identified regarding the adequacy of management measures applied to the new module installed in the ILMS to ensure that the system is able to perform its safety function when needed.

7.0 Open Item Followup

IFI 70-143/2005-205-02

This item tracks the 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). During this inspection, the licensee acknowledged that little work had been done to close the item, but the work is expected be completed by 12/31/07. This item remains open.

IFI 70-143/2005-205-03

This item tracks the impact of non-normality of experiments on the 0.97 limit for low enriched uranium (LEU) operations (BLEU validations 54T-03-0054 and 54T-03-0009) and failure to consider normality of data in other validations (HEU operation validations 54T-04-0043 and WRS-97-001). During this inspection, the inspectors reviewed 21T-06-2025 and 21-06-2004, which deal with "Evaluation of Non-Normality and "Evaluation of Normality (Validation Data)." The inspectors determined that there is no impact on non-normality of experiments operations. Additionally, the licensee performed a on the 0.97 limit for validation data. The inspectors determined that there is no normality test on the impact on the Upper Safety Limit (USL) calculation associated with the validation report. This item is closed.

IFI 70-143/2005-205-04

This item 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). During this inspection, the licensee acknowledged that little work had been done to close the item, but the work is expected be completed by 12/31/07. This item remains open.

VIO 70-143/2005-205-05

This item tracks the failure to prohibit use of positive bias in calculating USL values for HEU operations. During a previous inspection, the inspectors determined that the licensee violated its validation procedure by using positive bias in calculating the USL, which resulted in a USL greater than the maximum allowed k_{eff} . During this inspection, the inspectors reviewed the licensee's corrective actions which included updating the validation reports and revising procedure NFS-HS-A-63, "Verification and Validation of Nuclear Criticality Safety Analysis Codes." The procedure was revised to clarify that positive bias values are assumed to be zero when determining the USL. The inspectors verified that the corrective actions were complete. This item is closed.

IFI 70-143/2005-205-06

This item tracks the licensee's commitment to revise the validation report to correctly calculate the USL (BLEU 54T-03-0054, 54T-03-0009, and any others affected). During a previous inspection, the inspectors determined that the licensee was using a 95/99.9 confidence criterion in implementing the single-sided lower tolerance method instead of the 95/95 single-sided lower tolerance method as stated in License Condition S-10. During this inspection, the inspectors verified that the validation reports correctly calculated the USL without crediting positive bias. The inspectors also verified that an assessment had been done to confirm that other validation reports were not affected. This item is closed.

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IFI 70-143/2005-205-07

This item tracks the licensee's commitment to maintain the current prohibition on the use of positive bias in procedure NFS-HS-A-63, and to clarify license commitments regarding calculation of k_{eff} and the use of positive bias. This item was closed in Inspection Report 70-143/2006-205; however, the second part of the IFI relating to clarifying license commitments had not been completed and will be tracked as **Inspector Followup Item (IFI) 70-143/2007-202-02.**

IFI 70-143/2005-205-08

This item 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). During this inspection, the licensee acknowledged that little work had been done to close the item, but the work is expected be completed by 12/31/07. This item remains open.

IFI 70-143/2005-205-09

This item tracks the licensee's resolution of inconsistencies between the validation reports and the procedure NFS-HS-A-63, "Verification and Validation of Nuclear Criticality Safety Analysis Codes," and correcting the methods used to verify adequacy of the margin of subcriticality (HEU operation validations 54T-04-0043 and WRS-97-001). During this inspection, the licensee provided supporting documentation; however, the inspectors were unable to complete their review of this information. This item remains open.

IFI 70-143/2005-208-02

This item tracks the licensee's 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." During this inspection, the licensee acknowledged that little work had been done to close the item, but the work is expected to be completed by 8/1/07. This item remains open.

VIO 70-143/2006-205-01

This item concerned the licensee's failure to have dual criticality accident alarm system (CAAS) detector coverage at the Waste Water Treatment Facility (WWTF) as required by 10 CFR 70.24. During a previous inspection, the inspectors observed that the CAAS **Exercise**, which covers **Exercise** of the **Exercise**, only had one detector in service. During this inspection, the inspectors reviewed the licensee's revision to procedure NFS-HS-A-21. The inspectors determined that the licensee adequately completed the necessary corrective actions to both address the violation and prevent recurrence. This item is closed.

IFI 70-143/2006-205-02

This item tracks the licensee's review of the adequacy of its lightning protection system to perform its safety function. During a previous inspection, inspectors investigated an event which had taken place at the facility involving an electrical storm. The inspectors noted that the electrical storm had disabled one of two Victoreen detectors and the audible alarm system for the BLEU complex criticality accident alarm system. During this inspection, the licensee communicated to the inspectors that the design review of its lightning protection system is ongoing. The design review includes: collection of all licensee drawings on lightning protection, conformation of field installation to conformance to drawings, and review of alternate lightning protection. The design review of the lightning protection system is expected to be completed by June 2007. This item remains open.

URI 70-143/2006-205-03

This item tracks splitting a downblending accident sequence into additional sequences. During a previous inspection, the inspectors questioned whether the creation of additional sequences should have resulted in an amendment under 10 CFR 70.72. During this inspection, the licensee provided documentation clarifying its position. The inspectors reviewed the licensee's position and determined that this item should remain open pending guidance from NRC on 10 CFR 70.72.

IFI 70-143/2006-207-01

This item tracks the licensee's revision to the safety audit procedure to require that all recommended corrective actions be entered into PIRCS, along with an appropriate reference to work orders or other documentation for corrective actions completed during the audit. During this inspection, the inspectors noted that the licensee's procedure for safety audits and inspections, NFS-HS-A-16, had been revised to include guidance on the entry of all recommended corrective actions into PIRCS. The inspectors also noted that in recently completed audits the guidance was being followed. This item is closed.

8.0 Exit Meeting

The inspectors presented the inspection results to members of the licensee's management and staff during an exit meeting on March 30, 2007. The licensee acknowledged and understood the findings as presented.

SUPPLEMENTARY INFORMATION

1.0 List of Items Opened, Closed, and Discussed

Items Opened

URI 70-143/2007-202-01 Tracks the adequacy of the licensee's management measures applied to the new module installed in the ILMS to ensure that the system is able to perform its safety function when needed.

Items Closed

IFI 70-143/2005-205-03 Tracks the impact of non-normality of **Exercise** experiments on the 0.97 limit for LEU operations (BLEU validations 54T-03-0054 and 54T-03-0009) and failure to consider normality of data in other validations (HEU operation validations 54T-04-0043 and WRS-97-001).

VIO 70-143/2005-205-05 Tracks failure to prohibit use of positive bias in calculating USL values for HEU operations.

IFI 70-143/2005-205-06 Tracks commitment to revise the validation report to correctly calculate the USL (BLEU 54T-03-0054, 54T-03-0009, and any others affected).

VIO 70-143/2006-205-01 Failure to have dual CAAS detector coverage at the WWTF as required by 10 CFR 70.24.

IFI 70-143/2006-207-01 Tracks the licensee's revision to the safety audit procedure to require that all recommended corrective actions be entered into PIRCS, along with an appropriate reference to work orders or other documentation for corrective actions completed during the audit.

Items Discussed

IFI 70-143/2005-205-02

Tracks determination of appropriate experimental uncertainties and the reason for the observed spread in 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 AOA in BLEU validation reports (BLEU validations 54T-03-0054 and 54T-03-0009).

Attachment

IFI 70-143/2005-205-07	Tracks the licensee's commitment to maintain the current prohibition on the use of positive bias in procedure NFS-HS-A-63, and to clarify license commitments regarding calculation of k_{eff} and the use of bias.
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 NFS-HS-A-63, and correcting the methods used to verify adequacy of the margin (HEU operation validations 54T-04-0043 and WRS-97-001).
IFI 70-143/2005-208-02	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."
IFI 70-143/2006-205-02	Tracks the licensee's management measures to ensure that the new module installed in the ILMS is able to perform its safety function when needed.
URI 70-143/2006-205-03	Tracks splitting a downblending accident sequence into additional sequences.

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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.

R. Mauer	Engineer, NCS
N. Brown	Engineer, NCS
*R. Shackelford	Manager, NCS
*M. Tester	Manager, Radiological Control
*R. Crowe	Manager, Corrective Actions Program
*N. Kenner	Director, Human Performance Learning
*T. Coates	Manager, E&I Section
*D. Hopson	Manager, BLEU Safety and Regulatory
*R. Droke	Director, Safety
*B. Moore	Vice President, Safety and Regulatory
*J. Nagy	Senior Licensing and Regulatory Compliance Officer
*J. Wheeler	Manager, ISA
*T. Lindstrom	Executive Vice President, HEU Operations

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*G. Hazelwood	Director, Engineering
*K. Schutt	Executive Vice President, Site Services
*D. Ferguson	CEO
*A. Ward	General Counsel

<u>NRC</u>

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

*Attended the exit meeting on March 30, 2007.

4.0 List of Acronyms and Abbreviations

AOA	area of applicability
BLEU	blended low-enriched uranium
CAAS	criticality accident alarm system
EPB	effluent processing building
HEU	high-enriched uranium
IFI	inspector followup item
ILMS	in-line monitor system
IP	inspection procedure
IROFS	item relied on for safety
ISA	integrated safety analysis
k _{eff}	effective neutron multiplication factor
LEU	low enriched uranium
MCA	multi-channel analyzer
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
SRE	safety-related equipment
UNB	uranyl nitrate building
URI	unresolved item
USL	upper safety limit
WWTF	Waste Water Treatment Facility