

April 24, 2008

NMED 080185

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. 70-143/2008-202 AND NOTICE OF VIOLATION

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 31, 2008 – April 4, 2008. 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 4, 2008.

The inspection, which is described in the enclosure, focused on: (1) the most hazardous activities and plant conditions; (2) the most important controls relied on for safety and their analytical basis; and (3) 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.

Based on the results of the inspection, the NRC has determined that two Severity Level IV violations of NRC requirements occurred. The violations were evaluated in accordance with the "General Statement of Policy and Procedure for NRC Enforcement Actions" (Enforcement Policy), NUREG-1600. The current Enforcement Policy is included on the NRC's web site at www.nrc.gov; select What We Do, Enforcement, then, Enforcement Policy. The first violation is being cited in the enclosed Notice of Violation (Notice) as a Severity Level IV violation, and the circumstances surrounding it are described in detail in the subject inspection report. The violation is being cited in the Notice because it was identified as a result of NRC inspection. The violation being cited as a Severity Level IV violation is the failure to demonstrate the adequacy of subcritical margin under normal conditions. The second violation is being treated as a Non-Cited Violation (NCV), consistent with Section VI.A of the Enforcement Policy. The NCV is described in the subject inspection report. If you contest the violations or significance of the NCV, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington DC 20555-0001, with copies to: (1) the Director, Office of Nuclear Material Safety and Safeguards, United States Nuclear Regulatory Commission, Washington, DC 20555-0001; (2) the Director, Office of Enforcement, United States Nuclear Regulatory Commission, Washington, DC 20555-0001; and (3) the NRC Resident Inspector at NFS Erwin.

D. Ferguson

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You are required to respond to this letter and should follow the instructions specified in the enclosed Notice when preparing your response. The NRC will use your response, in part, to determine whether further enforcement action is necessary to ensure compliance with regulatory requirements.

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 Dennis Morey, of my staff, at (301) 492-3112.

Sincerely,

/RA/

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

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

Enclosure: 1. Notice of Violation
2. Inspection Report 70-143/2008-202

D. Ferguson

- 2 -

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NOTICE OF VIOLATION

Nuclear Fuel Services, Inc.
Erwin, TN

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

During a U.S. Nuclear Regulatory Commission (NRC) routine inspection conducted from March 31 through April 4, 2008, a violation of NRC requirements was identified. In accordance with NUREG-1600, "General Statement of Policy and Procedure for NRC Enforcement Actions," the violation is listed below.

Section 4.1.1 of the license application states that the nuclear criticality safety analysis used to demonstrate the safety of process equipment shall show the normal conditions. Normal conditions are defined as the most reactive values, as limited by identified controls on system parameters, for nuclear criticality safety parameters (i.e., reflection, mass, etc.).

Section 4.2.3.2 of the license application states that when using computer calculations the effective neutron multiplication factor (k_{eff}), including any bias and uncertainty, shall be less than 0.90 for normal conditions.

Contrary to the above, on and before April 4, 2008, the licensee failed to show in the nuclear criticality safety analysis for the Blended Low-Enriched Uranium Preparation Facility Centrifuge Bowl Cleaning Station the normal conditions related to moving centrifuge bowls or demonstrate that k_{eff} would be less than 0.90 for all normal conditions associated with centrifuge bowl cleaning.

This is a Severity Level IV Violation (Supplement VI).

Pursuant to the provisions of 10 CFR 2.201, Nuclear Fuel Services, Inc. is hereby required to submit a written statement or explanation to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, D.C. 20555 with copies to the Chief, Technical Support Branch, Division of Fuel Cycle Safety and Safeguards, NMSS, and Regional Administrator, Region II, within 30 days of the date of the letter transmitting this Notice of Violation (Notice). This reply should be clearly marked as a "Reply to a Notice of Violation" and should include: (1) the reason for the violation, or, if contested, the basis for disputing the violation; (2) the corrective steps that have been taken and the results achieved; (3) the corrective steps that will be taken to avoid further violations; and (4) the date when full compliance will be achieved. Your response may reference or include previously docketed correspondence if the correspondence adequately addresses the required response. If an adequate reply is not received within the time specified in this Notice, an Order or Demand for Information may be issued as to why the license should not be modified, suspended, or revoked, or why such other actions as may be proper should not be taken. Where good cause is shown, consideration will be given to extending the response time.

If you contest this enforcement action, you should also provide a copy of your response to the Director, Office of Enforcement, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555-0001.

Enclosure 1

Because your response will be made available electronically for public inspection in the NRC Public Document Room (PDR), or from the NRC's Agency-wide Documents Access and Management System (ADAMS), accessible from the NRC web site at <http://www.nrc.gov/reading-rm/adams.html>, to the extent possible, it should not include any personal privacy, proprietary, or safeguards information so that it can be made available to the public without redaction. If personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request withholding of such material, you must specifically identify the portions of your response that you seek to have withheld, and provide in detail the bases for your claim of withholding (e.g., explain why the disclosure of information will create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.390(b) to support a request for withholding confidential commercial or financial information). If safeguards information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21.

In accordance with 10 CFR 19.11, you may be required to post this Notice within two working days.

Dated at Rockville, Maryland

this 24 day of April 2008

**U.S. NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS**

Docket No.: 70-143

License No.: SNM-124

Report No.: 70-143/2008-202

Licensee: Nuclear Fuel Services, Inc.

Location: Erwin, TN

Inspection Dates: March 31, 2008 – April 4, 2008

Inspectors: Dennis Morey, Criticality Safety Inspector
Blake Purnell, Criticality Safety Inspector

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

Enclosure 2

EXECUTIVE SUMMARY

Nuclear Fuel Services, Inc. NRC Inspection Report No. 70-143/2008-202

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 31 – April 4, 2008. 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 item review. The inspection focused on risk-significant fissile material processing activities including the blended low-enriched uranium processing facility (BPF), the fuel manufacturing facility, the waste water treatment facility (WWTF), and the C and D production line.

Results

- A Severity Level IV violation was identified regarding the licensee's failure to demonstrate the adequacy of subcritical margin under normal conditions.
- A Non-Cited violation was identified regarding the licensee failure to survey filter media prior to packaging for disposal.
- No safety concerns were noted regarding the licensee NCS inspections, audits, and investigations.
- No safety concerns were identified during plant walkdowns.

REPORT DETAILS

1.0 Plant Status

NFS conducts high-enriched uranium (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.

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-58, "Nuclear Criticality Safety Evaluations," dated February 17, 2006, Rev. 10
- 21T-06-1465, "NCSE/A Writer's Guide," Rev. 7, dated June 9, 2006
- 54T-07-0032, "NCSE: BPF Centrifuge Bowl Cleaning Station," Rev. 3, dated December 2007
- 54T-07-0002, "NCSE: Waste Water Treatment Facility," Rev. 2, dated September 2007
- 54T-07-0047, "NCSE: Solvent Extraction," Rev. 6, dated February 2008
- 54X-07-0020, "NCSE: Tube Cleaning Room," Rev. 4, dated December 17, 2007

b. Observations and Findings

The inspectors determined that NCSEs were performed by qualified NCS engineers, independent reviews of the evaluations were completed by other qualified NCS engineers, and double contingency was assured for each credible accident sequence leading to inadvertent criticality. With the exception of the NCS analysis for centrifuge bowl cleaning, the inspectors determined that NCS controls for equipment and processes assured the safety of the operations.

When the licensee relies upon computer calculations to demonstrate that an operation is subcritical, Section 4.2.3.2 of the license requires that the NCSE must demonstrate adequate subcritical margin by showing that the neutron multiplication factor (k_{eff}), including any bias and uncertainty, does not exceed a value of 0.90 for normal conditions and a value of 0.95 for failure of a single contingency. Section 4.1.1 of the license application defines normal conditions as the most reactive values of NCS parameters (moderation, reflection, mass, etc.) as limited by identified controls on system parameters. Section 4.2.1.2 of the license states that full water reflection is assumed in determining NCS parameters for individual units, except when controls are established that can maintain conditions at less than full water reflection.

The licensee uses centrifuges in BPF to separate dissolved product from solvent. When centrifuging is complete, the product is removed from the centrifuge bowl in a cleaning station. The inspectors noted that the normal operations for BPF centrifuge bowl cleaning include the transfer of the bowl by hoist or by hand from the centrifuge station, a reflection controlled location, to the bowl cleaning station, another reflection controlled location. The inspectors determined that during this transfer operation there were no controls on reflection for the bowl, and the only NCS controlled parameter was the bowl geometry. The inspectors also noted that the NCSE for the centrifuge bowl cleaning operations did not describe a normal condition for moving the centrifuge bowls. The licensee's NCS staff indicated that models of bowls in the centrifuge bowl cleaning station NCSE had been expected to bound the process of moving a bowl for cleaning.

The inspectors also noted that the NCSE for the BPF Centrifuge Bowl Cleaning Station contained a study in which a single centrifuge bowl was modeled with full water reflection and varying amounts of optimally moderated SNM. The study indicated that k_{eff} is less than 0.90 if there is 6 kg or less of optimally moderated uranium oxide (UO_2) in the bowl, and that k_{eff} exceeds 0.90 if there is 12 kg or more of optimally moderated UO_2 in the bowl. The inspectors noted that when the bowl was completely filled (more than 40 kg) with optimally moderated UO_2 that k_{eff} is less than 0.95. The licensee's NCS staff stated that a centrifuge bowl was not expected to accumulate more material than that equivalent to 6 kg of UO_2 , but there was not a specified control that limited the mass of material in the bowl. The inspectors determined that this study was not sufficient to demonstrate that k_{eff} for the centrifuge bowl transfer operation was less than 0.90 since no mass controls had been established.

The inspectors determined that the licensee was required to demonstrate the adequacy of subcritical margin for bowl cleaning by showing that k_{eff} for centrifuge bowl transfer operations was less than 0.90 under a reasonably defined normal condition. The inspectors did not identify an immediate safety concern regarding the licensee failure to address centrifuge bowl movement because the licensee had numerous options for adequately analyzing centrifuge bowl movement within acceptable subcritical margin, including options related to reflection conditions. The licensee's failure to demonstrate the adequacy of subcritical margin under all normal conditions associated with BPF centrifuge bowl cleaning is **Violation (VIO) 70-143/2008-202-01**.

c. Conclusions

A Severity Level IV violation was identified regarding the licensee's failure to demonstrate the adequacy of subcritical margin under normal conditions.

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:

- 21T-08-0021, "NCS Audit of the NCS Analysis for Area C of the Uranium Recovery Facility," dated January 23, 2008
- 21T-08-0037, "NCS Audit of the NCSE for Packaging of Finished and Semi-Finished Fuel Samples, Rev. 0," dated January 16, 2008
- 21T-08-0087, "NCS Audit of the NCS Analysis for Area I of Uranium Recovery, Rev. 1," dated February 4, 2008
- 21T-08-0036, "NCS Audit of the NCSE for Transfer Carts and Process Floor Storage Racks, Rev. 1," dated January 16, 2008
- 21T-08-0031, "NCS Audit of the NCSE for HSSA Storage Racks in Building 333 and in the Corridor Between Buildings 301 and 306W, Rev. 4," dated January 14, 2008
- 21T-07-1855, "NCS Audit: Loading, Handling, and Storage of 55-Gallon Drums with Low-Level Solid SNM Trash in Buildings 302,304, 306," dated January 8, 2008
- 21T-07-1840, "NCS Audit of the NCSE of Lab B in Building 110 and Building 131 Lab, Rev. 0," dated December 13, 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

No safety concerns were noted regarding the licensee NCS inspections, audits, and investigations.

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 Item 13104 – Waste Drum Packaging
- PIRCS Item 12688 – Misaligned Concentration Monitor
- PIRCS Item 12860 – Nonfavorable Geometry Bag

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.

On March 28, 2008, the licensee reported (NMED 080185) that contaminated cartridge filters were packaged in 55-gallon waste drums without being scanned as required. Individual scanning contaminated items before packaging is an item relied on for safety (IROFS) which assures compliance with waste packaging procedures. The licensee uses letters of authorization (LOAs), a type of temporary procedure, to package these shipments. The licensee indicated that a poorly written LOA listed mass values for items which indicated to operators that scanning had taken place. Some of the listed mass values were estimates used for another purpose and were not valid for packaging the waste. Two filters had not been scanned at all. Immediate corrective actions included unpacking the drums and scanning all items. The licensee was conducting an investigation which was expected to identify long term corrective actions. The inspectors did not identify any immediate safety concern regarding this issue and consider this event closed. This non-repetitive, licensee identified and corrected violation is being treated as a Non-Cited violation, consistent with Section VI.A.8 of the NRC Enforcement Policy. The licensee failure to survey filter media prior to packaging for disposal is Non-Cited Violation (NCV) **70-143/2008-202-02**.

c. Conclusions

A Non-Cited violation was identified regarding the licensee failure to survey filter media prior to packaging for disposal.

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 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:

- 54T-07-0043, "NCSA LEU ISPRA Oxide Fuel Pins," Revision 1, dated November 21, 2007
- 54T-07-0038, "NCSA for Dissolution of Uranium Metal and HEU Storage Columns," Revision 12, dated October 11, 2007
- 54T-07-0045, "NCSE 310 Warehouse," Revision 1, dated December 6, 2007
- 54T-08-0010, "NCSE BLEU Preparation Facility Downblending," Revision 8, dated February 19, 2008

- 54T-07-0048, "Risk Index/IROFS Summary to Prevent Inadvertent Uranium Solution Flow," Revision 3, dated December 20, 2007
- 54X-06-0009, "Addendum 3 to Revision 1 of NCSA for 105/302/303 Laboratory," Revision 0, dated May 21, 2007
- NFS-HS-CL-26, NCS for BLEU Preparation Facility," Revision 5, dated April 8, 2008

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, 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.

6.0 Open Item Follow-up

URI 70-143/2007-207-01

This item tracks licensee use of gapped reflector models of fissile systems. During this inspection, the inspectors noted several NCSEs where the licensee uses gapped reflector models for SNM handled in reflector controlled areas. The inspectors noted that these gapped reflectors models have less than a one-inch-thick, tight-fitting reflector completely surrounding the fissile system. One example was shown in inspection report 70-143/2007-207. The inspectors also noted other examples where the tight-fitting reflector was intended to bound only one person's hands on a much larger unit. The inspectors discussed this modeling practice with the licensee and stated that it is less conservative than what is typically observed in other licensee's NCSEs. The inspectors did not identify any examples in the NCSEs reviewed during this inspection where the use of gapped reflector models would pose a significant safety problem. The inspectors determined that the license application does not clearly prohibit the use of gapped reflection. The licensee stated that it intends to clarify its commitments in the license application regarding reflector modeling during the next license renewal. 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 the American Nuclear Standards Institute/American Nuclear Society series standards and clarify the meaning of "published experimental data." During this inspection the licensee stated that, due to the impending license renewal, the NRC project manager for the facility had suggested that no further license amendments be submitted unless it was an emergency. The licensee stated that the issue associated

with License Condition S-9, reliance on consensus standards, will be corrected during license renewal. This item is closed.

IFI 70-143/2007-202-02

This item tracks licensee clarification of license commitments regarding calculation of effective neutron multiplication factor (k_{eff}) and the use of positive bias. The licensee had planned an amendment to clarify these commitments. During this inspection the licensee stated that, due to the impending license renewal, the NRC project manager for the facility had suggested that no further license amendments be submitted unless it was an emergency. During this inspection the licensee stated that the issue associated with positive bias will be addressed during the next license renewal. This item is closed.

7.0 Exit Meeting

The inspectors presented the inspection results to members of the licensee's management and staff during an exit meeting on April 4, 2008. The licensee acknowledged and understood the findings as presented.

SUPPLEMENTARY INFORMATION

1.0 List of Items Opened, Closed, and Discussed

Items Opened

VIO 70-143/2008-202-01 Failure to demonstrate the adequacy of subcritical margin under normal conditions.

NCV 70-143/2008-202-02 Failure to survey filter media prior to packaging for disposal.

Items Closed

URI 70-143/2007-207-01 Tracks licensee use of gapped reflector models of fissile systems.

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 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 effective neutron multiplication factor (k_{eff}) and the use of positive bias.

NCV 70-143/2008-202-02 Failure to survey filter media prior to packaging for disposal.

Items Discussed

None.

2.0 Inspection Procedures Used

IP 88015 Nuclear Criticality Safety Program
IP 88016 Nuclear Criticality Safety Evaluations and Analyses

3.0 Key Points of Contact

Nuclear Fuel Services, Inc.

*N. Brown Engineer, NCS
*R. Droke Director, Licensing / Safety
*T. Lindstrom Executive Vice President, HEU Operations
R. Mauer Engineer, NCS
*M. Moore Vice President, Safety and Regulatory
*J. Nagy Senior Licensing and Regulatory Compliance Officer
*R. Shackelford Manager, NCS

Attachment

*T. Lindstrom	General Manager
*S. Sanders	Training Manager
M. Eakin	NCS Engineer
*S. Skiles	NCS Engineer
*J. Wheeler	Licensing and ISA Manager
*A. Vaughan	Director, Fuel Production
*T. Sheekan	Director, HEU Operations
*K. Guinn	Acting Director, Engineering
*L. Sanders	NCS Engineer

NRC

S. Burris	Senior Resident Inspector, NRC Region II
*G. Smith	Resident Inspector, NRC Region II
*D. Morey	Senior Criticality Safety Inspector, NRC Headquarters
*B. Purnell	Criticality Safety Inspector, NRC Headquarters

*Attended the exit meeting on April 4, 2008.

4.0 List of Acronyms and Abbreviations

ADU	ammonium diuranate
BLEU	blended low-enriched uranium
BPF	BLEU processing facility
HEU	high-enriched uranium
IP	inspection procedure
IROFS	item relied on for safety
k_{eff}	effective neutron multiplication factor
LOA	letter of authorization
NCS	nuclear criticality safety
NCSE	nuclear criticality safety evaluation
NFS	Nuclear Fuel Services, Inc. (licensee)
PIRCS	Problem Identification, Resolution, and Corrective System
SNM	special nuclear material
UO ₂	uranium oxide
WWTF	waste water treatment facility