

[REDACTED]

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

Docket No: 70-143

Licensee No: SNM-124

Report No: 70-143/2005-203

Licensee: Nuclear Fuel Services, Inc.

Location: Erwin, TN

Inspection Dates: May 2 - 4, 2005

Inspectors: Dennis Morey, Senior Criticality Safety Inspector
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Approved by: Melanie A. Galloway, Chief
Technical Support Group
Division of Fuel Cycle Safety
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Enclosure

EXECUTIVE SUMMARY**Nuclear Fuel Services, Inc.
NRC Inspection Report No. 70-143/2005-203****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., Erwin, Tennessee, facility from May 2 through 4, 2005. The inspection included an on-site review of the licensee programs dealing with NCS function, NCS event review, plant operations, 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) preparation facility (BPF), the BLEU oxide conversion building (OCB), the BLEU uranyl nitrate building (UNB), and the waste water treatment facility.

Results

- One violation was identified involving a non-existent item credited for maintaining safety in the BLEU [REDACTED] dilution ventilation system.
- An unresolved item was identified involving the failure to recognize a potential NCS violation during review of an internal event.
- An unresolved item was identified involving the investigation and identification of potential NCS control failures resulting in [REDACTED] solution accumulation in the BLEU [REDACTED] [REDACTED] process off-gas system.
- The inspectors otherwise determined that NCS controls for equipment and processes assured the safety of the operations.
- Plant operations involving [REDACTED] materials were conducted safely and in accordance with written procedures.

REPORT DETAILS**1.0 NCS Function (88015)****a. Scope of Inspection**

The inspectors reviewed NCS evaluations to determine that criticality safety of risk-significant operations was assured through engineered features and human performance (controls) with adequate safety margin/certainty, preparation and review by capable staff. The inspectors reviewed selected aspects of the following documents:

- 54T-04-0100, "Nuclear Criticality Safety Evaluation for the Blended Low-Enriched Uranium Preparation Facility [REDACTED]," Revision 5, dated March 4, 2005
- 54T-04-022, "Nuclear Criticality Safety Analysis for the BPF (BLEU Process Facility) Process Ventilation System," Revision 2, dated April 27, 2004
- 54T-99-0079, "Nuclear Criticality Safety Analysis [REDACTED]," Revision 0, dated May 5, 1999
- 54T-04-0046, "Nuclear Criticality Safety Analysis [REDACTED]," Revision 0, June 7, 2004
- 54T-05-0013, "Nuclear Criticality Safety Evaluation for the Oxide Conversion Building (OCB) [REDACTED]," Revision 1 (draft to be approved)

b. Observations and Findings

The inspectors determined that analyses were performed by capable NCS engineers, that independent reviews were completed for the evaluations by other qualified NCS engineers, and that subcriticality of the systems and operations was assured through appropriate limits on controlled parameters. The inspectors determined that NCS controls for equipment and processes assured the safety of the operations.

The inspectors determined that the NCS analysis for the BLEU process ventilation system took credit for [REDACTED] to prevent backflow of [REDACTED] solution in the system. This component, although found in similar systems, was not present in the BLEU [REDACTED] dilution off-gas section of the process ventilation system due to the desire to prevent [REDACTED] from entering [REDACTED]. This analytical deficiency was identified by NCS staff during review of an event involving the discovery of uranium contaminated caustic solution of the [REDACTED] dilution system HEPA filter housing.

Section 4.1.1 of the license application requires that all process equipment and systems be designed to incorporate sufficient factors of safety to require at least two unlikely, independent, and concurrent changes in process conditions before a criticality is possible. Scenario 4.1.3 of nuclear criticality safety evaluation (NCSE) 54T-04-022,

Revision 2, dated April 27, 2004, takes credit for [REDACTED] and a drain or two drains to prevent solution from backflowing into the ventilation system. Contrary to the above, as of April 28, 2005, the BLEU [REDACTED] dilution ventilation system had only one drain and no [REDACTED] so that double contingency was not established [REDACTED]. Failure to establish double contingency for the backflow of solution into the [REDACTED] dilution process ventilation system is **Violation 70-143/2005-203-01**.

The inspectors did not identify any other safety concern during review of analyses. The inspectors otherwise determined that NCS controls for equipment and processes assured the safety of the operations.

c. Conclusions

A violation was identified involving a non-existent item credited for maintaining safety in the BLEU [REDACTED] dilution ventilation system. The NCS function was otherwise adequate for maintaining acceptable levels of safety.

2.0 **NCS Inspections, Audits, and Investigations (88015)**

a. Scope of Inspection

The inspectors reviewed corrective actions for internal and external reported events to determine the adequacy of the licensee corrective action system. The inspectors reviewed selected aspects of the following documents:

- NFS-GH-922, "The NFS Problem Identification, Resolution and Correction System (PIRCS)," Revision 5, dated October 15, 2004

b. Observations and Findings

The inspectors determined that the licensee requires corrective actions be developed and assigned as part of its internal tracking system, PIRCS. The inspectors noted that the licensee had assigned corrective actions for an internally reported event from April 7, 2005, in which misaligned valves in the BLEU process area resulted in a spill of uranium contaminated caustic solution. The inspectors noted that an assigned corrective action for the event was to evaluate instrument low points and HEPA filter housings for caustic hold up. The inspectors noted that the corrective action was to be completed by April 29, 2005, which meant that more than 3 weeks had been assigned to accomplish the corrective action even though an accumulation in a HEPA filter housing would violate NCS controls. The inspectors felt that the review of the event in question was weak since an NCS engineer with more than 2 years experience had participated in the initial review and assignment of corrective actions. Review of the caustic spill event is included in the ongoing review of the HEPA housing caustic solution accumulation event. The failure to recognize a potential NCS violation during review of an internal event will be tracked as **Unresolved Item (URI) 70-143/2005-203-02**.

c. Conclusions

An unresolved item was identified involving the failure to recognize a potential NCS violation during review of an internal event.

3.0 **NCS Event Review**

a. Inspection Scope

The inspectors reviewed the licensee response to one externally reported event and two 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:

- LOA-18771-043-1, "[REDACTED]," Revision 1, dated March 3, 2005
- SOP 409, Section 10, "[REDACTED]," Revision 3, dated March 15, 2005

b. Observations and Findings

HEPA Housing event

On April 28, 2005, during operation of the [REDACTED] system, an alarm was received indicating a problem with the [REDACTED] dilution HEPA filter. Investigation determined that the HEPA filter housing [REDACTED] contained caustic solution [REDACTED] in the housing. Solution was not expected in the housing due to drains in the ductwork. As shown in Figure 1, the solution accumulation was in the section of the housing containing the first HEPA filter which was saturated. The [REDACTED] system was shut down pending completion of the licensee investigation and correction of the cause of the accumulation. Because the system was shut down, the inspectors had no immediate safety concerns but noted that the event appeared to violate off-gas system NCS controls such as the HEPA drain. Licensee investigation and identification of potential NCS control failures resulting in [REDACTED] solution accumulation in the BLEU [REDACTED] process off-gas system will be tracked as **URI 70-143/2005-203-03**.

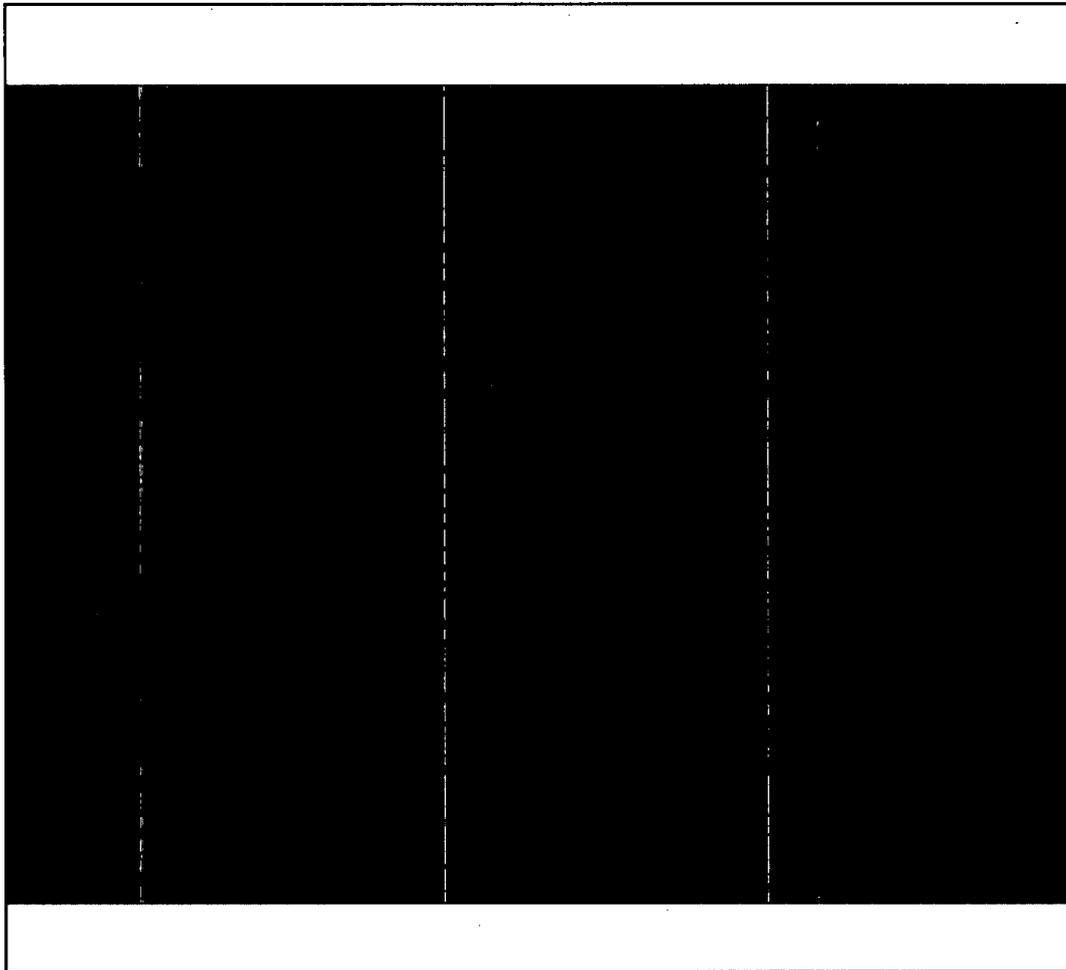
Caustic Solution Overflow Event

On April 7, 2005, [REDACTED] of caustic solution to the floor in the BLEU Process Facility. Figure 1 contains a representation of this drain labeled [REDACTED]. The licensee indicated that this event occurred during an attempt to return caustic discharge solution to [REDACTED] with an incorrect valve line-up and while level transmitters were giving incorrect level readings

[REDACTED]. As a result, caustic solution was pumped into the [REDACTED] dilution system through the process off-gas lines. Corrective actions included revising work instructions and replacing the level transmitters. The inspectors had a concern regarding the investigation of the event and assignment of short- and long-term corrective actions as noted in Section 2.0 above. The inspectors determined that the licensee's immediate corrective action of shutting down the [REDACTED] system was appropriate and eliminated any immediate safety concern.

Figure 1

BLEU [REDACTED] Systems



OCB Blender Mass Event

The inspectors reviewed an event in OCB involving an apparent human error of overloading a powder blender (the blender mass limit was an administrative item relied

on for safety (IROFS)) which the licensee identified when the blender appeared to have discharged more than its mass limit [REDACTED]. Licensee investigation revealed that a product [REDACTED] had been counted twice during blender discharge. Due to the identification of overcounting, the licensee determined that the blender had not been overloaded and the IROFS had not actually failed. The inspectors had no safety concerns regarding the event or corrective actions.

c. Conclusions

An unresolved item was identified involving the investigation and identification of potential NCS control failures resulting in [REDACTED] solution accumulation in the BLEU [REDACTED] process off-gas system.

4.0 Plant Operations (88015)

a. 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 operators and NCS engineers both before and during walkdowns. The inspectors reviewed selected aspects of the following documents prior to performing the walkdowns:

- 54T-05-0012, "Nuclear Criticality Safety Evaluation for OCB Oxide [REDACTED] [REDACTED]," Revision 2, dated May 12, 2005.
- 54T-05-0010, "Nuclear Criticality Safety Evaluation [REDACTED] [REDACTED]" Revision 0, dated April 4, 2005

b. Observations and Findings

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. The inspectors performed walkdowns of risk-significant [REDACTED] material processing activities in the BLEU preparation facility, OCB, the uranyl nitrate building, the [REDACTED] and the waste water treatment facility. No safety concerns were noted during walkdowns.

c. Conclusions

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

5.0 Open Item Followup

IFI 70-143/2004-207-04

This item tracks the licensee's actions to revise the NCSE for the scrap dissolver operation to adequately demonstrate double contingency protection. The inspectors had questioned the adequacy of an administrative control requiring the supervisor to be present when the mop sink was filled because the supervisor would have no means for positively verifying solution enrichment (e.g., no requirement to perform dual, independent sampling prior to transfer). The inspectors observed that the licensee's revisions to the NCSE included new requirements for the supervisor to verify that the solution being introduced into the mop sink is natural uranium by observation of the unique natural uranium container. In addition, the inspectors observed that the NCSE had been revised to require supervisory verification that no more than [REDACTED] is [REDACTED] from the favorable geometry mop sink to the unfavorable geometry natural uranium dissolver tank. The inspectors determined that double contingency protection for the scenario had been established. This item is closed.

VIO 70-143/2004-207-05

This item concerned the licensee's failure to ensure that k-effective values for credible abnormal conditions did not exceed the 0.95 limit. The licensee denied the violation, and the NRC is reviewing the denial. This item remains open.

VIO 70-143/2004-207-06

This item concerned the licensee's failure to demonstrate that concentration was less than [REDACTED] prior to a caustic discharge transfer. The inspectors reviewed the licensee response to the violation and determined that the licensee has not completed all corrective actions contained in the response. This item remains open.

6.0 Exit Meeting

The inspectors presented the inspection scope and results to members of the licensee's management and staff during an exit meeting on May 4, 2005. The licensee acknowledged and understood the findings as presented.

SUPPLEMENTARY INFORMATION

1.0 List of Items Opened, Closed, and Discussed

Opened

- VIO 70-143/2005-203-01** Failure to establish double contingency for the backflow of solution into the [REDACTED] dilution process ventilation system
- URI 70-143/2005-203-02** Failure to recognize a potential NCS violation during review of an internal event
- URI 70-143/2005-203-03** Investigation and identification of potential NCS control failures resulting in [REDACTED] solution accumulation in the BLEU [REDACTED] process off-gas system

Closed

- IFI 70-143/2004-207-04** Tracks the licensee's actions to revise the NCSE for the Scrap Dissolver operation

Discussed

- VIO 70-143/2004-207-05** Failure to ensure that k-effective values for credible abnormal conditions did not exceed the 0.95 limit
- VIO 70-143/2004-207-06** Failure to demonstrate that the concentration was less than [REDACTED] prior to a caustic discharge

2.0 Inspection Procedures Used

- IP 88015 Headquarters Nuclear Criticality Safety Program

3.0 Key Points of Contact

Nuclear Fuel Services, Inc.

- | | |
|----------------|---------------------------------------|
| R. Mauer | Engineer, NCS |
| R. Droke | Director, Safety |
| B. Moore | Vice President, Safety and Regulatory |
| R. Shackelford | Manager, NCS |
| M. Tester | Manager, Radiological Control |
| A. Vaughan | Director, Fuel Production |
| J. Kirk | Licensing Specialist |
| J. Nagy | Licensing and Regulatory Compliance |
- [REDACTED]

N. Brown	Engineer, NCS
S. Gizzie	Engineer, NCS
T. Sheehan	Director, High-Enriched Uranium Operations
G. Hazelwood	Director, Engineering
P. Johnson	Vice President, Applied Technology
D. Hopson	Manager, BLEU Safety and Regulatory
A. Ward	General Counsel

NRC

D. Rich	Senior Resident Inspector, NRC Region II
D. Morey	Criticality Safety Inspector, NRC-HQ
N. Jordan	Criticality Safety Inspector, NRC-HQ

All attended the exit meeting on May 5, 2005.

4.0 List of Acronyms and Abbreviations

BLEU	blended low-enriched uranium
BPF	BLEU preparation facility
CFR	Code of Federal Regulations
HEPA	high-efficiency particulate air
IFI	inspection followup item
IP	inspection procedure
IROFS	item relied on for safety
LEL	lower explosive limit
LOA	letter of authorization
NCS	nuclear criticality safety
NCSE	nuclear criticality safety evaluation
NMSS	Office of Nuclear Material Safety and Safeguards
NRC	U.S. Nuclear Regulatory Commission
OCB	oxide conversion building
PIRCS	problem identification, resolution and correction system
SNM	special nuclear material
SOP	standard operating procedure
[REDACTED]	[REDACTED]
UNB	uranyl nitrate building
URI	unresolved item
VIO	violation
wt%	weight percent