

[REDACTED]

May 21, 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. 70-143/2007-203

Dear Mr. Ferguson:

The U.S. Nuclear Regulatory Commission (NRC) conducted a routine announced criticality safety inspection at the Nuclear Fuel Services, Inc. (NFS) and AREVA facilities in Erwin, Tennessee, from May 7 - 11, 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 May 11, 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]

[REDACTED]

D. Ferguson

-2-

If you have any questions concerning this report, please contact Dennis Morey, of my staff, at (301) 415-6107.

Sincerely,

/RA/

Margaret A. Kotzalas, Acting Chief
Technical Support Branch
Division of Fuel Cycle Safety
and Safeguards, NMSS

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

Enclosure: Inspection Report 70-143/2007-203

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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.: 70-143/2007-203

Licensee: Nuclear Fuel Services, Inc.

Location: Erwin, TN

Inspection Dates: May 7 - 11, 2007

Inspector: Dennis Morey, Senior Criticality Safety Inspector

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

Enclosure



EXECUTIVE SUMMARY

**Nuclear Fuel Services, Inc.
NRC Inspection Report No. 70-143/2007-203**

Introduction

Staff of the U.S. Nuclear Regulatory Commission (NRC) performed a routine and announced nuclear criticality safety (NCS) inspection of the AREVA and Nuclear Fuel Services, Inc. (NFS), Erwin, Tennessee, facilities from May 7 - 11, 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 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), and review of open items.

Results

- No safety concerns were identified with regard to the licensee NCS program.
- No safety concerns were identified with regard to identification, reporting and correction of criticality safety-related events.
- No safety concerns were noted regarding the licensee criticality alarm system.
- No safety concerns were identified during walkdowns of [REDACTED] material operations.

REPORT DETAILS

1.0 Nuclear Criticality Safety Program (88015, 88016)

a. Inspection Scope

The inspector reviewed NCS analyses to determine that criticality safety of risk-significant operations was assured through engineered and administrative controls with adequate safety margin and including preparation and review by qualified staff. The inspector reviewed selected aspects of the following documents:

- NFS-HS-CL-25, "Nuclear Criticality Safety [REDACTED] UNB," Revision 2, dated July 14, 2003
- NFS-HS-CL-27, "Nuclear Criticality Safety [REDACTED] OCB/EPB," Revision 6, dated October 2, 2006
- 54T-07-0009, "NCSE [Nuclear Criticality Safety Evaluation] for the EPB [REDACTED] and Liquid Waste Processes," Revision 3, dated February 28, 2007

b. Observations and Findings

The inspector reviewed NCSEs and supporting calculations for selected operations. Within the selected aspects reviewed, the inspector 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 inspector 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

No safety concerns were identified with regard to the licensee NCS program.

2.0 Inspections, Audits, and Investigations (88015)

a. Inspection Scope

The inspector reviewed licensee corrective actions for a recent event at the facility. The inspector reviewed selected aspects of the following documents:



[REDACTED]

[REDACTED]

b. Observations and Findings

The inspector reviewed licensee handling of an event at the OCB/EPB facility involving the failure to take mass samples as directed by the NCSE and corresponding operating procedure. The inspector noted that the license had entered the event into the Problem Identification, Resolution and Correction System (PIRCS) and defined corrective actions. During a safety audit, the licensee determined that sampling was not being performed as described in the process criticality analysis or operating procedure. The inspector interviewed NCS and operations staff and walked down the system with the facility NCS engineer. The inspector did not have any safety concerns regarding processing of events and related corrective actions at the OCB/EPB/UNB facilities.

The inspector reviewed open item **Inspector Followup Item (IFI) 70-143/2006-209-01**. This item tracked revision of the EPB NCSE to provide a more detailed description of the sampling process. The licensee previously reported an event involving failure to take mass samples as directed by the NCSE and the corresponding operating procedure [REDACTED]

[REDACTED]. The EPB NCSE required monthly samples to be taken on the inlet and outlet of the EPB system. The requirement is to perform a proportional sample of the waste stream. As part of the licensee corrective actions, the NCSE will be revised to provide a more detailed description of the sampling process.

During this inspection, the inspector determined that the licensee had revised the NCSE and operating procedure to change the sampling requirement to every [REDACTED] rather than every month. This is based on the requirement to perform a proportional sample which cannot be done every month if the volume in a month is substantially less than [REDACTED] of waste water. Criticality safety of the EPB relies on prevention of [REDACTED] accumulation in the tanks and is accomplished by in-line monitoring, visual inspection, survey, and sampling. The inspector had no safety concerns regarding the NCSE and procedure revisions. Open item **IFI 70-143/2006-209-01** is closed.

c. Conclusions

No safety concerns were identified with regard to identification, reporting and correction of criticality safety-related events.

[REDACTED]

3.0 Criticality Accident Alarm System (IP 88017)

a. Inspection Scope

The inspector 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 inspector reviewed selected aspects of the following documents:

- Drawing [REDACTED], "BLEU Conversion Complex Site Criticality Detection Alarm Logic," Revision 1, dated January 2005
- NFS-HS-A-80, "Operation and Testing of the BLEU Complex Criticality Alarm System," Revision 2, dated February 28, 2007

b. Observations and Findings

The inspector determined that the licensee had installed and maintained a system of criticality detectors that was capable of monitoring [REDACTED] material operations at the facility. The inspector noted that the licensee had recently experienced damage to the criticality alarm system at the OCB facility due to a lightning related electrical surge. The licensee has completed reviewed of electrical surge-related issues and is implementing corrective actions.

The inspector reviewed open item **IFI 70-143/2006-205-02**. This item tracked the licensee's review of its lightning protection system. During a previous inspection, the inspector reviewed an event which had taken place at the facility involving an electrical storm. The inspector noted that the electrical storm had disabled one of two Victoreen criticality detectors and the horns for the BLEU complex criticality accident alarm system (CAAS). This CAAS failure was not noted because the lightning strike had disabled both the alarm and the diagnostic panel that should have indicated alarm failure. Because the licensee was preoccupied with other effects of the lightning storm, the alarm failure was not noticed for several days. The licensee has since instituted a new requirement to perform a "lamp test" on the diagnostic panel every shift to ensure that it is still working properly. During a subsequent inspection, the licensee stated that it is conducting a comprehensive review of the design of the lightning protection system, to determine compliance with applicable code (National Fire Protection Association 780), and to determine what enhancements can be made beyond the minimal features needed to meet the code.

During this inspection, the inspector noted that the licensee has completed review of the lightning protection system and has implemented improvements [REDACTED]

Open item **IFI 70-143/2006-205-02** is closed.

[REDACTED]

c. Conclusions

No safety concerns were noted regarding the licensee criticality alarm system.

4.0 **Plant Activities (88015)**

a. Inspection Scope

The inspector 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 inspector 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 inspector performed walkdowns of risk-significant [REDACTED] material processing activities in the following BLEU facilities: OCB, UNB, and EPB. The inspector interviewed operations staff and NCS engineers both before and during walkdowns. The inspector reviewed selected aspects of the following documents prior to performing the walkdowns:

- NFS-HS-CL-25, "Nuclear Criticality Safety [REDACTED] UNB," Revision 2, dated July 14, 2003
- NFS-HS-CL-27, "Nuclear Criticality Safety [REDACTED] OCB/EPB," Revision 6, dated October 2, 2006
- SOP 520, Section 13, "Natural Uranium (NUN [natural uranyl nitrate]) Dissolution," Revision 8, dated May 9, 2007

b. Observations and Findings

The inspector verified that controls identified in NCS analyses were installed or implemented and were adequate to ensure safety. The inspector also verified that safety was maintained for observed facility operations. The inspector noted that the licensee prepares NUN in the natural uranium dissolution room by dissolving natural [REDACTED] using an unsafe geometry vessel. The inspector reviewed the operating procedure for NUN dissolution and noted that the procedure required operators to check the label on drums of [REDACTED] that were to be transferred to the NUN dissolution vessel. The inspector was concerned that operators were not required to confirm that the material to be transferred [REDACTED]. The licensee modified the operating procedure by adding instructions to halt the transfer and notify supervision if the material in the drum did not appear to be [REDACTED]. The inspector did not identify any other safety concern during plant walkdowns.

c. Conclusions

No safety concerns were identified during walkdowns of [REDACTED] material operations.

5.0 Open Item Followup

URI 70-143/2007-202-01

This item tracks the adequacy of the licensee's 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. During the routine 6-month calibration of the [REDACTED] ILMS, the licensee observed that the ILMS spectrum appeared to have wide, short peaks, which were not normal, and which prevented completion of the calibration. The probable cause of the event was a partial failure of the voltage supply on the system multi-channel analyzer (MCA) board. The licensee replaced the MCA board and re-tested and re-calibrated the system. The manufacturer of the ILMS indicated that a failure of this type was not anticipated for the ILMS. The licensee's corrective actions included adding a module that would monitor the MCA voltage supply and alarm if the system voltage was not within its operating range.

During a previous inspection, the inspector noted that safety-related equipment (SRE) testing of the ILMS did not include testing of the new module. During this inspection the licensee indicated that the voltage monitoring module was tested prior to installation and was sent a signal throughout operation which was constantly monitored so that failure of the module would be immediately detected and cause the ILMS to shutdown. The licensee indicated that specific testing of the module did not justify additional SRE tests which would necessarily involve powering down the ILMS and risking damage to the module. The inspector determined that SRE testing of the ILMS was adequate to ensure it's safety function to interrupt discharge. 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 American National Standards Institute/American Nuclear Society (ANSI/ANS) series standards and clarify the meaning of "published experimental data." During a previous inspection, the inspector observed that the licensee was relying on a safety limit of [REDACTED] for concentration of [REDACTED] material in unsafe geometry Waste Water Treatment Facility (WWTF) tanks. The inspector determined that the [REDACTED] limit was a single parameter limit from Table 1 of the consensus standard ANSI/ANS-8.1.

The NFS license application requires the use of limits from Section 4.2.3.1 or the performance of analysis in accordance with Section 4.2.3.2. Section 4.2.3.2 of the license application states, in part, that "nuclear criticality safety analyses shall utilize published experimental data, the results of NFS sponsored critical experiments, or

[REDACTED]

[REDACTED]

analytical methods which have been validated by comparison with experimental data.” The inspector noted that the [REDACTED] safety limit that the licensee had applied to the WWTF tanks was a calculated single parameter limit from Table 1 of ANSI/ANS-8.1 and was based on a subcritical margin of between [REDACTED] [REDACTED] as noted in technical documentation of the standard. The inspector noted that the [REDACTED] [REDACTED] safety limit exceeded the license limits on effective neutron multiplication (k_{eff}) of 0.90 for normal conditions and 0.95 for credible upset conditions. The inspector determined that the current language in Safety Condition S-9 allows the use of a single parameter limit based on a k_{eff} value of 0.98 or less derived from critical experiments.

The licensee asserted that Section 4.2.3.2 of the license application along with Safety Condition S-9 authorized use of the ANSI/ANS-8.1 values as safety limits based on the words “published experimental data” in Section 4.2.3.2 and direct reference to ANSI/ANS standards in S-9. The inspector concluded that data in Table 1 of ANSI/ANS-8.1 did not appear to be published experimental data within the meaning of Section 4.2.3.2 of the license application but was actually a set of single parameter limits produced by computer calculations.

Licensee management committed to provide a licensee amendment that would incorporate Safety Condition S-9 into the licensee and clarify the meaning of “published experimental data.” The licensee plans to write the amendment to eliminate the need for Safety Condition S-9. This item is closed

6.0 Exit Meeting

The inspector presented the inspection results to members of the licensee’s management and staff during an exit meeting on May 11, 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

- URI 70-143/2007-202-01** This item 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.
- IFI 70-143/2006-209-01** This item tracks revision of the EPB NCSE to provide a more detailed description of the sampling process.
- IFI 70-143/2006-205-02** This item tracks the licensee's review of its lightning protection system.

Items Discussed

- 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."

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.

- *S. Gizzie Engineer, NCS
*R. Shackelford Manager, NCS
R. Ratner Health Physicist
*D. Hopson Manager, BLEU Safety and Regulatory
*R. Droke Director, Safety

[REDACTED]

*B. Moore Vice President, Safety and Regulatory
J. Nagy Senior Licensing and Regulatory Compliance Officer
G. Hazelwood Director, Engineering

AREVA

*J. Flaherty AREVA BLEU Complex Plant Manager
*R. Boyko Heath Physics

NRC

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

*Attended the exit meeting on May 11, 2007.

4.0 List of Acronyms and Abbreviations

ANS	American Nuclear Society
ANSI	American National Standards Institute
AREVA	company name
BLEU	blended low-enriched uranium
CAAS	criticality accident alarm system
EPB	effluent processing building
IFI	inspector followup item
IP	inspection procedure
ILMS	in-line monitor system
k_{eff}	effective neutron multiplication factor
MCA	multi-channel analyzer
NCS	nuclear criticality safety
NCSE	nuclear criticality safety evaluation
NFS	Nuclear Fuel Services, Inc. (licensee)
NUN	natural uranyl nitrate
OCB	oxide conversion building
PIRCS	Problem Identification, Resolution, and Corrective System
SRE	safety related equipment
UNB	uranyl nitrate building
[REDACTED]	[REDACTED]
U_{235}	uranium-235
WWTF	waste water treatment facility
Δk	fraction of calculated neutron multiplication