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NUCLEAR REGULATORY COMMISSION

REGION II
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August 28, 2006

CAL No. 02-06-003
NRC Event Nos. 42393, 42411

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

SUBJECT: NRC INSPECTION REPORT NO. 70-143/2006-011

Dear Mr. Ferguson:

This refers to the inspections conducted from June 5-9, June 19-23, June 26-30, and July 10-17, 2006, at your Erwin facility, which was part of the NRC's regional initiative in response to the March 6, 2006, event. The purpose of the inspection was to independently assess and verify the operational readiness of the Phase 1 equipment and procedures for the Blended Low Enriched Uranium Preparation Facility. The Phase 1 equipment included downblending, solvent extraction and their associated support utilities.

The inspections involved a focused review of the following areas: Configuration Management and Controls; Adequacy of Operating Procedures; Management Measures designed to ensure Items Relied On For Safety remained available; Change Control; and Nuclear Criticality Safety. Based on the results of this inspection, the NRC did not identify any significant program deficiencies nor violations of regulatory requirements.

This letter and the enclosed report contain sensitive unclassified information and will not be available for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS).

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D. B. Ferguson, Jr.

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Should you have any questions concerning this letter, please contact us.

Sincerely,

/RA/

David A. Ayres, Chief
Fuel Facility Inspection Branch 1
Division of Fuel Facility Inspection

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

Enclosure: NRC Inspection Report

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U. S. NUCLEAR REGULATORY COMMISSION

REGION II

Docket No.: 70-143

License No.: SNM-124

Report No.: 70-143/2006-011

Licensee: Nuclear Fuel Services, Inc.

Facility: Erwin Facility

Location: Erwin, Tennessee

Dates: June 5-9, 2006
June 19-23, 2006
June 26-30, 2006
July 10-17, 2006

Inspectors: M. Crespo, Fuel Facility Inspector
W. Gloersen, Senior Fuel Facility Project Inspector
J. Jimenez, Fuel Facility Inspector
T. Powell, Nuclear Criticality Safety Reviewer
N. Rivera, Fuel Facility Inspector
S. Subosits, Fuel Facility Inspector
G. Wertz, Senior Resident Inspector, BWX Technologies (Team Leader)

Approved by: D. Ayres, Chief
Fuel Facility Inspection Branch 1
Division of Fuel Facility Inspection

Enclosure

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EXECUTIVE SUMMARY

Nuclear Fuel Services, Inc.
NRC Inspection Report 70-143/2006-011

This inspection involved a review of the operational readiness of Phase 1 equipment and procedures for the Blended-Low Enriched Uranium Preparation Facility by NRC Region II inspectors and an NRC Headquarters nuclear criticality safety inspector. The Phase I equipment included downblending, solvent extraction, and their associated support utilities.


Configuration Management


- The field configuration of Phase 1 processing equipment was accurately reflected on the Process and Instrumentation Diagrams and in the Standard Operating Procedure. Potential unplanned special nuclear material solution “backflow” paths were not identified. Two discrepancies which involved misplaced Safety Related Equipment (SRE) tags and equipment incorrectly labeled with “0” (zero) rather than the letter “O” were identified and corrected. Additionally, rain water was observed leaking through the roof and into the operating area. An engineering project was planned to correct the leaks (Paragraph 2).

Operating Procedures

- Operating procedures adequately described the necessary steps to safely operate Phase 1 equipment; reflected the as-built condition of the system; highlighted Items Relied On For Safety (IROFS); and, reflected configuration changes associated with various operational modes. A few minor procedure discrepancies, identified by the inspectors, were corrected by the licensee (Paragraph 3).

Management Measures

- Management measures for Phase 1 equipment were reviewed and determined adequate to maintain IROFS and SRE safety function operable and available. No unapproved equipment was found in the processing area. Nuclear Criticality Safety postings were determined adequate. Corrective actions from the Problem Identification, Resolution and Corrective Action System were reviewed and determined adequate to resolve the discrepancies (Paragraph 4).
 - An integrated SRE test plan had not been developed prior to NRC review. The licensee completed the plan which was reviewed and determined adequate to ensure SRE was tested as soon as operationally feasible. SRE tests reviewed were found adequate to demonstrate the operability of the safety function (Paragraph 4).
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Change Control

- Facility changes implemented since the March 6 event were reviewed and adequately implemented in accordance with the licensee's revised work request system. Management and safety discipline review, as well as post-installation verification and functional testing were performed in accordance with the facility change process. Equipment not authorized for operation was physically isolated from other systems (Paragraph 5).

Nuclear Criticality Safety review

- Nuclear criticality safety of risk-significant fissile material operations in the downblending, solvent extraction, and ventilation systems was assured through engineering and administrative controls with adequate safety margin (Paragraph 6).

Attachment:

Partial List of Persons Contacted

Inspection Procedures Used

List of Items Opened, Closed, and Discussed

List of Acronyms


[REDACTED]

REPORT DETAILS

1. Summary of Plant Status

The Blended Low-Enriched Uranium (BLEU) Preparation Facility (BPF) remained shutdown during this inspection following the March 6, 2006, spill of high-enriched uranium (HEU) solution.

2. Configuration Management (Inspection Procedures (IP) 88005, 88020, 88025)

a. Scope and Observations

The inspectors reviewed the configuration of the BPF Downblending (DB) and Solvent Extraction (S/X) areas, and associated utilities (collectively known as "Phase 1" equipment) by comparing the installed configuration against the approved process and instrumentation diagrams (P&IDs). The inspectors also verified that "backflow paths" for special nuclear material (SNM)-bearing solutions were either isolated or eliminated to prevent unexpected accumulation in non-favorable geometry vessels. The inspectors also evaluated the solution's isolation effectiveness. The inspectors evaluated the licensee's configuration review of the Phase 1 equipment which involved area inspection by process engineers who performed system walkdowns and P&ID review.

The inspectors reviewed the DB, S/X and Utility P&IDs listed below:

(1) Downblending

333-F0404-D	333-F0549-D	333-F0550-D	333-F0551-D
333-F0552-D	333-F0553-D	333-F0554-D	-

(2) Solvent Extraction

333-F0450-D	333-F0456-D	333-F0457-D	333-F0459-D
333-F0463-D	333-F0452-D	333-F0454-D	333-F0458-D
333-F0460-D	333-F0461-D	333-F0462-D	333-F0464-D
333-F0465-D	333-F0466-D	333-F0467-D	333-F0603-D

[REDACTED]

(3) Utilities

333-F0060-D	333-F0066-D	333-F0422-D	333-F0067-D
333-F0061-D	333-F0068-D	333-F0052-D	333-F0415-D
333-F0600-D	333-F0601-D	333-F0050-D	333-F0065-D
333-F0054-D	333-F0057-D	333-F0051-D	333-F0464-D
333-F0062-D	333-F0072-D	333-F0055-D	-

The inspectors identified the following issues:

Safety Related Equipment (SRE) Tags Found on the Wrong Equipment

The inspectors noted that SRE tags for two failed float switches, FSL-2A12 and FSL-2B12, used for detection of the organic solvent/aqueous interface had been removed and relocated to external-mounted interface sensors on the strip columns for first and second pass S/X. Testing of the new sensors was not complete to ensure the acceptability of the equipment as an SRE and the respective P&IDs for the strip columns were not updated to reflect the new configuration. NFS management indicated that the SRE tags had probably been relocated in order to perform an SRE test on the new switches. The inspectors noted the level switches had been out of service for several months and reviewed their management measures which included a manual level verification. The new management measures were considered effective and had been properly documented in the Integrated Safety Analysis (ISA) and Standard Operating Procedure (SOP). However, NFS management considered the SRE tags acceptable on the new equipment since they represented a "level process" as opposed to a specific component. The inspectors noted that the P&ID and SRE tags' description was specific to the out of service level switches. Eventually, NFS management agreed and the SRE tags were removed.

Plant Equipment Labeling

The inspectors identified numerous S/X equipment labeled with "0" (zero) rather than the design required letter "O." The licensee's validation team had previously identified the condition but determined that it did not require correction prior to system operation. The inspectors disagreed and determined that the equipment was improperly labeled which could potentially confuse operators. The licensee agreed and corrected the labels.

Roof Leaks

The inspectors identified an operational concern when standing liquid was found on the mezzanine floor in DB. BPF management indicated that the liquid was rain water emanating from leaks in BPF roof. The inspectors were concerned that liquid could distract the operators during their normal work process and thus create a safety concern. Licensee management indicated roof leak repair attempts had been unsuccessful in the past but that an engineering plan was under development to correct the problem. The inspectors were satisfied with the long term corrective action.

b. Conclusions

Phase 1 processing equipment field configuration was accurately reflected on the P&ID and SOP. Potential unplanned SNM solution "backflow" paths were not identified. Two discrepancies which involved misplaced SRE tags and equipment incorrectly labeled with "0" (zero) rather than the letter "O" were identified and corrected. Additionally, rain water was observed leaking through the roof and into the operating area. An engineering project was planned to correct this problem.

3. Operating Procedures (IP 88020)

a. Scope and Observations

The inspectors reviewed the applicable sections of BPF SOP 409 for the Phase 1 equipment. The inspectors compared the SOP requirement and procedural actions to the associated P&IDs and to the installed equipment through field walkdowns.

Equipment identified in the SOP, P&IDs and in the facility as Item Relied On For Safety (IROFS) or SRE was reviewed against the applicable ISA requirements to determine the adequacy of installation and the effectiveness of the safety function. SOP post-operation equipment alignment and "generic procedure" usage were reviewed to assess whether processes were returned to a safe condition following operation.

The SOP and P&IDs were reviewed to ensure they reflected the specifications from the ISA. The licensee's completed changes were reviewed to ensure the appropriate configuration control was maintained, and IROFS's management measures were reviewed to ensure the safety functions had been tested and maintained adequately.

The inspectors reviewed the following sections of SOP 409:

(1) Downblending System

- SOP 409, Section 2, "*Natural Uranium Blendstock Dissolution and Transfer*," Revision 11
- SOP 409, Section 15, "*HEU Downblending Operations*," Revision 9
- SOP 409, Section 16, "*LEU Down Blending Operations*," Revision 8

(2) Solvent Extraction System

- SOP 409, Section 3, "*Processing of Materials Generated Outside Building 333 MAA*," Revision 4
- SOP 409, Section 4, "*Operation of Scales BPF Facility*," Revision 4
- SOP 409, Section 12, "*First Pass Solvent Extraction*," Revision 7
- SOP 409, Section 13, "*Second Pass Solvent Extraction*," Revision 6
- SOP 409, Section 14, "*BPF Raffinate Treatment Process*," Revision 4
- SOP 409, Section 20, "*General Cleaning of Building 333 Inside MAA*," Revision 3
- SOP 409, Section 21, "*General Cleaning of Building 333 Outside MAA*," Revision 3

(3) Utilities and Ventilation Systems

- SOP 409, Section 5; "*Monitoring and Servicing of Area Process Ventilation Systems*," Revision 3
- SOP 409, Section 6; "*333 Building HVAC Systems*," Revision 1
- SOP 409, Section 23; "*333 BPF Building Pressure Monitoring*," Revision 2
- SOP 409, Section 24; "*333 BPF Ventilation System*," Revision 4
- SOP 409, Section 25; "*333 BPF Scrubber Blowdown Tank*," Revision 1
- NFS-ACC-116; "*Procedure for NDA of the 333 Building Scrubber System Using Easy-Spec Instrument*," Revision 1
- SOP 409, Section 7, "*BPF Operation of the Bulk Chemical Supply Systems*," Revision 3
- SOP 409, Section 30, "*Process Gases for BPF*," Revision 0
- SOP 409, Section 28, "*33 Building Air Fluid Cooler and Pumping Station*," Revision 0

The inspectors identified the following issues:

Procedure Discrepancies:

- Two locked closed valves were not identified as locked on P&ID 333-F0553-D.
- An inlet line to Column 4A01 was not captured on the P&ID.
- In SOP 409, Section 16, step 6.5.5 (e) was missing the Process Logic Controller (PLC) action. Also, there was no operator action to complete a step prior to recording a level reading.
- P&ID 333-F0551-D showed two instruments on the P&ID in the wrong location.

These discrepancies were discussed with the cognizant engineers and were corrected.

b. Conclusions

Operating procedures adequately described the necessary steps to safely operate Phase 1 equipment; reflected the as-built condition of the system; highlighted IROFS; and, reflected configuration changes associated with various operational modes. A few minor procedure discrepancies, identified by the inspectors, were corrected by the licensee.

4. **Management Measures (IP 88025)**

a. Scope and Observations

The inspectors reviewed the management measures for IROFS and SRE for Phase 1 equipment and compared their descriptions and safety function as listed in the approved ISA with the installed configuration. The inspectors reviewed surveillance tests and modifications to IROFS and SREs to ensure the proper operation and safety function had been maintained. The inspectors reviewed the processing areas for unapproved or untested or uncontrolled systems or components. The inspectors reviewed nuclear criticality safety (NCS) postings. The inspectors reviewed problem reports in the Problem Identification, Resolution and Correction Action System (PIRCS) and evaluated the effectiveness of the corrective actions.

The inspectors reviewed the following work orders (WOs):

WO 77243	WO 78218	WO 77690	WO 101613
WO 101326	WO 96935	WO 96196	WO 97810

The inspectors reviewed the SRE and associated IROFS and concluded they were installed as described in the ISA and on the P&IDs. The inspectors verified the adequacy of NCS postings and found the SRE in the field to be properly tagged and labeled. The content and quality of the SRE test documentation was reviewed and found satisfactory to ensure proper testing of the SRE/IROFS functions. The inspectors determined that modifications were accurately reflected on the P&IDs.

The inspectors verified that all the IROFS detailed in the ISA were present in the process, that the licensee was adequately performing the scheduled maintenance. The functional test procedure and documentation for IROFS met the intent of the ISA. Functional tests reviewed showed the steps provided an adequate measure to test the IROFS complied with their design requirements.

SRE Test Plan Lacking

The team identified that the licensee lacked an integrated schedule to identify the SRE test sequence. Several SRE tests could not be performed because they required SNM-bearing solution. The inspectors were concerned that, absent a comprehensive test schedule, SRE tests could be overlooked and processing operations could occur without the assurance of an effective SRE function. The licensee concurred and developed an integrated SRE surveillance test plan. The inspectors reviewed the plan and determined it was adequate. The plan was integrated into the (restart) operational procedures.

Following completion of the SRE test plan, the inspectors reviewed the SRE tests to verify properly IROFS functional testing. The list was properly organized and accurate for the Phase 1 equipment. The inspectors also reviewed the contents and the implementation of several of the tests. The inspectors identified that the SRE test for the PLC program used some ambiguous language that could reduce the safety margin. The test language was modified to more accurately describe the test actions.

b. Conclusions

Management measures for Phase 1 equipment were reviewed and determined adequate to maintain IROFS and SRE safety function operable and available. No unapproved equipment was found in the processing area. NCS postings were determined adequate. Corrective actions from the PIRCS were reviewed and determined adequate to resolve the discrepancies.

[REDACTED]

An integrated SRE test plan had not been developed prior to NRC review. The licensee completed the plan which was reviewed and determined adequate to ensure SRE testing was performed as soon as operationally feasible. SRE tests reviewed were found adequate to demonstrate operability of the safety function.

5. **Change Control (IP 88010, 88020)**

a. **Scope and Observations**

The inspectors reviewed the facility changes and work requests for the Phase 1 equipment initiated since March 6, 2006 spill event. The work requests were reviewed to determine proper categorization and safety review. One work request involving the DB Loss-of-Function alarm was noted to have changed categories multiple times before the completion of the work. The inspectors verified that the appropriate safety evaluations were performed and that the work request was correctly categorized as "major."

The inspectors reviewed documentation from the licensee's completed facility changes as part of their restart efforts. The work request packages documented the required information for the safety evaluations and implementation of the changes. Reviews included the appropriate engineering discipline, management review of proposed changes upon implementation, verification of concurrence from all parties involved, incorporation of applicable functional tests to the package, results obtained after implementation of the changes, and verification by independent management or operations that approved changes were incorporated as prescribed by the work request. Changes reviewed were related to modification to the procedures, physical components and process diagrams of Phase 1 equipment.

The inspectors also noted appropriate implementation of the new revision of the work request procedure. The procedure revision required equipment not approved for operations to be physically disconnected from process and utility lines. The inspectors noted the appropriate disconnections on several gloveboxes in the S/X area.

b. **Conclusions**

Facility changes implemented since the March 6 event were reviewed and adequately implemented in accordance with the licensee's revised work request system. Management and safety discipline review, as well as post-installation verification and functional testing were performed as part of the facility change process. Equipment not authorized for operation was physically isolated from other systems.

[REDACTED]

6. Nuclear Criticality Safety (HQ) Review (IP 88015)

a. Scope and Observations

The inspectors performed a review of the NCS accident sequences for the DB, S/X and ventilation systems in BPF. The inspectors also performed walkdowns of NCS controls in these areas to assure that the NCS analyses accurately reflected the existing plant configuration. The inspectors reviewed aspects of the following NCS analyses:

- 54T-06-0031, "*Nuclear Criticality Safety Evaluation, BLEU Preparation Facility Downblending,*" Revision 7
- 54T-05-0037, "*Nuclear Criticality Safety Analyses for the BPF Process Ventilation System,*" Revision 4
- 54T-06-0015, "*Nuclear Criticality Safety Evaluation for the BPF Solvent Extraction,*" Revision 4
- JFK-06-002, "*BPF Blend Tank Freeze Calculations,*" dated July 11, 2006

The inspectors reviewed each NCS analysis to determine that realistic or conservative assumptions for each process description and condition were made, that the controls specified by the NCS analyses were appropriate and adequate to assure safety, and that ISA data supported a finding that the risk of a criticality accident was sufficiently low.

During a walkdown of the BPF S/X area, the inspectors noted that the NCS analyses for the BPF S/X process used an interaction model that included a glovebox that had been removed from the area. The inspectors determined that including the glovebox in the model had little impact on interaction and that the model was bounding for the equipment. The inspectors determined that the glovebox that was moved will be used in the future as part of the uranium metal dissolution process and a revision to the uranium metal dissolution NCS analyses was being developed to include the enclosure.

During a review of the NCS analyses for the DB area, the inspectors noted that the accident sequence involving precipitation of uranyl nitrate in the blend or hold tanks due to freezing was considered to be not credible. The NCS analyses stated that precipitation inside the tanks would require loss of the building heat, the inability to transfer solution within three days and record low ambient temperatures. The inspectors noted that the reference that included the calculations supporting the incredibility of freezing in the blend tanks could not be located. The licensee developed the calculations, which the inspectors reviewed. The inspectors determined that the calculations supported the licensee's conclusion.

[REDACTED]

The inspectors did not identify any risk-significant criticality safety issues during the inspection. The inspectors concluded that criticality safety of risk-significant fissile material operations in the BPF DB, S/X and ventilation systems was assured through engineering and administrative controls with adequate safety margin.

b. Conclusions

NCS of risk-significant fissile material operations in the BPF DB, S/X, and ventilation systems was assured through engineering and administrative controls with adequate safety margin.

7. Exit Meeting

The inspection scope and results were presented to members of the licensee management on June 30, 2006. Proprietary documents and processes were reviewed during this inspection. No dissenting comments were received from the licensee.

[REDACTED]

[REDACTED]

ATTACHMENT

1. PERSONS CONTACTED

Partial List of Licensee's Persons Contacted

R. Bond, Senior Project Director, HEU Operations
D. Craig, Verification and Validation Lead
R. Danna, BPF Engineering Manager
R. Droke, NFS Licensing & Compliance Director
D. Ferguson, Chief Executive Officer
F. Guinn, Advisor
G. Hazelwood, Engineering Director
M. Lee, ORR Verification and Validation Coordinator
B. Maurer, NCS Engineer
M. Moore, Vice President, Safety and Regulatory
D. Rodgers, BPF Facility Manager
R. Shackelford, NCS Manager
T. Sheehan, HEU Operations Director
M. Shope, Quality Engineering Supervisor
K. Schutt, Vice President
A. Ward, General Counsel
J. Wheeler, ISA Manager

Nuclear Regulatory Commission

D. Ayres, Branch Chief, Region II

Other licensee employees contacted included engineers, technicians, production staff, security, and office personnel.

2. INSPECTION PROCEDURES USED

IP 88005	Management Organization and Controls
IP 88010	Operator Training/Retraining
IP 88015	Headquarters Nuclear Criticality Safety Program
IP 88020	Regional Nuclear Criticality Safety Inspection Program
IP 88025	Maintenance/Surveillance

3. LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

None

[REDACTED]

4. LIST OF ACRONYMS USED

BLEU	Blended Low Enriched Uranium
BPF	BLEU Preparation Facility
DB	Downblending
HEU	High Enriched Uranium
IP	Inspection Procedure
IROFS	Item Relied On For Safety
ISA	Integrated Safety Analysis
NCS	Nuclear Criticality Safety
NFS	Nuclear Fuel Services
NRC	Nuclear Regulatory Commission
P&ID	Piping and Instrumentation Diagram
PIRCS	Problem Identification, Resolution and Correction Action System
PLC	Process Logic Controller
S/X	Solvent Extraction
SNM	Special Nuclear Material
SOP	Standard Operating Procedure
SRE	Safety Related Equipment
WO	Work Order