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NUCLEAR REGULATORY COMMISSION
REGION II
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[redacted]

September 11, 2006

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

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

SUBJECT: NRC INSPECTION REPORT NO. 70-143/2006-012

Dear Mr. Ferguson:

This refers to the inspection conducted from July 24 through 28, 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 Uranium-Aluminum, Uranium-metal, Uranium-oxide and Clean Out processes, procedures, and equipment (also known as the Phase 2 equipment) for the Blended Low Enriched Uranium Preparation Facility. The inspection involved a focused review of the Phase 2 equipment in the following areas: 1) Configuration Management and Controls; 2) Adequacy of Operating Procedures; 3) Management Measures designed to ensure Items Relied on For Safety remained available; 4) Change Control; and, 5) Nuclear Criticality Safety. In addition, special emphasis was placed on the review of process piping and equipment, and procedural controls used to ensure that potential special nuclear material backflow conditions were prevented.

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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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

cc w/encl:
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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:	July 24 through 28, 2006
Inspectors:	J. Jimenez, Fuel Facility Inspector N. Jordan, HQ Nuclear Criticality Safety Reviewer N. Rivera, Fuel Facility Inspector S. Subosits, Fuel Facility Inspector G. Wertz, Senior Resident Inspector, BWX Technologies
Approved by:	D. Ayres, Chief Fuel Facility Inspection Branch 1 Division of Fuel Facility Inspection

Enclosure

EXECUTIVE SUMMARY

Nuclear Fuel Services, Inc.
NRC Inspection Report 70-143/2006-012

This inspection involved a review of the operational readiness of the procedures and equipment for the uranium-aluminum (U-Al), uranium-metal (U-metal), uranium-oxide (U-oxide), and clean out processes, for the Blended-Low Enriched Uranium (BLEU) Preparation Facility (BPF) by NRC Region II inspectors and an NRC Headquarters nuclear criticality safety reviewer.

Uranium-Aluminum Operations

- The U-Al operations process was adequately described in the Process & Instrumentation Diagrams (P&IDs) and Standard Operating Procedure (SOP). Potential solution backflow paths were not identified. U-Al Safety Related Equipment (SRE) and Items Relied On For Safety (IROFS) were installed as described. The U-Al area nuclear criticality safety (NCS) postings were sufficient to provide adequate controls to the operators. U-Al SRE test documentation appeared adequate to ensure proper testing of the safety functions (Paragraph 2).

Uranium Metal and Uranium Oxide Operations

- The SOP for the U-metal and U-oxide process had sufficient detail to safely operate the processing equipment. IROFS were properly identified in the procedure. A review of work orders and SRE tests indicated IROFS were adequately maintained. No backflow concerns were identified during inspection of the processing areas (Paragraph 3).

Centrifugal Bowl Clean Out Operations

- The Centrifugal Bowl Clean Out Process was adequately described by the SOP. The as-found field configuration matched the P&IDs. SRE testing maintained the safety function. No backflow paths were identified (Paragraph 4).

Process Inventory Clean Out Operations

- The SOP and P&IDs for the Process Inventory Clean Out had been properly maintained to match the field configuration. Potential backflow paths were reviewed and none were identified. SRE tests were adequate to ensure the safety function was maintained (Paragraph 5).

[redacted]

Nuclear Criticality Safety Review

- The NCS of risk-significant fissile material operations in the U-metal and U-Al dissolution process 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

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[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. Uranium-Aluminum Process (Inspection Procedures (IPs) 88005, 88020, and 88025)

a. Scope and Observations

The inspectors walked down and reviewed the following BPF uranium-aluminum (U-Al) process piping and instrumentation diagrams (P&IDs):

333-F0406-D	333-F0409-D	333-F0412-D	333-F0416-D	333-F0420-D
333-F0407-D	333-F0410-D	333-F0413-D	333-F0417-D	333-F0421-D
333-F0408-D	333-F0411-D	333-F0414-D	333-F0419-D	333-F0422-D

The inspectors verified backflow paths for U-Al special nuclear material (SNM)-bearing solutions were either isolated or eliminated to prevent unexpected accumulation in non-favorable geometry vessels. The inspectors determined field configurations and modifications were accurately reflected on the P&IDs. The inspectors identified a minor issue regarding what appeared to be temporary installation of heat-trace tape on two sections of U-Al process piping. The tapes were not connected. The licensee was notified of the issue and agreed to review the need for permanent heat-trace. The inspectors identified some other minor discrepancies between the as-built configuration, the P&IDs and equipment labeling which were discussed with operations and engineering staff for resolution.

The inspectors reviewed following sections of Standard Operating Procedure (SOP) 409:

- SOP 409, Section 10, *"U-Aluminum Dissolution,"* Revision 11
- SOP 409, Section 10 A, *"U-Aluminum Accountability Columns,"* Revision 1

The inspectors reviewed the applicable portions of the Integrated Safety Analysis (ISA) including the Safety-Related Equipment (SRE) and Items Relied on For Safety (IROFS) to determine if they adequately described system startup, routine and abnormal operations. The inspectors determined the SOP sections contained sufficient detail to properly align system components for operations and restore the system to a safe

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configuration following use. The SOP sections reviewed did not contain generic procedures which may result in the inadvertent transfer or spill of SNM-bearing solutions.

The inspectors found the U-Al SRE and associated IROFS were installed as described in the ISA and P&IDs. The inspectors verified that nuclear criticality safety (NCS) postings in the U-Al process area were adequate and found the SRE in the field to be properly tagged and labeled. The content and quality of the SRE test documentation for U-Al process was reviewed and found satisfactory to ensure proper testing of the SRE/IROFS functions.

b. Conclusions

The U-Al operations process was adequately described in the P&ID and SOP. Potential solution backflow paths were not identified. U-Al SRE and IROFS were installed as described. The U-Al area NCS postings were sufficient to provide adequate NCS controls to the operators. U-Al SRE test documentation appeared adequate to ensure proper testing of the SRE functions.

3. Uranium Metal and Uranium Oxide Operations (IPs 88005, 88020, and 88025)

a. Scope and Observations

The inspectors reviewed the following SOP sections for the Uranium-metal (U-metal) and Uranium-Oxide (U-oxide) processes:

- SOP 409, Section 8, *"U-Metal Oxidation and U-Oxide Dissolution,"* Revision 14
- SOP 409, Section 9, *"TVA U-Metal Sampling/Container Splitting and U/Oxide Sampling,"* Revision 4

The inspectors verified that the U-metal and U-oxide sections included sufficient detail to operate the equipment, that proper configuration was maintained following operation, and that IROFS were identified. The inspectors identified the following minor procedure discrepancy:

> SOP 409, Section 8, covered two different processes which used the same equipment and had similar steps. The procedure had three sections (steps 4, 5, and 6) and those sections were divided into 'A' steps for U-metal and 'B' steps for U-oxide. Also, there were steps in the SOP that referenced other steps. The inspectors concluded the steps and multiple references could easily confuse an operator. The issue was discussed with the SOP owner who planned to revise the procedure.

[redacted]

The inspectors conducted walkthroughs of P&IDs for the U-metal and U-oxide processes to verify that they were accurate and that potential backflow situations were not possible. The following P&IDs were reviewed:

333-F0398-D	333-F0399-D	333-F0400-D
333-F0401-D	333-F0402-D	333-F0403-D
333-F0454-D	333-F0469-D	306-F0701-D

The inspectors identified the following P&ID discrepancies which were communicated to the licensee for correction:

- The SRE number for a drain on P&ID 333-F0399-D was labeled SRE-2 instead of SRE-1.
- One locked closed valve was not identified as locked on P&ID 333-F0403-D.
- Two locked closed valves were not identified as locked on P&ID 333-F0402-D.

The inspectors reviewed the work orders (WOs) 100642 and 98035 and the following SRE tests:

N333XCONDEN3A15	N333X DRAINH2I06	N333XVALVEBA3A25 (BUM-9)
N333XCONDEN3B15	N333XXXXPSV7W48	N333XVALVE3A04D (BUM-14, BUM-16)
N333XDISOLV3A05	-	-

The inspectors verified the SRE was properly tagged and labeled. The inspectors also inspected the U-metal and U-oxide process area and configuration. No backflow situations were identified.

b. Conclusions

The SOP for the U-metal and U-oxide process had sufficient detail to safely operate the processing equipment. IROFS were properly identified in the procedure. A review of WOs and SRE tests indicated IROFS were adequately maintained. No backflow concerns were identified during inspection of the processing areas.

[redacted]

[redacted]

4. Centrifuge Bowl Clean Out Process (IPs 88005, 88020, and 88025)

a. Scope and Observations

The inspector reviewed the following SOP 409 section:

SOP 409, Section 27, "*Centrifuge Bowl Cleanout Process,*" Revision 4

The inspectors verified that the licensee adequately explained how to safely conduct the cleaning procedure, that the instructions could be followed in the process floor, that safety significant components and measures were highlighted and that it adequately assessed the configuration of the system for the different modes of operations.

The reviewed procedure was also verified to be correspondent with the revised process PI&D 333-F0423-D. Walkdown of the procedure with the PI&D demonstrated the licensee had adequately revised the SOP through the configuration control process. Careful inspection of the valve arrangement and configuration throughout the procedure verified the licensee had adequately ensured that a backflow condition was not created.

The inspector verified that all the IROFS detailed in the ISA were present in the process, that the licensee adequately performed the scheduled maintenance, and that the safety function was maintained.

The inspector reviewed documentation samples from the licensee's completed changes to the Bowl Cleaning Station and the SRE tests performed as part of the restart efforts. The change requests documented the required information for the deletion of an IROFS including the appropriate management reviews. The inspectors reviewed the following SRE tests to ensure activities to be performed at the cleaning station would not result in an operator hazard or criticality accident and that the safety function according to the ISA had been adequately tested. The procedure for testing of the safety equipment was IROFS-333-UALBCS. The equipment tested included:

N333CNTRTFUGE186	N333CNTRTFUGE088	N333CNTRTFUGE075
N333CNTRTFUGE187	N333CNTRTFUGE073	N333XWOGVNT1N01
N333CNTRTFUGE087	N333CNTRTFUGE074	N333VALVEBA1N56

The inspectors reviewed the P&IDs and walked down the process utility connections to identify potential backflow conditions. The inspectors also reviewed the licensee's analysis for potential backflow which appeared adequate. The inspectors noted the licensee had completed an independent system alignment and connection verification walkdown. The inspector determined the licensee had adequately addressed possible backflow in the Bowl Cleaning station.

[redacted]

[redacted]

b. Conclusions

The Centrifugal Bowl Clean Out Process was adequately described by the SOP. The configuration matched the P&ID. SRE testing maintained the safety function. Backflow paths were not identified.

5. Process Inventory Cleanout (IPs 88005, 88020, and 88025)

a. Scope and Observations

The inspectors reviewed the Process Inventory Cleanout focusing on a review of possible connections that could create backflow pathways to unwanted locations that could result in an inadvertent criticality accident. The applicable procedures were reviewed for adequacy; PI&Ds were evaluated to ensure they reflect the specifications from the operating procedures; the licensee's completed changes were reviewed to ensure the appropriate configuration control was maintained; and IROFS management measures were reviewed to ensure the safety functions had been tested and maintained adequately. Procedures reviewed included:

- SOP 409, Section 19A, "*U-AL Process Inventory Cleanout,*" Revision 1
- SOP 409, Section 19B, "*HEU Downblend Process Inventory Cleanout,*" Revision 2
- SOP 409, Section 19C, "*HEU U-Metal Process Inventory Cleanout*," Revision 2
- SOP 409, Section 19D, "*BPF Solvent Extraction Process Inventory Cleanout,*" Revision 2
- SOP 409, Section 19E, "*Raffinate Solidification Process Inventory Cleanout,*" Revision 1

The procedure review included operational steps, safety significant requirements, and system valve configurations. The procedure steps were understandable and the critical steps were highlighted. The inspectors verified that the transfer flow paths detailed in the procedures did not create a backflow condition. The P&IDs reviewed were part of NRC's Phase 1 Operational Readiness Review (See NRC Inspection Report 70-143/2006-011).

A review of the management measures for the licensee's IROFS demonstrated the licensee had properly scheduled the required maintenance and surveillance for the applicable IROFS. The functional tests reviewed showed the steps provided an adequate measure to test the IROFS complied with their design requirements.

b. Conclusions

The SOP and P&ID for the Process Inventory Cleanout had been properly maintained to match the field configuration. Potential backflow paths were reviewed and none were identified. SRE tests were adequate to ensure the safety function was maintained.

[redacted]

6. Headquarters Nuclear Criticality Safety Review (IP 88015)

a. Scope and Observations

The inspector reviewed NCS accident sequences for the U-metal and U-Al dissolution processes. The inspector verified that the NCS analyses were representative of existing process configurations and that valid and bounding credible assumptions were used in their analytical bases.

The inspector performed a walkdown of the areas pertaining to the BPF process, and reviewed the following analyses and associated procedures and P&IDs:

- 54T-06-0034, "*Nuclear Criticality Safety Evaluation for the Dissolution of Uranium Metal and High Enriched Uranium Storage Columns*," Revision 9.
- 54T-06-0014, "*Nuclear Criticality Safety Evaluation for the Blended Low Enriched Uranium Preparation Facility U-Aluminum Dissolution*," Revision 9.

The inspector determined that NCS evaluations represented the existing configurations for the equipment associated with each of the two processes. The analyses also captured present process changes as part of the licensee's readiness effort. Assumptions in the analyses were based on existing system parameters, and controls credited in the analyses were shown to be adequate, if properly implemented, to maintain system safety. The accident sequences identified in the process evaluations were consistent with those assessed in the ISA. Accident sequences involving backflow into adjoining systems were also addressed in the NCS evaluations. There were no newly identified accident sequences that failed to be captured in the existing process evaluations.

During walkdowns of the area, the inspector found that flowpaths to the process enclosures were physically disconnected to ensure there were no available means for material to inadvertently enter the process enclosures. The inspector also found that overflow lines originally directed to the knockout column were redirected to the process floor which is credited with maintaining a safe slab height.

The inspector identified no significant criticality safety issues. The inspector concluded for the process as observed that nuclear criticality safety of risk-significant operations in the U-metal and U-Al dissolution process areas was assured through engineering and administrative controls with adequate safety margin.

b. Conclusions

The NCS of risk-significant fissile material operations in the U-metal and U-Al dissolution process systems was assured through engineering and administrative controls with adequate safety margin.

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[redacted]

7. Exit Meeting

The inspection scope and results were presented to members of the licensee management on July 28, 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

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

2. INSPECTION PROCEDURES USED

IP 88005	Management Organization and Controls
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

4. LIST OF ACRONYMS USED

BLEU	Blended Low Enriched Uranium
BPF	BLEU Preparation Facility
HEU	High Enriched Uranium
IP	Inspection Procedures
IROFS	Item Relied On For Safety
ISA	Integrated Safety Analysis

[redacted]

[redacted]

NCS	Nuclear Criticality Safety
NFS	Nuclear Fuels Services
P&IDs	Piping and Instrumentation Diagram
SNM	Special Nuclear Material
SOP	Standard Operating Procedure
SRE	Safety Related Equipment
U-Al	Uranium-Aluminum
U-metal	Uranium-metal
U-oxide	Uranium-Oxide
WO	Work Order

[redacted]