August 22, 2014

EN 49848, EN 49998

Mr. Joel W. Duling, President
Nuclear Fuel Services, Inc.
P.O. Box 337, MS 123
Erwin, TN 37650

SUBJECT: NUCLEAR FUEL SERVICES – U.S. NUCLEAR REGULATORY COMMISSION INSPECTION REPORT NO. 70-143/2014-203

Dear Mr. Duling:

The U.S. Nuclear Regulatory Commission (NRC) conducted a routine, announced nuclear criticality safety (NCS) inspection at your facility in Erwin, Tennessee, from July 21 – 24, 2014. The purpose of the inspection was to determine whether activities involving special nuclear material were conducted safely and in accordance with your license and regulatory requirements. Throughout the inspection, observations were discussed with your staff. An exit meeting was held on July 24, 2014, during which inspection observations and findings were discussed with your management and staff.

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 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 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. The inspection also included a review of the facility's criticality accident alarm system. Based on the inspection, your activities involving nuclear criticality hazards were found to be conducted safely and in accordance with regulatory requirements.

In accordance with Title 10 of the *Code of Federal Regulations* 2.390 of the NRC's "Agency Rules of Practice and Procedure," a copy of this letter and the enclosure will be made publicly available in the public electronic reading room of NRC's Agencywide 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 Christopher S. Tripp of my staff at 301-287-9153, or via email to Christopher.Tripp@nrc.gov.

Sincerely,

/RA/

Timothy Mossman, Acting Chief
Programmatic Oversight and
Regional Support Branch
Division of Fuel Cycle Safety
and Safeguards
Office of Nuclear Material Safety
and Safeguards

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

Enclosure:
Inspection Report 70-143/2014-203
w/Attachment: Supplementary Information

cc w/enclosure: See page 3

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cc w/enclosure:

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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.:	70-143/2014-203
Licensee:	Nuclear Fuel Services, Inc.
Location:	Erwin, TN
Inspection Dates:	July 21-24, 2014
Inspectors:	Christopher Tripp, Criticality Safety Inspector Timothy Sippel, Criticality Safety Inspector Nicholas Peterka, Fuel Facility Inspector
Approved by:	Timothy Mossman, Acting Chief Programmatic Oversight and Regional Support Branch Division of Fuel Cycle Safety and Safeguards Office of Nuclear Material Safety and Safeguards

Enclosure

EXECUTIVE SUMMARY

NUCLEAR FUEL SERVICES, INC.
NRC INSPECTION REPORT 70-143/2014-203

Introduction

Staff of the U.S. Nuclear Regulatory Commission (NRC) performed a routine, announced nuclear criticality safety (NCS) inspection of the Nuclear Fuel Services, Inc. (NFS) facility, License Number SNM-124, in Erwin, Tennessee, from July 21-24**,** 2014. The inspection included an onsite review of the licensee's NCS program, NCS training, NCS evaluations, NCS audits, internal NCS event review and follow-up, criticality accident alarm system (CAAS), plant operations, and open items follow-up. The inspection focused on risk-significant fissile material processing activities and areas related to high-enriched uranium fuel fabrication.

Results

- No safety concerns were identified regarding the licensee's NCS program.
- No safety concerns were identified regarding training and qualification for NCS engineers.
- No safety concerns were identified regarding NCS inspections, audits, and investigations.
- No significant issues were found during the review of the licensee's CAAS.
- No safety concerns were identified regarding NCS event review and follow-up.
- No safety concerns were identified during walkdowns of plant operations.
- No new safety concerns were identified during review of open items.

REPORT DETAILS

1.0 Summary of Plant Status

NFS produces low-enriched uranium liquid from down blending activities, performs activities for the Navy, conducts routine ammonia recovery process and liquid waste treatment at its Erwin, Tennessee site. During the inspection, NFS was performing routine down blending and fuel fabrication.

2.0 Nuclear Criticality Safety Program (IP 88015 & 88016)

a. Inspection Scope

The inspectors reviewed the licensee's NCS program and analyses. The inspectors evaluated the adequacy of the program and analyses to assure the safety of fissile material operations. The inspectors reviewed selected Nuclear Criticality Safety Evaluations (NCSEs) to determine that criticality safety of risk-significant operations was assured through engineered and administrative controls with adequate safety margin and prepared and review by qualified staff. The inspectors interviewed licensee managers and engineers in the safety and production departments. The inspectors reviewed selected NCS-related items relied on for safety (IROFS) to determine that the performance requirements have been met for selected accident sequences. The inspectors accompanied NCS and other technical staff on walkdowns of NCS controls in selected plant areas. The inspectors reviewed selected portions of the documents listed in Section 2.2 of the Attachment.

b. Observations and Findings

The inspectors examined new and revised NCS evaluations and analyses. All changes instituted since the previous inspection were determined to be minor in scope. The inspectors noted that the Building 100 non-destructive assay (NDA) lab (NCSE 54T-14-0029) was changed to explicitly allow special nuclear material (SNM) to be brought into the lab to fashion new NDA standards. Scenarios involving this material were discussed, which included bringing too many containers or overloaded containers into the lab or violating spacing limits between batches of material. However, none of the scenarios in the lab were deemed credible and no IROFS were designated. The NCSE indicated a minimum of three properly loaded containers would be needed to exceed the minimum critical mass. This was based on the hand-carry nuclear criticality safety analysis (NCSA) (54X-98-0024) and assumed the maximum mass allowed in the three containers was optimally moderated and assembled together in a hemisphere on a concrete floor, and also reflected above by several inches of water. The stated basis for why this configuration is incredible is that this would require many unlikely human actions or errors (multiple container upsets) to reach this configuration. The inspectors questioned whether two upsets were sufficient to meet the "many unlikely human actions or errors" standard and also whether successive upsets could be committed by the same individual. The inspectors further noted that an event involving multiple container upsets in the 310 Warehouse had occurred in 2013 (documented in problem identification resolution and corrective system (PIRCS) Condition Report 37846 and Investigation

Report 15684); the criterion involving multiple actions or errors, as stated in the definition of incredible in its Site-Wide integrated safety analysis (ISA) Summary (21T-14-0001), specifies that no such event must have actually occurred in any fuel facility.

The licensee indicated that the NDA lab NCSE also made reference to those materials not normally being present in the lab, and stated that its argument rested largely on the fact that fabricating standards is a rare operation and the scenario would require the uncontrolled movement of several containers of SNM from the material accountability area (MAA) to the lab. It further stated that the hand-carry NCSA, which formed the basis for the determination of the safe mass, assumed the material was normally present and readily available and did not treat such upsets as incredible in other areas. The inspectors determined, based on discussions with the licensee and the explanation in the NCSEs, that credit can be taken for material control and the unlikelihood of multiple inadvertent transfers from the MAA. Further, there was considerable safety margin in that several enabling conditions needed to also be present (including optimum moderation, removal from containers and assembling the material into a sphere, and tight reflection by water and concrete) before a criticality accident is possible. Because of this safety margin, and the necessary controls being in place, the inspectors determined this did not constitute a safety concern. There is potential for a regulatory concern if scenarios are improperly characterized as incredible, because those controls may not therefore be designated as IROFS. With regard to the previous incident (as documented in PIRCS Condition Report 37846), the licensee stated that it considered the incredibility criteria to be met, in part, because it had not resulted in an accident. The licensee therefore considered “no such sequence of events” to refer not to the multiple container upsets, but to the whole chain leading to a criticality accident. (The criticality accident at the Siberian Chemical Combine in 1978 was discussed, but considered to be inapplicable). The inspectors recognize there may be some ambiguity regarding the extent of “no such sequence of events,” but the upset in PIRCS Condition Report 37846 still indicates the potential exists for multiple container upsets by a single individual or group of individuals. However, due to the material control and accountability controls in place, the additional administrative controls in place (even though they are not IROFS), and the enabling conditions discussed above, the staff finds that the licensee’s handling of SNM for fabrication of standards in the NDA lab does not constitute a safety concern.

The inspectors also examined the NCSE for the Building 310 Warehouse (54T-13-0004), which involves the storage of 30-gallon and 55-gallon waste drums, birdcage drums containing bottles and 5-gallon buckets, and burial boxes and bags with miscellaneous waste. This was the area in which high-enriched waste was packaged in 5-gallon buckets and improperly stored as fissile exempt material in the warehouse (PIRCS Condition Report 37846). Fissile exempt material (by the definition in Title 10 of *the Code of Federal Regulations* 71.15 is low-level material requiring no specific NCS controls, such as restrictions on horizontal spacing or vertical stacking. The incident involved 18 drums of material in excess of the fissile exempt criteria; the total quantity of material exceeded a minimum critical mass, but no single drum contained an unsafe quantity and the drums were distributed in various locations and not assembled together. The inspectors determined that the NCSE had been revised so as to include multiple checks to verify that containers had been packaged correctly (although they were not IROFS, as criticality was not considered credible as in the case above). The inspectors did observe that these checks relied on content labels generated by upstream NDA, so

that they are not strictly independent. While the upstream waste characterization was not specifically examined during this inspection, it has been inspected in the past, and the calculations forming the basis for controlled parameter limits in the warehouse have considerable safety margin with regard to allowed mass, enrichment, container loading, and stacking restrictions. The licensee did not consider the incident that occurred to be a credible initiating event leading to an accident in the warehouse. The licensee stated that the incident was mentioned in the NCSE, and that it had put additional checks in place that it considered sufficient to prevent recurrence. Also, the licensee's conservative model assumed misloading every container in the storage array, as well as several containers stacked in violation of the stacking restrictions, and therefore it bounded any credible condition arising should a similar event recur as well as bounding the event that had actually occurred.

The inspectors walked down the 300 Complex, including the 400 and 500 Areas, and discussed the operations with the cognizant licensee NCS engineer. The inspectors reviewed selected portions of the NCSE and Control Flowdown for these Areas. The inspectors did not observe any discrepancies between the Control Flowdown and those established in the field.

The inspectors reviewed the licensee's most recent verification and validation report from 2012. The most significant revision to the report is the inclusion of SCALE 6.1 with the V7-238 group library from ENDF/B – VII. The statistical methods used for the validation did not change between revisions. However, the inspectors noted that the tests for normality (the Lilliefors and Kolmogorov-Smirnov tests) failed, but the licensee still used the Lower Tolerance Limit (LTL) approach to determine the Upper Safety Limit (USL) for the site which relies upon a normal distribution of data. The licensee explained the LTL yielded a more conservative (lower) USL than their distribution-free/nonparametric method (NPM), which would be the method normally used to determine a USL when the tests for a normal distribution fail. The inspectors noted that the NPM referenced in NUREG/CR-6698 and commonly used within the industry would be expected to yield a lower USL than the LTL method. The licensee utilized a different NPM than referenced in NUREG/CR-6698 and was able to provide the inspectors the reference source for their NPM. At the time of the inspection, the licensee has not used SCALE 6.1 for criticality safety calculations beyond running test cases and should the licensee use the new validation in the future, the inspectors will examine it at that time.

The inspectors observed that the USL derived for low enriched uranium conditions was slightly less than license condition of a k-effective of 0.97. The inspectors verified the USL derived for both low enriched and highly enriched uranium were appropriately implemented into license procedures.

c. Conclusions

The inspectors did observe that the basis for concluding that some event sequences are incredible is often not well-documented, although the licensee's reasoning appeared to be technically sound upon further discussion. The inspectors also observed that the licensee's criteria did not explicitly require consideration of dependency between successive failures, as with those involving repeated actions by a single operator, and took a very narrow view of the requirement that "no such sequence of events" could

have actually occurred in any fuel facility. In the cases examined during this inspection, however, there was no safety concern because the licensee had established sufficient controls and had substantial safety margin. No safety concerns were identified regarding the licensee's NCS program.

3.0 Nuclear Criticality Safety Training and Qualification (IP 88015)

a. Inspection Scope

The inspectors reviewed the content of training, and the training and qualifications procedures for NCS engineers to determine if they met specified qualification requirements. The inspectors evaluated the effectiveness of the license NCS training through interviews, and reviewed qualification records to verify completion of training. The inspectors reviewed selected portions of the documents listed in Section 2.3 of the Attachment.

b. Observations and Findings

The inspectors reviewed the qualification procedure for NCS engineers. The licensee currently has an individual going through the qualification process to become a NCS engineer. The inspectors interviewed the NCS engineer trainee and determined they have the requisite education and experience. In addition, the individual has previous ISA group experience and will be conducting a rotation as a Senior Engineering Watch member, which the individual explained to the inspectors will provide them with more process floor experience. Though not committed to American Nuclear Standards Institute/American Nuclear Society (ANSI/ANS) 8.26, "Criticality Safety Engineer Training and Qualification Program, the licensee has a combination of internal, external, and on-the-job training as part of their qualification process. No concerns were identified by the inspectors with the individual or the licensee's qualification process for new NCS engineers.

c. Conclusions

No safety concerns were identified regarding training and qualification for NCS engineers.

4.0 Nuclear Criticality Safety Inspections, Audits, and Investigations (IP 88015)

a. Inspection Scope

The inspectors reviewed licensee internal audit procedures, and results of the most recent NCS audits to assure that appropriate issues were identified and resolved. The inspectors accompanied licensee NCS engineers on a walkdown of the Secure Storage Area. The inspectors reviewed selected portions of the documents listed in Section 2.4 of the Attachment.

b. Observations and Findings

The inspector accompanied a licensee NCS engineer during the control verification of the Secure Storage Area. The inspector verified that the licensee NCS engineer confirmed the engineered NCS controls that apply to that area, including using a tape measure to verify controlled dimensions. The licensee NCS engineer performed the verification with the applicable section of the flowdown in hand. The inspector also reviewed the postings in the area and discussed the administrative controls with the licensee engineer.

The inspectors reviewed the most recent NCS audit records and confirmed that they were conducted by qualified staff and that the issues identified were tracked in PIRCS. The inspectors also noted that the licensee's NCS engineers would also record minor improvements and editorials that did not warrant a PIRCS, but could be fixed in later revisions of the applicable NCSE.

c. Conclusions

No safety concerns were identified regarding NCS inspections, audits, and investigations.

5.0 Criticality Alarm System (88017)

a. Inspection Scope

The inspectors reviewed documentation of criticality accident alarm detector coverage, interviewed engineering staff, and performed facility walkdowns to determine the adequacy of the licensee criticality alarm system. The inspectors reviewed selected portions of the documents listed in Section 2.5 of the Attachment.

b. Observations and Findings

The NRC inspectors interviewed licensee managers and staff responsible for the CAAS and conducted an extensive walkdown of a 'vertical slice' of the CAAS. The walkdown started with the detector pair in the 330 building and followed the signal and logic back through the system. Before and during the walkdown the inspectors and licensee personnel discussed the system's reliability and false alarms, testing and calibration, the audibility of the CAAS horns, how detector set points are controlled and changed, procedures for restoring the CAAS and imposing compensatory measures while the system, or portions of the CAAS, are down, and the licensee's use of storm mode. During this walkdown the system was in storm mode due to the thunderstorms that were passing through the area at the time. The inspectors reviewed NFS-HS-A-21 and confirmed that the procedure requires that compensatory measures (e.g., a stop work order, access restrictions) be imposed "immediately." This is in accord with the license commitment to ANS-8.3 "Criticality accident alarm system," and matches what was discussed during interviews.

Additionally, the inspectors reviewed the detector placement calculations in 21T-01-1216, as an example of the placement calculations that are used throughout the site. This calculation models 17 different locations for the minimum accident of concern, and compares the resulting dose rate at the detector with the detector's set point. The inspectors reviewed the methodology and assumptions used for the calculations. The inspectors also reviewed a map of the detector locations throughout the facility, the locations of the detectors on the map accurately represented the detector locations that the inspectors had observed during this and other walkdowns.

c. Conclusions

No significant issues were found during the review of the licensee's CAAS.

6.0 Nuclear Criticality Safety Event Review and Follow-up (IP 88015 & 88016)

a. Inspection Scope

The inspectors reviewed the licensee response to a selection of recent internally-reported events, and recent NCS-related event(s) that the licensee reported to NRC. The inspectors reviewed the progress of investigations and interviewed licensee staff regarding immediate and long-term corrective actions. The inspectors reviewed selected portions of the documents listed in Section 2.6 of the Attachment.

b. Observations and Findings

The inspectors reviewed a sample of the criticality-related PIRCS entries that have been entered since the last NCS inspection. The inspectors focused on changes that resulted in the systems being different from the expected/intended configuration. The inspectors reviewed PIRCS Condition Report 44564, and walked down the system with the cognizant licensee NCS engineer. The PIRCS related to an unapproved/unreviewed change to the facility in which plastic tubing was installed around the handles for manually actuated IROFS valves. The licensee has not yet completed its review of the condition and has not identified the cause or date of the change, which may predate the current change control process. The inspectors did not identify a mechanism were the change would have affected the availability or reliability of the IROFS.

The inspectors also reviewed PIRCS Condition Report 44084, in which a mobile pump appears to have been used improperly, and discussed this event with licensee personnel. The mobile pump has flexible hosing which creates the potential for unanalyzed transfers of liquids. Specifically the pump was found aligned such that it could have been used to circumvent controls on precipitating agents in the Waste Water Treatment Facility. The inspectors reviewed the NCSE (54T-12-0027, "Nuclear Criticality Safety Evaluation Waste Water Treatment Facility," Rev. 7, dated August 2012) and determined that the potential for such a transfer of precipitating chemicals had been accounted for in the analysis and design of the controls. The tanks in question are operated as a mass controlled batch process that would be subcritical for any concentration of the available fissile material. Multiple up-stream controls on concentration, and inspection of the tanks after transfer would remain effective in

preventing a criticality even if all the uranium in a batch precipitated. The margin of safety is also ensured by the small batch size and the assumption that a large residual amount of uranium remains in the tanks, and other conservative assumptions. Additionally, licensee personnel stated that they have found no evidence that the pump was actually used to inappropriately transfer solution (i.e., no pH change in the receiving tank was found, operator statements that a transfer was not performed). The licensee's corrective actions include installing a hard piped pump that cannot be so easily misaligned.

c. Conclusions

No safety concerns were identified regarding NCS event review and follow-up.

7.0 Plant Activities (IP 88015)

a. Inspection Scope

The inspector 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 inspector interviewed operations staff and NCS engineers both before and during walkdowns. The inspectors reviewed selected portions of the documents listed in Section 2.7 of the Attachment, prior to performing the walkdowns in the 300 Complex, including the analytical laboratory.

b. Observations and Findings

The inspectors verified that controls identified in NCSE were installed or implemented and were adequate to assure safety. During walkdowns the inspectors questioned the licensee NCS engineers about IROFS and safety-related equipment for selected systems. The NCS engineers were knowledgeable and interacted regularly with operators on the process floors. The inspectors also verified that the IROFS listed and described in postings matched the IROFS that were described by the NCS engineer and in the applicable NCSE.

c. Conclusions

No safety concerns were identified during walkdowns of plant operations.

8.0 Open Item Review

IFI 2013-204-01

Administratively closing IFI 2013-204-01, "Tracks completion of investigations and corrective actions associated with, and examination of NDA methods suitable for, wet uranium accumulations in process ventilation," which was closed in NRC Inspection Report 2014-002, dated April 29, 2014.

LER-2014-01/EN 49848

On the morning of February 21, 2014, licensee staff reported difficulty in hearing plant announcements in the Building 110B restroom. Because announcements and alarm systems (e.g., CAAS) use the same speakers the licensee conducted tests to determine if the CAAS alarm could be heard. These tests indicated that the alarm was difficult to hear, so the licensee locked and posted the restroom with signs to not occupy it. The licensee believes the audibility issue was due to a recent remodeling which included installing a fire resistant door. This door is more effective at blocking the sound from the speakers than the previous door. The licensee's corrective action was to install more speakers so that the alarms would be clearly audible.

The inspectors reviewed the licensee's 30-day report, and interviewed licensee management and staff. Although fissile material is not handled in the restroom, fissile material is handled in the 110 Laboratory. Nevertheless, the inspectors did not identify any safety concerns because the condition only existed in a small area for a short time, before the licensee identified the condition, and adequately followed their procedure (NFS-HS-A-21) to take immediate compensatory actions, and implemented appropriate corrective actions. Therefore, LER-2014-01 is **closed**.

LER-2014-03/EN 49998

On April 4, 2014 during a test of the CAAS the licensee identified that the CAAS evacuation alarms could not be heard in an office trailer restroom when the door was closed and the fan was running. The licensee checked other office trailers and found that the same condition existed in three other restrooms. The affected restrooms were locked and posted out of service. The licensee personnel stated that this was due to the loud fans in these restrooms. The proposed corrective actions in the 30-day report are to either use a quieter fan or add more speakers to ensure that the alarms are audible.

The inspectors reviewed the licensee's 30-day report, and interviewed licensee management and staff, including the individual who identified this condition. The inspectors did not identify any safety concerns because these trailers are not located in or near an area with fissile material, and the licensee identified the condition, and adequately followed their procedure (NFS-HS-A-21) to take immediate compensatory actions. Therefore, LER-2014-03 is **closed**.

9.0 Exit Meeting

The inspector presented the inspection results to members of the licensee's management and staff, including Joel Duling, during an exit meeting on July 24, 2014. The licensee acknowledged and understood the findings as presented.

SUPPLEMENTARY INFORMATION

1.0 List of Items Opened, Closed, and Discussed

Item Number	Status	Description
IFI 2013-204-01	Closed	Tracks completion of investigations and corrective actions associated with, and examination of NDA methods suitable for, wet uranium accumulations in process ventilation
LER-2014-01	Closed	EN 49848: Audibility of Alarm System
LER-2014-03	Closed	EN 49998: Criticality Accident Evacuation Alarm Not Audible in Certain Areas Outside the Material Handling Area

2.0 Key Documents Reviewed:

Inspectors reviewed selected aspects of the following documents. Documents that apply to multiple sections are listed in the section that is most applicable.

2.1 Plant Status

Not Applicable

2.2 Nuclear Criticality Safety Program

- 54T-14-0016, "Control Flowdown and Field Verification for NDA Lab in Building 100," Rev. 2, dated April 23, 2014.
- 54T-13-0004, "Nuclear Criticality Safety Evaluation 310 Warehouse NDA Laboratory," Rev. 2, dated March 20, 2013.
- 54T-13-0009, "Control Flowdown and Field Verification for Nuclear Criticality Safety Evaluation 310 Warehouse," Rev. 4, dated April 22, 2013.
- 54X-04-0006, "Nuclear Criticality Safety Evaluation for Area 500 and Area 400 Discard Columns of the Production Fuel Facility," Rev. 0, dated May 13, 2004.
- 54X-07-0008, "Control Flowdown and Field Verification for Area 500 and Area 400 Discard Columns of the Production Fuel Facility," Rev. 3, dated March 14, 2007.54T-14-0009, "Nuclear Criticality Safety Evaluation Building 100 NDA Laboratory," Rev. 3, dated April 17, 2014.
- NFS-HS-A-58, "Nuclear Criticality Safety Evaluations (NCSE)," Rev. 12, dated March 18, 2014.
- NFS-HS-A-63, "Verification and Validation of Nuclear Criticality Safety Analysis Codes", Rev. 6, dated May 21, 2014.
- NFS-HS-A-68, "ISA Risk Assessment Procedure," Rev. 5, dated June 23, 2014.
- NFS-NCSE-NCSAWG, "Nuclear Criticality Safety Evaluation/Analysis Writer's Guide," Rev. 10, dated April 2, 2014.
- 54X-98-0024, "Nuclear Criticality Safety Analysis Handling Fissionable Material in Portable Containers," Rev. 0, dated November 23, 1998.

- 21T-11-0609, “Nuclear Criticality Safety Engineer Qualification Program,” Rev. 0, dated June 20, 2011.
- 54X-12-0022, “Addendum I to the Nuclear Criticality Safety Evaluation for ENCLOS-0804, -1901, -2901, and -3901 of the Production Fuel Facility (U) Revision 2,” Rev. 0, dated January 2, 2013.
- Natrella, “Experimental Statistics Handbook 91,” National Bureau of Standards, 1963.
- PIRCS Condition Report 37846, dated January 23, 2013.
- PIRCS Investigation Report 15684, dated February 25, 2013.
- 21T-14-0001, “NFS Site ISA Summary,” Rev. 11, dated January 2014.
- “Validation of the SCALE-PC (Version 4.4a/27 – Group) Computer Code Package for Uranium System Enriched in the U-235 Isotope,” Rev. 1, dated September 2005.
- “Verification of Computer Codes for NCS for Uranium Systems with Enrichments up to 100 Wt.% 235U: SCALE 6.1 with V7-238 Library from ENDF/B-VII, and SCALE 4.4a with 27 GROUPNDF4 Library from ENDF/B-IV,” Rev. 0, dated December 12, 2012.

2.3 Nuclear Criticality Safety Training and Qualification

- NFS-NCS-QUALP, “Nuclear Criticality Safety Engineer Qualification Program”, Rev. 0, dated June 9, 2011.

2.4 Nuclear Criticality Safety Inspections, Audits, and Investigations (IP 88015)

- NCS-2014-01, “BPF Liquid Waste Discard System,” dated February 4, 2014.
- NCS-2014-02, “BPF Liquid Raffinate Solidification System,” dated February 14, 2014.
- NCS-2014-03, “Area 900 SNM Storage Racks,” dated February 19, 2014.
- NCS-2014-04, “300 Complex and 105 Laboratory,” dated February 25, 2014.
- NCS-2014-05, “Enclos-4901 and -9901 of Area 900 of the Production Fuel Facility,” dated February 24, 2014.
- NCS-2014-06, “Areas 100/200 of the Production Fuel Facility,” dated March 13, 2014.
- NCS-2014-07, “Nominal 6-Inch Borosilicate Glass Columns,” dated March 27, 2014.
- NCS-2014-08, “Area C of the Uranium Recovery Facility,” dated April 16, 2014.
- NCS-2014-09, “BPF Uranium Metal Sampling and Uranium Metal Shear System,” dated April 25, 2014.
- NCS-2014-10, “Area 900 Enclos-7901,” dated April 29, 2014.
- NCS-2014-11, “Rocket Storage in Building 302,” dated May 5, 2014.
- NCS-2014-12, “Area B,” dated May 13, 2014.
- NCS-2014-13, “Handling and Storage of 55-gallon Drums,” dated May 12, 2014.
- NCS-2014-14, “301 RFS Calciner Furnace,” dated May 23, 2014.
- NCS-2014-15, “Check Weighing Areas,” dated June 12, 2014.
- NCS-2014-16, “Prevention of Inadvertent Solution Backflow…,” dated July 16, 2014.

2.5 Criticality Alarm Systems (IP 88017)

- NFS-HS-A-21, “Operation and Testing of the Criticality, Fire, and CO_2 Alarm Systems,” dated October 1, 2011.
- 21T-01-1216, “Demonstration of Criticality Alarm System Coverage WWTF (Bldg. 330).”

2.6 Nuclear Critically Safety Event Review and Follow-up (IP 88015 & 88016)

- 54T-12-0027, “Nuclear Criticality Safety Evaluation Waste Water Treatment Facility,” Rev. 7, dated August 2012.
- PIRCS Condition Report 43068, dated March 5, 2014.
- PIRCS Condition Report 43655, dated April 29, 2014.
- PIRCS Condition Report 43730, dated May 2, 2014.
- PIRCS Condition Report 43907, dated May 15, 2014.
- PIRCS Condition Report 44084, dated May 30, 2014.
- PIRCS Condition Report 44298, dated June 17, 2014.
- PIRCS Condition Report 44439, dated June 21, 2014.
- PIRCS Condition Report 44559, dated July 9, 2014.
- PIRCS Investigation 18058, dated July 14, 2014.
- PIRCS Condition Report 44564, dated July 9, 2014.
- PIRCS Condition Report 44567, dated July 10, 2014.
- PIRCS Condition Report 44593, dated July 11, 2014.
- PIRCS Condition Report 44620, dated July 14, 2014.
- PIRCS Investigation 18078, dated July 16, 2014.

2.7 Plant Activities

Documents listed in other sections were reviewed related to facility walkdowns.

2.8 Open Items

- 21G-14-0065, “30-Day Written Notification of Event (NRC Event No. 49848)," dated March 17, 2014.
- 21G-14-0082, “30-Day Written Notification of Event (NRC Event No. 49998)," dated May 2, 2014.
- 21T-13-0013, “Laboratory 110A, 110B, 110D, and 131 Integrated Safety Analysis Summary,” Rev. 5, dated January 2013.

2.9 Exit Meeting

Not Applicable

3.0 Inspection Procedures Used

IP 88015	Nuclear Criticality Safety Program
IP 88016	Nuclear Criticality Safety Evaluations and Analyses
IP 88017	Criticality Alarm Systems

4.0 Key Points of Contact

NFS:

N. Brown	NCS Manager
R. Droke	Senior Regulatory Advisor
J. Duling	NFS President
R. Freudenberger	Safety and Safeguards Director
M. Lee	Licensing Specialist
B. Maurer	NCS Engineer
D. Rogers	Operations
A. Sabisch	Licensing & ISA Section Manager
L. Sanders	CAP Manager
M. Tester	Radiation Safety Manager

NRC:

J. Munson	HQ NCS Inspector; Acting Resident
N. Peterka	Region II Fuel Facility Inspector
T. Sippel	HQ NCS Inspector
C. Tripp	HQ NCS Inspector

All attended the Exit Meeting held on July 24, 2014.

5.0 List of Acronyms and Abbreviations

ANS	American Nuclear Society
CA	corrective action
CAAS	Criticality Accident Alarm System
HEU	high-enriched uranium
IFI	inspector follow-up item
IP	inspection procedure
IROFS	item relied on for safety
ISA	integrated safety analysis
LTL	Lower Tolerance Limit
MAA	material accountability area
MC&A	material control and accounting
NCS	nuclear criticality safety
NCSA	nuclear criticality safety analysis
NCSE	nuclear criticality safety evaluation
NDA	non-destructive assay
NFS	Nuclear Fuel Services, Inc. (licensee)
NPM	Non-Parametric Method
OCB	Oxide Conversion Building
PIRCS	Problem Identification, Resolution, and Corrective System
QA	Quality Assurance
USL	Upper Subcriticality Limit
SOP	Standard Operating Procedure
SRE	safety related equipment
SNM	Special Nuclear Material