



UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
SAM NUNN ATLANTA FEDERAL CENTER
61 FORSYTH STREET, SW, SUITE 23T85
ATLANTA, GEORGIA 30303-8931

February 12, 2010

NMED Nos. 090788, 090838
NRC Event Nos. 45446, 45497, 45601

Mr. David Kudsin
President
Nuclear Fuel Services, Inc.
P. O. Box 337, MS 123
Erwin, TN 37650

SUBJECT: NRC INSPECTION REPORT NO. 70-143/2009-004 AND NOTICE OF VIOLATION

Dear Mr. Kudsin:

This letter refers to inspections conducted from October 1, 2009 through December 31, 2009, at the Nuclear Fuel Services (NFS) facility in Erwin, TN. The results of the safeguards portion of the inspection will be transmitted in a separate cover letter. The purpose of this inspection was to determine whether activities authorized under the license were conducted safely and in accordance with NRC requirements. At the conclusion of the inspections, the findings were discussed on January 6, 2010, with those members of your staff identified in the enclosed report.

The inspections consisted of an examination of activities conducted under the license as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of the license. Areas examined during the inspections are identified in the enclosed report. Within these areas, the inspections consisted of a selective examination of procedures and representative records, observations of activities in progress, and interviews with personnel.

Based on the results of these inspections, the NRC has determined that one Severity Level IV violation of NRC requirements occurred. This violation was evaluated in accordance with the NRC Enforcement Policy included on the NRC's Web site at <http://www.nrc.gov/about-nrc/regulatory/enforcement/enforce-pol.html>.

The violation is cited in the enclosed Notice of Violation (Notice), and the circumstances surrounding it are described in the subject inspection report. The violation is being cited in the Notice because it was self revealing due to an event.

You are required to respond to this letter and should follow the instructions specified in the enclosed Notice when preparing your response. The guidance from NRC Information Notice 96-28, "Suggested Guidance Relating to Development and Implementation of Corrective Action," is available on the NRC's Web Site and may be helpful. The NRC will use your response, in part, to determine whether further enforcement action is necessary to ensure compliance with regulatory requirements.

D. Kudsin

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We received your reply to our Notice of Violation 70-143/2009-003-01, (letter, dated December 1, 2009). This reply met the requirements of 10 CFR 2.201 and your corrective actions will be reviewed during a future inspection.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosures, and your response will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (ADAMS), accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>. To the extent possible, your response should not include any personal privacy, proprietary, or safeguards information so that it can be made available to the Public without redaction.

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

Sincerely,

/RA/

D. Charles Payne, Chief
Fuel Facility Inspection Branch 1
Division of Fuel Facility Inspection

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

Enclosures: 1. Notice of Violation
2. NRC Inspection Report No. 70-143/2009-004

cc w/encls:
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Vice President, Operations
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Electronic Mail Distribution

David Ward
Interim Director
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Nuclear Fuel Services, Inc.
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Lawrence E. Nanney
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cc w/encls: (Cont'd on page 3)

D. Kudsin

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X PUBLICLY AVAILABLE NON-PUBLICLY AVAILABLE SENSITIVE X NON-SENSITIVE
ADAMS: X Yes ACCESSION NUMBER: _____ X SUNSI REVIEW COMPLETE

OFFICE	RII:DFFI	RII:DFFI	RII:DFFI	RII:DFFI	
SIGNATURE	Via Email		Via Email	MC 2/9/10	
NAME	GSmith		AGooden	MCrespo	
DATE	2/9/10	1/29/10	2/9/10		
E-MAIL COPY?	YES NO	YES NO	YES NO	YES NO	YES NO

NOTICE OF VIOLATION

Nuclear Fuel Services, Inc.
Erwin, Tennessee

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

During NRC inspections conducted from October 1, 2009 through December 31, 2009, a violation of NRC requirements was identified. In accordance with the NRC Enforcement Policy, the violation is listed below:

10 CFR 70.72 (a)(2) requires, in part, that prior to implementing any change to the facility, the impact of the change on the control of licensed material shall be addressed.

Contrary to the above, a change was made to the facility to install uranium hexafluoride sublimation stations. The impacts from fluorine oxidation of components that controlled licensed material, namely the flexible hose piping which passed special nuclear material from a uranium hexafluoride cylinder to the sublimation station, were not addressed prior to implementing the change and placing the system in service. This event was self revealing following a small glove box fire on November 14, 2009, when a hose containing uranium hexafluoride was damaged by a rapid oxidation reaction with fluorine gas. The licensee's failure was of low safety significance because the accident was adequately bounded by the integrated safety analysis and the installed items relied on for safety ensured that the performance requirements were met.

This is a Severity Level IV violation (Supplement VI).

Pursuant to the provisions of 10 CFR 2.201, Nuclear Fuel Services, Inc. is hereby required to submit a written statement or explanation to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, D.C. 20555 with a copy to the Regional Administrator, Region II, and a copy to the NRC Senior Resident Inspectors at the facility that is the subject of this Notice, within 30 days of the date of the letter transmitting this Notice of Violation (Notice). This reply should be clearly marked as a "Reply to a Notice of Violation" and should include for each violation: (1) the reason for the violation, or, if contested, the basis for disputing the violation or severity level, (2) the corrective steps that have been taken and the results achieved, (3) the corrective steps that will be taken to avoid further violations, and (4) the date when full compliance will be achieved. Your response may reference or include previously docketed correspondence, if the correspondence adequately addresses the required response. If an adequate reply is not received within the time specified in this Notice, an order or a Demand for Information may be issued as to why the license should not be modified, suspended, or revoked, or why such other action as may be proper should not be taken. Where good cause is shown, consideration will be given to extending the response time.

If you contest this enforcement action, you should also provide a copy of your response to the Director, Office of Enforcement, United States Nuclear Regulatory Commission, Washington, D.C. 20555-0001.

Enclosure 1

Because your response will be made publicly available, to the extent possible, it should not include any personal privacy, proprietary, or safeguards information so that it can be made publicly available without redaction. If personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request withholding of such material, you must specifically identify the portions of your response that you seek to have withheld, and provide in detail the basis for your claim of withholding (e.g., explain why the disclosure of information will create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.390(b) to support a request for withholding confidential commercial or financial information). If safeguards information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21.

In accordance with 10 CFR 19.11, you may be requested to post this Notice within two working days.

Dated this 12th day of February, 2010.

U. S. NUCLEAR REGULATORY COMMISSION

REGION II

Docket No.: 70-143

License No.: SNM-124

Report No.: 70-143/2009-004

Licensee: Nuclear Fuel Services, Inc.

Facility: Erwin Facility

Location: Erwin, TN 37650

Dates: October 1, 2009 – December 31, 2009

Inspectors: S. Burris, Senior Resident Inspector
G. Smith, Senior Resident Inspector
A. Gooden, Senior Fuel Facility Inspector

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

Enclosure 2

EXECUTIVE SUMMARY

Nuclear Fuel Services, Inc.
NRC Inspection Report 70-143/2009-004

This inspection included activities conducted by resident and regional inspectors during normal and off normal shifts in the areas of safety operations, radiological controls, and facility support.

Safety Operations

- Plant operations activities were generally performed safely and in accordance with approved procedures with the following exceptions. On October 13, an over-temperature event occurred in the Uranium-Aluminum bowl cleaning station. This event resulted in the establishment of an Augmented Inspection Team and the results of which will be documented in report 70-143/2009-011. On November 14, a fire occurred in a sublimation station of the Commercial Development line which damaged equipment and resulted in the shutdown of the line. (Paragraph 2.a)
- Transient combustibles were controlled and minimized. (Paragraph 2.b).
- Criticality station limit cards were followed by licensee personnel. (Paragraph 2.c)

Radiological Controls

- The radiation protection program was implemented in accordance with the facility license. Radiation work permits were adequately developed and implemented in order to ensure personnel exposure were kept as low as reasonably achievable. (Paragraph 3)

Facility Support

- Emergency preparedness activities were conducted in accordance with the site emergency plan. Based on documentation reviewed and interviews with members of the licensee's staff, program changes made since the last inspection did not reduce the effectiveness of the emergency preparedness program. (Paragraph 4.a).
- A violation of 10 CFR 70.72(a)(1) was identified for the failure to adequately address the material compatibility of uranium hexafluoride vent hose materials with F₂ gas that may be present in the storage cylinders. (Paragraph 4.b)
- The licensee's corrective action program did not implement sufficient actions to prevent the fire that occurred in the Commercial Development line. (Paragraph 4.c)

Attachment

Partial List of Persons Contacted

Inspection Procedures Used

List of Items Opened, Closed, and Discussed

REPORT DETAILS

1. Summary of Plant Status

The period began with the Nuclear Fuel Services (NFS) site operating in a normal status with the exception of the Blended Low Enrichment (BLEU) facility which was operating in a reduced status due to production needs. On October 13, 2009, the Uranium-Aluminum (UAl) system located within the BLEU Preparation Facility (BPF) was shutdown due to an over-temperature reaction. UAl remained shutdown for the remainder of the period. On November 14, 2009, the Commercial Development (CD) line was shutdown due to a fire in a glove box. The CD line remained shutdown for the remainder of the period as well. On December 21, the remainder of the facility was shutdown for the week-long annual Christmas shutdown and remained shutdown the following week until the end of the period for a planned safety stand-down effort.

2. Safety Operations

a. Plant Operations (Inspection Procedure (IP) 88135)

(1) Inspection Scope and Observations

Operating Area Observations

The inspectors performed daily tours of the plant operating areas and determined that equipment and systems were generally operated safely and in compliance with the license. Daily operational meetings were observed throughout the period where production status and issues were discussed. The inspectors reviewed selected licensee-identified events and corrective actions for previously identified events. No significant deficiencies were found. The inspectors focused on plant operations, safety-related equipment (for example: valves, sensors, instrumentation, in-line monitors, and scales) and items relied on for safety (IROFS).

The inspectors performed a review of records in the field, interviewed operations personnel, and toured various areas. No evidence of misrepresentations of plant parameters was noted. Some parameters are required to be maintained within certain limits and the operators are expected to adjust the control inputs in order to maintain the various process parameters within the desired ranges. These activities were performed in accordance with plant procedures. The inspectors noted no evidence of procedural non-compliance.

The daily inspector tours of the operating areas included the BPF, fuel manufacturing areas, storage areas, vaults, and the waste water treatment facility. The inspectors verified that there was adequate staffing and that operators were attentive to their duties, including the status of various alarms and annunciators. The inspectors also verified that activities, both normal and abnormal, were performed in compliance with procedures and station limits, and that safety controls were in place and were being controlled with supervision. The inspectors verified the adequacy of communications between supervisors and operators within the operating areas. The inspectors walked down sections of the standard operating procedures and verified that IROFS were identified and operable in each of the areas. The inspectors reviewed log books, lockout

tag-out records, and Letters of Authorization (that is, temporary modifications) to obtain information concerning operating trends and activities. The inspectors verified the licensee was actively pursuing corrective actions for conditions requiring temporary modifications as well as any prescribed compensatory measures.

Plant Tours

The inspectors performed periodic tours of the outlying areas of the facility and determined that equipment and systems were being operated safely and in compliance with the license. The focus of these tours centered around the evaluation of potential missile hazards and missile protection features, combustible material storage and fire loading, hazardous chemical storage, adequate storage of compressed gas containers, potential degradation of plant security features, and potential fire hazards. During these tours the inspectors also verified that required notices to workers were appropriately and conspicuously posted in accordance with 10 CFR 19.11.

Plan-of-the-Day-Meeting.

The inspectors attended various plan-of-the-day meetings throughout the inspection period to obtain the overall status of the plant. The inspectors evaluated the adequacy of the licensee's response to significant plant issues as well as approaches to solving various plant problems.

Safety-Significant System Walkdown

During the inspection period, the inspectors performed a walkdown of the below listed safety significant systems involved with the processing of special nuclear material (SNM). As part of this system evaluation, the inspectors reviewed the integrated safety analysis (ISA) for the system in order to identify assumptions and controls. The inspectors verified that these assumptions and controls were properly implemented in the field. During the walkdown, the inspectors verified that the as-built configuration matched the approved plant drawings. The inspectors also interviewed operators in order to ensure that plant personnel were familiar with the assumptions and controls associated with these systems as well as the IROFS and IROFS instrumentation for maintaining plant safety. Specifically, the inspectors verified correct valve and switch position alignments as required by procedure, the absence of conditions that may degrade plant performance as well as the operability of IROFS, safety-related devices, and support systems essential to safety system performance:

- Uranium-Aluminum Bowl Cleaning Station
- Sublimation Station #3 in Building 301

Uranium-Aluminum (UAI) Over Temperature Event

On October 13, 2009, the UAI system in BPF experienced an upset condition when UAI fines were added directly to the UAI bowl cleaning station (as part of a newly approved process change to the facility) and then mixed with nitric acid. The resultant chemical reaction generated an excessive amount of heat and nitrogen oxide and/or nitrogen dioxide (NO_x) gases. The upper level building NO_x gas alarm was received and all personnel evacuated building 333. After dissipation of the NO_x gas via the building scrubber system, personnel re-entered the area to assess the system condition. The

wet off-gas (WOG) overflow lines (transparent polyvinyl chloride) were noted to have deformed slightly due to the heat of reaction. Additionally, NO_x gases were noted in the overflow column. By design, the overflow column is vented to the plant off-gas (POG) system via a siphon break. The POG system is directly connected to the building scrubber system which processes the effluent gasses to allow release to the environment below regulatory limits. On October 19, the NRC dispatched a special inspection team (SIT) to the site. Following a more detailed review of the event, the licensee reported this event to the Headquarters Operations Officer (HOO) pursuant to 10 CFR 70, Appendix A (b)(1) as a potentially unanalyzed condition (Event Notification (EN) No. 45446). Following the report to the HOO and a reevaluation of the event by the NRC, the SIT was upgraded to an Augmented Inspection Team (AIT) on October 26. This event will be discussed in detail in the AIT inspection report 70-143/2009-011. The licensee shut down the UAI system for the remainder of the inspection period while a root cause team reviewed the event, developed causal factors, conducted an extent of condition review, and conducted an extent of cause review.

CD Line Fire Event

On November 14, 2009, the CD line experienced a small fire which damaged equipment and resulted in the shutdown of the line. This event is discussed in more detail in Paragraph 4.b. below.

(2) Conclusions

Plant operations activities were generally performed safely and in accordance with approved procedures with the following exceptions. On October 13, an over-temperature event occurred in the Uranium-Aluminum bowl cleaning station. This event resulted in the implementation of an AIT and the results will be documented in report 70-143/2009-011. On November 14, a fire occurred in a sublimation station of the Commercial Development line which damaged equipment and resulted in the shutdown of the line.

b. Criticality Safety (IP 88135)

(1) Inspection Scope and Observations

During daily operating area tours, the inspectors observed operations to verify whether various criticality controls were in place. The inspectors noted that station limit card requirements were being observed by personnel and containers were being adequately controlled in order to minimize criticality hazards. The inspectors sampled a number of criticality-related IROFS to verify their operability. Operators were found to be knowledgeable of the IROFS requirements. These IROFS were adequately identified in the field as well as on controlled plant drawings.

(2) Conclusions

Licensee criticality controls were being adequately followed by licensee personnel. No issues of significance were identified.

c. Fire Protection (IP 88135)

(1) Inspection Scope and Observations

During daily plant tours, the inspectors observed facility activities to verify whether transient combustibles were being adequately controlled and minimized, and that fire barriers located between fire areas were being properly maintained.

During the inspection period, the inspectors conducted a fire safety tour of building 301. The inspectors verified that combustible material was being adequately controlled. The inspectors walked down various fire suppression components and systems that supply building 301 and verified these systems were properly aligned and operational. The inspectors verified that various aspects of the fire protection/prevention strategies conformed to the applicable nuclear criticality safety evaluation.

(2) Conclusions

Maintenance of fire barriers was adequate and transient combustibles were being adequately controlled. No issues of significance were identified.

3. Radiological Controls

Radiation Work Permit (RWP) Review (IP 88135)

(1) Inspection Scope and Observations

During various tours of the operating areas, the inspectors observed worker compliance with health physics procedures. The inspectors noted that plant workers properly wore dosimetry, used protective clothing in accordance with applicable Radiological Work Permits (RWPs), and properly frisked upon exiting the controlled area. The inspectors verified radiation areas were properly posted and that radiation maps included up-to-date radiation levels. The inspectors also verified the operability of radiation protection instruments as well as their calibration frequencies.

The inspectors performed a detailed review of Safety Work Permit (SWP) #13461. This SWP included radiological requirements detailed under the RWP section as well as industrial safety requirements under the industrial safety section of the permit. The work involved sampling of the UAI bowl cleaning station following the October 13 over-temperature event. The inspectors verified that craft personnel complied with the prescribed controls and precautions. The inspectors noted that the RWP contained adequate requirements concerning the radiation levels, respiratory equipment, dosimetry, contamination levels, special tools and equipment, airborne radioactivity, and containment devices. The area was effectively controlled by health physics personnel. The SWP was prominently posted for employees' review and observation. Workers entering the SWP area signed onto the SWP to indicate their understanding of the required entry requirements.

(2) Conclusions

Radiation protection practices were performed in accordance with plant procedures and ensured that dose was maintained As Low As Reasonably achievable (ALARA). No issues of significance were identified.

Radiation Protection Program Review (IP 88030)

(1) Inspection Scope and Observations

The inspectors evaluated Radiation Technicians (RTs) performing routine surveys in controlled areas of the facility. Specifically, the inspectors evaluated survey practices in the field for the following: a direct area survey of Building 304, a smear survey of Building 306 West, and an RWP down-posting of a controlled area outside of building 105. The RTs demonstrated adequate contamination and direct survey techniques. The inspectors reviewed selected survey results for accuracy and completeness. No issues or concerns were identified.

The inspectors observed the performance of daily source response and operational checks of radiation monitoring equipment, and functional alarm verification of contamination monitors located at exit points from controlled areas. Licensee personnel were knowledgeable of the operational check requirements and performed activities in accordance with approved procedures.

The inspectors reviewed records associated with the calibration of portable survey instruments. The inspectors reviewed calibration sources for appropriate configuration and to confirm suitability of sources for their intended function. The inspectors reviewed selected calibration records for accuracy and completeness. The inspectors found that personnel responsible for calibration were knowledgeable of associated procedural requirements. No issues or concerns were identified.

The inspectors reviewed personnel exposure data for 2009 to verify that exposures were maintained as low as reasonably achievable (ALARA) and within the limits of 10 CFR 20.1201. The doses were well below the regulatory limits requiring monitoring. A reduction in exposures from previous years was noted and was attributed to processing of new feed material which exhibited lower external radiation levels. The inspectors reviewed the program for monitoring exposures and determined that the exposure control program was adequately implemented.

The inspectors evaluated the licensee's process for free-releasing equipment from the site. Specifically, the inspectors reviewed procedure, NFS-GH-63, "Unrestricted Equipment/Item Release," Rev. 1 and observed an RT perform an external survey of a component that was to be removed from the site. The inspectors noted that for inaccessible surfaces of an internal combustion engine, the Area Health Physicist reviewed and approved the item for site removal based on the item's history. No issues or concerns were identified.

The inspectors interviewed personnel responsible for the implementation of the ALARA program and the trending and tracking of personnel exposures. The inspectors noted that the Safety and Safeguards Review Committee (SSRC) served as the ALARA committee, and SSRC meetings were held on a routine basis. The SSRC committee

meeting agendas included a review of personnel exposures and contamination control issues. The inspectors noted that radiological safety-related trending data presented to the SSRC for review and evaluation was comprehensive and presented in a manner that facilitated the identification of any adverse trends.

The inspectors reviewed the licensee's corrective action program pertaining to issues involving radiological safety matters. The threshold for radiological safety-related problem identification was adequate and corrective actions were implemented in accordance with the licensee's corrective action program.

(2) Conclusions

The radiation protection program was being implemented in accordance with the facility license. No issues of significance were identified.

4. **Facility Support**

a. Emergency Preparedness (88050)

Review of Program Changes (F3.01)

(1) Inspection Scope and Observations

The inspectors reviewed changes to the Emergency Plan (EP), organization, facilities, and equipment to assess the impact on the effectiveness of the program. The adequacy of the emergency preparedness audit required by Section 7.5 of the Plan was also evaluated.

Since the last inspection (August 2008), changes were made to the EP, Emergency Control Center (ECC), and the assignment of personnel to the emergency organization. The inspectors determined the changes that were reviewed and discussed did not result in a negative impact on the state of emergency preparedness. The inspectors noted several changes inside the ECC which are discussed below in "Emergency Equipment and Facilities (F3.06)" as facility enhancements.

The inspectors reviewed documentation from the annual independent audit performed by the quality assurance staff and determined that the audit met the requirements described in Section 7.5 of the Plan. The audit provided an adequate assessment regarding the state of readiness of the emergency preparedness program.

(2) Conclusions

Based on documentation reviewed and interviews with members of the licensee's staff, program changes made since the last inspection did not reduce the effectiveness of the program. The independent audit provided an adequate assessment regarding the state of readiness of the emergency preparedness program. No issues of significance were identified.

Implementing Procedures (F3.02)

(1) Inspection Scope and Observations

The inspectors reviewed several implementing procedures, revised since the last inspection, to determine the adequacy of the implementation of the EP. The inspectors noted that procedures were revised to reflect operations involving the CD line, administrative changes to the emergency organization, and editorial changes. The inspectors verified that a program governing the review and approval of procedures was in place and all changes were made in accordance with the procedural requirements. The reviewed changes did not result in a decrease in the effectiveness of the program or any inconsistencies between the Plan and implementing procedures.

(2) Conclusions

The revised emergency procedures continued to implement the Emergency Plan. No issues of significance were identified.

Training and Staffing of Emergency Organization (F3.03)

(1) Inspection Scope and Observations

The inspectors reviewed emergency response training to determine if the licensee had provided training to key response personnel in accordance with Section 7.2 of the EP and various implementing procedures.

For training reviews, the inspectors selected the names of individuals from the emergency call-list filling various emergency response organization positions and determined that, with one exception, personnel were being trained in accordance with Section 7.2 of the EP. The exception involved three individuals assigned to the emergency organization in roles where staffing levels were adequate for each of the identified positions such that the lack of training for any of the three did not reduce the effectiveness of the emergency organization to respond to postulated accidents. The licensee promptly trained the identified individuals and verified all remaining training was current for response personnel.

The inspectors reviewed emergency response training documentation and conducted staff interviews which disclosed that training included both performance based training via tabletop drills, and instructions regarding changes to the EP and implementing procedures. The inspectors noted that current emergency response organization staffing levels for responding to routine events were adequate.

(2) Conclusion

Key emergency response personnel were trained in accordance with the EP. The combination of drills and instructions pertaining to the EP and procedure changes, provided an adequate level of training to maintain the proficiency of emergency personnel regarding response to postulated site accidents. No findings of significance were identified.

Offsite Support (F3.04)

(1) Inspection Scope and Observations

The inspectors reviewed licensee activities in the areas of training, agreements, and exercises to determine if the licensee was periodically involving offsite support groups in EP activities. The inspectors telephoned the Johnson City Medical Center to discuss with the contact for emergency planning the interface with the licensee on training, response to events, and periodic participation in drills. No issues were identified. The inspectors reviewed documentation which showed that the NFS Emergency Preparedness Coordinator frequently participated in meetings involving local and regional support agencies on matters of mutual interest involving emergency preparedness. The inspectors observed that agreement letters with the offsite support agencies described in the EP were current.

(2) Conclusions

Based on documentation and discussions with an offsite contact, the site Emergency Preparedness Coordinator maintains frequent contact with offsite support organizations on matters involving emergency preparedness to include training, site tours, agreement updates, and participation in exercises. No issues of significance were identified.

Tests, Drills, and Exercises (F3.05)

(1) Inspection Scope and Observations

The inspectors reviewed documentation for drills and exercises to determine the level of challenges presented to the emergency organization, and to verify that key emergency response personnel were participating as players during drills and/or exercises.

Members of the emergency organization implemented the EP and emergency procedures in response to several accident scenarios postulated during the calendar year including the biennial NRC evaluated exercise. The inspectors found the scenarios to be realistic and provided adequate conditions for testing the capability of the response organization to implement the EP and procedures. Based on staff interviews and review of documentation, the inspectors determined that the licensee also participated in an imminent threat drill during the year with NRC Operations Center. The licensee held critiques following drills and items requiring corrective actions were reviewed by the appropriate disciplines and assigned for corrective action follow up. The inspectors selected a specific item, identified during the biennial exercise conducted in September 2009, for review and determined that the item had been assigned and corrective actions were initiated but incomplete at the time of the inspection. The inspectors determined through interviews with staff and a review of an actual event (discussed below in "Event Review") that the licensee did not include members of the fire brigade in a critique following a response to an actual fire. Consequently, lessons learned from the brigade members were not captured. In response, the licensee took immediate actions to review the event response with the involved brigade members and issued communications to all personnel connected with the fire brigade to conduct meetings immediately after event response to determine what functioned appropriately and what could be improved.

(2) Conclusions

The inspectors determined that the accident scenarios postulated for drills and exercises provided adequate challenges to the emergency organization to maintain proficiency in the implementation of the emergency program. Critiques were candid assessments of the response and items requiring corrective actions were being tracked. No issues of significance were identified.

Emergency Equipment and Facilities (F3.06)(1) Inspection Scope and Observations

The inspectors examined several locations where emergency equipment was stored to determine whether the emergency response equipment, instrumentation, and supplies were maintained in a state of operational readiness.

The inspectors conducted an inventory of select equipment and supplies for adequacy in responding to various postulated accidents around the site. All equipment operated as designed. When radiation detection instruments were exposed to a radioactive source, an appropriate response was obtained. All neutron detection equipment was properly calibrated according to calibration stickers. No problems were noted with instrument operability or calibration. The inspectors observed a performance check on respiratory protection equipment to verify that the equipment was properly maintained and stored in a state of readiness. No problems were noted.

Since the last inspection, several enhancements were made to the ECC as follows: large flat screen monitors were installed in the key decision-making area and the support staff area; an additional computer was installed for the dedicated purpose of dose projection or obtaining meteorological data; the capability for running an accountability summary from the ECC was added; the capability to review and display the status of criticality detectors and criticality readings plant-wide on the large flat screen monitors was added; and, utilizing an electronic database, the capability to retrieve site map showing facility layout details and various process facilities as well as local offsite map. The inspector observed an operational check to review the level of detail available to the ECC staff via the electronic database and determined that the available data would be of benefit to ECC operations. Physical changes were made to the ECC to enhance the communications between the key decision-making area and the support staff working area.

(2) Conclusions

Based on operability checks, and a review of surveillance documentation, the emergency response equipment, instrumentation, and supplies were being maintained in sufficient quantities and in an adequate state of operational readiness. The physical and cosmetic changes to the ECC were considered facility enhancements. No issues of significance were identified.

Event Review(1) Inspection Scope and Observations

The inspectors reviewed the licensee's response to a fire inside a process glove box in the CD line (see NRC Event No. 45497, dated November 14, 2009). The inspectors

performed a visual inspection of the affected process box and the area of impact, conducted interviews with several individuals involved in the response to the fire, reviewed the licensee's EP and procedures which implement it, and reviewed documentation associated with the incident.

Based on a visual inspection, interviews with responding fire brigade members, and event documentation, the inspectors determined that the integrity of the process glove box was not breached and the fire was contained inside the box. Based on staff interviews and reviews of documentation, the inspectors confirmed that personnel monitoring and air sampling were conducted in the area for chemicals (hydrofluoric acid) and radiation. No elevated readings were detected. The fire was noted as being extinguished almost immediately after ignition. Interviews with fire brigade members indicated that upon arrival at the incident scene (approximately 16 minutes after the fire was reported) there was no evidence of smoke or fire. The inspectors reviewed the emergency action levels and the EP criteria for an emergency declaration involving a fire and confirmed that no emergency declaration was required.

The inspectors determined that the response by the process operator, fire brigade (including the City of Erwin Fire Department), and Plant Shift Superintendent was timely and appropriate. As discussed above, the inspectors identified that the post-event critique included the Erwin Fire Department but failed to include the onsite fire brigade members. Not conducting a critique immediately following an actual event or exercise could result in the loss of valuable information (e.g. time-line, response data, and communication issues) for making improvements to the response program.

(2) Conclusions

Based on interviews, documentation from the event, and an examination of the incident scene, the decisions made regarding event classification and EP implementation were determined to be appropriate. No issues of significance were identified.

b. Permanent Plant Modifications (IP 88135)

(1) Inspection Scope and Observations

On November 14, 2009, a fire occurred in the #3 sublimation station located in the CD line and was reported to the HOO as EN No. 45497. The #3 sublimation station is a glove box that is used to process the large 5A/5B highly enriched uranium hexafluoride (UF₆) cylinders. The fire originated in a stainless steel braided, Teflon-lined hose. The operators were in the early stages of processing the cylinder. When the operators opened the main cylinder vent valve, the hose glowed red and a fire ball traveled down the hose approximately one foot. The hose ruptured and a small flame impacted the Plexiglas cover of the glove box. The operator immediately activated the manual carbon dioxide (CO₂) system for the glove box and then evacuated the building as required by facility procedures. The fire brigade was dispatched to the scene and confirmed the fire was extinguished.

The licensee established a full root cause team which enlisted the assistance of National Nuclear Security Administration (NNSA) experts in UF₆ processing. The cylinder contained approximately 11.4 kilograms of uranium (U) at ~97% enrichment and was believed to have originated from the K-25 plant (Oak Ridge, TN) circa the early 1960's. Documentation was poor due to the age of the cylinder.

This cylinder was the second large cylinder to be processed in the CD line. The first cylinder was processed with no upsets. However, the operators had noted a large amount of heel material remaining in the cylinder following sublimation. The cause of the fire was later determined to be from residual fluorine (F₂) gas residing in the top of the cylinder. Fluorine is considered a strong oxidizer that rapidly reacts with organic material. The root cause team noted that the hose may have been kinked and thus caused potential cracking of the internal Teflon lining. The F₂ gas could then react with the internal fiber braid lining that surrounded the Teflon. This braiding likely became a source of fuel for the fire. No ignition source would be required to start this type of fire.

The F₂ gas is created from the radiolytic decomposition of UF₆. This well understood phenomenon is caused by the high specific activity (SA), i.e. curies/gm, of high enriched uranium (HEU). In fact, the SA for HEU is approximately 100 times greater than natural uranium (due to the relatively higher amount of U-234). The U-234 is naturally occurring in uranium and increases along with U-235 during the enrichment process. The U-234 has a very short half-life when compared to U-235 and U-238. This short half-life results in a similarly higher specific activity. This higher activity greatly affects the resulting specific activity of the HEU and thus, on a per gram basis, the HEU has a much higher specific activity than natural uranium. This higher specific activity results in a correspondingly higher alpha (α) flux which then reacts with the UF₆ as follows:



This conclusion was supported by the large amount of heel material (UF₅) found remaining following processing of the first 5A cylinder. Based on discussions with other NFS personnel who have had experience processing these cylinders in the past, the piping connecting to the vent lines of these cylinders was not a stainless steel braided, Teflon-lined hose but instead a solid metal (for example, Copper or Monel) tube that would not react with F₂ gas. This historical knowledge had not been passed on to the engineers that designed the sublimation system.

The NNSA consultants also noted that chlorine tri-fluoride (ClF₃) had been used as a chemical additive in the past. This chemical is also highly reactive, potentially explosive, and was noted as a potential cause for the fire. However, NNSA also speculated that the reaction in this event would most likely have been more violent if ClF₃ was the source. Thus, the licensee concluded that the oxidizing agent was more likely to be F₂ gas.

Additionally, the licensee found that a potential precursor event may have occurred the day before this event (on November 13). The larger UF₆ cylinders (5A/5B) have a vent valve for the cylinder as well as a vent valve for the dip tube. The dip tube is a pipe that travels to the bottom of the cylinder and is used for purging purposes. In this instance, the operator was preparing the same cylinder that was later involved in the event. While opening the vent valve on the dip tube, the operator noted a small burning ember that floated past the stainless steel portion of the dip tube vent hose to a portion of the hose that was opaque. The ember hit the inside of the opaque hose and then extinguished itself. The occurrence was immediately entered into the corrective program. The corrective actions however were not thorough or comprehensive. The opaque hose was replaced (changed to a stainless steel, instead of polymer, construction). The inspectors concluded that a more in-depth examination of the event may have led the licensee to recognize the F₂ gas phenomenon before the fire occurred.

The inspectors confirmed that a glove box fire was analyzed in the fire hazards analysis (FHA) for the CD line. However, no credit was given for the CO₂ system in the ISA. The CO₂ was to be used to put UF₆ into a solid form in the event it vaporized in the glove box. The CO₂, however, was mentioned in the FHA. The licensee's approach to a fire in a sublimation station was not to attempt extinguishment. Instead, the operator was expected to see the fire, flee the area, and then sound the alarm. Using this approach, no exposure to the operator would occur. Thus, the accident sequence of a fire in a single glove box was not specifically analyzed in the ISA. The licensee only analyzed larger fires that damage several glove boxes and subsequently breaches the building. The licensee demonstrated compliance with NRC regulation (specifically, 10 CFR 70.61) by limiting the amount of cylinders stored in the processing area. Procedures limit the number of cylinders in the area to a maximum of three. For a large fire in the CD line, this constraint would limit UF₆ exposure at the site boundary to below regulatory requirements.

10 CFR 70.72 (a)(2) requires that prior to implementing any facility change, the impact of the change on the control of licensed material shall be addressed. Prior to implementing the change allowing the operation of the CD line, the licensee failed to address the impact of radiolytic buildup of F₂ gas in the UF₆ cylinders would have on the components that control SNM. The licensee's failure was of low safety significance because the accident was adequately bounded by the ISA and the IROFS in place ensured that the performance requirements were met. This failure is a violation of NRC requirements and will be tracked as VIO 70-143/2009-004-01. Following the event, the licensee shutdown all sublimation activities in the CD line until root cause(s) could be determined.

(2) Conclusions

A violation of 10 CFR 70.72(a)(1) was identified for the failure to adequately address the material compatibility of UF₆ vent hose materials with F₂ gas that may be present in the storage cylinders.

c. Management Organization and Controls (IP 88135)

(1) Inspection Scope and Observations

The inspectors performed daily reviews of the licensee's PIRCS entries to ensure that items adverse to facility requirements and quality were being identified and tracked to closure. The inspectors verified that issues were being properly identified, reviewed and tracked to completion. The inspectors noted that regarding the fire that occurred on November 14 (see Section 4.b) in the CD line glove box, a previous PIRCS entry from the day before dealt with a related anomaly within this glove box. However, the corrective actions were not thorough or comprehensive, and the evaluation failed to probe deep enough into the issue such that the follow on event was not prevented or mitigated.

(2) Conclusions

The licensee's corrective action program did not implement sufficient actions to prevent the fire that occurred in the CD line.

5. Follow-up on Events (88135)**(1) Inspection Scope and Observations**

The inspectors reviewed EN No. 45601 involving a press release issued on December 31, 2009. This press release dealt with a suspension in production operations following the normal holiday shutdown period which ended December 28. The facility will be brought back on line following implementation of various safety improvement programs, a third party review, and a NRC review of these safety improvements. The decision to keep the facility shut down was made by the licensee after discussion with NRC about a steadily declining trend in facility performance. The EN was issued to comply with 10 CFR 70, Appendix A which requires a report to the HOO concurrent with any press release that deals with a situation related to the health and safety of the public or the environment.

(2) Conclusions

No issues of significance were identified.

6. Exit Meeting

The inspection scope and results were presented to members of the licensee's staff at various meetings throughout the inspection period and were summarized on January 7, 2010 with the licensee's management. No dissenting comments were received from the licensee. Proprietary information was discussed but not included in the report.

ATTACHMENT

1. PERSONS CONTACTED

Partial List of Licensee's Persons Contacted

D. Kudsin, President
T. Lindstrom, General Manager
M. Moore, Director, Safety & Regulatory
J. Nagy, Chief Nuclear Safety Officer
R. Bond, Senior Project Director, HEU Operations
R. Droke, Licensing Director
T. Coates, Engineering Section Manager
R. Shackelford, Nuclear Criticality Safety Manager
G. Athon, Vice President, Applied Technology/Principle Scientist
R. Dailey, Engineering
N. Brown, Criticality Safety Engineer
M. Tester, Sr. Manager, Radiation Control
D. Gardner, Licensing Coordinator
A. Vaughan, Director Fuel Production

2. INSPECTION PROCEDURES USED

IP 88135 Resident Inspectors Program for Category 1 Fuel Cycle Facilities
IP 88050 Emergency Preparedness
IP 88030 Radiation Protection

3. LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

<u>Item Number</u>	<u>Status</u>	<u>Type/Description</u>
70-143/2009-004-01	Open	VIO – Inadequate design of a system containing SNM (Paragraph 4.b)