



**UNITED STATES
NUCLEAR REGULATORY COMMISSION**
REGION II
245 PEACHTREE CENTER AVENUE NE, SUITE 1200
ATLANTA, GEORGIA 30303-1257

October 22, 2015

EA-15-214
EN-51411

Mr. B. Joel Burch
Vice President and General Manager
BWX Technologies
Nuclear Operations Group, Inc.
P.O. Box 785
Lynchburg, VA 24505-0785

**SUBJECT: BWXT NOG-L, INC. - NUCLEAR REGULATORY COMMISSION SPECIAL
INSPECTION REPORT NUMBER 70-27/2015-008**

Dear Mr. Burch:

This report documents the results of the Nuclear Regulatory Commission (NRC) special inspection (SI) conducted from September 25-29, 2015, at your facility in Lynchburg, Virginia. The purpose of the inspection was to inspect and assess the facts and circumstances surrounding the loss of an administrative item relied on for safety (IROFS) on limiting moderating material mass in a process glovebox in the Specialty Fuel Facility (SFF). This event was reported to the NRC Operations Center on September 19, 2015, (Event Notice 51411) in accordance with the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 70, Appendix A, (b)(2) – Loss or degradation of items relied on for safety that results in failure to meet the performance requirement of 10 CFR 70.61.

Based on preliminary information provided by the licensee in the Event Notice (EN), the NRC determined that a SI was the appropriate level of regulatory response to obtain additional information to fully assess the significance of the event (see Enclosure 2). The SI objectives were to (1) review the facts surrounding the failure to maintain an administrative IROFS limiting the amount of moderating material mass in the affected production line and the potential for similar failures on other lines using the same mass/moderator control protocols, (2) assess the licensee's response to the failure, and (3) evaluate the licensee's immediate and planned long-term corrective actions to prevent recurrence. The SI consisted of facility walk-downs of several areas within the facility; multiple interviews with operators, area front line management, nuclear criticality safety (NCS) staff, and facility management; and selective document review including procedures and NCS analyses. At the close of the inspection, the licensee's root cause analysis report had not yet been finalized and issued for NRC review. The enclosed report documents the results of the SI. The inspection results were discussed with you and other members of your staff at an exit meeting held on September 29, 2015.

Based on the results of this inspection, the NRC has identified two apparent violations (AVs) being considered for escalated enforcement in accordance with the NRC Enforcement Policy. The current Enforcement Policy is included on the NRC's Web site at <http://www.nrc.gov/about-nrc/regulatory/enforcement/enforce-pol.html>.

The first AV is associated with the failure to establish adequate management measures to ensure that an administrative IROFS was implemented and maintained such that it was available and reliable to perform its function. The second AV involves the failure to apply sufficient controls to reduce the likelihood of occurrence of a high consequence event to "highly unlikely." Since the NRC has not made a final determination in this matter, no Notice of Violation is being issued for this inspection at this time.

Before the NRC makes its enforcement decision, we are providing you an opportunity to (1) respond in writing to the apparent violations addressed in this inspection report within 30 days of the date of this letter, (2) request a Pre-decisional Enforcement Conference (PEC), or (3) request Alternative Dispute Resolution (ADR). If a PEC is held, the NRC will issue a press release to announce the time and date of the conference. If you decide to participate in a PEC or pursue ADR, please contact Omar R. López-Santiago at 404-997-4703 within 10 days of the date of this letter. A PEC should be held within 30 days and an ADR session within 45 days of the date of this letter.

If you choose to provide a written response, it should be clearly marked as a "Response to Apparent Violations in NRC Inspection Report 70-27/2015-008" and should include for each apparent violation (1) the reason for the apparent violation or, if contested, the basis for disputing the apparent violation; (2) the corrective steps that have been taken and the results achieved; (3) the corrective steps that will be taken; 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 response is not received within the time specified or an extension of time has not been granted by the NRC, the NRC will proceed with its enforcement decision or schedule a PEC.

If you choose to request a PEC, the conference will afford you the opportunity to provide your perspective on these matters and any other information that you believe the NRC should take into consideration before making an enforcement decision. The decision to hold a PEC does not mean that the NRC has determined that a violation has occurred or that enforcement action will be taken. This conference would be conducted to obtain information to assist the NRC in making an enforcement decision. The topics discussed during the conference may include information to determine whether a violation occurred, information to determine the significance of a violation, information related to the identification of a violation, and information related to any corrective actions taken or planned. In presenting your corrective actions, you should be aware that the promptness and comprehensiveness of your actions will be considered in assessing any civil penalty for the apparent violations.

In lieu of a PEC, you may also request ADR with the NRC in an attempt to resolve this issue. ADR is a general term encompassing various techniques for resolving conflicts using a third party neutral. The technique that the NRC has decided to employ is mediation. Mediation is a voluntary, informal process in which a trained neutral (the "mediator") works with parties to help them reach resolution. If the parties agree to use ADR, they select a mutually agreeable neutral mediator who has no stake in the outcome and no power to make decisions. Mediation gives parties an opportunity to discuss issues, clear up misunderstandings, be creative, find areas of

agreement, and reach a final resolution of the issues. Additional information concerning the NRC's program can be obtained at <http://www.nrc.gov/about-nrc/regulatory/enforcement/adr.html>. The Institute on Conflict Resolution (ICR) at Cornell University has agreed to facilitate the NRC's program as a neutral third party. Please contact ICR at 877-733-9415 within 10 days of the date of this letter if you are interested in pursuing resolution of this issue through ADR.

In addition, please be advised that the number and characterization of the AVs described in this inspection report may change as a result of further NRC review. You will be advised by separate correspondence of the results of our deliberations on this matter.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice and Procedure," 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 Agencywide Documents Access and Management 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 classified information so that it can be made available to the Public without redaction.

If you have questions, please call Omar R. López-Santiago, Chief, Safety Branch at (404) 997-4703.

Sincerely,

/RA/

Mark S. Lesser, Director
Division of Fuel Facility Inspection

Docket No. 70-27
License No. SNM-42

Enclosures:

1. Inspection Report 70-27/2015-008
2. Special Inspection Charter

cc: (See page 4)

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cc: (See page 4)

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ADAMS: Yes ACCESSION NUMBER:ML15295A206 SUNSI REVIEW COMPLETE FORM 665 ATTACHED

OFFICE	RII:DFFI	RII:DC	RII:DFFI	RII:DFFI	RII:ORA	RII:EICS	
SIGNATURE	/RA/	/RA/	/RA/	/RA/	/RA/	/RA/	
NAME	JMunson	NPitoniak	BAdkins	OLopez	SPrice	DGamberoni	
DATE	10/20/2015	10/20/2015	10/20/2015	10/21/2015	10/21/2015	10/21/2015	10/ /2015
E-MAIL COPY?	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO

cc:

Joseph G. Henry
Chief Operating Officer
BWXT Nuclear Operations Group, Inc.
2016 Mount Athos Road
Lynchburg, VA 24505

Charles A. England, Manager
Licensing and Safety Analysis
BWXT Nuclear Operations Group, Inc.
P.O. Box 785
Lynchburg, VA 24505-0785

Steve Harrison, Director
Division of Radiological Health
Department of Health
109 Governor Street, Room 730
Richmond, VA 23219

Letter to Mr. B. Joel Burch from Mark S. Lesser dated October 22, 2015

SUBJECT: BWXT NOG-L, INC. - NUCLEAR REGULATORY COMMISSION SPECIAL
INSPECTION REPORT NUMBER 70-27/2015-008

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U.S. NUCLEAR REGULATORY COMMISSION

REGION II

Docket No.: 70-27

License No.: SNM-42

Report No.: 70-27/2015-008

Licensee: BWXT Nuclear Operations Group, Inc.

Location: Lynchburg, VA

Inspection Dates: September 25-29, 2015

Inspector: Jeremy Munson, Nuclear Criticality Safety Inspector

Approved by: Mark Lesser, Director
Division of Fuel Facility Inspection

EXECUTIVE SUMMARY

BWXT NUCLEAR OPERATIONS GROUP, INC. NRC INSPECTION REPORT 70-27/2015-008

BWXT NOG-L is authorized to receive, possess, use, store, and ship special nuclear material pursuant to 10 CFR Part 70. The primary activity on the BWXT NOG-L site is the production of fuel material containing highly enriched uranium for naval reactors. In addition, BWXT has many other operations including the production of uranium fuel for the Advanced Gas Reactor (AGR). Activities involving the production of AGR fuel take place in an area of the facility referred to as the Specialty Fuel Facility (SFF).

Certain operations in the SFF are conducted in gloveboxes, where two separate administrative items relied on for safety (IROFS) on limiting fissile mass and moderating material mass are implemented to prevent an inadvertent criticality. The controls are credited to prevent multiple accident sequences analyzed in the licensee's integrated safety analysis. The accident sequences prevented by these controls involve upsets of the moderating material mass limits. Likewise, the controls are also credited in accident sequences involving upsets of the fissile material mass limits. The administrative controls are implemented by the use of a fissile mass and moderator log and a three-tier station limit card to verify that both fissile and moderating material mass remain within safe limits.

On September 16, 2015, a licensee nuclear criticality safety (NCS) engineer was conducting a routine audit of the SFF area and discovered anomalies in the logs used to track fissile and moderating material mass within a glovebox designed to process AGR fuel. The anomalies indicated that on July 13 and 14, 2015, the safe moderating mass limit may have been exceeded for the associated limit on fissile mass. The logs also contained two entries noted as "box corrections" in which no material entered or was removed from the glovebox, but both the fissile mass and moderating material mass were adjusted. It was not readily clear at the time whether the limits on fissile mass and moderating material mass were actually exceeded. The NCS engineer immediately notified the area front line manager (FLM) and later met with members of the Operations and Engineering departments to discuss the log anomalies.

At approximately 1:00 p.m. on September 18, 2015, the licensee determined during a critique meeting that the log entries may not have been bookkeeping errors and that the posted moderating material mass limits may have, in fact, been exceeded. The operators involved stated their understanding at the time of the log entries was that they needed to adhere only to the fissile mass limit *or* the moderating material mass limit, not both. The licensee immediately suspended operations in the SFF area and initiated an extent-of-condition review to identify other areas of the facility where similar controls on mass and moderator are utilized. The licensee identified four other areas with similar controls on fissile mass and moderator and immediately suspended activities in these areas as well pending further investigation.

At approximately 12:56 p.m. on September 19, 2015, the licensee submitted a 24-hour report of the condition to the NRC (Event Notification 51411) pursuant to the requirement of 10 CFR Appendix A (b)(2), which requires, in part, a report of a:

Loss or degradation of items relied on for safety that results in failure to meet the performance requirement of 10 CFR 70.61.

On September 23, 2015, the licensee amended their report to include an additional glovebox in the SFF area that was identified as having similar log anomalies through their extent-of-condition review.

The NRC evaluated the event and initiated a special inspection (SI) to assess the facts and circumstances surrounding the event.

Assessment of the Licensee's Immediate Corrective Actions

The licensee immediately suspended operations in the SFF and initiated an extent-of-condition review to identify any other areas that were subject to similar controls on mass and moderation. The licensee identified four other areas: (1) filler area including the pharmacy, conventional filler line, and Bay 17 sampling room, (2) research and test reactors (RTR) area, (3) nuclear material control (NMC) filler breaking glovebox, and (4) uranium recovery. The licensee suspended operations in these areas pending further investigation. The inspector determined that the licensee's immediate corrective actions were comprehensive and effective.

Assessment of Adequacy of Controls

Although mass and moderation are parametrically dependent, the inspector determined that adequate independence of the controls on fissile mass and moderating material mass was established. The inspector determined that the established controls on fissile mass and moderator would have been sufficient to satisfy both the double contingency principle (DCP) and the performance requirements of 10 CFR 70.61, if implemented properly. However, the event presented a situation where one of the two controls essential to compliance with the DCP and performance requirements of 10 CFR 70.61 was rendered unreliable. Therefore, the inspector identified an Apparent Violation (AV) for the failure to apply sufficient controls to reduce the likelihood of occurrence of a high consequence event (criticality) to "highly unlikely" (AV 70-27/2015-008-01).

Assessment of Defense-in-Depth

The inspector identified no other apparent controls, including both IROFS and non-IROFS, in place that could have provided additional defense-in-depth for the situation encountered.

Assessment of Management Measures

The inspector determined that the licensee failed to establish adequate management measures to assure the availability and reliability of the administrative IROFS on limiting moderating material mass. Specifically, the licensee failed to provide adequate training to operators to ensure that they understood and implemented the controls on mass and moderation as intended. Therefore, the inspector identified an AV (AV 70-27/2015-008-02) for the failure to establish adequate management measures to ensure the availability and reliability of the administrative IROFS limiting moderating material mass.

Assessment of the Licensee's Decision to Restart

The inspector determined that the licensee's decision-making process to restart four of the five process areas affected by the event did not violate any NRC requirements.

Assessment of the Licensee's Root Cause Analysis

The licensee is still in the early stages of their root cause analysis; however, the inspector performed an interview with a member of the licensee's staff assigned to lead the investigation. An Inspector Follow-up Item (IFI 70-27/2015-008-03) was identified to review and evaluate the licensee's root cause analysis once complete.

Assessment of Internal and External Event Reporting

The inspector determined that the licensee submitted all required reports, both internally and externally, in accordance with procedures and regulatory requirements.

Attachment

Key Points of Contact

List of Items Opened, Closed, and Discussed

Inspection Procedures Used

Documents Reviewed

REPORT DETAILS

BWXT NOG-L produces uranium fuel for the Advanced Gas Reactor (AGR) in an area of the facility referred to as the Specialty Fuel Facility (SFF). Certain activities in the SFF are conducted in gloveboxes, where controls on limiting fissile and moderating material mass are implemented to prevent an inadvertent criticality. A three-tier limit for control of fissile and moderating material mass is used along with a mass/moderator log sheet to verify that activities are performed within safe limits. As the safe fissile mass limit increases, the safe moderating material mass decreases. Operators are expected to log any incoming or outgoing material from the gloveboxes and verify that the safe fissile and moderating material mass limits will not be exceeded prior to introducing any material into the glovebox.

1. Event Timeline

Through interviews with licensee personnel and review of licensee records, the inspector developed a timeline associated with the event surrounding the loss of an administrative item relied on for safety (IROFS) on limiting moderating material mass in a process glovebox in the SFF.

September 16, 2015

- At approximately 8:00 a.m., a licensee nuclear criticality safety (NCS) engineer discovered anomalies in the logs used to track fissile material and moderating material mass during a routine audit of the SFF. The anomalies indicated that on July 13 and 14, 2015, the safe moderating material mass for the associated fissile mass may have been exceeded. Additionally, the logs contained two entries noted as “box corrections” in which no material entered or was removed from the glovebox, but both fissile mass and moderating material mass were adjusted.
- The NCS engineer immediately notified the area front line manager (FLM).

September 18, 2015

- At approximately 1:00 pm, the licensee determined during a critique meeting that the log entries may not have been bookkeeping errors. The operators involved stated their understanding at the time of the log entries was that they needed to adhere only to the fissile mass limit *or* the moderating material mass limit, not both.
- The licensee immediately suspended activities in the SFF area and initiated an extent-of-condition review to identify any other areas where similar controls on fissile mass and moderating material mass are utilized.

September 19, 2015

- The licensee identified four other areas where similar controls are utilized and suspended operations in these areas pending further investigation. The other areas included: (1) filler area including the pharmacy, conventional filler line, and Bay 17 sampling room, (2) research and test reactors (RTR) area, (3) nuclear material control (NMC) filler breaking glovebox, and (4) uranium recovery.

- At approximately 12:56 p.m., the licensee submitted a 24 hour report of the event to the NRC under 10 CFR Appendix A (b)(2) (Event Notification (EN) 51411).

September 21, 2015

- At approximately 8:35 a.m., the licensee resumed operations in the filler area including the pharmacy, conventional filler line, and Bay 17 sampling room.
- At approximately 10:48 a.m., the licensee resumed operations in the NMC filler breaking glovebox.
- At approximately 11:26 a.m., the licensee resumed operations in the RTR area.

September 22, 2015

- At approximately 6:48 a.m. and 9:18 a.m., the licensee resumed operations in the recovery area furnace and gloveboxes, respectively.

September 23, 2015

- The licensee amended their report to include an additional glovebox in the SFF area that was identified as having similar log anomalies through their extent-of-condition review.

September 27, 2015

- At approximately 9:00 a.m., the licensee discovered during additional review that there was a potential issue with the implementation of the controls limiting fissile material and moderating material mass in a filler area glovebox and re-suspended operations in the filler area including the pharmacy, conventional filler line, and Bay 17 sampling room.

October 5, 2015

- At approximately 6:00 a.m., the licensee resumed operations on the conventional filler line.

October 13, 2015

- On first shift, the licensee resumed operations in the pharmacy and Bay 17 sampling room.

2. Assessment of the Licensee's Immediate Corrective Actions

a. Scope and Observations

Immediately after discovering that the log anomalies may not have been bookkeeping errors, the licensee suspended activities in the SFF area and initiated an extent-of-condition review to identify other potential areas where similar controls on fissile mass and moderating material mass are utilized. The licensee identified four other areas (filler area, RTR, NMC filler breaking glovebox, and uranium recovery) and immediately suspended operations in those areas pending further investigation.

The inspector concluded that the licensee's immediate corrective actions of suspending operations in the SFF, initiating an extent-of-condition review, and suspending operations in other areas identified pending further investigation were comprehensive and effective.

b. Conclusion

No findings of significance were identified.

3. **Assessment of Adequacy of Controls**

a. Scope and Observations

The inspector reviewed NCS analyses, reviewed integrated safety analysis (ISA) documents, reviewed NCS postings, and conducted technical discussions with the licensee's NCS staff in order to evaluate the technical basis and the intent of the NCS controls on limiting fissile and moderating material mass. The inspector performed one-on-one interviews on the process floor with operators from the SFF, RTR, conventional filler line, pharmacy area, and uranium recovery in order to observe the method at which the NCS controls were being implemented. Additionally, the inspector performed interviews with members of the licensee's NMC staff regarding the implementation of the NCS controls on the NMC filler breaking glovebox.

The inspector determined that, although parametrically dependent, the controls on limiting the fissile mass and moderating material mass were sufficiently independent. Independence of the controls is established through demonstrated analysis, procedural implementation, and the required upset of each parameter. The inspector determined that the controls would have been sufficient to meet both the double contingency principle (DCP) and the performance requirements of 10 CFR 70.61 had they been implemented properly. However, the event presented a situation where one of the two controls essential to compliance with the DCP and performance requirements of 10 CFR 70.61 was rendered unreliable.

Failure to Limit the Likelihood of Criticality to "Highly Unlikely"

Introduction: A license-identified Apparent Violation (AV) of 10 CFR 70.61(b) was identified for the licensee's failure to apply sufficient controls to reduce the likelihood of occurrence of a high consequence event (criticality) to "highly unlikely." Specifically, the licensee failed to limit the likelihood of an inadvertent criticality to "highly unlikely" in the SFF area when operators performed actions that rendered a control on moderating material mass unreliable. The unreliability of this control resulted in the likelihood of an inadvertent criticality shifting from "highly unlikely" to "unlikely" based on the licensee's ISA.

Description: The licensee relies on two administrative IROFS in the SFF area gloveboxes to limit the likelihood of an inadvertent criticality to "highly unlikely": (1) operator controls the fissile material mass and (2) operator controls the moderating material mass. For the situation encountered in the SFF, the control on limiting the moderating material mass was rendered unreliable because not only did the operators

violate the safe moderating material mass limit for the associated fissile mass numerous times, but they also were of the incorrect understanding that they needed to adhere to the fissile mass limit *or* the moderating material mass limit, not both.

The licensee's ISA analyzes such an upset. The applicable ISA accident sequence involves an operator introducing more than a double-batch of moderating material into the enclosure as the initiating event. The initiating event of this accident sequence is the failure of the control limiting the moderating material mass and is assigned an initiating event frequency of [-2] per the licensee's ISA methodology. The accident sequence is further prevented by the control limiting the fissile material mass in the enclosure and is assigned an effectiveness of protection score of [2] per the licensee's ISA methodology. With both controls available and reliable, the overall likelihood index of the accident sequence is [-4], which is "highly unlikely" based on the licensee's ISA ($[-2] - [2] = [-4]$).

Initiating Event	Control	Initiating Event Frequency	Effectiveness of Protection	Overall Risk Index
Operator places more than a double-batch of moderating material into glovebox	IROFS: Operator controls the amount of moderating material	[-2]		
	IROFS: Operator controls the amount of fissile mass		[2]	
				[-4]

For the event, the control limiting the moderating material mass was not implemented properly as the operators were not giving consideration to moderating material mass to verify that posted limits were not exceeded. Therefore, the inspector determined that this control was not reliable. The unreliability of the control limiting moderating material mass resulted in the overall likelihood index of the accident sequence to shift from [-4] to [-2], which is "unlikely" based on the licensee's ISA.

Analysis: The licensee failed to apply sufficient controls to reduce the likelihood of occurrence of a high consequence event (criticality) to "highly unlikely." Specifically, the licensee failed to limit the likelihood of an inadvertent criticality to "highly unlikely" in the SFF when operators performed actions that rendered a control on moderating material mass unreliable. The loss of the control limiting moderating material mass resulted in a shift from "highly unlikely" to "unlikely" based on the licensee's ISA. This failure is a violation of 10 CFR 70.61(b), which states, in part, that "[t]he risk of each credible high consequence event must be limited. Engineered controls, administrative controls, or both, shall be applied to the extent needed to reduce the likelihood of occurrence of the event so that, upon implementation of such controls, the event is highly unlikely...." This issue was determined to be more than minor because it aligns with Inspection Manual

Chapter (IMC) 0616 Appendix B screening criteria 5, which states, “[d]oes the noncompliance result in a change in risk such that the licensee fails to meet 10 CFR 70.61(b) or (c) performance requirements?”

The actual safety significance of this AV is low because no criticality or overexposures to radiation occurred. However, the potential safety significance is high because the failure resulted in a substantial increase in the risk of a high consequence event.

Enforcement: 10 CFR 70.61(a) states, in part, that the “...licensee shall evaluate, in the integrated safety analysis performed in accordance with 10 CFR 70.62, its compliance with the performance requirements in paragraphs (b), (c), and (d) of this section.” 10 CFR 70.61(b) of 10 CFR states, in part, that “[t]he risk of each credible high consequence event must be limited. Engineered controls, administrative controls, or both, shall be applied to the extent needed to reduce the likelihood of occurrence of the event so that, upon implementation of such controls, the event is highly unlikely....”

Contrary to this requirement, on or before July 13 and 14, 2015, the licensee failed to apply sufficient controls to reduce the likelihood of occurrence of a high consequence event to “highly unlikely.” Specifically, the licensee failed to limit the likelihood of an inadvertent criticality to “highly unlikely” in the SFF when operators performed actions that rendered a control on moderating material mass unreliable. The unreliability of this control resulted in the likelihood of an inadvertent criticality shifting from “highly unlikely” to “unlikely” based on the licensee’s ISA. This is an AV of NRC requirements and is documented as AV 70-27/2015-008-01, Failure to Limit the Likelihood of Criticality to “Highly Unlikely.”

The licensee’s immediate corrective actions were to suspend activities in the SFF and initiate an extent-of-condition review to identify any other areas where similar controls on fissile mass and moderating material mass are utilized. The licensee identified four other areas and immediately suspended operations in those areas pending further investigation.

b. Conclusion

The inspector determined that the controls on limiting the fissile mass and moderating material mass were sufficient to satisfy both the DCP and the performance requirements of 10 CFR 70.61 when implemented properly. However, the event presented a situation where one of the two controls essential to compliance with the DCP and performance requirements of 10 CFR 70.61 was rendered unreliable. Therefore, an AV was identified involving the failure to limit the likelihood of criticality to “highly unlikely.”

4. **Assessment of Defense-in-Depth**

a. Scope and Observations

The inspector performed walk-downs of the SFF area with operators and NCS staff to identify any additional controls which may have provided additional defense-in-depth to prevent an inadvertent criticality. Additionally, the inspector reviewed NCS analyses and ISA documents.

The inspector identified no other apparent controls, including both IROFS and non-IROFS, in place that could have provided additional defense-in-depth for the situation encountered.

b. Conclusion

No findings of significance were identified.

5. Assessment of Management Measures

a. Scope and Observations

The inspector reviewed training and qualification records of SFF operators, procedures in the SFF area, and audits of the SFF area to assess the management measures applied to the administrative IROFS on limiting fissile mass and moderating material mass. The inspector performed one-on-one interviews on the process floor with operators from the SFF, RTR, conventional filler line, pharmacy area, and uranium recovery in order to observe the method at which the NCS controls were being implemented and assess whether the implementation was aligned with the intent. Additionally, the inspector performed interviews with members of the licensee's NMC staff regarding the implementation of the NCS controls on the NMC filler breaking glovebox.

The inspector determined that, in general, the implementation of the NCS controls was aligned with the intent. However, the inspector determined that there were cases where the implementation was not aligned with the intent of the controls, and the management measures applied to the administrative IROFS were not sufficient to ensure they were available and reliable.

Failure to Establish Adequate Management Measures

Introduction: A licensee-identified AV of 10 CFR 70.62(d) was identified for the licensee's failure to establish adequate management measures to ensure that an administrative control identified as an IROFS was implemented and maintained such that it was available and reliable to perform its function. Specifically, the licensee failed to provide adequate training to operators in the SFF to ensure that an administrative IROFS for limiting the amount of moderating material in a process glovebox was implemented correctly.

Description: Certain activities in the SFF area are conducted in gloveboxes, where controls on limiting fissile mass and moderating material mass are implemented to prevent an inadvertent criticality. The controls are implemented by a fissile mass and moderating material mass log sheet and NCS station limit card. Fuel is handled in 2.5 liter containers. For fuel from early stages of the AGR fuel manufacturing process, hereafter referred to as "wet" material, the operators assume that the entire weight of the 2.5 liter container is U-235 and that 50% of the weight is moderating material. For example, a 1000g container would be logged as 1000g U-235 and 500g moderating material, totaling 1500g. For fuel from a later stage of the process, hereafter referred to

as “dry” material, the content of the moderating material is significantly lower than that of “wet” material and is more precisely known. The operators log the weight of the fissile mass for “dry” material, but do not log the weight of the moderating material (the operators draw a line through this box on the log).

After the log anomalies were discovered, the licensee retroactively reconstructed the glovebox material additions and removals in order to understand the issues with the mass/moderator logs. The licensee’s reconstruction indicated that during temporary storage of both “dry” and “wet” material in process gloveboxes, the moderating material mass of various containers may have been logged incorrectly. In 2010, the licensee began using gloveboxes intended for processing AGR fuel as temporary storage locations for fuel from various stages of the AGR fuel manufacturing process. Typically, highly enriched uranium (HEU) dedicated to AGR down-blending is stored in vault locations and natural assay uranium is stored on the floor. This licensee stated that this resulted in a continual issue with not having sufficient storage space for the in-process AGR fuel. Under this practice, gloveboxes intended for the processing of “dry” material were used as temporary storage of both “dry” and “wet” material, and sometimes both types of fuel were stored together.

As previously stated, the moderating material mass of “wet” material is logged differently from that of “dry” material. The licensee’s reconstruction of the logs indicated that at some point the contents of “dry” material containers were logged as having 50% moderator by weight, which is more aligned with the treatment of “wet” material. Additionally, the operators involved in the event stated that their understanding was that they needed to adhere to the fissile material mass limit *or* the moderating material mass limit, not both. This is more aligned with the treatment of “dry” material, where operators do not log moderating material mass (they draw a line through this box on the log sheet). The inspector noted that the practice of temporarily storing both “wet” and “dry” material, two material types whose moderating material mass is logged differently, together likely contributed to the event as evidenced by both the incorrect logging of the moderating material mass of “dry” containers and the operators’ incorrect understanding of the mass/moderator controls. The inspector determined that the controls on limiting fissile mass and moderating material mass would be sufficient when implemented properly. However, in the event described above, the control on limiting moderating material mass was not properly implemented due to the operators’ lack of understanding of the intent and proper implementation of the controls. The inspector determined that the licensee failed to provide sufficient training to SFF area operators to ensure that they understood the controls and safety limits and their intended implementation.

In addition to the issues discovered in the SFF, the licensee identified an issue involving daily cleanouts of a glovebox in the filler area. The glovebox is cleaned out daily using various cleaning tools, which contribute to the moderating material mass within the glovebox. The licensee’s NCS staff was of the understanding that daily cleanouts were being performed with all fissile mass removed from the glovebox to ensure that safe limits on fissile mass and moderating material mass would not be exceeded; however, this was not the case. Based on the typical amount of moderating material mass added from the cleaning supplies, the licensee determined that with fissile mass present in the glovebox that the limit for moderating material mass has likely been exceeded in the past and is vulnerable to being exceeded in the future. As before, the inspector determined that the controls on limiting fissile material and moderating material mass

would be sufficient when implemented properly. However, the control on limiting moderating material mass may not have been properly implemented due to the addition of cleaning materials during daily cleanouts with fissile material present.

Analysis: The licensee failed to establish adequate management measures to ensure that an administrative IROFS was implemented and maintained such that it was available and reliable to perform its function. Specifically, the licensee failed to provide adequate training to operators in the SFF to ensure that an administrative IROFS for limiting the amount of moderating material in a process glovebox was implemented correctly. Consequently, operators did not properly control moderating material mass and performed actions that rendered an IROFS unreliable, resulting in a substantial increase in risk. Based on the licensee's ISA, the inspector determined that the likelihood of criticality shifted from "highly unlikely" to "unlikely."

This is a violation of 10 CFR 70.62(d), which states, in part, that the "licensee shall establish management measures to ensure compliance with the performance requirements of §70.61...The management measures shall ensure that engineered and administrative controls that are identified as items relied on for safety pursuant to 10 CFR 70.61(e) of this subpart are designed, implemented, and maintained, as necessary, to ensure they are available and reliable to perform their function when needed, to comply with the performance requirements of 10 CFR 70.61 of this subpart." This issue was determined to be more than minor because it aligns with IMC 0616 Appendix B screening criteria 7, which states, "[d]oes the noncompliance involve the failure of a management measure such that an IROFS would not be available or reliable to perform its intended safety function when needed as required by 10 CFR 70.61(e) and 70.62(d) and is risk significant?"

The actual safety significance of this AV is low because no criticality or overexposures to radiation occurred. However, the potential safety significance was high because the failure resulted in a substantial increase in the risk of an inadvertent criticality.

Enforcement: Title 10 of the Code of Federal Regulations (10 CFR) 70.62(d) requires, in part, that the licensee shall establish management measures to ensure compliance with the performance requirements of 10 CFR 70.61. The management measures shall ensure that engineered and administrative controls that are identified as items relied on for safety pursuant to 10 CFR 70.61(e) are designed, implemented, and maintained, as necessary, to ensure they are available and reliable to perform their function when needed, to comply with the performance requirements of 10 CFR 70.61.

Contrary to this requirement, on or before July 13 and 14, 2015, the licensee failed to establish adequate management measures to ensure that an administrative control identified as IROFS was implemented and maintained such that it was available and reliable to perform its function. Specifically, the licensee failed to provide adequate training to operators in the SFF to ensure that an administrative IROFS for limiting the amount of moderating material in a process glovebox was implemented correctly. This is an AV of NRC requirements and is documented as AV 70-27/2015-008-02, Failure to Establish Adequate Management Measures.

The licensee's immediate corrective actions were to suspend activities in the SFF and initiate an extent-of-condition review to identify any other areas where similar controls on fissile mass and moderating material mass are utilized. The licensee identified four other areas and immediately suspended operations in those areas pending further investigation.

b. Conclusion

This inspector identified one AV for failure to establish adequate management measures.

6. Assessment of the Licensee's Decision to Restart

a. Scope and Observations

Following the event on September 16, 2015, and subsequent suspension of operations in five affected areas, the licensee restarted four of the five process areas that were originally identified as having similar controls on limiting fissile mass and moderating material mass. Prior to restart, the licensee conducted discussions with area operators to verify that they understood the intent of the administrative IROFS. The inspector discussed the licensee's decision-making process to restart these areas with members of licensee management. The licensee stated that they do not have a formal, documented process for making this determination. The inspector determined that the licensee's decision to restart did not violate any NRC requirements.

b. Conclusion

No findings of significance were identified.

7. Assessment of the Licensee's Root Cause Analysis

a. Scope and Observations

The inspector conducted an interview with a senior member of the licensee's staff assigned to lead the root cause investigation. At the time of the inspection, the licensee was still in the early stages of their TAPROOT root cause analysis, which began on September 22, 2015. To date, the licensee has conducted interviews with the SFF area operators and has begun developing a timeline of events.

At the close of this inspection, the final results of the licensee's root cause analysis had not been completed and issued for NRC review. A final assessment of the licensee's root cause analysis and planned actions could not be completed. Therefore, an inspector follow-up item (IFI) was identified to review and assess the licensee's root cause investigation once completed. This item is documented as IFI 70-27/2015-008-03, Root Cause Analysis Follow-up.

b. Conclusion

IFI 70-27/2015-008-03 was identified to further evaluate adequacy of the licensee's root cause investigation.

8. **Assessment of Internal and External Event Reporting**

a. Scope and Observations

The licensee discovered at approximately 1:00 p.m. on September 18, 2015, that the event presented a situation where one of two IROFS relied on to meet the performance requirements of 10 CFR 70.61 was unreliable and that the event required a 24-hour report to the NRC. The licensee submitted a 24-hour report to the NRC at approximately 12:56 p.m. on September 19, 2015.

The inspector reviewed the licensee's reportability determination and procedure for making such a determination. The inspector determined that the licensee made all required internal reports and appropriately reported the event to the NRC.

b. Conclusion

No findings of significance were identified.

9. **Exit Meeting**

The inspection scope and results were presented to members of the licensee's staff of September 29, 2015. No dissenting comments were received from the licensee. Proprietary information was discussed but not included in the report.

SUPPLEMENTARY INFORMATION

1. Key Points of Contact

B&W NOG

D. Faidley Manager, Nuclear Criticality Safety
D. Spangler Section Manager, Nuclear Safety & Licensing
D. Ward Department Manager, Environmental, Safety, Health and Safeguards

NRC

S. Subosits Senior Resident Inspector, NRC RII
E. Michel Chief, Projects Branch 2, NRC RII
J. Munson Nuclear Criticality Safety Inspector, NRC RII

2. List of Items Opened, Closed, and Discussed

<u>Item Number</u>	<u>Status</u>	<u>Description</u>
AV 70-27/2015-008-01	Opened	Failure to Limit the Likelihood of Criticality to "Highly Unlikely"
AV 70-27/2015-008-02	Opened	Failure to Establish Adequate Management Measures
IFI 70-27/2015-008-03	Opened	Root Cause Analysis Follow-up

3. Inspection Procedures Used

IP 88003 Reactive Inspection for Events at Fuel Cycle Facilities
IP 88015 Nuclear Criticality Safety
IP 93812 Special Inspection

4. Key Documents Reviewed

E61-001A, Revision (Rev.) 11
M11-F-070, FMO U235 and Moderating Materials Control List – Conventional Line,"
Rev. 9
M-35-025, Rev. 10
NCS-2000-018
NCS-2015-06, "NCS Safety Concern Analysis," dated September /24, 2015
OP-1008157, Rev. 7
OP-1014613, Rev. 9
OP-1015211, Rev. 5
OP-1015213, Rev. 2
OP-1015306, Rev. 6
RP-10-06, "Initial NCS Training," Rev. 9
RP-10-06, "2014 NCS Training Annual Refresher," Rev. 9
RP-10-06, "Revised NCS Refresher and New Hire Training," Rev. 9

September 25, 2015

MEMORANDUM TO: Jeremy Munson, Lead Inspector
BWXT NOG-L, Special Inspection

FROM: Leonard D. Wert, Deputy Regional Administrator */RA/*
for Operations

SUBJECT: SPECIAL INSPECTION CHARTER FOR BWXT NOG-L,
DOCKET NO. 70-27 (INSPECTION REPORT 70-27/2015-008)

This memorandum confirms the establishment of a Special Inspection (SI) at BWXT NOG-L to inspect and assess the facts and circumstances surrounding the failure to meet the performance requirements of 10 CFR 70.61 due to exceeding the moderator mass limits in a production line glovebox. Multiple exceedances were identified on September 18, 2015, by BWXT NOG-L nuclear criticality safety engineers who were auditing previous production data logs. The audit concluded that one production line likely exceeded established nuclear criticality moderator limits on and around July 13 and July 14, 2015. BWXT NOG-L staff reported the potential occurrence to the Nuclear Regulatory Commission (NRC) Operations Center on September 19, 2015 (12:56 EST) (Event #51411). There were no safety-related consequences resulting from the exceedances.

Regional Office Instruction No. 0704, "Documenting Management Directive 8.3, NRC Incident Investigation Program, Reactive Team Inspection Decisions in the Division of Fuel Facility Inspection," Revision 3, was used to evaluate the level of NRC response for this operational event. Based on the deterministic criteria, the staff concluded that this issue may have involved an event or condition which led to the loss of multiple barriers in systems used to mitigate an actual event. The NRC determined that the appropriate level of response was to conduct a Special Inspection based on the potential for a substantial increase in the likelihood of a criticality.

The inspection will be performed in accordance with the guidance of Inspection Procedure (IP) 88003, "Reactive Inspection for Events at Fuel Cycle Facilities," and the applicable provisions of IP 93812, "Special Inspection." The report will be issued within 30 days of the completion of the inspection.

CONTACTS: Eric Michel, RII/DFFI
404-997-4555

Mark Lesser, RII/DFFI
404-997-4700

A copy of the Charter is enclosed for your use. The objectives of the inspection are to gather information, and make appropriate findings and conclusions in the areas listed in the Charter. These results will be used as a basis for any necessary follow-up. As indicated in the Charter, the foremost objective is to determine the safety implications and adequacy of the licensee's immediate corrective actions for the issues which resulted in the event.

The lead inspector should notify Region II management of any potential generic issues identified as a result of this event for discussion with the Office of Nuclear Material Safety and Safeguards. Safety or security concerns identified that are not directly related to the event should be reported to the Region II office for appropriate action.

This Charter may be modified should you develop significant new information that warrants review.

Enclosure: SI Charter

cc: V. McCree, EDO
M. Weber, DEDMRT
C. Haney, NMSS
S. Moore, NMSS
M. Bailey, NMSS
N. Baker, NMSS
L. Wert, RII
M. Lesser, RII
C. Evans, RII
E. Michel, RII
N. Pitoniak, RII

**Special Inspection Charter
BWXT NOG-L
Failure of Nuclear Criticality Safety Limits
During Production Operations**

Event

On September 18, 2015, BWXT NOG-L criticality safety engineers were performing routine audits of production logs in the Specialty Fuel Facility (SFF) for development of Advanced Gas Reactor fuel. The production logs identified the amount of uranium and its corresponding moisture content (moderator) being handled in a glovebox. A three-tier limit control of uranium mass versus moderator content was utilized to determine the maximum amount of uranium that could be handled within a series of gloveboxes. The higher the moisture content, the lower the uranium mass allowed. The audit identified at least two potential events on July 13 and July 14, 2015, where the maximum limit for moderating material was likely exceeded. In addition, the logs contained two entries in which no uranium was removed from the glovebox, but the total amount of uranium and moderator was adjusted. Once the discoveries were identified, similar operations utilizing mass/moderator logs in the entire facility were placed into a safe condition and shut down. There were no safety related consequences resulting from the exceedances.

The licensee performed an initial extent-of-condition evaluation on other process lines that used similar mass and moderator control protocols and determined that all other lines could be restarted with additional daily review of mass control logs by area management and/or cognizant area engineers. The SFF line was operationally suspended except for the required six-month uranium inventory effort. The SFF line will remain shut down until the licensee's internal investigations have been completed and corrective actions have been implemented.

Objectives

The objectives of the inspection are to: 1) review the facts surrounding the failure to maintain the mass/moderator controls in the affected production line and the potential for similar failures on other lines using the same mass/moderator control protocols; 2) assess the licensee's response to the failures; and 3) evaluate the licensee's immediate and planned long term corrective actions to prevent recurrence.

In order to develop the safety significance of the event, the lead inspector should focus on the areas listed below. They are listed in order of importance.

1. Develop a complete sequence of events related to the event.
2. Identify and evaluate the effectiveness of the immediate corrective actions taken by the licensee in response to the event.
3. The licensee has stated that a control on mass is still available and reliable; however, this control appears to be dependent on the failed moderator control (i.e., mass limits established based on levels of moderation). Assess whether the controls implemented, as documented in the licensee's integrated safety analysis for the applicable accident sequences, were sufficient to limit the risk of criticality to "highly unlikely" before the

occurrence of any upsets, giving specific consideration to the potential dependence of the controls and any common-mode failures. Additionally, assess the independence of these controls as it pertains to the Double Contingency Principle.

4. Assess if any other controls were in place that could provide additional barriers to prevent criticality. The purpose of this objective is to provide insight to any potential additional defense-in-depth, and the applicability and reliability of these controls need not be assessed at this time.

5. Assess the adequacy of the management measures applied to the administrative IROFS on mass and moderator in question. This should include a review of NCS-related training.

6. Assess the licensee's decision process to restart four of five production lines implementing additional management/engineering oversight.

7. Review and evaluate the licensee's progress in their root cause analysis for adequacy of scope, depth, identification of causal factors, and proposed corrective actions.

8. Determine the adequacy of internal and external licensee event reporting. This should include a review of the information available to the licensee that was used to evaluate the significance event and determine their event reporting requirements.

Documentation

Document the inspection findings and conclusions in an inspection report within 30 days of the completion of the inspection.