



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

December 30, 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: BWX TECHNOLOGIES NUCLEAR OPERATIONS GROUP, INC. - NUCLEAR
REGULATORY COMMISSION INSPECTION REPORT 70-27/2015-009 AND
NOTICE OF VIOLATION**

Dear Mr. Burch:

This letter refers to the apparent violations that were identified during a special inspection conducted at your facility in Lynchburg, VA, from September 25-29, 2015. The details of the inspection are documented in Nuclear Regulatory Commission (NRC) Inspection Report 70-27/2015-008 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML15295A206).

In a letter dated October 22, 2015, we provided you with the opportunity to address the apparent violations identified in the report by attending a predecisional enforcement conference, by attending alternative dispute resolution, or by providing a written response before we made our final enforcement decision. In a letter dated November 20, 2015, you provided a written response to the two apparent violations. Your response acknowledged the two apparent violations, provided the causes of the violations, and described corrective actions taken to preclude recurrence. Additionally, your response provided a correction to NRC Inspection Report 70-27/2015-008. The inspection report incorrectly stated that conventional filler line operations were suspended on September 19, 2015. Conventional filler line operations were suspended on September 27, 2015. In your written response, you detailed a basis that the apparent violations were not risk significant and therefore should be considered minor violations that do not warrant escalated enforcement.

Based on the information developed during the inspection, subsequent communications, and the information that you provided in your response dated November 20, 2015, the NRC has determined that two violations of NRC requirements occurred. The violations are cited in the enclosed Notice of Violation (Notice) (Enclosure 1) and the circumstances surrounding them are described in detail in NRC Inspection Report 70-27/2015-008. The first violation involves the

failure to provide adequate management measures, specifically training, to operators in the Specialty Fuel Facility (SFF) to ensure that an administrative item relied on for safety (IROFS) limiting internal moderation remained available and reliable. The operators involved did not understand that they were required to adhere to limits for both U-235 mass and internal moderation, which resulted in a failure to control internal moderation. The second violation involves the failure to limit the likelihood of an inadvertent criticality to “highly unlikely” in the SFF when operators performed actions that rendered the IROFS limiting internal moderation unreliable.

The NRC recognizes that the violations did not result in any actual consequences to the workers, the public, or the environment, since no criticality occurred. The NRC acknowledges that the as-found conditions presented a situation in which less than twice the posted limit of internal moderation was present. However, the NRC considers the potential consequences to be significant because the failures involved a substantial increase in risk as an inadvertent criticality was no longer “highly unlikely,” and the operators involved exhibited a lack of fundamental knowledge regarding nuclear criticality safety (NCS) hazards. The details of the NRC’s risk assessment performed in accordance with inspection manual chapter (IMC) 2606 are included in Enclosure 2.

Given the operators’ lack of understanding of the intent and proper implementation of the IROFS limiting internal moderation, the NRC considers the amount of internal moderation present to be incidental. The NRC considers the nature of the IROFS failure to represent a loss of control over the magnitude of an internal moderation upset, regardless of the magnitude of the actual upset. Additionally, the operators involved exhibited a lack of important, fundamental knowledge regarding NCS hazards. The NRC considers the apparent lack of important knowledge regarding NCS-related hazards to be significant. Management measures are expected to ensure the availability and reliability of IROFS. Specifically, adequate training is a crucial management measure for maintaining the availability and reliability of administrative IROFS. The cognizance of NCS-related hazards, the knowledge of the intent and proper implementation of controls, and the knowledge of the relationship of NCS parameters are fundamental and necessary items for the assurance that administrative NCS controls remain available and reliable. In this case, the failure to establish adequate management measures resulted in the unreliability of an IROFS and a substantial increase in the risk of a criticality accident. With no reliable barrier to prevent an upset in excess of more than twice the posted internal moderation limit, a single change in process conditions could have resulted in an unsafe condition. As such, the NRC considers these failures to be risk significant, despite the as-found conditions.

The NRC acknowledges that the two violations discussed above are interrelated. Therefore, these violations are categorized collectively in accordance with the NRC Enforcement Policy as a Severity Level III Problem.

In accordance with the NRC Enforcement Policy, a base civil penalty in the amount of \$35,000 is considered for a Severity Level III problem. Because your facility has been the subject of escalated enforcement actions within the last two years¹, the NRC considered whether credit was warranted for *Identification* and *Corrective Action* in accordance with the civil penalty assessment process in Section 2.3.4 of the Enforcement Policy.

¹ A Severity Level III violation was issued to BWXT NOG-L on June 18, 2015 (EA-15-021).

The failure of the IROFS limiting internal moderation was discovered by the licensee during a routine NCS audit of the SFF. The licensee reported this discovery to the NRC under 10 CFR 70, Appendix A (EN-51411), in a timely manner. The licensee identified inadequate training during a critique meeting before making any notifications to the NRC. Additionally, the licensee identified inadequate training as a root cause in their causal analysis. As such, credit is warranted for the factor of *Identification*. As documented in your written response, the NRC recognizes that your immediate and long-term corrective actions included but were not limited to the following: (1) immediate suspension of all SFF operations pending further actions, (2) an extent of condition review including suspension of operations outside the SFF that used mass/moderator logs pending further investigation, (3) implementation of an over-check by a second operator for each log entry with a daily over-check by the area front line manager or process engineer, (4) standardization of mass/moderator logs for all operating areas with a revision to include specific instructions on log maintenance and operator responsibilities, (5) implementation of area specific procedures that provide detailed instructions on the use of mass/moderator logs, (6) implementation of automated computer based mass/moderator logs in the place of manual paper logs, (7) development of a more robust NCS control approach, (8) training including the testing of operators, front line managers, and process engineers on the use of mass/moderator logs, (9) requalification of SFF operators, and (10) development of a division wide policy requiring that any operation shutdown for more than six months be reviewed and approved by a Change Review Board. Based on the above, the NRC determined that credit is warranted for the factor of *Corrective Action*.

Therefore, to encourage prompt identification and comprehensive correction of violations, I have been authorized, after consultation with the Director, Office of Enforcement, not to propose a civil penalty in this case. However, significant violations in the future could result in a civil penalty.

The NRC has concluded that information regarding (1) the reason for the violations, (2) the corrective actions that have been taken and the results achieved, and (3) the date when full compliance will be achieved is already addressed on the docket in your letter dated November 20, 2015. Therefore, you are not required to respond to this letter unless the description therein does not accurately reflect your corrective actions or your position. In that case, or if you choose to provide additional information, you should follow the instructions specified in the enclosed Notice. Administratively, apparent violations 70-27/2015-008-01 and 70-27/2015-008-02 are closed. The following violation is opened: 70-27/2015-009-01, Failure to Establish Adequate Management Measures Resulting in the Failure to Limit the Likelihood of Criticality to "Highly Unlikely."

In accordance with 10 CFR 2.390 of the NRC's "Agency Rules of Practice and Procedure," a copy of this letter, and its enclosure will be made available electronically for public inspection in the NRC Public Document Room and in the NRC's ADAMS, accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>.

B. Burch

4

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

Sincerely,

/RA/

Leonard D. Wert
Acting Regional Administrator

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

Enclosures:

1. Notice of Violation
2. Assessment of Risk from the Violation
IMC 2606

cc: (see page 5)

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Sincerely,

/RA/

Leonard D. Wert
Acting Regional Administrator

Docket No. 70-27
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2. Assessment of Risk from the Violation IMC 2606

cc: (see page 5)

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DATE	12/16/15	12/16/15	12/16/15	12/28/2015	12/30/15	
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NOTICE OF VIOLATION

BWX Technologies Nuclear Operations Group, Inc.
Lynchburg, VA

Docket No. 70-27
License No. SNM-42
EA-15-214

During an NRC inspection conducted on September 25 – 29, 2015, two violations of NRC requirements were identified. In accordance with the NRC enforcement Policy, the violations are described below:

- A. 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 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 Specialty Fuels Facility (SFF) to ensure that an administrative IROFS for limiting the amount of interstitial moderating material in a process glovebox was implemented correctly. Consequently, operators performed actions that rendered the IROFS unreliable, resulting in a substantial increase in risk and a state where only one change in process conditions was required before a criticality accident was possible.

- B. Title 10 of the *Code of Federal Regulations* (10 CFR) 70.61(b) requires, in part, that the 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 interstitial 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 integrated safety analysis.

This is a Severity Level III Problem (Section 6.2).

The NRC has concluded that information regarding the reason for the violations, the corrective actions taken and planned to correct the violations and prevent recurrence, and the date when full compliance will be achieved, is already adequately addressed on the docket in your letter

Enclosure 1

dated November 20, 2015. However, you are required to submit a written statement or explanation pursuant to 10 CFR 2.201 if the description therein does not accurately reflect your corrective actions or your position. In that case, or if you choose to respond, clearly mark your response as a "Reply to a Notice of Violation, EA 15-214", and send it to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001 with a copy to the Regional Administrator, Region II, within 30 days of the date of the letter transmitting this Notice of Violation (Notice).

If you choose to respond, your response will be made available electronically for public inspection in the NRC Public Document Room or in 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>. Therefore, to the extent possible, the response should not include any personal privacy, proprietary, or safeguards information so that it can be made available to the Public without redaction.

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

Dated this 30th day of December, 2015.

ASSESSMENT OF RISK FROM THE VIOLATION IMC 2606

A risk assessment was performed in accordance with Inspection Manual Chapter (IMC) 2606 based on your Integrated Safety Analysis (ISA). As detailed in your written response, your ISA includes two accident sequences that are potentially applicable to the event in question: (1) an interstitial moderation upset up to a double-batch and (2) an interstitial moderation upset greater than a double-batch.

Interstitial Moderation Upset Up to a Double-Batch

In your written response, you stated that at no time was there interstitial moderation (i.e., internal moderation mixed with U-235) in excess of a double-batch Limiting Condition for Operation (LCO) limit present. You stated that the actual accident sequence for the actual upset condition involved an additional IROFS limiting interspersed moderation (i.e., moderation between fissile-bearing bodies).

The NRC acknowledges that the as-found conditions presented a situation in which less than a double-batch of interstitial moderation was present. However, the operators involved stated that their understanding at the time of the event was that they needed to adhere to the U-235 mass limit *or* the interstitial moderation limit, not both. Given the operators' lack of understanding of the intent and proper implementation of the IROFS, the NRC considers the amount of interstitial moderation present to be incidental. The NRC acknowledges that administrative controls, like any other control, are subject to random failure. However, the nature of the IROFS failure was more significant than the random human error of a trained operator performing a routine task. Rather, the failure represented a situation where no reliable barrier was in place to provide assurance that an interstitial moderation upset could not easily be more severe. The NRC considers the operators' lack of understanding of the intent and proper implementation of the IROFS to represent a loss of control over the magnitude of an interstitial moderation upset, regardless of the magnitude of the actual upset. Given the method in which the operators' involved were performing activities, the IROFS limiting interstitial moderation did not provide any assurance that the operators would control interstitial moderation within the posted limits. Given the nature of the upset encountered, the NRC does not consider the potential consequences of the upset to be bound by this accident sequence.

Interstitial Moderation Upset Greater Than a Double-Batch

Given the nature of the IROFS failure, the NRC considers an interstitial moderation upset greater than a double-batch to be the bounding accident sequence from your ISA. For this accident sequence, two IROFS are implemented: (1) operator limits amount of interstitial moderation and (2) operator limits amount of U-235 mass. For these controls, your ISA assigns a [-2] {"Not expected, but might occur during plant lifetime"} for Frequency of Initiating Event, which is the failure of the IROFS limiting interstitial moderation, and a [2] for Effectiveness of Protection, which is related to the IROFS limiting U-235 mass.

The initiating event for this accident sequence is prevented by the IROFS limiting interstitial moderation. As previously discussed, the IROFS limiting interstitial moderation was unreliable. Given that the IROFS implemented to prevent the occurrence of the initiating event was

unreliable, NRC staff assigned a score of [0] for the Frequency of Initiating Event per the licensee's ISA methodology as the event is now "Expected to occur occasionally during plant lifetime."

In terms of U-235 mass, the NRC acknowledges other factors of the as-found conditions including enrichment and material composition which provided additional margin from criticality. However, the limits associated with controlling fissile mass were defined in terms of U-235, not total U. Additionally, there were no restrictions, in terms of controls, with regard to material composition imposed for the SFF process gloveboxes involved. Therefore, the NRC does not consider these factors to be effective at limiting the potential consequences based on what is allowed by the established controls and set limits.

The NRC did not identify any issues with the implementation of the IROFS limiting U-235 mass; the IROFS limiting U-235 mass remained available and reliable. This barrier is a designated IROFS and is subject to management measures (training, procedures, audits, etc.). Therefore, the NRC assigned a [2] for Effectiveness of Protection per your ISA methodology for this barrier as it involves "protection by a trained operator performing a routine task."

Combining the Frequency of Initiating Event with the Effectiveness of Protection indices per the ISA methodology results in this accident sequence being "unlikely" (i.e., $[0] - [2] = [-2] > [-4]$) per the ISA risk assessment table.