September 9, 2011

Mr. Roger P. Cochrane, General Manager
Babcock and Wilcox Nuclear Operations Group, Inc.
P.O. Box 785
Lynchburg, VA 24505-0785

SUBJECT: INSPECTION REPORT NO. 70-0027/2011-204

Dear Mr. Cochrane:

The U.S. Nuclear Regulatory Commission (NRC) conducted a routine announced nuclear criticality safety (NCS) inspection at your Babcock and Wilcox Nuclear Operations Group, Inc. facility in Lynchburg, Virginia, form August 8-11, 2011. The purpose of the inspection was to determine whether activities involving special nuclear materials were conducted safely and in accordance with regulatory requirements. Observations and findings were discussed with members of your management and staff throughout the inspection and at an exit meeting held on August 11, 2011.

The inspection, which is described in the enclosure, focused on: (1) the most hazardous activities and plant conditions; (2) the most important controls relied on for safety and their analytical basis; and (3) the principal management measures for ensuring controls are available and reliable to perform their functions relied on for safety. The inspection consisted of analytical basis review, selective review of related procedures and records, examinations of relevant NCS-related equipment, interviews with NCS engineers and plant personnel, and facility walkdowns to observe plant conditions and activities related to safety basis assumptions and related NCS controls. Based on the inspection, your activities involving nuclear criticality hazards were found to be conducted safely and in accordance with regulatory requirements.

In accordance with Title 10 of the *Code of Federal Regulations* 2.390 of NRC's "Rules of Practice," a copy of this letter and the enclosure will be made publicly available in the public electronic reading room of the NRC's Agency-Wide Document Access and Management System (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/ADAMS.html.

If you have any questions concerning this report, please contact Thomas Marenchin, of my staff, at 301-492-3209.

Sincerely,

**/RA/**

Margie Kotzalas, Acting Chief
Technical Support Branch
Division of Fuel Cycle Safety
and Safeguards
Office of Nuclear Material Safety
and Safeguards

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

Enclosure: Inspection Report No. 70-0027/2011-204

cc: Barry Cole
Licensing Officer
Babcock and Wilcox
Nuclear Operations Group, Inc.

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cc: Barry Cole
Licensing Officer
Babcock and Wilcox
Nuclear Operations Group, Inc.

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|---|---|---|---|---|
| **NAME** | TPowell via email | TMarenchin | DWalker | MKotzalas |
| **DATE** | 9/ 07 /11 | 9/ 06 /11 | 9/ 08 /11 | 9/09/11 |

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**U. S. NUCLEAR REGULATORY COMMISSION**
**OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS**

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|---|---|
| Docket No.: | 70-27 |
| License No.: | SNM-42 |
| Report No.: | 70-27/2011-204 |
| Licensee: | Babcock and Wilcox Nuclear Operations Group, Inc. |
| Location: | Lynchburg, Virginia |
| Inspection Dates: | August 8-11, 2011 |
| Inspectors: | Thomas Marenchin, Criticality Safety Inspector<br>Tamara Powell, Criticality Safety Inspector |
| Approved by: | Margie Kotzalas, Acting Chief<br>Technical Support Branch<br>Division of Fuel Cycle Safety<br>and Safeguards<br>Office of Nuclear Material Safety<br>and Safeguards |

Enclosure

## EXECUTIVE SUMMARY

### Babcock and Wilcox Nuclear Operations Group, Inc.
### NRC Inspection Report 70-27/2011-204

### Introduction

Staff of the U.S. Nuclear Regulatory Commission (NRC) performed a routine and announced nuclear criticality safety (NCS) inspection of the Babcock and Wilcox (B&W) Nuclear Operations Group, Inc., Lynchburg, Virginia (VA), facility from August 8-11, 2011. The inspection included an on-site review of the licensee's NCS program, NCS-related inspections, audits and investigations, plant operations and open item review. The inspection focused on risk-significant fissile material processing activities including fuel fabrication and machining; the uranium recovery (UR) area; the Research, Test Reactor and Target (RTRT) area; the Specialty Fuels Facility (SFF); Advanced Gas Reactor (AGR) Compact Area; and the core assembly area.

### Results

- No safety concerns were identified regarding the licensee's NCS program or the development, review, or approval of NCS analysis or calculations or resulting NCS controls.

- No safety concerns were noted regarding licensee internally-reported NCS-related events including identification and tracking of corrective actions (CAs).

- No safety concerns were identified regarding licensee NCS audits.

- No safety concerns were identified regarding the licensee's controlled access areas coverage of fissile material operations.

- No safety concerns were identified during facility walkdowns.

## REPORT DETAILS

### 1.0 Summary of Plant Status

B&W Nuclear Operations Group, Inc., manufactures high-enriched uranium (HEU) fuel, reactor core components and reactor cores at its facility near Lynchburg, VA. During the inspection, the licensee conducted routine fuel manufacturing operations and maintenance activities in the fuel fabrication areas.

### 2.0 Nuclear Criticality Safety Program (IP 88015 & IP 88016)

a. Inspection Scope

The inspectors reviewed NCS analyses to determine that criticality safety of risk-significant operations was assured through engineered and human controls with adequate safety margin and preparation and review by qualified staff. The inspectors reviewed selected aspects of the following documents:

- NCS-2011-084, "Nuclear Safety Release for Drum Dryer in Uranium Recovery per CR-1036010," dated July 25, 2011
- NCS-2011-094, "NCS Safety Analysis for Corrective Actions in Vault 2," dated June 21, 2011
- NCS-2011-102, "NCS Safety Analysis Revising the Safety Basis of the Automated Filler Storage Unit," dated August 1, 2011
- NCS-2011-114, "NCS Analysis to Review the Mass Limits in SAR 15.22 for the Arc Melt Furnace" dated July 18, 2011
- NCS-2011-117, "Nuclear Criticality Release Supporting Phase 1 of SER 09-049, 'Automated Scribe'," dated July 19, 2011
- NCS-2011-118, "NCS Safety Analysis for CR-1036604, 'Update to SAR 15.20 to Include 10-Location Container Rack," dated July 19, 2011
- NCS-2011-119, "NCS Safety Analysis of Posting Improvement Suggestion for RTR Proceco Washer (CA201101649)," dated July 26, 2011
- NCS-2011-120, "Nuclear Criticality Safety Release for HEU Arc Melt Furnace per CR-1036565," dated July 21, 2011
- NCS 2011-122, "Nuclear Safety Release for Like Kind Replacement of AGR Forming Column for Workstation 100," dated July 22, 2011
- NCS-2011-124, "Assessment of the New NCS Evaluation Methodology (COM-36136)," dated July 28, 2011
- NCSE-02, [Nuclear Criticality Safety Evaluation] "Nuclear Criticality Safety Analyses and Quality Assurance Reviews," Revision 40, dated March 1, 2011

b. Observations and Findings

The inspectors reviewed NCS approvals, NCS evaluations, and supporting calculations for new, changed, and other selected operations. Within the selected aspects reviewed, the inspectors verified that the analyses were performed by qualified NCS engineers, that independent reviews of the evaluations were completed by qualified NCS engineers, and that the analyses provided for subcriticality of the systems and operations. The inspectors observed that the analyses contained appropriate limits on controlled parameters for each credible accident sequence leading to inadvertent criticality.

Nuclear criticality safety analyses and supporting calculations demonstrated adequate identification and control of NCS hazards to assure operations within subcritical limits.

c. Conclusions

No safety concerns were identified regarding the licensee's NCS program or the development, review, or approval of NCS analysis or calculations or resulting NCS controls.

## 3.0 Nuclear Criticality Safety Event Review and Follow-Up (IP 88015 & IP 88016)

a. Inspection Scope

The inspectors reviewed the licensee response to internally reported events. The inspectors reviewed the progress of investigations and interviewed licensee staff regarding immediate and long-term CAs. The inspectors reviewed selected aspects of the following documents:

- QWI [Quality Work Instruction] 14.1.1, "Preventive/Corrective Action System," Revisions 19, dated September 27, 2010
- QWI 14.1.4, "Reporting Unusual Incidents," Revisions 10, dated January 2010
- QWI 14.1.10, "Safety Evaluation of Unusual Incidents," Revision 12, dated September 2009
- NCS-2011-071, "30-Day Report to the General Manager for CA201100843, Recovery Steam Condenser Failed Integrity Testing," dated April 14, 2011
- NCS-2011-101, "Safety Concern Analysis for Recovery Low Level Dissolver (CA201101698)," dated June 8, 2011
- NCS-2011-106, "NCS Safety Analysis to Address Corrective Actions for SAR 15.21 and SAR appendix 15.21 (CA-200902985, CA-201003089, CR-1036357)," dated June 16, 2011
- NCS-2011-109, "30-Day Report to the General Manager for CA-201101698 Recovery Low Level Dissolver Geometry Upset," dated June 23, 2011
- NCS-2011-110, "30-Day Report to the General Manager for CA-201101698 – Failure to Obtain Verification Signature for a Cluster Prior to Immersion," dated June 23, 2011
- NCS-2011-127, "30-Day Report to the General Manager for CA-201101981 – Spacing Upset in the Accountability Work Area," dated August 8, 2011

b. Observations and Findings

The inspectors reviewed selected licensee internally-reported events. The inspectors determined that internal events were investigated in accordance with written procedures and appropriate CAs were assigned. The inspectors had no safety concerns regarding the licensee's reporting, investigation, and correction of internal NCS related events.

c. Conclusions

No safety concerns were noted regarding licensee internally-reported NCS-related events including identification and tracking of CAs.

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

a. Inspection Scope

The inspectors reviewed results of the most recent NCS quarterly audit to assure that appropriate issues were identified and resolved. The inspectors reviewed selected aspects of the following documents:

- NCS-2011-115, "NCS Violation and Observation Summary – 2nd Quarter 2011," dated July 19, 2011
- NCSE-03, "Nuclear Criticality Safety Audits and Inspections," Revision 24, dated February 27, 2009
- QWI 17.1.1, "Environment, Safety, Health and Safeguards Audit Programs," Revision 10, dated June 16, 2009

b. Observations and Findings

The inspectors determined that the licensee's NCS audits were conducted in accordance with written procedures. The inspectors noted that the audits were performed by NCS engineers who reviewed open NCS issues from previous audits; reviewed new violations that occurred during the audit quarter; reviewed the adequacy of control implementation; reviewed plant operations for compliance with license requirements, procedures, and postings; examined equipment and operations to determine that past evaluations remained adequate; and analyzed non-compliances for potential trends.

c. Conclusions

No safety concerns were identified regarding licensee NCS audits.

## 5.0 Criticality Accident Alarm System (IP 88017)

a. Inspection Scope

The inspectors reviewed documentation of criticality accident alarm system (CAAS) coverage, interviewed engineering and maintenance staff, and performed facility walkdowns to determine the adequacy of the licensee CAAS.

b. Observations and Findings

In selected facility areas, the inspectors verified that the licensee's placement of criticality accident alarm detectors has been established in accordance with the criteria described in Title 10 of the *Code of Federal Regulations* (10 CFR) 70.24. No safety concerns were identified with the licensee practices regarding maintenance of the criticality alarm system.

c. Conclusions

No safety concerns were identified regarding the licensee's CAAS coverage of fissile material operations.

## 6.0 Plant Operations (IP 88015)

a. Inspection Scope

The inspectors performed plant walkdowns to review activities in progress and to determine whether risk-significant fissile material operations were being conducted safely and in accordance with regulatory requirements. The inspectors interviewed operations staff and NCS engineers both before and during walkdowns.

b. Observations and Findings

The inspectors performed walkdowns in risk-significant fissile material processing activities including fuel fabrication and machining; the UR area; the RTRT area; the SFF; AGR Compact Area; the Lynchburg Technology Center; and the core assembly area. The inspectors verified that controls identified in NCS analyses were installed or implemented and were adequate to ensure safety. The inspectors also verified that safety was maintained for observed facility operations. The cognizant, NCS engineers were knowledgeable and interacted regularly with operators on the process floors. The inspectors verified the adequacy of management measures for assuring the continued availability and reliability of safety-significant controls relied upon by the licensee for controlling criticality risks.

c. Conclusions

No safety concerns were identified during facility walkdowns.

## 7.0 Open Item Review

**VIO 70-27/2011-203-01**

This violation tracks the licensee's failure to maintain items relied on for safety (IROFS) credited in the integrated safety analysis to meet the performance requirements of 10 CFR 70.61.

During the previous inspection, the inspectors reviewed the licensee's response to the discovery of an unfavorable geometry container in UR. At the time of discovery, the licensee had two IROFS or controls in place to prevent a nuclear criticality accident from occurring. The controls were:

- Unfavorable geometry containers are prohibited in the container control area (CCA) by procedure and independent verification.
- Recovery system equipment is designed to install to contain less than 2.5 liters of solution.

The licensee had failed to ensure that unfavorable geometry container did not enter into the CCA. During this inspection inspectors reviewed the licensee's corrective actions in CA 201100409 and determined that when fully implemented the following CAs identified should prevent a similar recurrence of issues involving unfavorable geometry equipment within the CCA boundary. The CAs include providing improved procedure guidance in QWI 14.1.1; "Preventative/Corrective Action System," on the conduct of extent of condition reviews; training on the revisions to QWI 14.1.1; further evaluation of

equipment in the CCA with implementation of IROFS where appropriate; and, the implementation of periodic inspections to ensure proper control and maintenance of existing containers within the CCA boundary. The inspectors also noted the licensee identified a CA to review all events reported to the NRC under 10 CFR 70 Appendix A (a) and (b) performance requirements criteria to ensure the adequacy of any applicable extent of condition reviews conducted in response to applicable events reported to the NRC since January 1, 2006. To date, the licensee has completed all of the CAs except for the extent of cause evaluation. The licensee expects to have the extent of cause evaluation completed by October 15, 2011. This item remains open.

## 8.0 Exit Meeting

The inspectors presented the inspection scope and results to members of the licensee's management and staff during an exit meeting on August 11, 2011. The licensee acknowledged and understood the findings as presented.

## SUPPLEMENTARY INFORMATION

### 1.0 List of Items Opened, Closed, and Discussed

**Items Opened**

None

**Items Discussed**

| | |
|---|---|
| **VIO 70-27/2011-203-01** | Tracks the licensee's failure to maintain IROFS credited in the ISA to meet the performance requirements of 10 CFR 70.61. |

**Items Closed**

None

### 2.0 Inspection Procedures Used

| | |
|---|---|
| IP 88015 | Nuclear Criticality Safety Program |
| IP 88016 | Nuclear Criticality Safety Evaluations and Analyses |
| IP 88017 | Criticality Accident Alarms |

### 3.0 Partial List of Persons Contacted

**B&W NOG**

| | |
|---|---|
| D. Faidley | Manager, Nuclear Criticality Safety |
| L. Wetzel | Senior Engineer, Nuclear Criticality Safety |
| B. Cole | Manager, Licensing and Safety Analysis |
| D. Ward | Manager, EHS&S |
| D. Spangler | Nuclear Safety & Licensing |

**NRC**

| | |
|---|---|
| T. Marenchin | Criticality Safety Inspector, NRC Headquarters |
| T. Powell | Criticality Safety Inspector, NRC Headquarters |
| B. Prince | Acting Senior Resident Inspector, NRC Region II |

Attachment

## 4.0 List of Acronyms

| | |
|---|---|
| B&W | Babcock and Wilcox |
| CA | Corrective Action |
| CAAS | criticality accident alarm system |
| CCA | Container Control Area |
| COM | Commitment |
| HEU | high enriched uranium |
| NCSE | nuclear criticality safety evaluation |
| IP | inspection procedure |
| IROFS | items relied on for safety |
| ISA | integrated safety analysis |
| NCS | nuclear criticality safety |
| RTRT | Research, Test Reactor and Target |
| SER | Safety Evaluation Report |
| SFF | Specialty Fuels Facility |
| SNM | Special Nuclear Material |
| UR | uranium recovery |
| VIO | violation |