

March 27, 2012

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. 70-027/2012-202

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.'s, (B&W NOG) facility in Lynchburg, Virginia, from February 27 through March 1, 2012. 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 March 1, 2012.

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 an 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. One unresolved item was found in regards to the licensee's review of the safety basis and extent of condition for double-cased piping in moderation-controlled areas.

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 Agencywide Documents Access and Management System (ADAMS). ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/ADAMS.html>.

R. Cochrane

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If you have any questions concerning this report, please contact Thomas Marenchin of my staff at (301) 492-3209 or via thomas.marenchin@nrc.gov.

Sincerely,

/RA/

Thomas G. Hiltz, 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. 70-027/2012-202

cc: Barry Cole, B&W NOG

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

Docket No.: 70-27

License No.: SNM-42

Report No.: 70-27/2012-202

Licensee: Babcock and Wilcox Nuclear Operations Group, Inc.

Location: Lynchburg, VA

Inspection Dates: February 27 through March 1, 2012

Inspectors: Thomas Marenchin, Criticality Safety Inspector
Timothy Sippel, Criticality Safety Inspector

Approved by: Thomas G. Hiltz, Chief
Technical Support Branch
Division of Fuel Cycle Safety
and Safeguards
Office of Nuclear Material Safety
and Safeguards

Enclosure

EXECUTIVE SUMMARY

Babcock and Wilcox Nuclear Operations Group, Inc. NRC Inspection Report 70-27/2012-202

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 Nuclear Operations Group, Inc.'s (B&W NOG or licensee), Lynchburg, Virginia, facility from February 27 through March 1, 2012. The inspection included an onsite review of the licensee's NCS program, NCS training, NCS-related inspections, audits and investigations, plant operations and an open item review. The inspection focused on risk-significant fissile material processing activities—including fuel fabrication and machining, the uranium recovery area, the Research Test Reactor and Target (RTRT) area, the Specialty Fuels Facility (SFF), and the Lynchburg Technology Center (LTC).

Results

- An unresolved item tracking the licensee's review of the safety basis and extent of condition for double-cased piping in moderation-controlled areas.
- No safety concerns were identified regarding the licensee's NCS program.
- No safety concerns were noted regarding licensee-identified, NCS-related events; and corrective actions (CA) were adequately tracked by the licensee.
- No safety concerns were identified regarding NCS audits.
- No safety concerns were identified during facility walkdowns.

REPORT DETAILS

1.0 Summary of Plant Status

B&W NOG manufactures high-enriched uranium 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 and uranium recovery areas.

2.0 Nuclear Criticality Safety Program (IP 88015 and IP 88016)

a. Inspection Scope

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

- EPR-02-05, "NCS EOC Guidance," Revision 5, dated September 1, 2009
- NCS-2006-041, "Level 3 NCS Evaluation for Automated Storage Unit," Revision 0, dated March 30, 2006
- NCS-2008-026, "Nuclear Safety Release for Pharmacy Can Usage," Revision 0, dated July 8, 2008
- NCS-2010-247, "Nuclear Criticality Study of 2.5 Liter Bottles of UNX," Revision 0, dated November 24, 2010
- NCS-2011-179, "Closeout of Regulatory Commitment 35245 – Extent of Condition report," Revision 0, dated October 13, 2011
- NCS-2011-226, "Assessment of the new NCS Evaluation Methodology," Revision 0, dated December 15, 2011
- NCSE-02, "Nuclear Criticality Safety Analyses & Quality Assurance Reviews," Revision 36, dated March 31, 2009
- NCSE-11, "Verification and Validation of Computer Codes Used for Nuclear Criticality Safety Analyses," Revision 6, dated December 2, 2005

b. Observations and Findings

The inspectors reviewed NCS Approvals; nuclear criticality safety evaluations (NCSEs); and supporting calculations for new, changed, and other selected operations. Within the selected aspects reviewed, the inspectors determined 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 corrections and changes made by the independent review that improved the quality and accuracy of the NCSEs. The inspectors observed that the analyses contained appropriate limits on controlled parameters for each credible accident sequence leading to inadvertent criticality. The NCS's 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 development, review, or approval of NCS's analysis or calculations or resulting NCS controls.

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

a. Inspection Scope

The inspectors reviewed the licensee's 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:

- NCS-2011-151, "Safety Concern Analysis for Bagged Items Found in Recovery (CA201102651)," dated September 19, 2011
- NCS-2011-155, "NCS Safety Analysis for Modification to Vent Line on SFF Area Sink Collection Column (CR-1037051, CR-1037052, CA-201102726)," dated September 27, 2011
- NCS-2011-156, "Safety Concern Analysis for SFF Sink Vent (CA201102726)," dated September 23, 2011
- NCS-2011-180, "30-Day Report to the General Manager for CA-201102651 – Bagged Items Found in Recovery," dated October 13, 2011
- NCS-2011-185, "30-Day Report to the General Manager for CA-201102726 – SFF Sink Vent too High," October 20, 2011
- NCS-2011-220, "Safety Concern Analysis for Retention Tank Inline Monitor Failure (CA-201103505)," dated December 7, 2011
- NCS-2011-222, "Safety Concern Analysis for 55-Gallon Drum Spacing Violation (CA 201103594)," dated December 14, 2011
- NCS-2012-001, "NCS Violation & Observation Summary – Fourth Quarter 2011," dated January 16, 2012
- NCS-2012-006, "Safety Concern Analysis for ATR Fuel Plates Stored on Two Tier Racks in RTRT - CA200901410," dated February 27, 2012
- NCS-2012-007, "Safety Concern Analysis for Spacing Violation with Fuel Carts (CA201200074)," dated January 13, 2012

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-identified, NCS-related events; and CAs were adequately tracked by the licensee.

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:

- NCSE-03, "Nuclear Criticality Safety Audits and Inspections," Revision 21, dated November 7, 2005
- NCS-2012-012, "NCS Violations & Observation Trending Report Year End 2011," dated January 25, 2012
- "2011 NCS Triennial Audit," dated December 3, 2011

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; interviewed operators and management personnel; examined equipment, operations, and documents to determine that past evaluations remained adequate; and analyzed non-compliances for potential trends.

c. Conclusions

No safety concerns were identified regarding NCS's audits.

5.0 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 before and during walkdowns. The inspectors reviewed selected aspects of the following documents:

- BAZ92-02, "Nuclear Criticality Safety Evaluation of the Bay 2A/3A Pharmacy," Revision 0, dated January 7, 1992
- LLW92-13, "Nuclear Safety Release for LER 91-78," Revision 0, dated June 4, 1992
- NCS-1998-317, "SER 98-74 MFP Furnace Installation," Revision 0, dated November 19, 1998
- NCS-2001-002, "SER 99-104, Phase 3: Fuel Area Lines 1 and 4 Safety Refurbishment," Revision 0, dated January 2, 2001
- NCS-2008-026, "Nuclear Safety Release for Pharmacy Can Usage," Revision 0, dated July 8, 2008

- NCS-2008-037, “NCS Safety Analysis for a Raschig Ring Free Vacuum Cleaner (the “Hyclone”),” dated April 28, 2008
- SAR 15.32, “Fuel Reclamation Operations,” Revision 33, dated April 13, 2011
- SAR 15.35, “MFP Operations,” Revision 51, dated October 25, 2011
- QWI 4.1.5, “Design Criteria for NRC Licensed Activities,” Revision 12, dated October 25, 2011

b. Observations and Findings

The inspectors performed walkdowns in risk-significant fissile material processing activities—including fuel fabrication and machining, the uranium recovery (UR) area, the RTRT area, the SFF, advanced gas-cooled reactor Compact Area, the LTC, and the core assembly area. The inspectors verified that controls identified in NCS’s 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. Operators and various safety disciplines were involved in redesign, and the operators received additional training on redesigned systems. 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.

The inspectors observed that in the Pharmacy area of fuel operations, SAR 15.32, Pharmacy Operations, lists the building design as the control for moderation for the Fuel Transport Cart. The moderation control is established by Quality Work Instruction (QWI) 4.1.5, Design Criteria for NRC-licensed activities, which states that “areas under moderation control should provide that all water and steam lines are either left out by design, disconnected and plugged, double-cased, or shielded.” The licensee’s staff indicated that there were at least two lines in the area that were double-cased, but they were unable to locate drawings of water or steam lines in the area; and were unsure if there were additional lines in the area. The double-cased water lines in the area are not required to meet the performance requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) 70.61 but were established by the licensee as an additional items relied on for safety (IROFS) (defense-in-depth).

The control was established as an IROFS in 2008; and at that time, the control was not verified by a Nuclear Safety Release. The requirement for the double casing was established in 1992 (NCS-1992-002 and NCS-1992-062). The building design had not changed from 1992 until 2008, and the licensee did not verify the IROFS due to the building design not changing. NCSE-02, Nuclear Criticality Safety Analyses and Quality Assurance Reviews, requires that IROFS that are established be verified and documented in a Nuclear Safety Release. The licensee generated CA 201200690 to review the scenarios associated with the Fuel Transport Cart’s performance and an extent-of-condition review of the safety basis for other moderation-controlled areas. The inspectors determined that because this IROFS was not needed to meet the performance requirements of 10 CFR 70.61, the licensee’s review of the safety basis and extent of condition for double-cased piping in moderation-controlled areas will be tracked as **Unresolved Item (URI) 70-27/2012-202-01**.

c. Conclusions

No safety concerns were identified during facility walkdowns.

6.0 Open Item Review

VIO 70-27/2011-203-01

This violation tracks the licensee's failure to maintain 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 CAs 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. QWI 14.1.1 has since been revised with Revision 23 issued on October 25, 2011. The inspectors also noted that 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. This was the only CA the licensee had not completed as of the last inspection. It was documented in NCS-2011-179, which documents the licensee's reexamination of the extent-of-condition reviews of 16 events (since January 1, 2006) that were NRC Reportable. One instance, the extent-of-condition review associated with Event No. 43616 (see Agencywide Documents Access and Management System Accession No. ML072900645) was identified as needing improvement because its recommendations were not fully implemented. The licensee generated Commitment 37313, due April 30, 2012, to "Review and implement the recommendations outlined in NCS-2008-016 as appropriate, with the assistance of RTR Operations and complete an NCS Evaluation as necessary." Although the follow-on commitment has not been completed, all CAs associated with VIOLATION 70-27/2011-203-01 have been completed. This item is closed.

7.0 Exit Meeting

The inspectors presented the inspection scope and results to members of the licensee's management and staff during an exit meeting on March 1, 2012. The licensee acknowledged and understood the findings as presented.

SUPPLEMENTARY INFORMATION

1.0 List of Items Opened, Closed, and Discussed

Item Opened

URI 70-27/2012-202-01 Tracks the licensee's review of the safety basis and extent of condition for double-cased piping in moderation-controlled areas.

Item Closed

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

2.0 Inspection Procedures Used

IP 88015 Nuclear Criticality Safety Program
IP 88016 Nuclear Criticality Safety Evaluations and Analyses

3.0 Partial List of Persons Contacted

B&W NOG

D. Faidley Manager, Nuclear Criticality Safety
R. Cochrane General Manager
B. Cole Manager, Licensing and Safety Analysis
D. Ward Manager, Environmental Health, Safety and Safeguards
D. Spangler Nuclear Safety and Licensing

NRC

T. Marenchin Criticality Safety Inspector, NRC Headquarters
T. Sippel Criticality Safety Inspector, NRC Headquarters
S. Subosits Senior Resident Inspector, NRC Region II

4.0 List of Acronyms

10 CFR	Title 10 of the <i>Code of Federal Regulations</i>
B&W NOG	Babcock and Wilcox Nuclear Operations Group, Inc. (Licensee)
CA	corrective actions
CCA	container control area
IROFS	item relied on for safety
LTC	Lynchburg Technology Center
NCS	nuclear criticality safety
NCSE	Nuclear Criticality Safety Evaluation
QWI	Quality Work Instruction
RTRT	Research Test Reactor and Target
SFF	Specialty Fuels Facility
SNM	special nuclear materials
UR	uranium recovery
URI	unresolved item