

June 5, 2009

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. 70-0027/2009-204 AND NOTICE OF VIOLATION

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 from May 4-7, 2009. 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 your management and staff throughout the inspection and at an exit meeting held on May 7, 2009.

The inspection, which is described in the enclosure, focused on the most hazardous activities and plant conditions; the most important controls relied on for safety and their analytical basis; and 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 results of this inspection, the NRC has determined that a Severity Level IV violation of NRC requirements occurred. The violation was evaluated in accordance with the NRC Enforcement Policy included on the NRC's web site at [www.nrc.gov](http://www.nrc.gov); select **What We Do, Enforcement**, then **Enforcement Policy**. The violation is being cited in the enclosed Notice of Violation (Notice), and the circumstances surrounding it are described in detail in the subject inspection report. The violation is being cited in the Notice because it was identified by the NRC during the inspection. The violation that is being cited as a Severity Level IV violation is the failure to maintain the Integrated Safety Analysis Summary up-to-date.

You are required to respond to this letter and should follow the instructions specified in the enclosed Notice when preparing your response. The NRC will use your response, in part, to determine whether further enforcement action is necessary to ensure compliance with regulatory requirements.

R. Cochrane

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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 Dennis Morey, of my staff, at (301) 492-3112.

Sincerely,

**/RA/**

Patricia A. Silva, Chief  
Technical Support Branch  
Division of Fuel Cycle Safety  
and Safeguards  
Office of Material Safety  
and Safeguards

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

Enclosure: Inspection Report No. 70-0027/2009-204

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

R. Cochrane

-2-

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cc: Barry Cole  
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## NOTICE OF VIOLATION

B&W NOG, Inc.  
Lynchburg, VA

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

During a Nuclear Regulatory Commission (NRC) inspection conducted May 4-7, 2009, a violation of NRC requirements was identified. In accordance with the NRC Enforcement Policy, the violation is listed below:

Safety Condition No. S-1 of Special Nuclear Material License No. 42, requires that material be used in accordance with the statements, representations, and conditions in the license application dated July 14, 1995, and supplements thereto.

Chapter 5.1.2, of the License Application states, in part, that "The Integrated Safety Analysis (ISA) Summary and supporting documents that are referenced in the ISA Summary are maintained up-to-date."

Contrary to the above, on and before May 5, 2009, the licensee failed to maintain accident sequence SCRP-2 up to date in the ISA Summary. Specifically, criticality safety analysis approved and implemented in 2000 had eliminated the requirement for polyvinyl chloride piping on which the accident sequence was based and the accident sequence should have been removed from the ISA Summary at that time.

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

Pursuant to the provisions of 10 CFR 2.201, Babcock and Wilcox Nuclear Operations Group, Inc., is hereby required to submit a written statement or explanation to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, D.C. 20555 with copies to the Chief, Technical Support Branch, Division of Fuel Cycle Safety and Safeguards, NMSS, and Regional Administrator, Region II, within 30 days of the date of the letter transmitting this Notice of Violation (Notice). This reply should be clearly marked as a "Reply to a Notice of Violation" and should include: (1) the reason for the violation, or, if contested, the basis for disputing the violation; (2) the corrective steps that have been taken and the results achieved; (3) the corrective steps that will be taken to avoid further violations; and (4) the date when full compliance will be achieved. Your response may reference or include previously docketed correspondence if the correspondence adequately addresses the required response. If an adequate reply is not received within the time specified in this Notice, an Order or Demand for Information may be issued as to why the license should not be modified, suspended, or revoked, or why such other actions as may be proper should not be taken. Where good cause is shown, consideration will be given to extending the response time.

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

Enclosure 1

Because your response will be made available electronically for public inspection in the NRC Public Document Room, or from the NRC's document system, accessible from the NRC web site at <http://www.nrc.gov/reading-rm/adams.html>, to the extent possible, it should not include any personal privacy, proprietary, or safeguards information so that it can be made available to the public without redaction. If personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request withholding of such material, you must specifically identify the portions of your response that you seek to have withheld, and provide in detail the bases for your claim of withholding (e.g., explain why the disclosure of information will create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.790(b) to support a request for withholding confidential commercial or financial information). If safeguards information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21.

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

**Dated this 5<sup>th</sup> day of June 2009**

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

Docket No.: 70-27

License No.: SNM-42

Report No.: 70-27/2009-204

Licensee: Babcock and Wilcox Nuclear Operations Group, Inc.

Location: Lynchburg, VA

Inspection Dates: May 4-7, 2009

Inspectors: Dennis Morey, Senior Criticality Safety Inspector  
Thomas Marenchin, Criticality Safety Inspector

Approved by: Patricia A. Silva, Chief  
Technical Support Branch  
Division of Fuel Cycle Safety  
and Safeguards





## **EXECUTIVE SUMMARY**

### **Babcock and Wilcox Nuclear Operations Group, Inc. NRC Inspection Report 70-27/2009-204**

#### **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 (NOG), Inc., Lynchburg, Virginia facility from May 4-7, 2009. The inspection included an on-site review of the licensee's NCS program, NCS training, 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 area; the Research, Test Reactor and Target area; various fuel fabrication areas; and the Uranium Recovery area.

#### **Results**

- A Severity Level IV Violation was identified due to the failure to maintain the Integrated Safety Analysis (ISA) Summary up-to-date.
- A weakness was identified regarding the scoring of an initiating event for an accident sequence in the ISA.
- With the exception of the weakness identified above, no safety concerns were identified regarding development, review, or approval of NCS analysis or calculations or resulting NCS controls.
- No safety concerns were noted regarding the licensee's identified NCS-related events and corrective actions.
- No safety concerns were identified regarding NCS audits.
- No safety concerns were identified regarding the licensee's criticality accident alarm system coverage of fissile material operations.
- No safety concerns were identified during plant 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, Virginia. 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 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:

- NCSE-02, "Nuclear Criticality Safety Analysis & Quality Assurance Review," Revision 36, dated March 31, 2009
- NCS-1989-361, "NCS Evaluation of Handling Low Level Waste in RTRFE," dated March 9, 1989
- NCS-1992-060, "NCSE for using 5-inch PVC Waste Columns in Recovery, CRF and Drum Count," dated May 27, 1992
- NCS-2000-245, "NCS Level 2 Analysis Target Seal Welding," dated August 3, 2000
- NCS-2009-011, "Posting Change for High Level Dissolution (HLD)," dated February 3, 2009
- NCS-2009-021, "NCS Safety Analysis to Change Co-ordinates for Evaporator #4," dated April 29, 2009
- NCS-2990-023, "30-Day Report to the General Manager CA-200-00181," dated March 4, 2009
- NCS-2009-025, "30-Day Report to the General Manager for CA-200900202," dated March 9, 2009
- NCS-2009-26, "NCS Analysis for Plastic Bag Waste Collection Columns, dated March 27, 2009
- NCS-2009-028, "NCS Safety Analysis to Anneal Elements," dated March 23, 2009
- NCS-2009-39, "NCS Analysis for Boats, dated April 9, 2009
- NCS-2009-044, "NCS Analysis for Phase 1 of SER 08-052 –Remove Pharmacy Glovebox/Relocate Existing Storage Rack/Remove Cabinet," dated April 16, 2009
- Safety Analysis Report [SAR] 15.37, "Higher Tier Assemblies," Revision 73, dated August 28, 2008
- Safety Evaluation Request (SER) 08-032, "Move Work Tables," dated September 11, 2008
- SER 08-005, "Hyclone Vacuum Cleaners," dated October 30, 2008
- QWI [Quality Work Instruction] 14.1.10, "Safety Evaluation of Unusual Incidents," Revision 11, dated September 7, 2008
- QWI 2.1.3, "Integrated Safety Analysis," Revision 8, dated September 7, 2008
- Change Request (CR) CR-1029232, "High Level Dissolver Modification," dated September 9, 2008

- CR-1027837, "Empty Raschig Ring Drum Restraint," dated March 17, 2008
- CR-1027721, "Modify Vacuum Cleaner NCS Sign," dated March 31, 2008

b. Observations and Findings

The inspectors reviewed NCS approvals, nuclear criticality safety evaluations (NCSE), 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 sub-criticality 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.

The inspectors reviewed accident sequences listed in Safety Analysis Report (SAR) 15.37 and compared the scoring of the initiating events to requirements for scoring listed in the license application. The inspectors noted that accident sequence 7-25 listed two IROFS as part of the initiating event but did not credit those two IROFS as part of the existing protection. Accident sequence 7-25 was scored in the SAR as -5. The license application states that initiating events scored as -5 must be not physically possible. The licensee's staff stated that the initiating event for accident sequence 7-25 was physically possible. The license staff stated that the accident sequence initiating event should have been scored -4. The inspectors determined that the risk significance of this issue was low because of the existing credited controls. Corrective actions associated with correcting the initiating event scoring for accident sequence 7-25 for SAR 15.37 will be tracked as **Inspection Follow-up Item (IFI) 70-27/2009-204-01**.

c. Conclusions

A weakness was identified regarding the scoring of an initiating event for an accident sequence in the ISA.

With the exception of the weakness identified above, no safety concerns were identified regarding 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's response to internally reported events. The inspectors reviewed the progress of investigations and interviewed the licensee's staff regarding immediate and long-term corrective actions. The inspectors reviewed selected aspects of the following documents:

- NCS-2009-013, SCA [Safety Concern Analysis], for failed functional test of Line 1 tank dump valve, dated February 5, 2009

- NCS-2009-015, SCA for shelf thickness violation, dated February 11, 2009
- NCS-2009-017, SCA for LLD [low level dissolver] Catch Tray Depth, dated February 20, 2009
- NCS-2009-031, SCA for placing fuel elements on table posted for non-fuel, dated March 18, 2009
- NCS-2009-032, SCA for LLD Catch Tray Depth, dated March 18, 2009
- NCS-2009-036, SCA for violation of posted limit in storage chest, dated April 6, 2009
- NCS-2009-037, SCA for furnace boat dimension violation, dated April 7, 2009
- NCS-2009-041, SCA for placing 5-gallon bucket on scale posted for 2.5-liter bottles only, dated April 9, 2009

b. Observations and Findings

The inspectors reviewed selected internally reported conditions which had been reported by the licensee's staff and required evaluation by NCS staff for reportability. The inspectors determined that unusual conditions and events were investigated in accordance with written procedures and appropriate corrective actions were assigned.

c. Conclusions

No safety concerns were noted regarding licensee identified NCS-related events and corrective actions.

#### **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:

- CA [Corrective Action] 20091348, "NCS Spacing Violation," dated May 6, 2009
- NCS-2009-042, "NCS Violation and Observation Summary – First Quarter of 2009," dated April 10, 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 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 certificatee CAAS. The inspectors reviewed selected aspects of the following documents:

- NCS-2005-073, "Level 2 Evaluation to Relocate Criticality Detector Pair 2-7 and 2-8," dated April 11, 2005

### b. Observations and Findings

The inspectors verified that the licensee's placement of criticality accident alarm detectors has been established in accordance with the criteria described in 10 CFR 70.24. The inspectors reviewed criticality accident alarm system placement calculations to determine the adequacy of models, assumptions, and results and visually inspected detector configuration.

### c. Conclusions

No safety concerns were identified regarding the licensee's criticality accident alarm system 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. The inspectors reviewed selected aspects of the following documents prior to performing the walkdowns:

- Change Request (CR) CR-1029232, "High Level Dissolver Modification," dated September 9, 2008
- CR-1027837, "Empty Raschig Ring Drum Restraint," dated March 17, 2008
- CR-1027721, "Modify Vacuum Cleaner NCS Sign," dated March 31, 2008

### b. Observations and Findings

The inspectors performed walkdowns in Research Test Reactors and Targets (RTRT), RTRT Filler, Recovery, Downblending, and fuel manufacturing areas. 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, reliability, and capability of safety-significant controls relied upon by the licensee for controlling criticality risks.

c. Conclusions

No safety concerns were identified during plant walkdowns.

## 7.0 Open Item Review

### **IFI 70-27/2009-201-01**

This item tracks licensee actions to add an accident sequence to the facility ISA to account for liquids collecting in plastic waste collection columns. The inspectors reviewed new licensee criticality analysis which was developed to resolve the 5-inch waste column issue. The inspectors observed that the new analysis did not change the ISA to resolve the issue. This item remains open.

The inspectors noted that the new analysis contained an accident sequence, SCRP-2, previously in the ISA which had an initiating event of non-PVC material used for a 5-inch column and an IROFS preventing unauthorized material from being placed in the column. The inspectors noted that this accident sequence had actually occurred and the licensee had not reported a failure to meet the performance requirements. The licensee noted that the requirement for the columns to be made of PVC had been eliminated by analysis in 2000 but the accident sequence had never been updated or removed from the ISA. The licensee position was that the issue was not reportable because the accident sequence was in the ISA erroneously. The inspectors noted that license section 11.1.4 requires, in part, that "The ISA Summary and supporting documents that are referenced in the ISA Summary are maintained up-to-date." Supporting documents include: Evaluations of Changes including the safety analysis and identification of accident scenarios and IROFS." The inspectors determined that the age of the erroneous accident sequence (nine years) and its presence in the recently completed criticality analysis did not demonstrate adherence to the license requirement to maintain the ISA. The inspectors determined that the risk significance of this specific failure to maintain the ISA was low because the accident sequence involved was erroneous. Failure to maintain the ISA Summary up-to-date is **Violation (VIO) 70-27/2009-204-02**.

While discussing the failure to maintain the ISA Summary, the licensee noted that as many as 10% of accident sequences could have errors. During subsequent meetings, senior licensee management disputed that assertion and agreed to perform an extent of condition evaluation. The licensee's efforts to evaluate the extent of erroneous accident sequences in the ISA will be tracked as **IFI 70-27/2009-204-03**.

## 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 May 7, 2009 and a telephonic re-exit meeting on May 14, 2009. The licensee acknowledged and understood the findings as presented.

## SUPPLEMENTARY INFORMATION

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

#### Items Opened

- IFI 70-27/2009-204-01** Tracks licensee corrective actions to correct the initiating event scoring for accident sequence 7-25 for SAR 15.37.
- VIO 70-27/2009-204-02** Failure to maintain the ISA Summary up-to-date.
- IFI 70-27/2009-204-03** Tracks licensee efforts to evaluate the extent of erroneous accident sequences in the ISA.

#### Items Discussed

- IFI 70-27/2009-201-01** Tracks licensee actions to add an accident sequence to the ISA to account for liquids collecting in plastic waste collection columns.

#### 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

#### Babcock and Wilcox Nuclear Operations Group

- J. Creasey Manager, Uranium Processing  
D. Faidley Nuclear Criticality Safety  
J. Manning Manager, Quality Control  
B. Morcom Manager, Assembly Operations  
B. Cole Manager, Licensing and Safety Analysis  
S. Nagley Manager, Uranium Processing Operations  
T. Nicks Manager, Security  
S. Peters Licensing Engineer  
D. Ward Manager, EHS&S  
C. Yates Nuclear Safety & Licensing

**NRC**

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

**4.0 List of Acronyms**

B&W	Babcock and Wilcox
NOG	Nuclear Operations Group
HLD	High Level Dissolution
IFI	inspector follow-up item
IP	inspection procedure
IROFS	item relied on for safety
ISA	integrated safety analysis
NCS	nuclear criticality safety
NCSE	nuclear criticality safety evaluation
NOV	Notice of Violation
RTRT	Research, Test Reactor and Target
SAR	Safety Analysis Report
SER	Safety Evaluation Report
SFF	Specialty Fuels Facility
SNM	Special Nuclear Material