

September 22, 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.: 70-0027/2009-205

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 from August 24-28, 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 members of your management and staff throughout the inspection and at an exit meeting held on August 28, 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.

In accordance to 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-room/ADAMS.html>.

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

Sincerely,

**/RA/**

Patricia A. Silva, Chief  
Technical Support Branch  
Special Projects  
and Technical Support Directorate  
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.: 70-0027/2009-205

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

Docket No.: 70-27

License No.: SNM-42

Report No.: 70-27/2009-205

Licensee: Babcock and Wilcox Nuclear Operations Group, Inc.

Location: Lynchburg, VA

Inspection Dates: August 24-28, 2009

Inspectors: Thomas Marenchin, Criticality Safety Inspector  
Tamara Powell, Criticality Safety Inspector

Approved by: Patricia A. Silva, Chief  
Technical Support Branch  
Special Projects  
and Technical Support Directorate  
Division of Fuel Cycle Safety  
and Safeguards  
Office of Nuclear Material Safety  
and Safeguards

Enclosure

## **EXECUTIVE SUMMARY**

### **BWX Technologies, Inc. NRC Inspection Report 70-27/2009-205**

#### **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 facility from August 24-28, 2009. The inspection included an on-site review of the licensee 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 area; the Research, Test Reactor and Target (RTRT) area; and the Specialty Fuels Facility (SFF).

#### **Results**

- 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 licensee identified NCS-related events and corrective actions were adequately tracked by the licensee.
- No safety concerns were identified regarding NCS audits.
- No safety concerns were identified regarding the licensee's Criticality Accident Alarm System (CAAS) coverage of fissile material operations.
- No safety concerns were identified during walkdowns of the facility and operations.

## REPORT DETAILS

### 1.0 Summary of Plant Status

B&W Nuclear Operations Group, Inc. 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 & 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-1992-028, "NCS Analysis of the Bay 16 Pharmacy and Shipping and Receiving Area," dated March 2, 1992
- NCS-1992-041, "NCS Analysis for Revised Limits in the RTRT Compact Room Gloveboxes," dated April 9, 1992
- NCS-1993-156, "Concern for Accidental Placement of HEU [high enriched uranium] Metal into LEU [low enriched uranium] Glovebox in RTRT," dated October 26, 1993
- NCS-2008-116, "IROFS [items relied on for safety] Verification Project – SAR [Safety Analysis Report] 15.22," dated May 28, 2009
- NCS-2009-039, "NCS Analysis for Fuel Boats," dated April 9, 2009
- NCS-2009-071, "NCS Safety Evaluation Revising Limits for the Fuel Area Weigh Table," dated June 17, 2009
- NCS-2009-073, "NCS Justification for Corrective Action CA-200800319," dated June 22, 2009
- NCS-2009-083, "NCS Safety Analysis Supporting Revised SER 08-015," dated May 27, 2009
- NCS-2009-087, "NCS Analysis for Hot Solution in PVC Columns," dated July 10, 2009
- NCS-2009-089, "NCS Justification to use a Cyclone Larger Collection Cup in Work Station 330," dated July 14, 2009
- NCS-2009-099, "Safety Concern Analysis for Drain Plug in Recovery Drum Dryer Over 1 Inch High," dated August 7, 2009
- NCS-2009-102, "NCS Analysis for Phase 01 and Phase 02 of SER 09-019," dated August 20, 2009
- NCS-2009-112, "NCS Analysis to Revise SAR 15.22 for Plastic Bag Waste Collection Columns," dated July 15, 2009
- OP-1014829, "Operation Procedure for Bay 14A," Revision 2, dated August 17, 2009
- QWI [Quality Work Instruction] 2.1.3, "Integrated Safety Analysis Methodology," Revision 8, dated October 7, 2008
- RWP [Radiation Worker Permit] 09-0057, "Do-All Saw Operation and Cleanup," Revision 0, dated August 24, 2009

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 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. NCS 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 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 corrective actions. The inspectors reviewed selected aspects of the following documents:

- NCS-2009-061, "30-Day Report to the General Manager for Fuel Box/Fuel Can Spacing Violation," dated May 26, 2009
- NCS-2009-068, "Safety Concern Analysis (SCA) for Spacing Violation on Bay 8A Standards Rack," dated June 12, 2009
- NCS-2009-069, "SCA for Potential Mass violation in Fuel Work Station," dated June 12, 2009
- NCS-2009-076, "SCA for RTRT ARC Melt Furnace Cavity Depth Violation," dated June 25, 2009
- NCS-2009-084, "SCA for RTRT Compact Vacuum Storage Rack," dated July 15, 2009
- NCS-2009-085, "30-Day Report to the General Manager for Spacing Violation on Bay 8A Standards Rack," dated July 8, 2009
- NCS-2009-086, "NCS Safety Evaluation Revising Appendix to SAR 15.35 in response to CA-200901787," dated July 10, 2009
- NCS-2009-094, "SCA for RTRT ARC Melt Furnace coolant Boron Concentration Violation," dated July 21, 2009
- NCS-2009-095, "SCA for LTC Indoor Storage Tubes Fixed Spacing Violation," dated July 23, 2009
- NCS-2009-096, "SCA for Loss of Fire Sprinkle Water Capacity," dated July 24, 2009
- NCS-2009-097, "SCA for Pressure Rupture Disk for RTRT Autoclave," dated August 20, 2009
- NCS-2009-099, "SCA for Drain Plug in Recovery Drum Dryer Over 1 Inch High," dated August 10, 2009

- QWI 14.1.10, "Safety Evaluation of Unusual Incidents," Revision 11, dated October 7, 2008

b. Observations and Findings

The inspectors noted that licensee staff had investigated an event involving a potential mass violation at a fuel workstation. Licensee operators were straining the solids from vacuum water pans at the workstation, which was not an authorized operation. The liquids would be discarded and the solids placed in a 2.5 liter bottle to be stored on a storage rack. The NCS posting for the workstation required that a mass log be used to show compliance with the 350 gram U-235 limit at the workstation however, the operators were not logging the material into the mass log. The licensee investigated the event and determined that the mass quantities not logged were well below the mass limit for the workstation. The licensee corrective action included revising the NCS posting to allow vacuum pan cleaning operations. The inspectors noted that the safety significance of this internal event was low.

The inspectors determined that 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 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 document:

- NCS-2009-088, "NCS Violation and Observation Summary – Second Quarter 2009," dated July 15, 2009

b. Observations and Findings

The inspectors determined that the licensee NCS audits were conducted in accordance with written procedures. The inspectors noted that the audits involved review of open NCS issues from previous audits; review of the adequacy of NCS control implementation; and review of plant operations for compliance with license requirements, procedures, and postings.

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 CAAS coverage, interviewed engineering and maintenance staff, and performed facility walkdowns to determine the adequacy of the licensee CAAS. The inspectors reviewed selected aspects of the following document:

- RP-07-28, "Maintaining and Testing the Plant Criticality Monitoring System and RMS II Area Monitors," Revisions 21, dated October 27, 2008

### **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 10 CFR 70.24. The inspectors reviewed the licensee's procedures for maintaining and testing the criticality alarm system and observed the monthly check of the monitoring system. The inspectors noted that the licensee had recently linked the howler control boxes to the fire alarm system which alarms in the security control room. The licensee made the modification so that a blown fuse on the howler control box could be easily identified through monitoring at the alarm center. 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. The inspectors reviewed selected aspects of the following documents prior to performing the walkdowns:

- NCS-2008-116, "IROFS Verification Project – SAR 15.22," dated May 28, 2009
- NCS-2009-112, "NCS Analysis to Revise SAR 15.22 for Plastic Bag Waste Collection Columns," dated July 15, 2009
- RWP 09-0057, "Do-All Saw Operation and Cleanup," Revision 0, dated August 24, 2009

b. Observations and Findings

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 walkdowns of the facility and operations.

**7.0 Open Item Review**

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

This item tracks licensee actions to add an accident sequence to the facility integrated safety analysis (ISA) to account for liquids collecting in plastic waste collection columns. During a previous inspection the inspectors noted that licensee staff had investigated an event involving liquids collecting in plastic waste collection column. The licensee uses 5-inch plastic tubes to collect potentially contaminated waste at the entry/exit points of contaminated areas. A plastic trash bag is placed into the tube and then removed when it is filled with waste. The trash bag is an unfavorable geometry when removed from the 5-inch tube. The event occurred when a sponge was discarded in a tube after being used to clean up oil which resulted in oil draining out of the sponge and into the tube. Licensee staff concluded that the ISA did not contain an accident sequence for the accumulation of moderator in the bags. Licensee NCS staff added a corrective action to incorporate an accident sequence into the ISA to address potential moderator accumulation in the plastic waste bags.

During this inspection the inspectors reviewed the licensee's revised NCS analysis for the plastic bag waste collection columns, NCS-2009-112. The licensee demonstrated that a waste collection column fully reflected and moderated would require a highly unlikely amount of U-235 before a criticality might occur. Due to their revised analysis, the licensee concluded that a criticality was not possible due to liquids collecting in the plastic waste collection columns. Because the revised NCS analysis determined that the accident sequence was not credible, the licensee did not have to add the accident sequence to the ISA. This item is closed.

**IFI 70-27/2009-204-01**

This item tracks licensee corrective actions to correct initiating event scoring for accident sequence 7-25 for SAR 15.37. During a previous inspection the inspectors identified in SAR section 15.37 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.

During this inspection the licensee stated to the inspectors that the corrective action for this item was part of the corrective actions for VIO 70-27/2009-204-02. The licensee had not completed this corrective action. The inspectors determined that the corrective action for IFI 70-27/2009-204-01 was being tracked as part of the corrective actions for VIO 70-27/2009-204-02, so this IFI could be closed. This item is closed.

#### **VIO 70-27/2009-204-02**

This item tracks the licensee's failure to maintain the ISA Summary up-to-date. During a previous inspection the inspectors noted during review of IFI 70-27/2009-201-01 that the licensee had a requirement that the columns be made of PVC. This requirement had been eliminated by analysis in 2000, but the accident sequence had never been updated or removed from the ISA Summary.

During this inspection the inspectors reviewed the licensee's corrective steps to prevent reoccurrences of future violations. The licensee had identified three corrective actions. They were:

1. An NCS evaluation will be completed to account for liquids collecting in plastic waste collection columns and to remove the erroneous accident sequence. The ISA summary and related accident scenarios for RTRT will be revised to include the results of the evaluation.
2. The ISA Summary and accident scenarios for the RTRT process will be reviewed to ensure there are no other erroneous accident sequences present.
3. The ISA Summary and accident scenarios for high risk immersion operations documented in other areas will be reviewed to ensure there are no other erroneous accident sequences present from a broader perspective.

The licensee had only completed the first corrective action and was working on completing the remaining corrective actions. Because the licensee had not completed the corrective actions for this violation the violation will remain open. This item remains open.

#### **IFI 70-27/2009-204-03**

This item tracks the licensee's efforts to evaluate the extent of erroneous accident sequences in the ISA. During a previous inspection 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.

During this inspection the licensee stated to the inspectors that the corrective action for this item was part of the corrective actions for VIO 70-27/2009-204-02. The licensee had not completed this corrective action. The inspectors determined that the corrective action for IFI 70-27/2009-204-03 was being tracked as part of the corrective actions for VIO 70-27/2009-204-02, so this IFI could be closed. This item is closed.

## **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 28, 2009. 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 70-27/2009-204-02** Failure to maintain the ISA Summary up-to-date.

#### Items Closed

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

**IFI 70-27/2009-204-01** Tracks licensee corrective actions to correct initiating event scoring for accident sequence 7-25 for SAR 15.37.

**IFI 70-27/2009-204-03** Tracks licensee efforts to evaluate the extent of erroneous accident sequences in the ISA.

### 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

#### BWXT

J. Burch Manager, Operations  
R. Cochrane General Manager, Babcock and Wilcox Nuclear Operations Group, Inc.  
J. Creasey Manager, Uranium Processing  
D. Faidley Nuclear Criticality Safety  
C. Goff Group Lead, Licensing & Safety Analysis  
D. Spangler Manager, Nuclear Safety & Licensing  
C. Yates Manager, Uranium Processing Operations

#### NRC

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

#### 4.0 List of Acronyms

B&W	Babcock and Wilcox
CAAS	Criticality Accident Alarm System
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
QWI	Quality Work Instruction
RTRT	Research, Test Reactor and Target
RWP	Radiation Worker Permit
SAR	Safety Analysis Report
SCA	Safety Concern Analysis
SER	Safety Evaluation Report
SNM	Special Nuclear Material
VIO	Violation