

December 4, 2009

Mr. Cary Alstadt, Plant Manager
Westinghouse Electric Company
Commercial Nuclear Fuel Division
P.O. Drawer R
Columbia, SC 29250

SUBJECT: INSPECTION REPORT NO. 70-1151/2009-203

Dear Mr. Alstadt:

The U.S. Nuclear Regulatory Commission (NRC) conducted a routine and announced criticality safety inspection at your facility in Columbia, South Carolina, from November 2-5, 2009. The purpose of the inspection was to determine whether activities involving licensed material were conducted safely and in accordance with NRC requirements. Observations and findings were discussed with your staff throughout the inspection and during an exit meeting held on November 5, 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 capable, 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 nuclear criticality safety (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 with 10 CFR 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>.

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

Sincerely,

/RA/

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

Docket No.: 70-1151
License No.: SNM-1107

Enclosures: Inspection Report 70-1151/2009-203

cc w/enclosures:
Mr. Marc Rosser
Westinghouse Electric Company

cc w/o enclosures:
T. Pearce O'Kelley
Bureau of Radiological Health
South Carolina Department of Health
and Environmental Control

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

Docket No.: 70-1151

License No.: SNM-1107

Report No.: 70-1151/2009-203

Licensee: Westinghouse Electric Company

Location: Columbia, South Carolina

Inspection Dates: November 2-5, 2009

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

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

Enclosure

EXECUTIVE SUMMARY

Westinghouse Electric Company NRC Inspection Report 70-1151/2009-203

Introduction

Staff of the U.S. Nuclear Regulatory Commission (NRC) performed a routine and announced nuclear criticality safety (NCS) inspection of the Westinghouse Electric Company (WEC), Columbia, South Carolina facility from November 2-5, 2009. The inspection included an on-site review of the licensee's NCS program, NCS evaluations, NCS audits, recent NCS-related events, the criticality accident alarm system, and open items. The inspection focused on risk-significant fissile material processing activities and areas including ammonium diuranate (ADU) conversion, fuel manufacturing including Erbia fuel manufacturing, uranium recovery, the incinerator, and the wet/dry waste SeaLand containers.

Results

- A weakness was identified in the licensee's NCS program regarding documentation of analytical conclusions and resulting identification of items relied on for safety (IROFS).
- No safety concerns were identified regarding the licensee's NCS audits.
- No safety concerns were identified during a review of recent licensee investigation of internal events.
- No safety concerns were identified during a review of the licensee's criticality accident alarm system.
- No safety concerns were identified during plant walkdowns.

REPORT DETAILS

1.0 Summary of Plant Status

WEC manufactures light water reactor fuel at its Columbia, SC facility. During the inspection, the plant operated normally.

2.0 NCS Program (IP 88015, IP 88016)

a. Inspection Scope

The inspectors reviewed selected criticality safety evaluations (CSE) generated or revised since the last inspection to determine the adequacy of the analytical basis for facility operations. The inspectors reviewed selected aspects of the following documents:

- NCS-010, "Categorizing potential Criticality Scenarios," Revision 3, dated November 3, 2009
- CSE-1-B, "CSE for the 800 CFM Portable Ventilation Unit," Revision 1, dated September 2009
- CSE-1-Y, "CSE for Rod Assembly Ventilation (Line 5)," Revision 1, dated September 2009
- CSE-1-AF, "CSE for S-7159 Scrubber Filter Housing (FL-7100)," Revision 2, dated September 2009
- CSE-4-B, "CSE for the URRS [uranium recycle and recovery] Sifting/Cleaning Hood," Revision 1, dated September 2009
- CSE-9-B, "CSE for Cylinder Wash," Revision 2, dated August 2009
- CSE-11-D, "CSE for Scrap Cage Tanks," Revision 5, dated September 2009
- CSE-11-F, "CSE for Scrap Cage Sorting Hood," Revision 1, dated August 2009
- CSE-13-A, "Incinerator," Revision 5, dated October 2009
- CSE-13-C, "CSE for the LLRW [Low Level Radioactive Waste] Miscellaneous Operations (Rotary Shear Shredder, Compactor, Ultrasonic Clean, Liquid Honing, Soft Media Blasting, and Transfer of LLRW for Staging/Storage in Sealands)," Revision 0, dated February 2009
- CSE-13-E, "URRS Trash and Assay Operations," Revision 0, dated January 2009
- CSE-14-C, "Miscellaneous Operations in Fuel Fabrication Area," Revision 2, dated August 2009
- CSE-15-C, "CSE for Waterglass Liquid Waste Effluent Treatment System," Revision 1, dated September 2009
- CSE-16-F, "Floor Storage of SNM," Revision 1, dated July 2008
- CN-CRI-08-24, "Spacing Exempt Array Limits," Revision 0, dated June 11, 2008

b. Observations and Findings

The inspectors determined that NCS evaluations were prepared by qualified NCS engineers, independent reviews of the evaluations were completed by other qualified NCS engineers, and that appropriate limits on controlled parameters were established and maintained. The inspectors determined that NCS controls for equipment and processes assured the safety of the operations. The inspectors identified a weakness

related to licensee analysis and determination that accident sequences are not credible. The inspectors determined that this weakness has resulted in the licensee's failure to declare some controls and other relied on features as IROFS when the controls and features supported the non-credibility determination.

The licensee's Integrated Safety Analysis (ISA) methodology gives criteria for determining that an accident scenario is not credible. The inspectors noted that one of the ISA criteria states "...the accident sequence is a process deviation for which there is a sound argument that the deviation is not possible or is extremely unlikely. The validity of the argument must be independent of the failure of any feature of the design or materials controlled by a system of safeguards, IROFS, or management measures."

The inspectors determined that licensee procedure NCS-010, "Categorizing potential Criticality Scenarios," contains a non-credibility criteria which states "the method relies on crediting passive engineering controls (PECs) or passive design features, such as vacuum breaks that prevent backflow. If one or more PECs are credited, and either 1) explicit calculations demonstrate that a postulated criticality scenario yields a 95/95 k_{eff} value that does not exceed 0.98 or 2) logic demonstrates that the PEC absolutely prevents the postulated scenario from leading to criticality (e.g., an overflow valve that prevents the addition of moderator to a non-favorable geometry vessel), the scenario may be categorized as incredible" [non-credible].

The licensee agreed during the inspection to eliminate the 0.98 k_{eff} the test from all of the NCS-010 criteria. However, the NCS-010 criteria above relies on controls (PECs) for making non-credibility determinations. The inspectors also noted that Section 7.2.3 of the Westinghouse ISA Handbook prohibits the use of "any feature of the design or materials controlled by the facility's system of PECs or management measures" in non-credibility arguments. This requirement appears to conflict with the procedural criteria above resulting in failure to correctly characterize accident sequences or identify IROFS. Because the licensee is currently responding to a violation that addresses this issue and because no missing controls or immediate safety concerns were identified, the inspectors limited the review during the current inspection to two examples.

The licensee decontaminates items with cleaning equipment called the sponge blaster that blasts the item with a soft media. The inspectors observed that the sponge blast media was not identified as an IROFS based on the conclusion that criticality in the sponge blast equipment is not credible due to restrictions on the type of media allowed. Licensee analysis of the sponge blast system resulted in the conclusion that criticality in the system is not credible based on models of the system with a specified blast media. Subsequently, the blast media was not identified as an IROFS. The inspectors determined that this conflicted with Section 7.2.3 of the licensee ISA methodology.

The licensee cleans pellets with acid in a hood and then pumps the cleaning solution to a geometrically safe column called the acid stripping column. The inspectors observed that the column is not identified as an IROFS because the acid is not normally expected to dissolve fuel pellets even though it is possible to dissolve pellets (incorrectly sintered pellets for example). If pellets did dissolve in the acid stripping system, the dimensions of the stripping column would be important for safety. Potentially incorrect characterization of accident sequences and failure to identify the sponge blast media or acid stripping column as IROFS will be tracked as **Unresolved Item (URI) 70-1151/2009-201-01**.

c. Conclusions

A weakness was identified in the licensee's NCS program regarding documentation of analytical conclusions and resulting identification of IROFS.

3.0 NCS Inspections, Audits, and Investigations (IP 88015)

a. Inspection Scope

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

- EHS-Audit-09-3, "Report of EH&S NCS Audit," dated March 18, 2009
- RA-316, "NCS Facility Walkthrough Assessments," Revision 2, dated May 22, 2008
- NCS-003, "NCS Facility Walkthrough Assessments," Revision 10, dated August 10, 2009
- QA-617, "Processing an EPN [electronic problem notice]," Revision 24, dated September 29, 2009
- QCI-310351, "UF₆ Components – Receiving Inspection Area," Revision 8 dated July 16, 2007

b. Observations and Findings

The inspectors reviewed the licensee procedure for conducting NCS Facility Walkthrough Assessments (FWA) and accompanied a licensee NCS engineer on a FWA in the URRS area. The specific FWA conducted was for the URRS Trash and Assay Operations and the Incinerator. The inspectors determined that NCS walkthroughs were conducted in accordance with written procedures.

The inspectors also reviewed the recently completed external audit of the NCS program. The inspectors reviewed licensee corrective actions for several observations identified by the external auditor including the connection of CSE assumptions to procurement. The inspectors were concerned that the licensee had established management measures over procurement of items which would be used as IROFS. The licensee only procured a few items which were directly incorporated into the plant as IROFS such as UF₆ cylinder pigtails and valves. The inspectors noted that the licensee had well established receipt inspection procedures which it also employed when IROFS were directly procured rather than manufactured. Based on the UF₆ cylinder valve example, the inspectors determined that the licensee had adequately connected CSE assumptions to procurement.

c. Conclusions

No safety concerns were identified regarding licensee NCS audits.

4.0 Nuclear Criticality Safety Event Review and Follow-up (IP 88015, 88016, 88017)

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

- Issue Report #09-188-C001, dated August 2, 2009
- Issue Report #09-197-C009, dated August 16, 2009
- Issue Report #09-212-C001, dated August 31, 2009
- Issue Report #09-255-C001, dated September 12, 2009
- Issue Report #09-285-C006, dated October 12, 2009
- Issue Report #09-296-C006, dated October 23, 2009

b. Observations and Findings

The inspectors reviewed selected licensee internally-reported events. The inspectors observed that internal events were investigated in accordance with written procedures and appropriate corrective actions 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 identified during a review of recent licensee investigation of internal events.

5.0 Criticality Alarm System (IP 88017)

a. Inspection Scope

The inspectors reviewed documentation of criticality accident alarm detector coverage, interviewed engineering and maintenance staff, and performed facility walkdowns to determine the adequacy of the licensee criticality alarm system. The inspectors reviewed selected aspects of the following document:

- CSE-13-C, "CSE for the LLRW [Low Level Radioactive Waste] Miscellaneous Operations (Rotary Shear Shredder, Compactor, Ultrasonic Clean, Liquid Honing, Soft Media Blasting, and Transfer of LLRW for Staging/Storage in SeaLands," dated February 2009

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 the CSE to understand the use of the exemption from criticality monitoring system requirements for 40 foot SeaLand containers that are stored onsite. The inspectors discussed the CSE with the licensee staff and walked down the area with the 40 foot SeaLand containers. The licensee's staff stated that the 40 foot SeaLand containers were loaded to meet the requirements of 49CFR173 for low specific activity packages. After reviewing the loading data for selected 40 foot SeaLand containers the inspectors determined that containers met the requirements in section 12.2.5 of the license application for exemption from criticality monitoring system requirements.

c. Conclusions

No safety concerns were identified during a review of the licensee's criticality accident alarm system.

6.0 Plant Operations (IP 88015, IP 88016)

a. Inspection Scope

The inspectors walked down portions of the facility to determine whether risk-significant fissile material operations were being conducted safely and in accordance with regulatory requirements including those addressed by newly issued or revised CSEs mentioned under Section 2.0.

b. Observations and Findings

The inspectors performed walkdowns of operations in ADU conversion, fuel manufacturing including Erbia fuel manufacturing, uranium recovery, the incinerator, and the wet/dry waste SeaLand containers. The inspectors verified that controls identified in NCS analyses were installed or implemented and were adequate to ensure safety. 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

URI 70-1151/2009-202-01

This item tracks licensee use of 0.98 as a limit on k_{eff} for other than credible abnormal configurations. During a previous inspection, the inspectors observed that the licensee's staff believed that if they modeled a system in the worst case configuration and the resulting calculated k_{eff} was subcritical, criticality resulting from the scenario could be determined to be not credible.

During this inspection, the inspectors determined that licensee procedure NCS-010, "Categorizing Potential Criticality Scenarios," allowed characterization of criticality accident scenarios as not credible based on an explicit model having a calculated k_{eff} less than 0.98. The inspectors determined that procedure NCS-010 has three non-credibility criteria which include a 0.98 k_{eff} test.

The inspectors determined that the 0.98 k_{eff} test in procedure NCS-010 was an unapproved expansion of the ISA non-credibility criteria which resulted in failure to establish the actual basis for a non-credibility determination such as the difficulty of reaching the modeled configuration. The inspectors determined and the licensee agreed that the actual non-credibility determination must be based on the likelihood of a system actually reaching the modeled condition and not on whether the model had a k_{eff} less than 0.98. Licensee staff proposed to revise NCS-010 to eliminate the 0.98 k_{eff} test. Licensee removal of the 0.98 k_{eff} test from procedure NCS-010 will be tracked as **Inspector Follow-up Item (IFI) 70-1151/2009-203-02. URI 70-1151/2009-202-01** 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 November 5, 2009. The licensee acknowledged and understood the findings as presented.

SUPPLEMENTARY INFORMATION

1.0 List of Items Opened, Closed, and Discussed

Items Opened

- URI 70-1151/2009-203-01** Tracks potentially incorrect characterization of accident sequences and failure to identify IROFS.
- IFI 70-1151/2009-203-02** Tracks removal of the 0.98 k_{eff} test from procedure NCS-010

Items Closed

- URI 70-1151/2009-202-01** Tracks the possibility that the licensee used 0.98 k_{eff} limit for more than credible abnormal scenarios.

Items Discussed

None

2.0 Inspection Procedures Used

- IP 88015 Nuclear Criticality Safety Program
IP 88016 Nuclear Criticality Safety Evaluations and Analyses
IP 88017 Criticality Alarm Systems

3.0 Partial List of Persons Contacted

WEC

- C. Alstadt Plant Manager
G. Couture EH&S
S. Gough NCS
J. Peterson Maintenance Manager
D. Precht Operations
M. Rosser EH&S Manager
C. Snyder NCS

NRC

- C. Cramer Fuel Facility Inspector, RII
O. Lopez Fuel Facility Inspector, RII
D. Hartland Fuel Facility Inspector, RII
T. Marenchin Criticality Safety Inspector, HQ
D. Morey Sr. Criticality Safety Inspector, HQ

All attended the exit meeting on November 5, 2009.

4.0 List of Acronyms

ADAMS	Agencywide Documents Access and Management System
ADU	ammonium diurate
CFR	Code of Federal Regulations
CSE	criticality safety evaluation
EH&S	environment, health, and safety
FWA	Facility Walkthrough Assessments
IP	inspection procedure
IROFS	item relied on for safety
ISA	integrated safety analysis
LLRW	Low Level Radioactive Waste
NCS	nuclear criticality safety
PEC	passive engineering controls
SSC	safety-significant control
URI	unresolved item
URRS	uranium recycle and recovery
WEC	Westinghouse Electric Company (licensee)