March 12, 2010

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

SUBJECT: INSPECTION REPORT NO. 70-1151/2010-201

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 February 22-25, 2010. 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 February 25, 2010.

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 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.

If you have any questions concerning this report, please contact Dennis Morey, of my staff, at (301) 492-3112 or via email to dennis.morey@nrc.gov.

Sincerely,

/RA/

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

Enclosures: Inspection Report 70-1151/2010-201

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

cc w/o enclosures:
Aaron A. Gantt, Chief
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.:	70-1151/2010-201
Licensee:	Westinghouse Electric Company
Location:	Columbia, South Carolina
Inspection Dates:	February 22-25, 2010
Inspectors:	Dennis Morey, Senior Criticality Safety Inspector Christian Fisher, Criticality Safety Inspector Nicole Coleman, Office of Enforcement NSPDP
Approved by:	Patricia 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

Westinghouse Electric Company
NRC Inspection Report 70-1151/2010-201

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 February 22-25, 2010. The inspection included an on-site review of the licensee's NCS program, NCS evaluations, NCS audits, and 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, uranium dioxide (UO_2) powder handling and pelletizing, fuel manufacturing including Erbia and integral fuel burnable absorber (IFBA) fuel manufacturing, uranium recovery, the incinerator, uranium hexafluoride (UF_6) cylinder wash, and UF_6 cylinder recertification.

Results

- A minor violation was identified due to the licensee's failure to ensure that NCS evaluations are reviewed by NCS engineers qualified on the specific process.
- No safety concerns were identified regarding the licensee's NCS program.
- No safety concerns were identified regarding the licensee's NCS audits.
- Other than the minor violation above, no safety concerns were identified regarding NCS training.
- 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 and Safety Significant Controls," Revision 3, dated November 3, 2009
- CSE-7-A, "CSE for Solvent Extraction," Revision 5, dated December 2009
- CSE-01-W, "ERBIA FL-9166 Ventilation System," Revision 1, dated December 2009
- CSE-03-H, "Conversion Lines Oil Dryers and Bucket Elevators," Revision 3, dated September 2009
- CSE-03-I, "CFFF [Columbia Fuel Fabrication Facility] ADU Conversion Calciner," Revision 2, dated February 2010
- CSE-03-M, "Conversion Quarantine Tank System," Revision 5, dated August 2009
- CSE-12-A, "Rod Transfer Caskets," Revision 3, dated September 2009
- CSE-15-A, "Waste Treatment Tanks," Revision 3, dated December 2009
- CSE-20-C, "Powder Preparation and Pressing in the ERBIA Area," Revision 2, dated July 2009
- CSE-1-K, "ADU Pellet Lines 1-5 Torit Ventilation Systems," Revision 3, dated December 2009
- CSE-1-F, "Conversion Decon Room Dry Filter housing and Torit," Revision 4, dated January 2010
- CSE-1-J, "Solvent Extraction Torit," Revision 3, dated February 2010
- CSE-1-M, "ADU Conversion Line Torits," Revision 3, dated January 2010
- CSE-1-N, "URRS [uranium recycle and recovery] Decon Room Torits," Revision 3, dated January 2010
- CSE-1-Q, "ADU Bulk Blening Room Torit," Revision 3, dated January 2010
- CSE-1-R, "Incinerator/ABF Torits," Revision 3, dated January 2010
- CSE-1-S, "Erbia Central Vacuum Torits," Revision 3, dated January 2010

b. Observations and Findings

The inspectors observed that, with the exception noted in Section 4.0, NCS evaluations were prepared by qualified NCS engineers and that independent reviews of the evaluations were completed by other qualified NCS engineers, and limits on controlled parameters were established and maintained. The inspectors determined that NCS controls for equipment and processes assured the safety of the operations.

c. Conclusions

No safety concerns were identified regarding the licensee's NCS program.

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

a. Inspection Scope

The inspectors reviewed the licensee's audit procedure and accompanied an NCS engineer on a routine internal audit. The inspectors reviewed selected aspects of the following documents:

- RA-316, "NCS Facility Walkthrough Assessments," Revision 2, dated May 22, 2008
- MOP-735306, "Rod and Channel Handling for the Fuel Rod Storage Area," Revision 42, dated September 10, 2009
- CSE-21-C, "Rod Storage and Handling (Including boiling water reactor)," Revision 4, January 2008

b. Observations and Findings

The inspectors spoke with the licensee's NCS staff and determined that the licensee's NCS inspections, called "Facility Walkthrough Assessments (FWA)," were conducted in accordance with written procedures. The inspectors accompanied an NCS engineer on a FWA in the rod storage area. The inspectors noted that FWAs were performed by NCS engineers who reviewed the NCS analysis for the inspected area, reviewed open NCS issues from previous audits; 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 interviewed operators to verify understanding of controls.

c. Conclusions

No safety concerns were identified regarding the licensee's NCS audits.

4.0 NCS Training (IP 88015)

a. Inspection Scope

The inspectors reviewed training and qualifications procedures to determine if the NCS staff met specified qualification requirements. The inspectors interviewed staff and reviewed qualification records to verify completion of training. The inspectors reviewed selected aspects of the following documents:

- CA-014, "Orientation Process," Revision 4, dated February 2009
- RA-125, "Indoctrination, Training and Qualification of EH&S [environment, health, and safety Personnel," Revision 12, dated February 2010
- RAF-125-5, "EH&S Nuclear Criticality Safety Engineer Training Checklist," Revision 2, dated June 2005
- RAF-125-5, "EH&S Nuclear Criticality Safety Engineer Training Checklist," Revision 4, dated January 2008

- RA-310, “Nuclear Criticality Safety Independent Technical Reviews,” Revision 13, dated December 2009
- RA-313, “Criticality Safety Evaluations,” Revision 9, dated December 2009
- RA-314, “Implementation of CSEs,” Revision 8, dated January 2009

b. Observations and Findings

The inspectors reviewed two administrative procedures controlling the qualification of NCS engineers and interviewed an NCS engineering staff member. The inspectors also reviewed the licensee’s NCS staff training qualifications documents (RAF-125-5) to ensure that criticality safety activities are performed by qualified staff, in accordance with license requirements. During this review, the inspectors determined that a technical review of a CSE was completed by an NCS engineer who was not formally qualified in the specific process area analyzed. Specifically, the engineer’s training qualification checklist was not signed off for the process area addressed by the CSE. Section 6.1.4.2 of the license application requires, in part, that CSEs be reviewed by a qualified Criticality Safety Technical Reviewer, approved by Criticality Safety Management and appropriate plant operations management, or designates. Section 4.2 of licensee procedure RA-313 requires, in part, that the Senior Nuclear Criticality Safety Engineer performs independent technical reviews of CSEs, in accordance with the requirements of RA-310, “Nuclear Criticality Safety Independent Technical Reviews.” Section 3.7 of license procedure RA-310 defines a Technical reviewer, in part, as a Senior NCS Engineer who is documented to be qualified to perform the applicable review. Section 6.3.6 of licensee procedure RA-125 documents that the level of NCS qualification required by NCS engineers and Senior NCS engineers is defined in Section 5.0 of licensee procedure RAF-125-5. Section 5.0 of licensee procedure RAF-125-5 requires that Sections 1 through 3 of licensee form RAF-125-5 be completed in order to the conduct a CSE Technical Review.

The failure of the senior NCS engineer to be qualified in the process area is contrary to the above license and procedural requirements. The inspectors determined that the senior NCS engineer had completed training in the subject process area several years previously and had failed to get the required signature on the form RAF-125-5 and that there was no reason to believe that he was not competent to perform the review. The inspectors determined that the failure to complete the form RAF-125-5 was not safety significant. Although this issue should be corrected, it constitutes a violation of minor significance that is not subject to enforcement action in accordance with Section IV of the NRC Enforcement Policy.

c. Conclusions

A minor violation was identified due to the licensee’s failure to ensure that NCS evaluations are reviews by NCS engineers qualified on the specific process. Other than the minor violations above, no safety concerns were identified regarding NCS training.

5.0 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 the licensee’s staff

regarding immediate and long-term corrective actions. The inspectors reviewed selected aspects of the following documents:

- Issue Report #09-336-604
- Issue Report #09-315-C009
- Redbook Entry #15559
- Redbook Entry #15480
- Redbook Entry #15539

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.

6.0 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:

- "Westinghouse Criticality Detector Coverage Report," Part 2, Revision 2, dated February 22, 2010
- 500F00CR02, "Criticality Badge and Detector Locations and Coverage," Revision 10

b. Observations and Findings

The inspectors reviewed the detector coverage area to verify the assessment that the detector pair 2 has a larger coverage area than previously identified. This change was in response to the ongoing Accident Cause Analysis concerning the wiring of the inside and outside criticality accident alarms not being integrated together. The inspectors also verified the output from the detectors at the guard station was adequate. The only concern with the output is that detector pair 17 is not visible at this time at the guard station, however the licensee will correct this after the completion of the Accident Cause Analysis.

c. Conclusions

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

7.0 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, UO_2 powder handling and pelletizing, fuel manufacturing including Erbia and IFBA fuel manufacturing, uranium recovery, the incinerator, UF_6 cylinder wash, and UF_6 cylinder recertification. 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.

8.0 Open Item Review

VIO 70-1151/2009-201-01

This violation concerned the failure of the licensee to correctly apply criteria from the ISA Handbook for classifying events as noncredible when relying on facility safety-signficant controls (SSCs). During a previous inspection, the inspectors determined that the licensee had classified certain upset conditions as noncredible based on SSCs and that such a classification conflicted with the licensee's ISA Handbook, Section 7.2.3, which states that the validity of the noncredibility argument must not depend on any feature of the design or materials controlled by the facility's system of SSCs or management measures.

During the previous inspection, the inspectors identified accident sequences where the licensee noncredibility determination was based on engineered and/or administrative controls. CSE-3-G dismissed criticality in the vaporizer trench as incredible based on dimensions of the trench and a volume limiter (with both dimensions and material composition requirements) in the trench sump. With these controls in place the trench and sump were evaluated to be subcritical under credible abnormal conditions. CSE-03-M dismissed criticality in the non-favorable geometry Q-Tanks based on the presence of Raschig rings. CSE-03-E dismissed criticality in the nitrogen system based, in part, on the presence of two valves on the nitrogen supply line. In most cases, the design features and human actions relied on in making the noncredibility determination were classified as SSCs. The licensee stated that these SSCs were not, in general, items relied on for safety (IROFS). These SSCs and their associated accident sequences were not included in the licensee's ISA Summary.

During this inspection, the inspectors reviewed the licensee response to the violation and participated in a conference call with NRC HQ NCS staff regarding the licensee's proposed resolution. The inspectors noted that the licensee planned to analyze 190 accident sequences previously categorized as noncredible to determine whether IROFS were needed. This item remains open pending NRC acceptance of the licensee corrective actions and final disposition of the noncredible accident sequences.

URI 70-1151/2009-203-01

This item concerns the potentially incorrect characterization of accident sequences and resultant failure to identify IROFS. During a previous inspection, the inspectors identified two accident sequences which the licensee had had determined were not credible based on SSCs. The first example is the failure to identify the sponge blast media as an IROFS based on the conclusion that criticality in the sponge blast equipment is not credible due to the media. 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. The second example is acid stripping where criticality is considered not credible because the acid is not normally expected to dissolve fuel pellets even though it is possible to dissolve pellets (such as incorrectly sintered pellets). If pellets did dissolve in the acid stripping system, the dimensions of the stripping column would be important for safety and the column is an SSC. These accident sequences are additional examples of VIO 70-1151/2009-201-01 and included in the 180 accident sequences identified by the licensee in the response to that Violation to be evaluated as credible. This item remains open pending licensee disposition of VIO 70-1151/2009-201-01.

IFI 70-1151/2009-203-02

This item tracks removal of the 0.98 k_{eff} test from the licensee's procedure NCS-010. During a previous inspection, the inspectors determined that the licensee's procedure NCS-010, "Categorizing potential Criticality Scenarios," allowed characterization of criticality accident scenarios as noncredible based on an explicit model having a calculated k_{eff} less than 0.98. The licensee ISA methodology gives three criteria for determining that an accident scenario is not credible. Licensee procedure NCS-010 "Categorizing potential Criticality Scenarios," has three criteria which are versions of the second and third ISA criteria and which include a 0.98 k_{eff} test. During the previous inspection, the inspectors determined that the 0.98 k_{eff} test was an unapproved expansion of the ISA criteria which eliminated the actual analysis required. The inspectors determined and the licensee agreed that the actual noncredibility 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.

During this inspection, the inspectors determined that the licensee had revised its procedure NCS-010 to eliminate the 0.98 k_{eff} test from the noncredibility criteria. This item is closed.

9.0 Exit Meeting

The inspectors presented the inspection scope and results to members of the licensee's management and staff during an exit meeting on February 25, 2010. The licensee acknowledged and understood the findings as presented.

SUPPLEMENTARY INFORMATION

1.0 List of Items Opened, Closed, and Discussed

Items Opened

None

Items Closed

IFI 70-1151/2009-203-02 Tracks removal of the 0.98 k_{eff} test from procedure NCS-010.

Items Discussed

VIO 70-1151/2009-201-01 Failure of licensee to correctly apply criteria from ISA Handbook for classifying events as incredible when relying on facility SSCs.

URI 70-1151/2009-203-01 Tracks potentially incorrect characterization of accident sequences and failure to identify IROFS.

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
D. Precht	Operations
M. Rosser	EH&S Manager
C. Snyder	NCS
S. Armstrong	URRS
D. Graham	EH&S
R. Winiarski	IFBA

NRC

R. Gibson	Senior Fuel Facility Inspector, RII
D. Morey	Senior Criticality Safety Inspector, HQ
C. Fisher	Criticality Safety Inspector, HQ
N. Coleman	Office of Enforcement NSPDP

All attended the exit meeting on February 25, 2010.

4.0 List of Acronyms

ADAMS	Agencywide Documents Access and Management System
ADU	ammonium diurante
CSE	criticality safety evaluation
CFFF	Columbia Fuel Fabrication Facility
EH&S	environment, health, and safety
FWA	Facility Walkthrough Assessments
IFBA	integral fuel burnable absorber
IP	inspection procedure
IROFS	item relied on for safety
ISA	integrated safety analysis
NCS	nuclear criticality safety
SSC	safety-significant control
UF_6	uranium hexafluoride
UO_2	uranium dioxide
URI	unresolved item
URRS	uranium recycle and recovery
WEC	Westinghouse Electric Company (licensee)