

August 7, 2009

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

SUBJECT: INSPECTION REPORT NO. 70-1151/2009-202

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 July 13-17, 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 July 17, 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 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>.

C. Alstadt

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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

Enclosure: Inspection Report 70-1151/2009-202

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

C. Alstadt

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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.: 70-1151/2009-202

Licensee: Westinghouse Electric Company

Location: Columbia, South Carolina

Inspection Dates: July 13-17, 2009

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

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

Enclosure

EXECUTIVE SUMMARY

Westinghouse Electric Company NRC Inspection Report 70-1151/2009-202

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 July 13-17, 2009. The inspection included an on-site review of the licensee NCS program, NCS evaluations, NCS audits, recent NCS-related events, and open items. The inspection focused on risk-significant fissile material processing activities and areas including uranium recycle and recovery including solvent extraction and the incinerator, ammonium diuranate conversion, pelleting, integrated fuel burnable absorber (IFBA) and Erbia process areas, wastewater processing areas, and laboratories.

Results

- An unresolved item was identified regarding the possibility that the licensee used the 0.98 k_{EFF} limit for more than credible abnormal configurations.
- No safety concerns were noted regarding the licensee's NCS program.
- No safety concerns were identified regarding licensee's NCS audits.
- No safety concerns were identified during a review of recent licensee's investigation of internal events.
- No safety concerns were identified during a review of licensee's criticality accident alarm system.
- Plant operations involving fissile materials were conducted safely and in accordance with written procedures.

REPORT DETAILS

1.0 Summary of Plant Status

WEC manufactures light water reactor fuel at its Columbia, SC facility. During the inspection, the plant was shutdown for a maintenance outage in all manufacturing areas.

2.0 NCS Program (IP 88015, IP 88016)

a. Inspection Scope

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

- CN-CRI-08-24, "Spacing Exempt Array Limits," Revision 0, dated June 2008
- CN-CRI-08-38, "CQ1000 Decanters, Solids Discharge Receiver Tanks, and Liquid Discharge Receiver Tanks," Revision 0, dated June 2009
- CSE-1-G, "CSE [Criticality Safety Evaluation] for Acid Scrubber S-2A/2B." Revision 0, dated June 2009
- CSE-03-E, "The Columbia Fuel Fabrication Facility (CFFF) Decanter," Revision 2, dated March 2009
- CSE-08-D, "CSE for the Columbia Fuel Fabrication Facility Pellet Grinder Line," Revision 7, dated March 2009
- CSE-10-A, "CSE for ADU [Ammonium Diuranate] Rod Area," Revision 2, dated March 2009
- CSE-10-B, "CSE for Product Assurance Rod Inspection," Revision 1, dated March 2008
- CSE-14-D, "CSE for Integrated Fuel Burnable Absorber (IFBA) Pail Storage Racks," Revision 0, dated November 2007
- CSE-16-A, "CSE for Storage of Uranium Bearing Materials System," Revision 3, dated June 2009
- CSE-16-C, "CSE for Chemical Area Mop Buckets," Revision 1, dated May 2009
- CSE-16-F, "CSE for Floor Storage of Special Nuclear Material," Revision 1, dated July 2008
- CSE-20-A, "CSE for Erbium Bulk Blending System," Revision 4, dated May 2009
- CSE-20-B, "CSE for the CFFF Erbium Pellet Sintering Lines," Revision 1, dated February 2009
- CSE-99-A, "CSE for Transfer of Material from Type 3516 Shipping Container to Polypaks in the Crystals Area," Revision 0, dated September 7, 2005
- NCS-002, "Criticality Safety Evaluation Guidelines," Revision 3, dated November 6, 2007
- RA-108-1, Storage of Uranium Bearing materials Safety Significant Controls," Revision 24, dated June 29, 2009
- RA-301, "Floor Storage of Special Nuclear material," Revision 22, dated June 26, 2009
- RA-313, "Criticality Safety Evaluations," Revision 7, dated April 2, 2008

- NCS-002, "Criticality Safety Evaluation Guidelines," Revision 3, dated November 6, 2007
- NCS-010, "Categorizing Potential Criticality Scenarios and Criticality Safety Significant Controls," Revision 2, dated September 18, 2007

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 observed in the CSEs (CSE-08-B, CSE-14-D, and CSE-16-F) that a k_{EFF} of 0.98 was being used as screening criteria for incredibility for criticality scenarios. In the CSEs the models that are used for the worst case configuration use assumptions for the models. The Calc Note (CN-CRI-08-24) for CSE-16-F describes the model and results for calculations for the 5 gallon pails. The inspectors observed in the calculations that assumptions that the powder is dry and only single batched in the pails is used to show the calculation is below 0.98.

Section 6.1.5.2 of the license application states that "Based on the results of calculations, the sensitivity of key parameters are evaluated to determine the effect on k_{EFF} , and to assure that adequate controls have been provided to demonstrate a sufficient margin of safety for the analyzed system." In addition the section also states "For credible abnormal configurations, a sufficient margin of safety is defined as a 95/95 k_{EFF} that is ≤ 0.98 when all applicable biases and computational uncertainties are taken into account."

The licensee's staff stated in discussion that in section 6.1.5.2 of the license application they had agreed to limit the value for determining if a configuration is subcritical to a maximum value of 0.98. The inspectors were unable to determine how the licensee staff was able to apply the 0.98 value for k_{EFF} to anything besides credible abnormal configurations. The licensee's staff believes that if they model a system in the worst case configuration and the resulting calculated k_{EFF} is subcritical, it can be clearly stated that a criticality resulting from the scenario is incredible. The inspectors were unable to determine if the licensee was correctly using the 0.98 k_{EFF} limit as it was described in the license application. The possibility that the licensee has used the 0.98 k_{EFF} limit for more than credible abnormal configurations will be tracked as **Unresolved Item (URI) 70-1151/2009-202-01**.

c. Conclusions

No safety concerns were identified regarding the licensee NCS program.

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

a. Inspection Scope

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

- NCS Manual, NCS-003, "NCS Facility Walkthrough Assessments [FWA]," Revision 8, dated June 12, 2009
- RA-316, "NCS Facility Walkthrough Assessments," Revision 2, dated May 22, 2008
- NCS Facility Walkthrough Assessment Checklists, Second Quarter 2009

b. Observations and Findings

The inspectors reviewed the NCS FWAs for the most recent quarter and interviewed NCS staff. The inspectors discussed the selected FWA findings with the licensee NCS staff. The inspectors determined that licensee NCS inspections were conducted in accordance with written procedures.

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

- RA-107, "Corrective Action Program for Regulatory Events," Revision 18, dated January 22, 2009
- RA-121, "Redbook Internal Reporting System," Revision 5, dated March 19, 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 licensee 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 documents:

- RA-304, "Criticality Accident Alarm System," Revision 12, dated December 6, 2007

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 during a review of the licensee's criticality accident alarm system.

6.0 Plant Operations (IP 88015, IP 88016)

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 reviewed selected aspects of the following documents:

- CSE-4-B, "CSE for Uranium Recycle and Recovery System (URRS) Sifting/Cleaning Hood," Revision 0, dated October 2006
- CSE-16-C, "CSE for Chemical Area Mop Buckets," Revision 1, dated May 2009
- CSE-16-F, "CSE for Floor Storage of Special Nuclear Material," Revision 1, dated July 2008
- RA-301. "Floor Storage of Special Nuclear material," Revision 22, dated June 26, 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 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 and reliability of safety-significant controls relied upon by the licensee for controlling criticality risks.

During a walkdown of the URRS Solvent Extraction Area, the inspectors observed a polypak containing SNM along with a sifter screen that also contained material in the Sifting/Cleaning Hood. The as-found condition was not in compliance with the NCS posting for the hood, which stated, "Only one uranium bearing item shall be allowed in the hood at a time." The licensee immediately corrected the non-compliance and entered item number 09-197-C-009 into CAPS to clarify the posting. The inspectors reviewed the NCSE for the hood and noted that the additional uranium bearing item in the hood was bounded by the analysis.

c. Conclusions

Plant operations involving fissile materials were conducted safely and in accordance with written procedures.

7.0 Open Item Review

URI 70-1151/2009-201-02

During a previous inspection the inspectors reviewed the CSE and Calculation Note (CN) for the new decanter. The inspectors noted that some of the decanter's internal steel components (bowl and scroll shaft) were designated as safety significant controls. The CSE stated that the bowl and scroll shaft were credited for NCS purposes because they limit the internal volume of the decanter and will absorb some neutrons. The CSE specified a large number of dimensional limits on the decanter as well as the type of steel that must be used for the bowl and scroll shaft. The inspectors noted that the manufacturer certified that the decanter met the design requirements specified by the NCS staff, and provided an elemental analysis of the steel components. Based upon discussions with the licensee staff, the inspectors also determined that the corrosion allowance specified in the CSE for the bowl and scroll shaft was conservative. The inspectors noted that neutron absorbers were not listed as a controlled parameter in the CSE for the decanter. The CSE did not include any analysis of the decanter that would demonstrate that the neutron absorption properties of the steel were not needed to demonstrate that the decanter would be adequately subcritical. The inspectors questioned why neutron absorbers were not considered to be a controlled parameter when the CSE stated that the ability to absorb neutrons was an important property of the steel components. The licensee's NCS staff stated that since the equipment had to be made out of something, and they did not explicitly procure equipment with a strong absorber (e.g., boron), they did not consider the steel components to be a neutron absorber in the context of controlled parameters.

During this inspection the inspectors discussed the CSE and CN with the licensee and reviewed both the CSE and CN. The licensee was performing inspections and verifications of the decanter prior to installation and use. The licensee was not performing in-service inspections of the equipment on the decanter. The licensee's staff agreed to update the CSE to include a discussion in the CSE to why they had determined that in-service inspections were not required for the decanter. The

licensee's staff had determined because of the tight tolerances on the decanter and the modeling assumptions for erosion of the steel components that no in-service inspection was required. In addition, the licensee staff stated that the operators of the decanter would be able to tell if the erosion of the steel components had started because the decanter would not function properly. The inspectors determined that the licensee's staff was meeting the intent of the standard with their commitment to update the CSE to include a discussion of why an in-service inspection is not required. 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 July 17, 2009. The licensee acknowledged and understood the findings as presented.

SUPPLEMENTARY INFORMATION

1.0 List of Items Opened, Closed, and Discussed

Items Opened

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

Items Closed

URI 70-1151/2009-201-02 Tracks the reliance on the neutron absorbing properties of steel components in a decanter in the CSE without implementing ANSI/ANS-8.21 (1995).

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
S. Armstrong	URRS
R. Bates	Maintenance
G. Couture	Environment, Health, and Safety (EH&S)
D. Graham	EH&S
M. Rosser	EH&S
R. Winiarski	NCS Manager

NRC

T. Marenchin	Criticality Safety Inspector, NRC HQ
T. Powell	Criticality Safety Inspector, NRC HQ

All attended the exit meeting on July 17, 2009.

4.0 List of Acronyms

ADAMS	Agencywide Documents Access and Management System
ADU	ammonium diranate
CFFF	Columbia Fuel Fabrication Facility
CFR	Code of Federal Regulations
CN	calculation note
CSE	criticality safety evaluation
EH&S	environment, health, and safety
FWA	facility walkthrough assessments
IFBA	integral fuel burnable absorber
IP	inspection procedure
NCS	nuclear criticality safety
URI	unresolved item
URRS	Uranium Recycle and Recovery System
WEC	Westinghouse Electric Company (licensee)