February 20, 2013

Mr. David J. Precht, Plant Manager
Westinghouse Electric Co., LLC
Nuclear Fuel Division
5801 Bluff Road
Hopkins, SC 29061-9121

SUBJECT: WESTINGHOUSE ELECTRIC COMPANY – NUCLEAR REGULATORY COMMISSION INSPECTION REPORT NO. 70-1151/2013-201

Dear Mr. Precht:

The U.S. Nuclear Regulatory Commission (NRC) conducted a routine, announced Nuclear Criticality Safety (NCS) inspection at your facility in Columbia, South Carolina, from January 28-31, 2013. The purpose of the inspection was to determine whether activities involving special nuclear material were conducted safely and in accordance with your license and regulatory requirements. Throughout the inspection, observations were discussed with your staff. An exit meeting was held on January 31, during which inspection observations and findings were discussed with your management and staff.

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 inspection, your activities involving nuclear criticality hazards were found to be conducted safely and in accordance with regulatory requirements.

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 Timothy Sippel, of my staff, at (301) 492-3164, or via e-mail to Timothy.Sippel@nrc.gov.

Sincerely,

/RA/

Larry Campbell, Acting Chief
Programmatic Oversight and
Regional 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 No. 70-1151/2013-201

cc w/encl: (See page 3)

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Mr. Wayne Sepitko
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Commercial Nuclear Fuel Division
Electronic Mail Distribution

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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.:	70-1151/2013-201
Licensee:	Westinghouse Electric Company, Inc.
Location:	Columbia, South Carolina
Inspection Dates:	January 28-31, 2013
Inspectors:	Timothy Sippel, Criticality Safety Inspector Sheena Whaley, Criticality Safety Inspector Greg Chapman, Criticality Safety Inspector (In-training)
Approved by:	Larry Campbell, Acting Chief Programmatic Oversight and Regional Support Branch Division of Fuel Cycle Safety and Safeguards Office of Nuclear Material Safety and Safeguards

Enclosure

EXECUTIVE SUMMARY

WESTINGHOUSE ELECTRIC COMPANY, INC.
NRC INSPECTION REPORT 70-1151/2013-201

Introduction

Staff of the U.S. Nuclear Regulatory Commission (NRC) performed a routine, announced nuclear criticality safety (NCS) inspection of the Westinghouse Electric Company Inc., (WEC) facility, in Columbia, South Carolina from January 28-31, 2013. The inspection included an onsite review of the licensee's NCS program, NCS evaluations, NCS audits, internal NCS event review and follow-up, plant operations, and open items follow-up. 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, and final assembly wash.

Results

- No safety concerns were identified regarding the licensee's NCS program.
- 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.
- Except for a minor violation, no safety concerns were identified during walkdowns of plant operations.

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 Nuclear Criticality Safety Program (IP 88015 & 88016)

a. Inspection Scope

The inspectors reviewed the licensee's NCS program and analyses. The inspectors evaluated the adequacy of the program and analyses to assure the safety of fissile material operations. The inspectors reviewed selected criticality safety evaluations (CSE) to determine that criticality safety of risk-significant operations was assured through engineered and administrative controls with adequate safety margin and prepared and review by qualified staff. The inspectors interviewed licensee managers and engineers in the safety and production departments, and selected operators. The inspectors reviewed selected NCS-related items relied on for safety (IROFS) to determine that the performance requirements have been met for selected accident sequences. The inspectors accompanied NCS engineers on walkdowns in selected plant areas. The inspectors reviewed selected aspects of the following documents:

- CF-83-147, "Solvent Extraction Normal Operation Sampling Plan," Rev. 8, dated December 10, 2012
- COP-836036, "Operation of 8A Scrubber," Rev. 7, dated June 25, 2009.
- CSE-1-AE, "Criticality Safety Evaluation (CSE) for the IFBA Scrubber," Rev. 3, dated November 2012
- CSE-1-D, "Criticality Safety Evaluation (CSE) for Ammonia Fume Ventilation System," Rev. 7, dated November 2012
- CSE-1-E, "Criticality Safety Evaluation for S-1030 Scrubber," Rev. 4, dated November 2012
- CSE-1-G, "Criticality Safety Evaluation (CSE) For Acid Scrubber S-2A/2B," Rev. 6, dated November 2012
- CSE-1-H, "Criticality Safety Evaluation (CSE) For Solvent Extraction Scrubber," Rev. 1, dated May 2009
- CSE-1-H, "Criticality Safety Evaluation (CSE) For Solvent Extraction Scrubber," Rev. 4, dated December 2012
- CSE-1-S, "Criticality Safety Evaluation (CSE) For Erbia Central Vacuum Torit," Rev. 5, dated January 2013
- CSE-3-D, "Criticality Safety Evaluation (CSE) for the ADU Conversion Hydrolysis Column with Passive Overflow, Nitrate Vessel, and Precipitator," Rev. 3, dated December 2012
- CSE-3-L, "Criticality Safety Evaluation (CSE) for Storage of Legacy 8A Cylinders," Rev. 3, dated December 2012
- CSE-3-O, "Criticality Safety Evaluation (CSE) for the ADU Conversion Hydrolysis Column with Passive Overflow, Nitrate Vessel, and Precipitator on Lines 1-4," Rev. 3, dated September 2012

- CSE-8-C, “Criticality Safety Evaluation (CSE) for the ADU and Erbia Pellet Sintering Lines,” Rev. 8, dated November 2012

- CSE-8-D, “Criticality Safety Evaluation (CSE) for the CFFF Pellet Grinder Line,” Rev. 16, dated August 2012
- CSE-10-B, “Criticality Safety Evaluation (CSE) for Product Assurance Rod Inspection,” Rev. 4, dated December 2012
- CSE-11-B, “Criticality Safety Evaluation (CSE) for Scrap Cate Precipitation (Precipitation Tanks and Filter Press),” Rev. 4, dated January 2013
- CSE-11-D, “Criticality Safety Evaluation (CSE) for the Scrap Cage Tanks,” Rev. 7, dated September 2012
- CSE-16-A, “Criticality Safety Evaluation (CSE) for Storage of Uranium Bearing Materials System,” Rev. 7, dated August 2012
- CSE-18-B, “Criticality Safety Evaluation (CSE) for the Analytical Services Laboratory,” Rev. 9, dated October 2012
- CSE-18-G, “Criticality Safety Evaluation (CSE) for QC Polypak Sampling Hood,” Rev. 3, dated August 2012
- CSE-20-A, “Criticality Safety Evaluation (CSE) for Erbia Bulk Blending System,” Rev. 5, dated June 2010
- CSE-99-K, “Criticality Safety Evaluation (CSE) for Material Transferfrom the Pilot Line Hood to a NT-IX Shipping Container,” Rev. 0, dated December 2012
- NCS-017, “Guidance for the NCSIP2,” Revision 3, dated September 2012
- PM [Preventative Maintenance] 85161, “SI-Safety, SOLX Ventilation System Scrubber – Annual PM,” dated February 10, 2012. And related Work Orders (WOs):
    - WO: 514466, dated April 29, 2010
    - WO: 546579, dated April 7, 2011
    - WO: 581619, dated April 5, 2012
- PM 85046, “SI-Safety, Water Backflow Prevention Verification – Annual PM,” dated June 01, 2011. And related Work Orders:
    - WO: 519102, dated June 17, 2010
    - WO: 551368, dated May 31, 2011
    - WO: 581893, dated April 5, 2012
- RA-313, “Criticality Safety Evaluations (CSEs),” Rev. 13, dated September 13, 2012.
- ROP-05-062, “Radiation Survey of Ventilation Equipment,” Rev. 15, dated October 11, 2012. And forms:
    - ROF-05-062-1, “Ventilation Systems Equipment Radiation Survey Monthly Surveys,” Rev. 20, dated June 24, 2009
    - ROF-05-062-4, “Ventilation Systems Equipment Radiation Survey (Quarterly Surveys),” Rev. 13, dated June 26, 2009
- TA-500, “Columbia Manufacturing Plant Configuration Control,” Rev. 27, dated April 9, 2012

b. Observations and Findings

The inspectors observed that the licensee’s NCS program reviewed changes affecting criticality safety. The NCS department reviews all changes to determine if the change impacts NCS. Such changes are only reviewed by NCS engineers who have received the appropriate qualification. An inspector interviewed licensee NCS engineers about the review process and discussed some recent change reviews. A configuration control form (CCF) is used to document proposed changes to the facility. These are then

reviewed by a qualified NCS engineer, using a computerized system that forces the reviewers to complete the proceduralized steps. Such steps include recording the applicable CSEs when CSEs are affected. The system requires the engineer to fill in some justification for the determination. During walkdowns and in discussions with NCS engineers the inspectors noted that the licensee's NCS engineers appeared to the knowledgeable with the processes and safety controls. No safety concerns were identified regarding the change control process.

The inspectors also reviewed documentation relating to a selection of the controls identified in the CSEs; including PMs 85046, 85161, COP-836036, and ROP-05-062. The licensee used a variety of controls with a preference for passive controls such as favorable geometry and moderator exclusion. Active engineered controls, such as valves, are subject to routine testing and maintenance. The inspectors reviewed the associated work orders to verify that the necessary management measures are being performed. In some areas the licensee uses monthly gamma scans as an administrative control on mass. The licensee uses ROP-05-062 to perform these gamma scans where there is a potential for powder buildup in ventilation equipment. This procedure simply requires the ventilation equipment be cleaned out when the count rate/dose rate exceeds the action threshold. A lower threshold is used for notification purposes. No safety concerns were identified with regards to the controls use to prevent criticality, or the management measures applied to the controls.

The inspectors review of licensee CSEs focused on CSEs that were revised since the last NCS inspection. The inspectors determined that, for the CSEs reviewed, the CSEs were: performed by qualified NCS engineers, independently reviewed by qualified NCS engineers, provided for the subcriticality of the systems and operations through appropriate limits on controlled parameters, and assured double contingency for each of the credible accident sequences leading to inadvertent criticality that was selected for review. The inspectors reviewed selected NCS controls and determined that the designated controls were adequate to meet performance requirements for the selected accident sequences. The inspectors reviewed a sample of accident sequences and confirmed that the double contingency principle was met. NCS analyses and supporting calculations demonstrated adequate identification and control of NCS hazards to assure operations within subcritical limits.

The inspectors did note that clarification of the description of some credited controls was necessary to properly understand the purpose of the control. For example: in CSE-11-B, Rev 4, dated January 2013, the double contingency argument in Section 4.1.1, "Wrong Filter Press Configuration—Wrong Number of Plates or Incorrect Plates," required clarification. Specifically, the inspectors interpreted the section title to mean that an incorrect number of plates could be utilized to create an unsafe configuration even though a statement appeared in the section that the number of plates was effectively fixed. The controls credited configuration control processes to address the primary contingency and essentially four independent inspections (two prior to initial use and two inspections annually thereafter) to address the secondary contingency. The inspectors questioned the effectiveness of the annual inspections to identify an improper configuration which could occur through reassembly of the filter press. They were informed that the section title had improperly implied that an increase in the number of plates was credible and that the annual inspections were to identify wear of the plates such that larger void areas would be identified and corrective actions taken. The inspectors found the explanation reasonable under the circumstances but also observed

other CSEs where clarification in the text would have been helpful in understanding the logic of the evaluator.

c. Conclusions

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

3.0 Nuclear Criticality Safety Inspections, Audits, and Investigations (IP 88015)

a. Inspection Scope

The inspectors reviewed the licensee's procedures for NCS inspections, called "Facility Walkthrough Assessments (FWA)," and records of previously completed FWAs to assure that appropriate issues were identified and resolved. The inspectors reviewed selected aspects of the following documents:

- FWA, "Torits," dated December 28, 2012
- FWA, "ADU Pelleting – Powder Operations," dated December 28, 2012
- FWA, "Dry and Wet Trash Collection/Assay Systems/Incinerator," dated December 28, 2012
- FWA, "Safe Geometry dissolvers/Fluoride Stripping/706 Hood," dated December 28, 2012
- Issue Report No. 10-252-C007, "NCS FWA for SOLX," Assigned November 9, 2010
- Issue Report No. 12-317-C008, "Clarification of Requirements for Plastic Bags in the Chemical Area," Assigned November 19, 2012
- Issue Report No. 12-355-C009, "Organizational Change Control Review of EH&S NCS Engineer," Assigned January 4, 2013
- RA-316, "NCS Facility Walkthrough Assessments," Rev. 6, dated March 21, 2012

b. Observations and Findings

The inspectors observed that the licensee's FWAs were conducted in accordance with written procedures. The inspectors confirmed that deficiencies identified during the FWA were appropriately captured in the licensee's corrective action program and resolved in a timely manner. In at least one instance, the controls being walked down were not verified as the equipment was taken out of service such that the controls were no longer applicable. In that instance, the licensee NRC engineer described the controls as "obsolete" to describe the reason they were not verified when in fact, the controls will still be applicable should the equipment be returned to service.

Regarding Issue Report No. 12-317-C008, confusion had resulted from bulk storage of plastic bags in an area where NCS controls limited the number of bags as potential collection points of solution. The issue was clarified in that the controls pertained to bags in use which could potentially contain/collect solutions and not stored bags with no opportunity to contain solutions. Bags are stored laying flat, in this configuration they can't collect solution.

c. Conclusions

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

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

a. Inspection Scope

The inspector reviewed the licensee response to a selection of recent internally-reported events. There were no NCS-related reportable events identified by the licensee since the last NCS inspection. The inspector reviewed immediate and long-term corrective actions. The inspector reviewed selected aspects of the following documents:

- CN-CRI-10-8, "Sperry Filter Press with Polypropylene Plates," Rev. 2, dated October 3, 2011
- CSE-14-C, "Criticality Safety Evaluation for Miscellaneous Operations in the Integral Fuel Burnable Absorber (IFBA) Area," Rev. 4, dated August 2010
- CSE-14-C, "Criticality Safety Evaluation for Miscellaneous Operations in the Integral Fuel Burnable Absorber (IFBA) Area," Rev. 5, dated February 2012
- CSE-16-B, "Criticality Safety Evaluation (CSE) for Storage of Uranium Bearing Materials System [Polypak Storage Carts]," Rev. 5, dated December 2010
- Redbook Entry 61654, dated 09/11/12
- Redbook Entry 61900, dated 10/16/12
- Redbook Entry 62014, dated 10/25/12
- Redbook Entry 62099, dated 11/02/12
- Redbook Entry 62242, dated 11/18/12
- Redbook Entry 62326, dated 11/29/12

b. Observations and Findings

The inspectors reviewed selected licensee internally reported events that occurred since the last NCS inspection. In one event, documented in Redbook Entry 62326, the licensee discovered that a filter press plate height exceeded the allowed dimensions. During the investigation the licensee discovered that the plastic plate had been gradually deformed (squeezed) by the force of the press, increasing its height (a dimension perpendicular to the direction of the force). The inspector confirmed that the dimensions of the plate were bounded by the analysis in CN-CRI-10-8, and that the licensee's corrective action of filling the plate down to size was adequate. The inspector concluded that this event has essentially no safety significance; but it is still of some interest because it involves a credible failure mode for a passive geometry controlled component.

In an event documented in Redbook Entry 61654, the licensee discovered that 10 poly packs of incinerator ash, stored on 3 different carriers, exceeded the net weight of 8kg specified by the criticality posting (control STORAGE-GEN-108). Weights ranged from 8.05 -8.79 kg. The 8kg limit corresponded with a 3.5kg uranium limit as described in CSE-16-B. Actual uranium measured was within the licensee's limits, and ranged from 0.101-0.111kg. Inspectors reviewed the last 6 months of ChAMPS data for the incinerator ash and found no exceedances of either the 8kg net weight or the 3.5kg

uranium weight limit. The exceedances noted in the events had been corrected and revised data were substituted. Inspectors found the event had no safety significance.

The inspectors observed that internal events were investigated in accordance with written procedures and appropriate corrective actions were assigned and tracked. The inspectors determined that the licensee adequately determined whether or not these events were reportable to the NRC.

c. Conclusions

No safety concerns were identified during a review of recent licensee investigation of internal events; and corrective actions were adequately tracked by the licensee.

5.0 Plant Activities (IP 88015 & 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 some of those addressed by the revised CSEs mentioned in Section 2.0. The inspectors reviewed selected portions of the following:

- CCF No. 12188, dated April 24, 2012
- CSE-99-G, "Criticality Safety Evaluation for Inadvertent Containers," Rev. 1, dated June 2011
- Issue Report # 13-031-C003, "Curtain Barrier in Solvent Extraction," dated January 31, 2013
- RAF-104-3 No. 12188-01-r0

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. 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 of operations and controls in the areas they were questioned about.

The inspectors reviewed the runsheet for tracking mass in the incinerator, and confirmed that the mass of Uranium being loaded was less than the mass limit. The inspectors also sampled postings in various areas to confirm that they were being complied with.

While in the uranium recovery area the inspectors observed that a plastic sheet/tarp had been left hanging. In most places the tarp was taped up, although in one place it had been secured with a cloth strap. The tarp had been partially rolled up, such that some uranium solution could accumulate if the sheet were to be hit by a spray of solution from the right angle.

Use of such sheeting in the 'wet' area requires NCS approval via a change request form.

This approval was granted in RAF-104-3 No. 12188-01-r0, which documents the NCS review and approval. The inspectors reviewed the change request form (CCF No. 12188) and CSE-99-G. The operators had been supposed to take the tarps down, and they were supposed to be "installed such that material cannot accumulate inside the tarp(s)." Licensee management and staff, including an additional NCS engineer, inspected the sheeting and implemented immediate corrective actions. The licensee's immediate corrective actions included removing the sheeting, and notifying area operators on all shifts of the incident and providing additional instruction. The licensee's long-term corrective actions had not been completed and Issue Report 13-031-C003 remains open. This constitutes a minor violation not subject to enforcement action.

c. Conclusions

A safety concern was identified during plant walkdowns concerning the proper use of plastic sheeting in 'wet' areas.

6.0 Open Items

IFI 70-1151/2012-203-01

This item tracks the reevaluation and possible redesign of the batch control system and roll hood enclosure. The counter for the batch control system is currently designed such that simply removing a container from the scale, whether it is empty or not, counts as if a batch were removed. The licensee is tracking this under Redbook Entry 60149, "Powder Lodged in Pellet Line/Prep System." The licensee identified three potential causes; a. poor communication between shifts, b. the procedure did not correctly describe the batch counter system, and c. the granulator design allows the screen to loosen over time. The corrective actions taken were to require a pre-job brief before cleaning out any powder in the granulator, add a note to the procedure to warn against resetting the counter without verifying that the granulator hopper is empty, and to investigate potential improvements to the batch counter system to understand how many batches are in the system at one time. An additional commitment (commitment #12-122-C003.05, dated 1/22/2013) was recently added to investigate adding a level probe in the granulator. During this inspection, the inspectors discussed with the process engineering group the results of the investigation to control the batches in the system. Another proposal is to replace the mechanical scale with a digital scale and tying this into the powder preparation system programmable logic controller so that the programmable logic controller can use the scale to know when the poly pack has reached a target weight. Because no decision has been made on any design changes, this item remains open pending completion of the corrective actions.

LER 2010-006 for EN 46138

The licensee is currently working on its NCSIP-II (Nuclear Criticality Safety Improvement Project 2). As part of this effort, a number of CSEs have been revised to strengthen the safety basis and reduce the number of administrative controls. The inspectors reviewed a number of CSEs that were revised as part of NCSIP-II; including CSE-1-AE, CSE-1-E, CSE-1-H, and CSE-1-G. The inspectors found that the CSEs generally followed the guidance from NCS-017; and generally contained improved double contingency arguments, specifically regarding geometry controls. The inspectors noted that these

new CSEs have not yet been implemented. So documentation for newly established controls is not yet available. Item **LER 2010-006** is being administratively closed to **Inspector Follow-up Item 2013-201-01**, due January 31, 2015.

7.0 Exit Meeting

The inspectors presented the inspection scope and results to members of the licensee's management and staff during an exit meeting on January 31, 2013. The licensee acknowledged and understood the findings as presented.

SUPPLEMENTARY INFORMATION

1.0 List of Items Opened, Closed, and Discussed

Items Opened

IFI 70-1151/2013-201-01 Tracks the completion of NCSIP-II, due January 31, 2015.

Items Closed

LER 2010-006 Incorporation of incredible criticality sequences into ISA Event 46138

Items Discussed

IFI 70-1151/2012-203-01 Tracks the reevaluation and possible redesign of the batch control system and roll hood enclosure

2.0 Inspection Procedures Used

IP 88015	Nuclear Criticality Safety Program
IP 88016	Nuclear Criticality Safety Evaluations and Analyses

3.0 Key Points of Contact

WEC

D. Precht	Plant Manager
G. Couture	EH&S
M. Rosser	EH&S Manager
C. Snyder	NCS
D. Graham	EH&S

NRC

T. Sippel	Criticality Safety Inspector, HQ
G. Chapman	Criticality Safety Inspector, HQ
S. Whaley	Criticality Safety Inspector, HQ

All attended the exit meeting on January 31, 2013.

4.0 List of Acronyms

ADAMS	Agencywide Documents Access and Management System
ADU	ammonium diurante
CCF	configuration control form
CCR	CCF change request
ChAMPS	chemical and mechanical process systems
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)
WO	Work Order