September 27, 2012

Mr. David J. Precht, Plant Manager
Westinghouse Electric Company, Inc.
Commercial Nuclear Fuel Division
PO Drawer R
Columbia, SC 29250

SUBJECT: INSPECTION REPORT NO. 70-1151/2012-203

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 August 27-30, 2012. 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 August 30, 2012, 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* (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 Sheena Whaley, of my staff, at (301) 492-3200, or via e-mail to sheena.whaley@nrc.gov.

Sincerely,

/RA/

Thomas G. Hiltz, 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 70-1151/2012-203

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

If you have any questions concerning this report, please contact Sheena Whaley, of my staff, at (301) 492-3200, or via e-mail to sheena.whaley@nrc.gov.

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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.:	70-1151/2012-203
LICENSEE:	Westinghouse Electric Company, Inc.
LOCATION:	Columbia, South Carolina
INSPECTION DATES:	August 27-30, 2012
INSPECTORS:	Christopher S. Tripp, Criticality Safety Inspector Sheena Whaley, Criticality Safety Inspector
APPROVED BY:	Thomas G. Hiltz, Chief Technical Support Branch Division of Fuel Cycle Safety and Safeguards Office of Nuclear Material Safety and Safeguards

Enclosure

EXECUTIVE SUMMARY

Westinghouse Electric Company, Inc.
U.S. Nuclear Regulatory Commission Inspection
Report 70-1151/2012-203

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 August 27-30, 2012. The inspection included an onsite review of the licensee's NCS program, NCS training, NCS evaluations, NCS audits, internal NCS event review and followup, the criticality accident alarm system, plant operations, and open items followup. 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

- No safety concerns were identified regarding the licensee's NCS program.
- No safety concerns were identified regarding the licensee's NCS audits.
- An Inspector Follow-up Item (IFI) was identified during a review of recent licensee investigation of internal events, concerning an event involving a powder spill into the Line 1 powder preparation roll hood.
- No safety concerns were identified during a review of the licensee's criticality accident alarm system.
- 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 (Inspection Procedures [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 (CSEs) 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, operations engineers, 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 and other technical staff on walkdowns of NCS controls in selected plant areas. The inspectors reviewed selected aspects of the following documents:

- CSE-08-B, Rev. 1, "Criticality Safety Evaluation (CSE) for the ADU Pelleting Powder Preparation and Pressing Operations," July 2012
- CN-CRI-12-3, Rev. 0, "ADU Pelleting Powder Lift Enclosure"
- CSE-08-C, Rev. 4, "Criticality Safety Evaluation (CSE) for the Columbia Fuel Fabrication Facility Pellet Sintering Lines," February 2009
- CSE-08-C, Rev. 5, "Criticality Safety Evaluation (CSE) for the ADU and Erbia Pellet Sintering Lines," June 2011
- CSE-08-C, Rev. 6, "Criticality Safety Evaluation (CSE) for the ADU and Erbia Pellet Sintering lines," October 2011
- CSE-1-AE, Rev. 2, "Criticality Safety Evaluation (CSE) for the IFBA Scrubber," May 2012
- [Criticality Control Form] CCF 11588
- CCF 12165
- CCF 12365
- CSE-14-C, Rev. 4, "Criticality Safety Evaluation for Miscellaneous Operations in the Integral Fuel Burnable Absorber (IFBA) Area," August 2010
- CSE-14-B, Rev. 4, "Criticality Safety Evaluation (CSE) for Integrated Fuel Burnable Absorber (IFBA) Coaters," November 2011.
- CN-CRI-06-9, Rev. 0, "IFBA Pellet Coaters," August 2006
- CN-CRI-06-27, Rev. 1, "Heterogeneous UO_2-Oil Minimum Mass and Moderator Limits," August 2006
- CSE-18-B, Rev. 7, "Criticality Safety Evaluation for the Analytical Services Laboratory," February 2012
- CN-CRI-08-17, "ADU Pelleting Roll Hood and Pellet Press Feed Hopper," July 2008
- NCS-007, "Homogeneous UO_2 Single Parameter Limits," May 2009

- CN-CRI-08-18, Rev. 1, "ADU Pelleting Ribbon Blending Hood and Recycle Hood," August 2008

b. Observations and Findings

The inspectors reviewed the licensee's CSEs for new or changed facility processes, focusing on changes other than those made solely in connection with NCSIP-2. In general, the new and revised analyses demonstrated that processes were subcritical under normal and credible abnormal conditions and complied with the double contingency principle. Controls were established as appropriate to ensure safety and regulatory compliance.

The inspectors reviewed recent revisions (Revisions 4 through 6) of CSE-08-C covering the pellet sintering furnace. Revision 4 covered only the ADU line furnace, and did not contain any credible accident scenarios leading to criticality. As shown in the licensee's calculations, a ribbon of intact pellet boats inside the furnace will remain subcritical even when optimally moderated. Revision 5 added the Erbia line furnaces to the analysis and added a number of credible accident scenarios, including an accumulation of pellets due to a jam inside the furnace. Pellet accumulation is not a concern unless moderator also intrudes into the furnace. Moderator intrusion could occur from the cooling water or from overflow from the atmospheric moisture tank (saturator tank). To preclude against these scenarios, the licensee added inspections for pellet jams, along with cleanout as needed (PELSINT-108 and BAESNT-108), integrity of the cooling water system (PELSINT-122), and saturator tank level switches (PELSINT-915, BAEDWX-906, and BAESNT-906). Revision 6 added redundant saturator tank level switches (PELSINT-916, BAEDWX-907, and BAESNT-907). (The reason for these redundant switches was not criticality safety, as double contingency was already ensured by geometry and moderator control, but because moderator intrusion into a hot furnace constitutes an industrial hazard.) The inspectors determined that the CSE revisions to address scenarios now treated as credible were appropriate, and that the new controls met the performance requirements and double contingency principle.

The inspectors reviewed the revision to CSE-1-AE for the IFBA scrubber and associated CCFs. The CSE was revised to address newly identified credible scenarios involving backflow from the scrubber system, and identified several new controls—including a new overflow line, elevated risers, a backflow preventer on the Deionized Water supply line, and two air gaps. Design changes were also made to remove unnecessary liquid pathways into the scrubber system.

As part of its review of new and revised operations, the inspectors reviewed the new CSEs, associated change forms, and calculations as appropriate; walked down the affected operations; and discussed the analysis with the cognizant NCS staff. The inspectors reviewed other analyses as discussed in this report's sections on internally reported events and follow-up from previous inspection findings. In all such cases, the licensee's revisions to address newly identified or re-categorized scenarios were appropriate.

The inspectors also discussed the status of NCSIP-2 project with the licensee. The licensee discussed its general approach, which is to add a new section to the CSEs to discuss favorable geometry IROFS as needed. At this time, the licensee does not foresee any issues in meeting the date to complete this project.

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 records of previously completed Facility Walkthrough Assessments (FWA) to assure that appropriate issues were identified and resolved. The inspectors also reviewed the NCS Program's external audit. The inspectors reviewed selected aspects of the following documents:

- ESH-Audit-12-7, "Nuclear Criticality Safety Audit for Westinghouse Columbia Fuel Fabrication Facility," dated July, 2012
- FWA, "IFBA Miscellaneous Operations," 6/29/12
- FWA, "Analytical Services Lab," 6/29/12
- FWA, "ERBIA Powder Processing," 6/29/12
- FWA, "ERBIA Pelleting," 6/29/12
- FWA, "IFBA Miscellaneous Operations," 6/29/12
- FWA, "Conversion Decontamination Room," 6/29/12
- FWA, "ADU Bulk Blending," 6/29/12
- FWA, "UF6 Vaporization," 6/29/12
- FWA, "Safe Geometry Dissolvers/Fluoride Stripping/706 Hood," 6/29/12
- FWA, "ADU Pelleting – Powder Operations," 6/29/12
- FWA, "Chemical Development Lab," 6/28/12
- FWA, "Miscellaneous Operations in the ERBIA Area," 6/28/12
- FWA, "Conversion Drying – Hot Oil Dryer/Elevator/K-Tron Feeders/Calciner/Fitzmill/Hoods," 6/26/12
- FWA, "Metlab," 6/26/12
- FWA, "Waterglass/Warm Caustic/Aqueous Waste," 6/25/12
- FWA, "Final Assembly," 6/22/12
- FWA, "Torits," 6/19/12
- FWA, "Dry and Wet Trash Collection/Assay Systems/Incinerator," 6/19/12
- FWA, "Conversion Scrap," 6/19/12
- FWA, "Cylinder Wash," 6/19/12

b. Observations and Findings

The inspectors determined that the NCS Programmatic Audit, which focused on seven major areas, was comprehensive and completed in accordance with the licensee's commitments in the licensee's Safety Analysis Report. The FWAs were also performed by NCS staff in accordance with the licensee's procedural requirements. When appropriate, the licensee took immediate corrective action to correct the issue; and all findings were entered into the licensee's corrective action program.

c. Conclusions

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

5.0 Nuclear Criticality Safety Event Review and Followup (IP 88015 & 88016)

a. Inspection Scope

The inspector reviewed the licensee's response to a selection of recent internally reported events. Since the previous NCS inspection, there were no events reported to the NRC.

The inspector reviewed the progress of investigations and interviewed licensee staff regarding immediate and long-term corrective actions. The inspector reviewed selected aspects of the following documents:

- RA-107, Rev. 22, "Corrective Action Process for Regulatory Events," January 2012
- Redbook Entry #59149 (April 19, 2012)
- Redbook Entry #60149 (April 28, 2012)
- Issue Report #12-122-C003 (May 1, 2012)
- COP-820114, Rev. 69, "Automatic Feed Preparation System," July 2012
- Redbook Entry #60489 (May 2, 2012)
- Redbook Entry #60889 (May 14, 2012)
- Redbook Entry #60912 (May 16, 2012)
- Redbook Entry #61161 (July 4, 2012)
- Redbook Entry #61237 (July 12, 2012)
- Redbook Entry #61262 (July 19, 2012)
- Redbook Entry #61362 (August 6, 2012)
- Redbook Entry #61464 (August 21, 2012)

b. Observations and Findings

The inspectors reviewed licensee actions in response to several internally reported events that occurred since the last inspection. The inspectors reviewed the incident reports and corrective actions, walked down the affected operations, and interviewed plant NCS and operations personnel. The inspectors determined that the licensee had adequately responded to the incidents, both in terms of assessing the safety significance of the immediate situation—including reportability—and in taking long-term corrective actions to prevent recurrence.

The inspectors' assessment of selected incidents is provided below. The remaining internally reported events did not appear to be safety significant.

Redbook Events 59149 and 50489

These incidents involved the improper stacking of sample cups in the Analytical Services Lab. The prohibition against stacking is credited to support an argument that criticality is not credible in the lab. The inspectors walked down the lab and observed that there are signs posted in the windows through which samples are passed into the lab stating that stacking of sample cups is prohibited. The licensee's NCS staff stated that typically this limit is violated when personnel from other areas drop samples off in the windows.

Sample cups are small-lidded plastic cups similar to those used for condiments in restaurants, with a capacity of 4 ounces. The inspectors determined that the minimum applicable single-parameter volumetric limit is 3.1 gallons of optimally moderated UO_2 and oil (for a 95/95 k_{eff} of 0.98). It would require the entire contents of 100 sample cups to be assembled in a spherical arrangement, with optimal moderation and reflection, to exceed this k_{eff} limit. Alternately, an infinite planar array stacked three cups high would be needed to exceed the limit. The inspectors determined that these were isolated incidents and that, based on the licensee's calculations, they did not challenge subcriticality for lab operations.

Redbook Event 60149

This incident involved the inadvertent accumulation of powder in the mass-controlled roll hood beneath the Line 1 roll compactor/granulator. The roll compactor/granulator exists inside a favorable geometry vessel, but it is limited to no more than five 18-kg batches of UO_2 powder. When a batch is dumped into the roll compactor hopper from the powder lift elevator, the counter increments. When a filled polypak is removed from the scale in the roll hood, it decrements. IROFS PELHOOD-102 allows no more than three 9-inch polypaks in the roll hood at a time; effectively a mass control.

In this incident, the roll compactor/granulator got jammed and material was not filling the polypaks in the roll hood. According to the licensee's Apparent Cause Analysis (ACA #12-122-C003) and the inspectors' discussion with operations personnel, the apparent cause was a loose screen, which can become dislodged and impeded the flow of powder out of the granulator. Maintenance was performed on the equipment to get the rollers moving and powder flowing again. Operators are believed to have repeatedly removed the polypak from its scale to see if it was filling, which resulted in inadvertently resetting the batch counter and allowed the roll compactor/granulator to fill up with 162 kilograms UO_2 (9 batches) without activating the alarm. Operators then removed the screen, poked at the blocked material with a screwdriver, and struck the roll compactor/granulator with a hammer. Approximately 100 kg of UO_2 powder fell into a mound in the roll hood, was cleaned up, and the remaining 60 kg fell into the hood, violating the mass limit.

The licensee determined that this event was not reportable because while mass control was lost, moderator control was maintained. The licensee determined that there were no readily available sources of moderation due to the integrity of the roof, the piping integrity program, and provisions of the fire protection program, to which it assigned a likelihood index of -3. In addition, the licensee stated that drains in the bottom of the roll hood—including a large opening accessing the pelletizer—prevented the accumulation of water in the hood, to which it assigned a likelihood index of -3. The licensee therefore concluded that the performance requirements were still met.

The inspectors reviewed the criticality analysis, CSE-08-B, "Criticality Safety Evaluation (CSE) for ADU Pelletizing Powder Preparation and Pressing Operations," and walked down the powder preparation area. While the roll hood is on a mezzanine and there do not appear to be any readily available sources of moderation nearby, the inspectors saw that the front of the hood had a large opening for operators to access the equipment and does not completely prevent moderator intrusion. The inspectors also reviewed the licensee's corrective actions, which included revising the applicable operating procedure, COP-820114, Rev. 69, "Automatic Feed Preparation System," to warn operators that the

batch counter should not be reset without verifying that the feed hopper is empty, and to require a pre-job brief before cleaning out the granulator. The corrective actions also included investigating possible changes to the batch count system (e.g., replacing the mechanical scale with a digital scale tied into the powder preparation Programmable Logic Controller), as well as design changes to keep the screen from loosening during operation. While the licensee concluded that the design of the screen was adequate, there was no conclusion and no follow-on actions evident from investigating the possible redesign of the batch control system, which was listed as being completed. In response to questions, the licensee confirmed that the issue remains open and opened a new corrective action (#12-122-C003.05) to investigate improvements to the process, including possible changes to the batch control system and possibly converting the roller hood to an enclosed glovebox.

The inspectors determined that the current design of the batch counter did not succeed in preventing the accumulation of up to 9 batches (in excess of the 6 polypaks analyzed as an upset condition in CN-CRI-08-17, "ADU Pelleting Roll Hood and Pellet Press Feed Hopper") in the roll hood. A review of maintenance records indicates that there have been several issues associated with either loose or failed screens over the past decade, some of which have led to blockage in the roll compactors/granulators. Improvements in the procedure may be beneficial, but the batch counter does not seem to function as a robust mass control; and the design of the hood does not seem to definitively preclude moderator intrusion. While the licensee appears to be taking appropriate and timely corrective action, the outcome of that corrective action remains to be determined. The reevaluation and possible redesign of the batch control system and roll hood enclosure will therefore be tracked as **Inspector Follow-up Item IFI 70-1151/2012-203-01**.

Redbook Events 60889, 61161, and 61262

These incidents involved leaks of oil from the roughing pump and water from a cathode within the IFBA coater. The inspectors reviewed CSE-14-B, "Criticality Safety Evaluation (CSE) for Integrated Fuel Burnable Absorber (IFBA) Coaters," and supporting analysis establishing subcritical limits for a UO_2-water and UO_2-oil system (CN-CRI-06-9, "IFBA Pellet Coaters;" CN-CRI-06-27, "Heterogeneous UO_2-Oil Minimum Mass and Moderator Limits"). The inspectors determined that as long as the pellets remain within the coater's fixtures, they will remain subcritical with any amount of moderator present. If the pellets accumulate in the bottom of the coater, the minimum amount of oil needed for criticality exceeds the quantity of oil in the roughing pump. Collecting sufficient water would take more than an hour, during which time the pressure within the coater would rise due to the high temperature to which the water would be subjected. This would activate alarms that would alert operators to the condition. Attaining such a condition would require the pellets to be spilled from multiple fixtures simultaneously and collected together into the worst-case configuration at the bottom of the coater, concurrent with a large water leak. No credible mechanism was identified that could lead to these concurrent conditions. The inspectors therefore concur that small water or oil leaks in the coater are expected conditions and that the licensee's response to these conditions is appropriate.

Redbook Event 60912

This incident involved the discovery of an unfavorable geometry cardboard box that was converted into an "inadvertent container" when it was opened and was left unattended

without putting holes in the box. The inspectors examined this because it was similar to a finding in Inspection Report 70-1151/2012-201, but determined that the previous incident occurred in an unrelated area, IFBA. The inspectors also reviewed the operator training module TRN-111, Rev. 3, "Inadvertent Containers," to determine if the training given to operators was adequate. The box did not contain any fissile material, was not in the vicinity of overhead process lines, and was appropriately modified so that it could not collect fissile solution.

Redbook Event 61237

This incident involved the closure of the IFBA filter press without performing the required verifications. IROFS MISC-123 and -124 require that an Area Process Engineer and Area Team Manager verify that the correct number of plates are in place whenever the filter press is opened. Although the verification was not performed, the filter press was found to contain only the allowed number of plates.

The licensee determined that, although involving the same controls as in a previous inspection finding (Inspection Report 70-1151/2010-202), the incident was not reportable because it did not involve failure to meet the performance requirements. The inspectors examined the licensee's double contingency evaluation provided in CSE-14-C, "Criticality Safety Evaluation for Miscellaneous Operations in the Integrated Fuel Burnable Absorber (IFBA) Area," to determine whether it agreed with the licensee's assessment. The inspectors determined that the relevant accident sequence was in Section 4.1.2 of CSE-14-C, "too many filter press plates used." This sequence relies on redundant administrative controls to verify the pegs in the plate's peg-and-hole design are properly affixed, as one leg of double contingency, and the required use of only three plates (along with the dual verification controls MISC-123 and -124) as the second leg. In addition, the press will not seal properly if the plates and pegs are not assembled correctly. The inspectors determined on this basis that the controls for the second contingency were degraded, but that double contingency was still maintained.

Redbook Event 61464

The incident involved the apparent incorrect installation of door stops on the doors of the chemical lab hoods. IROFS VENT-IFBA-137 requires that the hoods must remain open a minimum of 12 inches at all times. (If some of the hood doors are closed, the air flow in other hoods will increase, resulting in the possible uptake of uranium in the ventilation ductwork.) Plant personnel observed that door stops were installed that kept the doors from being opened all the way, rather than shut. Subsequent to reporting this incident, the licensee determined that the reason for the stops was splash protection, rather than criticality safety. Further inspection showed that VENT-IFBA-137 is implemented by an air gap partly hidden behind louvers at the top of the hoods, and that this control was not compromised as first thought. The inspectors reviewed the analysis and walked down the lab and concur with this assessment.

c. Conclusions

An IFI was identified during a review of recent licensee internal events, involving the design of the roll compactor/granulator batch control system and roll hood enclosure. No other safety concerns were identified.

6.0 Criticality Alarm Systems (IP 88017)

a. Inspection Scope

The inspectors reviewed documentation of criticality accident alarm detector coverage, for the installation of a new alarm cluster. The inspectors reviewed selected aspects of the following document:

- NSA-TR-06-09, Rev. 1, "Westinghouse Criticality Detector Coverage Report, Part 2, Supplement," March 2012

b. Observations and Findings

The inspectors reviewed the licensee's analysis to demonstrate coverage of a new UF_6 cylinder storage pad (the "customer" UF_6 cylinder storage pad) by a detector pair to be located in the northwest corner of the Mechanical Building. The licensee's analysis also demonstrated coverage of the "heel" cylinder storage pad by an existing detector pair. The licensee's analysis relied on explicit MNCP dose calculations, stating that it could not use a simpler point-kernel transport method due to the design of the area and the type and quantity of intervening shielding. The licensee instead constructed an explicit 3-D model of the Mechanical Building and cylinder storage pads, using the methods in NSA-TR-06-06, Rev. 1, "Westinghouse Criticality Detector Coverage Report, Part 2." The licensee's model normalized the source strength to produce an unshielded dose rate of 20 rad/min at 2 meters from the material. This source was placed at the furthest corner of the respective cylinder storage pad. The licensee stated that it conservatively took the configuration of cylinders in the storage array, and intervening shielding, into account. The inspectors determined that the licensee's calculated dose significantly exceeded the detector threshold of 15 mR/hr (55.27±0.05 mR/hr for the "heel" cylinder storage pad, and 121.54±0.04 mR/hr for the "customer" cylinder storage pad). Given the conservative nature of the assumed source strength and location, and the large margin in the calculated detector dose rate, the inspectors determined that coverage has been adequately demonstrated.

c. Conclusions

No safety concerns were identified during a review of the licensee's criticality accident alarm system. The licensee's detector placement analysis was conservative.

7.0 Plant Activities (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. The inspectors focused on the following NCS controls in final assembly:

- FA-103, "Structural Design of Wash Tanks"
- FA-105, "CFFF Fuel Assembly Storage Rack"

- FA-PIPE-101, “Final Assembly Area Piping Integrity”
- FA-Roof-101, “Final Assembly Area Roof Integrity”

b. Observations and Findings

The inspectors reviewed the associated Operating Maintenance and Preventive Maintenance records for the subject controls. The maintenance was generally completed on time. The inspectors noted that for some controls, the completion records were poorly documented, but the maintenance had been completed.

c. Conclusions

No safety concerns were identified during plant walkdowns.

8.0 Open Items

IFI 70-1151/2012-201-01

This item concerned the licensee’s planned revision to CSE-08-B, “Criticality Safety Evaluation (CSE) for the ADU Pelleting Powder Preparation and Pressing Operations,” to address the scenario of moderator intrusion into the powder lift enclosure during enrichment cleanout and the proper functioning of the level probes. During the current inspection, the inspectors reviewed Revision 1 of CSE-08-B. In Revision 1, the licensee evaluated powder accumulation in the enclosure using the actual enclosure dimensions rather than the single parameter limit, which is applicable to an infinite powder slab (as documented in CN-CRI-12-3, “ADU Pelleting Powder Lift Enclosure”). This reanalysis showed that more than 6 inches of optimally moderated powder is required before the 95/95 k_{eff} limit of 0.98 could be exceeded. The licensee’s analysis also shows that the enclosure can be completely filled with dry powder and remain subcritical. The licensee stated that dry powder susceptible to mounding would be highly subcritical and that a powder-water system approaching optimum moderation would comprise a wet slurry that would not readily mound. The licensee showed the inspectors a film of experiments in which the moisture content of UO_2 powder was steadily increased, demonstrating that such a powder-water system readily flows at higher hydrogen-to-uranium (H/U) ratios; the licensee’s calculations covered a hydrogen-to-fissile (H/X) range from 150 – 300, to determine the optimum (at H/X = 200). The inspectors noted that IROFS PELPREP-106 and -107 required that the powder lift be shut down if the level probes detected powder at greater than 3.1 inches from the enclosure bottom. The level probes are actually set at less than 2.3 inches from the enclosure bottom. Based on the characteristics of the highly moderated powder required to reach a 95/95 k_{eff} of 0.98, and the considerable margin between the set point of the level probes and the maximum permissible limit as determined in licensee calculations, the inspectors determined that concerns about the preferential mounding of moderated UO_2 have been adequately addressed.

The inspectors also noted that the licensee has added PELPREP-116, which requires visual inspection of the enclosure bottom for powder accumulation at least once a shift. Based on the margin discussed in the previous paragraph and the added assurance provided by PELPREP-116, Inspector Followup Item 70-1151/2012-201-01 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 August 30, 2012. The licensee acknowledged the findings as presented.

SUPPLEMENTARY INFORMATION

1.0 List of Items Opened, Closed, and Discussed

Items Opened

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

Items Closed

IFI 70-1151/2012-201-01 Tracks revision to CSE-08-B to address the scenario of moderator intrusion into the powder lift enclosure during enrichment cleanout and address function of the level probes

Items Discussed

EN46138 Status Check of NCSIP-2 Project

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 Key Points of Contact

WEC

D. Precht	Plant Manager
G. Couture	Environment, Health and Safety (EH&S)
M. Rosser	EH&S Manager
C. Snyder	NCS
S. Armstrong	Uranium Recycle and Recovery
D. Graham	EH&S
R. Winiarski	IFBA

NRC

C. Tripp	Criticality Safety Inspector, Headquarters (HQ)
S. Whaley	Criticality Safety Inspector, HQ

All attended the exit meeting on August 30, 2012.

4.0 List of Acronyms

ADAMS	Agencywide Documents Access and Management System
ADU	ammonium diurantae
CCF	Criticality Control Form
CSE	criticality safety evaluation
EH&S	environment, health, and safety
FWA	Facility Walkthrough Assessments
H/X	hydrogen-to-fissile
Kg	Kilograms
IFBA	integral fuel burnable absorber
IFI	Inspector Followup Item
IP	inspection procedure
IROFS	item relied on for safety
NCS	nuclear criticality safety
NRC	U.S. Nuclear Regulatory Commmission
UF_6	uranium hexafluoride
UO_2	uranium dioxide
WEC	Westinghouse Electric Company (licensee)