Subject: Westinghouse Reported Event #EN52090 60-Day Follow-Up Report

The following information is being provided by Westinghouse Electric Company LLC (Westinghouse) in accordance with 10 CFR Part 70, Appendix A, ¶ (b)(2) and 10 CFR § 70.50(c)(2). Also, Westinghouse previously notified the NRC of the event through LTR-RAC-16-49 (Reference 1). There was no consequence to the public, the workers, or the environment.

A copy of the initial notification report, Event Report #EN52090, pertaining to the Columbia Fuel Fabrication Facility (CFFF) can be found in Enclosure 1 and provides the applicable information required by 10 CFR § 70.50(c)(1). The information required in accordance with 10 CFR § 70.50(c)(2) is provided in Enclosure 2.

Westinghouse is committed to continuous compliance with all governing regulations and license requirements.

If you have any questions regarding this information, please contact me at the number listed above.

Sincerely,

Nancy Blair Parr
Nancy Blair Parr, Manager
Licensing
Westinghouse CFFF
Docket 70-1151 License SNM -1107

Reference:
1. Westinghouse (Precht) letter to NRC (Haney), LTR-RAC-16-49, “Commitments to Address the Columbia Fuel Fabrication Facility Scrubber Event.”

Enclosure 1: Original Event Report #EN52090 dated July 14, 2016
Enclosure 2: 10 CFR 70.50(c)(2) Required Information
September 12, 2016

Our ref: LTR-RAC-16-56

cc:

U. S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, Maryland 20852-2738
Attn: Mr. Christopher Ryder
Mail Stop: T-4A60

U. S. Nuclear Regulatory Commission, Region II
245 Peachtree Center Avenue NE, Suite 1200
Atlanta, GA 30303-1257
Attn: Mr. Thomas Vukovinsky
ENCLOSURE 1

Original Event Report #EN52090 dated July 14, 2016

Caller Identification and Facility Information
Nancy Parr, Licensing Manager. Westinghouse Electric Company LLC, Commercial Fuel Fabrication Facility, Columbia SC.
Low enriched (~5.0 wt.% U-235) fuel fabricator for commercial light water reactors. License: SNM-1107.
Call-Back Number (803) 647-3338.

24 Hour Event Notification based on 10CFR70 Appendix A(b)(2) “Loss or degradation of IROFS that results in failure to meet the performance requirements of 10CFR70.61.”

Description of the Event
On July 13, 2016, it was determined by the Environment, Health and Safety (EH&S) department that scrubber clean-out material, found in the S-1030 scrubber transition section during the annual maintenance shutdown that occurred in late May, potentially exceeded the uranium mass limit for the scrubber transition.

(IROFS VENT-S1030-110) requires annual inspection and removal of significant solids buildup in the transition section. Upon inspection, significant buildup was found, and the ductwork was opened to permit extensive cleanout. 36 containers of material with a total gross weight of 210.4 kg was removed from the inlet transition during the cleanout on May 28th – May 29th. Grab samples were subsequently taken from each container and analyzed for uranium concentration. On July 13th, the EH&S department was made aware that the grab sample results averaged 47.8% U. Although the exact uranium mass cannot be determined until the material is dissolved and representatively sampled, available evidence suggests that the mass limit of 29 kg U in the inlet transition was exceeded. The 29 kg U limit is based on an optimally moderated, fully reflected spherical geometry which very conservatively bounds the conditions in the inlet transition of the scrubber. IROFS remained to limit the quantity of uranium available to the scrubber (IROFS VENT-S1030-101, -102, -103 & -104), which are physical barriers designed to minimize uranium in the airflow entering the transition area. Continuous liquid spraying in the inlet transition section to limit solids accumulation (IROFS VENT-S1030-109) was also in place.

The inlet transition and scrubber were thoroughly cleaned, and the uranium bearing solids were placed into favorable geometry containers. Also, the inspection and cleanout of the transition frequency was increased to monthly.

Based on available but degraded IROFS, this accident sequence was unlikely. Therefore, this mass accident sequence does not meet the performance requirements of 10CFR70.61. The actual configuration remained safe at all times. Also, no external conditions affected the event.

Immediate Corrective Actions
NRC Region II personnel, who were onsite at the CFFF, were made aware of the discovery.

The Conversion area was shutdown to plan for a second extensive scrubber clean-out to validate that the accumulation of solids is a slow buildup over time. The last extensive cleanout was performed in 2009.
An extent of condition was performed to determine if other scrubbers potentially had significant uranium buildup. Inspection data indicated that this material accumulation issue was limited to the S-1030 scrubber.

This event has been entered into the facility Corrective Action Prevention And Learning system (CAPAL) #100397353.

**UPDATED INFORMATION ON JULY 26, 2016 BY NANCY PARR**
Notification Time 10:25 a.m.

Onsite chemical analysis confirmed that uranium mass limit for the scrubber transition piece was exceeded. The accumulated material contained 87 kgs of Uranium.

The Criticality Safety Evaluation for this system was revised and implemented on July 20, 2016 to add Items Relied on For Safety to prevent recurrence of a mass exceedance while the causal analysis and additional corrective actions are completed.

**UPDATED INFORMATION ON JULY 31, 2016 BY NANCY PARR**
Notification Time 5:59 p.m.

On July 31, 2016, it was determined by the Environment, Health and Safety (EH&S) department that clean-out material found in the S-1030 scrubber packing and floor also potentially exceeded the uranium mass limit for the scrubber criticality safety evaluation. Over years of operations, the same available but degraded mass prevention and inspection/clean-out IROFS did not prevent exceedance of the mass limit.

This report is being upgraded to a 1 Hour Event Notification based on 10CFR70 Appendix A(a)(4).

There was no consequence to the public, the workers or the environment.

The scrubber process will remain in a safe shutdown mode until further investigation and corrective actions are completed.

**UPDATED INFORMATION ON AUGUST 7, 2016 BY JOHN HOWELL**
Notification Time 4:20 p.m.

On August 6, 2016 at 1700, it was reported to the Environment, Health and Safety (EH&S) department that residual material located within the abandoned S-1056 scrubber was sampled and confirmed to contain Uranium.

24 Hour Event Notification based on 10CFR70 Appendix A(b)(1) "Any event or condition that results in the facility being in a state that was not analyzed, was improperly analyzed, or is different from that analyzed in the Integrated Safety Analysis, and which results in failure to meet the performance requirements of 10CFR70.61."

The S-1056 is an out-of-service scrubber. When operational, it scrubbed the acid fumes from the Conversion area. It currently is an unanalyzed system without IROFS or controls. The reported volume of approximately 15 kg is well within safety margins.
It was taken out of service in 2002, when the S-1030 scrubber replaced it. The material in the S-1056 was discovered as an extent of condition for the S-1030 event.

The discovery and sampling were documented in Redbook 71409. At no time was there any actual or potential health and safety consequence to the workers, the public, or the environment.

**UPDATED INFORMATION ON AUGUST 23, 2016 BY NANCY PARR**

Notification Time 3:46 p.m.

On August 23, 2016, during the extent of condition for this S-1030 scrubber system event, a review of inspection video for the S-1030 ductwork in Conversion identified material accumulation in an elbow which potentially could exceed the uranium mass limit for the elbow section (36.5 kgU).

This report is being updated based on a potential to meet the 10CFR70 Appendix A(a)(4) in the ductwork.

There was no consequence to the public, the workers or the environment.

The scrubber process will remain in a safe shutdown mode until further investigation and corrective actions are completed.
ENCLOSURE 2

10CFR70.50(2)(2) Required Information

(i) Complete applicable information required by § 70.50(c)(1);

This information has been provided in Enclosure 1 of this correspondence.

(ii) The probable cause of the event, including all factors that contributed to the event and the manufacturer and model number (if applicable) of any equipment that failed or malfunctioned;

A root cause analysis (RCA) investigation is in progress and evaluates how and why uranium mass in excess of allowable limits accumulated in the S-1030 scrubber transition and body. The RCA investigation is examining equipment design, criticality evaluation, operating experience, preventative maintenance, change management, uranium sampling, and configuration management aspects associated with the S-1030 scrubber. The investigation is also examining nuclear safety culture attributes, management oversight, and determines how the extent of condition and extent of cause impact other plant systems. As of September 12, 2016, the RCA has not been finalized. However, the following discussion is based on the information available at this time.

**Root Causes**

Procedure requirements for configuration management were not robust enough to ensure sufficient evaluation of design changes and procedure changes that led to deposition of uranium in the S-1030 scrubber. Implementation of configuration management and procedures has been less than adequate in reliably predicting performance under normal operating conditions when modifying plant systems and the procedures directing system operation.

CFFF management did not ensure personnel had the knowledge necessary to recognize adverse latent conditions in maintaining margins for criticality safety during operation and maintenance of the S-1030 scrubber. Long-standing deficiencies in verifying the effectiveness of controls used to maintain uranium accumulation below mass limits in the S-1030 scrubber resulted in accumulations exceeding mass limits without detection. Organizational shortfalls in understanding and reinforcing the high performance standards required for a nuclear facility contributed to a less than adequate questioning attitude and a non-conservative bias that allowed operations to continue without challenge to the effectiveness of management measures used to prevent a criticality accident.

**Contributing Causes**

CFFF did not fully embrace the value of detailed work instructions and recording information that may be important to reconstruct data important to safety.

Invalid assumptions described in Criticality Safety Evaluation (CSE) CSE-1-E provided part of the basis for the Items Relied on for Safety (IROFS) that were developed to limit the accumulation of uranium in the S-1030 scrubber.

The evaluation of external and internal operating experience was less than effective in applying lessons learned to prevent events.
The scope of CFFF audits and assessments did not include a review of all CSEs over a 3-year period to ensure they were correctly developed and that IROFS, assumptions, and general requirements were implemented and/or validated through work instructions.

(iii) Corrective actions taken or planned to prevent occurrence of similar or identical events in the future and the results of any evaluations or assessments;

Corrective Actions Taken
Suspend all NRC-licensed operations of the S-1030 scrubber system and conversion process equipment until actions are completed to assure safety prior to restart and NRC approval is obtained in accordance with EA-16-173, Confirmatory Action Letter, Westinghouse Electric Company, Columbia Fuel Fabrication Facility (Aug. 11, 2016) (CAL).

Corrective Actions Planned to Prevent Occurrence of Similar or Identical Events
Westinghouse plans to complete all commitments to the NRC identified in the CAL.

As previously noted, the RCA is not yet complete, but the investigation has, at this time, identified four corrective actions to prevent recurrence (CAPRs):

1. Install filtration or other equivalent means for particulate removal between the uranium inputs to S-1030 and the S-1030 inlet duct.

2. Review all CSEs with administrative controls to ensure procedures implement the management measures necessary to ensure administrative controls are verified to be reliable and effective.

3. Revise RA-134, Columbia Plant Safety Event Response Guideline, to adopt industry standards in accordance with operational decision making process.

4. Revise CSE-1-E IROFS and implementing procedures to ensure packing inspections determine the mass of uranium present in comparison to the mass limits.

Results of any Evaluations or Assessments
Westinghouse performed a criticality calculation using the as-found masses of material in the S-1030 trough and scrubber packing to determine the criticality ($k_{\text{eff}}$) of the as-found condition. Although the inspection IROFS was degraded, it identified the accumulation of material in the S-1030 scrubber. Calculations show that a conservative, yet representative model of the as-found conditions of the S-1030 scrubber yields a $k_{\text{eff}}$ of 0.89.

Westinghouse conducted a historical review (previous ten years) of the Corrective Action Program (CAP) at the CFFF, which identified potential challenges to the safety basis of other CSEs. Identified issues were entered into CAPAL and will either be corrected prior to restart or adequate compensatory measure put in place. The review identified recurring issues with storage of special nuclear material (SNM), accumulation of SNM, and procedure non-compliance for Nuclear Criticality Safety (NCS) administrative IROFS. Additionally, the review identified recurring individual IROFS failures or degraded conditions.

Westinghouse conducted a self-assessment to examine the effectiveness of management measures and implementation controls, specifically focusing on management measures supporting administrative IROFS. The primary emphasis was on wet scrubbers with non-favorable geometries, but a sampling was completed for the CSEs with non-favorable geometry components that have mass limits. The identified programmatic weaknesses, findings, and suggestions for improvement were entered into CAPAL.
Westinghouse conducted a work environment assessment of the NCS organization at the CFFF. The results of that assessment are available to the NRC for review.

The verification review of CSEs and associated IROFS are documented in four types of protocols. The protocols cover:

- CSEs for wet scrubbers with non-favorable geometry components, including an independent criticality safety evaluation,
- CSEs for non-favorable geometry components that have mass limits,
- CSEs with IROFS satisfied by visual inspection, and
- Ventilation systems with non-favorable components that are permanently removed from service.

As of September 12, 2016, 122 of 122 protocols have been executed, and 71 of 122 protocols have corrective actions identified through the protocol execution as restart, recovery, or suggestions for improvement.

(iv) For licensees subject to Subpart H of this part, whether the event was identified and evaluated in the Integrated Safety Analysis.

The CFFF is subject to Subpart H, and the event was identified and evaluated in the Integrated Safety Analysis (ISA) and associated ISA Summary. As a result of this event, the accident sequences are being re-evaluated and will be incorporated into a revised ISA and ISA Summary.