

# INES Event Rating Form

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| <b>Event Title:</b>                    | Excessive Deposits of Material Containing Uranium In Scrubber                  |
| <b>Date of Event:</b>                  | 2016-07-13   |
| <b>Event Location / Facility Name:</b> | Hopkins, South Carolina, USA / Westinghouse Columbia Fuel Fabrication Facility |
| <b>Event Country:</b>                  | US   |
| <b>Type of Event:</b>                  | Fuel Fabrication   |

|                          |            |
|--------------------------|------------|
| <b>INES Rating:</b>      | 2          |
| <b>Status of Rating:</b> | Final      |
| <b>Date of Rating:</b>   | 2016-09-20 |

|   |                          |  |
|---|--------------------------|--|
| <b>Impact on People and Environment</b>   |                          |  |
| <i>Release beyond authorized limits?</i>  | <input type="checkbox"/> |  |
| <i>Overexposure of a member of the public?</i>                                  | <input type="checkbox"/> |  |
| <i>Overexposure of a worker?</i>  | <input type="checkbox"/> |  |
| <b>Impact on the Radiological Barriers and Controls at Facilities</b>           |                          |  |
| <i>Contamination spread within the facility?</i>                                | <input type="checkbox"/> |  |
| <i>Damage to radiological barriers (incl. fuel damage) within the facility?</i> | <input type="checkbox"/> |  |
| <b>Degradation of Defence In-Depth?</b>   | X                        |  |
| <b>Person injured physically or casualty?</b>                                   | <input type="checkbox"/> |  |
| <b>Is there a continuing problem?</b>   | <input type="checkbox"/> |  |

## Event Description:

*Note: When the ERF is published on IAEA NEWS, the first 300 characters of the event description will appear on the NEWS home page.*

At a facility authorized to use low-enriched uranium to fabricate commercial nuclear fuel assemblies, excessive deposits of uranium-bearing material were found in the main scrubber and associated ventilation ductwork. The function of the scrubber is to remove gases and particulates from various process exhaust streams. During the most recent planned annual wet scrubber system cleanout, personnel noticed an abnormal amount of material buildup in the inlet transition region and associated ductwork (i.e. elbow). Over the course of the 2-day maintenance evolution approximately 197 kilograms of material were removed from these two sections. These sections are not a favorable geometry from a criticality perspective. Since the facility personnel were under the assumption that this material had a low uranium concentration, operators attempted to break up and wash away the material to facilitate its removal. The facility personnel did not sample the material to confirm the uranium concentration before conducting these activities. After the material was removed, grab samples of the material were taken and analyzed for uranium concentration. The grab sample results indicated that the uranium concentrations ranged from 34wt% – 55wt%, which corresponded to approximately 87 kilograms of uranium. As such, the criticality safety evaluation mass limit of 29 kilograms was exceeded by a factor of 3.

After the cleanout activities were completed, the scrubber was restarted. The scrubber was in operation for a period of 6 weeks when the facility personnel shutdown the scrubber to perform another cleanout of the inlet transition region and elbow. The facility personnel removed 24 kilograms of material which corresponded to approximately 5 kilograms of uranium. The scrubber was restarted again following the cleanout. Approximately 1 week later, while discussing the extent of condition, the licensee decided to shut down the scrubber again and thoroughly inspect the entire scrubber to ensure that it was free of uranium

accumulation. An additional 184 kilograms of material was removed from the scrubber body, and about 71 kilograms of material was removed from the packing material.

In this incident, the mass limit was exceeded by a factor of 3; moderation was available from the scrubber spray nozzles and the clean out process; and the scrubber packing, elbow, and transition region sections are all unfavorable geometries. As a result, the safety margin available to preclude an inadvertent criticality was significantly degraded. The scrubber was shut down and the licensee commenced extent of condition and root cause evaluations. The licensee implemented several short-term and long-term corrective actions to include, revising their criticality safety analysis and integrated safety analysis, improving maintenance procedures to ensure ventilation and scrubber inspections are effective, and implementing design modifications to minimize the accumulation of material. Adequate corrective actions must be implemented and approved by regulatory authorities before processing can be restarted.

**Justification of INES Rating:**

*Note: When the ERF is published on IAEA NEWS, the justification of the INES rating will only appear to privileged users.*

This event is rated Level 2 based on Table 11, “Rating Events Using the Safety Layers Approach” in Section 6, “Assessment of Impact on Defense in Depth for Events at Specified Facilities” of the INES Manual (2008 Edition). This rating is determined by taking account of the maximum potential consequences and the number and effectiveness of safety provisions available. For this event, the maximum potential consequences were Level 3 or 4 because, “The main hazard from a criticality excursion is exposure of personnel due to high radiation fields from direct neutron and gamma radiation,…” The number of remaining safety layers were zero because all of the controls relied on to prevent criticality were compromised. Therefore, this event is rated a Level 2. While there were significant failures in safety provisions, there were no actual consequences.

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|-----------------------------------|------------------------------------|
| <b>Further Info on Web (URL):</b> | Click here to enter text.          |
| <b>Contact Person:</b>            | Patricia Milligan                  |
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**Annexes:**

| <b>Annex Title</b>        | <b>Category</b> | <b>Description (optional)</b> |
|---------------------------|-----------------|-------------------------------|
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| Click here to enter text. | Choose an item. | Click here to enter text.     |