

# Caution Bulletin

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**Title:** Nuclear Criticality Safety Concern in Furnace Vacuum Filter Housing

**Identifier:** 2006-RL-HNF-0043

**Date:** September 19, 2006

**Lessons Learned Statement:** A detailed understanding of equipment design, modes of fissile material transport, potential for moderator intrusion, and nuclear criticality safety controls is required to ensure long-term accumulations in support systems are recognized and addressed in nuclear criticality safety analyses. Assumptions and requirements identified in these analyses must be protected through incorporation into the appropriate implementing documents and technical basis documentation.

**Discussion:** On April 25, 2006, at the Y-12 Complex, Oak Ridge, Tennessee, Non-Destructive Analysis (NDA) measurements of the casting vacuum filter housing indicated the possible presence of an unexpected buildup of uranium mass in excess of the nominal cleanout threshold. As a result, the casting vacuum system containing the filter housing was immediately isolated and administrative controls were implemented.

The following day operators opened a drain valve at the bottom of the filter housing to prevent the possible accumulation of oil in the housing that would act as a moderator. No oil was observed to drain from the filter housing at that time. However, about seven days later, several pints of oil was discovered on the floor beneath the open filter housing drain. It was determined to classify this as a NCS Significance Category 1 occurrence. Meaning; the loss of criticality safety controls such that no valid controls for mass or moderator control could be demonstrated to prevent a criticality accident. This declaration was because conclusive proof that double contingency had not been violated was not possible given the uncertainties regarding the actual amounts of both fissile material buildup and oil accumulation. Execution of the plan determined the actual amount of fissile material and oil present in the filter housing did not represent a credible criticality incident.

**Analysis:** An Investigation Board noted that given the design and operation of the casting vacuum systems, migration of small amounts of uranium particulate from the casting furnaces to the filter housings is not unexpected. However, only one point, near the top of the 4-foot-tall filter housing, was routinely measured for verification purposes. This point was established eight years prior, when initial NDA measurements indicated the most significant accumulation in the filter housing was near the top of the housing. As a result of this observation, the routine measurement point was located there as an "indicator" of accumulation.

It was not recognized that the bottom of the housings would be a significant accumulation point due to the action of gravity on the particles. The unexpected accumulation of uranium was discovered as a result of performing multiple NDA measurements on the filter housing and identifying a deposit on the bottom head of the filter housing.

The NCS technical basis document for the filter housings assumed the majority of uranium particulate would be caught by a roughing filter within the casting vacuum system. However, this was not put into Criticality Safety Requirements (CSRs) or operating procedures. As a result, uncontrolled changes in operating practices and degradation of the roughing filter retention mechanism compromised the integrity of this assumed engineered feature.

**Recommendations:**

- Evaluate equipment during design to determine if it may contribute to ineffective moderator or mass control problems.
- When developing new procedures and safety basis documentation (for standard and off-standard conditions) take into account accumulation prevention measures of fissionable materials within support systems.
- Facilities containing fissionable material should periodically review their existing procedures involving the prevention of fissionable materials accumulation to ensure the possibility for fissionable material movement/accumulation within the system is taken into account.

**Cost Savings/Avoidance:** N/A

**Work Function:** Authorization Basis; Conduct of Operations - General, Configuration Management, Procedure Development; Criticality; Engineering and Design - Nuclear

**Hazards:** Radiation

**Keywords:** Nuclear Criticality Safety, Filter, Uranium, Fissile Material

**Originator:** Fluor Hanford Inc.

**Reference:** DOE Lessons Learned L-2006-BWXY12-0901, J. T. Cleveland, 865-576-7762