Project Hanford Lessons Learned

Title: Consequences of Stuck Ventilation Exhaust Damper Not Anticipated in Safety Basis

Date: September 29, 2005

Identifier: 2005-RL-HNF-0033

Lessons Learned Summary:
Safety Basis assumptions that rely on building structure and HEPA filtration to contain contamination should include the effect of a damper failure to a mode other than fail-safe mode.

Discussion of Activities:
During ventilation system investigative maintenance, Exhaust Damper D-17 for Room 637 in Building 2736-ZB was found to not always respond properly. The damper was discovered to stick sometimes in the closed position and sometimes in the 3/4 open position. The damper problem led to the determination of a Potential Inadequacy in the documented Safety Analysis (PISA). The PISA was followed by a positive determination of an Unreviewed Safety Question (USQ). The issue was that the 2736-Z Complex Documented Safety Analysis (Safety Basis) did not analyze the consequences of Damper 17 failing closed. The Safety Basis relies on the damper to open in the event of a Continuous Air Monitor alarm. Consequently, an unanalyzed condition occurs if the damper fails to open properly during a spread of contamination, and the supply air system pushes contaminated air outside through a personnel emergency exit.

Analysis:
Safety Basis accident analyses are typically worst case scenarios. These scenarios are based on assumptions about the things that could happen and the conditions under which these things would happen. Accident analyses are likely to use conservative scenarios that border on incredible; in this way, less conservative but more likely scenarios are bounded within the Safety Basis.

This event was initiated by the discovery that Damper D-17 could stick in the closed position. Restoration of the damper to pre-event normal operation would require replacement of the damper. The event was reportable because the consequences of an accident (if the damper stuck closed) were not anticipated in the Safety Basis. The Safety Basis clearly describes the modes of ventilation system operation, but the Damper 17 failure was not recognized. The likely reason is that failure analysis for the Safety Basis would have looked at the normal mode and the fail-safe mode. The Safety Basis assumed that NDA Lab Exhaust Damper 17 would fail-safe. In failing safe, the NDA Lab would not become pressurized and no loss of confinement would occur. Documented Failure Modes and Effects Analysis do not exist for the ventilation system.

The damper problem was remediated with a Facility Modification Package. The modification disconnected control to Damper 17, preventing it from sticking. The damper is held open by the damper actuator. The current ventilation configuration is described for the Safety Basis in an Engineering Document Change. The change to prevent the damper sticking closed brought the ventilation system into compliance with the assumptions in the Safety Basis. The damper modification resolved the USQ.

Although not related, this USQ shares aspects common to other Safety Basis USQs. Two recent examples are described in RL--PHMC-PFP-2004-0040 "Buoyant plume atmospheric dispersion coefficients (X/Qs) utilized for analyses of exterior fires may not be appropriate (USQ)" and RL--PHMC-PFP-2004-0043 "216-Z-9 crib roof vehicle overload collapse accident in the Documented Safety Analysis doesn't consider effects of vehicle fuel fire (USQ)".

Recommended Actions:
Design Authorities should evaluate their Safety Basis documentation to determine if assumptions were made which relied upon the building structure and HEPA filtration to contain contamination and look for similar conditions in other engineered safety systems that have been credited for mitigating accident consequences (i.e., safety class and safety significant systems).

Estimated Savings/Cost Avoidance: Not evaluated

Priority Descriptor: BLUE/Information

Work / Function: Authorization Basis, Engineering and Design - Nuclear

Hanford Functional Categories: Associated Causal Factors - A2B6C04 - End of life failure A1B2C01 - Design output scope LTA

Hazard: Environmental/Radiological Release, Personal Injury/Exposure-Radiation Contamination

ISM Core Function: Analyze Hazards, Develop/Implement Controls

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Authorized Derivative Classifier: Not required

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References: Occurrence report: RL--PHMC-PFP-2005-0012