Attachment 2

From: Alex Murray
To: Joseph Giitter; Joseph Holonich; Robert Pierson
Date: 2/19/04 6:31PM
Subject: FTA and Further Thoughts on Burnback

FYI,

At our discussion of the burnback issue on February 9th, questions were asked about the estimated frequencies of such events. I have performed a quick, top-level, phenomenological Fault Tree Analysis (FTA) on the burnback type of events to try and gauge the potential frequency of occurrence.

The event scenario is:

1. Fine uranium powder is being handled in drums, hoppers, or other containers, normally under nitrogen. Inerting is not identified as a safety function for any accident sequence.
2. The material has been size-reduced (1-2 micron range) and has not been stabilized (partially oxidized). This is normal processing and anticipated.
3. Local air/oxygen intrusion occurs due to loss of nitrogen inerting, air ingress due to loading/unloading into gloveboxes, or glove failure. This would be an anticipated or even a routine event. It is unlikely that sufficient oxygen could be present to completely oxidize the UO2 if it is present in multiple tens or 100 kg quantities.
4. UO2 is spilled outside of its container and either partially oxidizes (some oxygen present and particles close together) or is entrained into the ventilation system by the C4 flow.
5. Intermediate filters (glovebox and VHD) are not identified with safety functions for any accident sequence, including burnback.
6. Further UO2 oxidation significantly slows down due to greater particle-particle distances and/or mixing with nirogen from other powder gloveboxes nearby.
7. UO2 particle-particle distance decreases in the C4 final filter areas due to plenums, particles go through pre-filters/load on HEPAs etc. More oxygen is present due to mixing with gas draw from non-powder (not inerted) gloveboxes. C4 HEPA filters are identified as PSSCs.
8. Burnback reaction initiates, damaging HEPAs (a PSSC) and releasing any entrained plutonium or plutonium captured on the C4 HEPAs.

The simple FTA indicates a serious burnback event (with final C4 HEPA damage) with approximate frequencies between 1 in 25 and 1 in 100 years. Using the 1992 Information Notice rate applied to the MOX facility, I back calculated approximate frequencies of 1 in 100 years for significant burnback events and about 1 in 250 years for HEPA filter damage. This represents a rough, order of magnitude agreement.

The FTA consists of 5 first level events feeding the top level event of burnback/HEPA failure - all connected by an "AND" gate:

Event 1: Air/oxygen source near final C4 HEPAs: in normal operation, C4 draw comes from both powder (inerted) and non-powder (air) gloveboxes. Mixing locations are not identified. Thus, air/oxygen will be present in the final C4 HEPA draw. The assumed probability is unity.

Event 2: C4 Suction/Draw on: the C4 system runs continuously to maintain negative pressure in the gloveboxes and is identified as a PSSC with emergency power supplies. The assumed probability is unity.

Event 3: Presence of intermediate HEPAs: currently, these glovebox and VHD HEPAs are not credited for any safety scenario and do not have management measures. The assumed probability of failure is unity.

Event 4: Enough Uranium Present:: this threshold has been identified as exceeding 250 grams to a final C4 HEPA, based upon heating the HEPA filter media up to its maximum design basis temperature. The applicant has identified 300 grams as passing through the prefilter. My estimates are 300-800 grams, depending on the scenario (spill, fire, glove breach). This value can go higher, depending on the particle size and the degree of entrainment by the glovebox draw (C4 suction). The applicant has no safety controls or specifications on the UO2 powders. The stated numerical values exceed the HEPA threshold value for one filter and are at least 50-80% of the threshold if the material is distributed uniformly over all four final C4 HEPA filters. Consequently, the assumed probability of sufficient uranium present is unity.

Event 5: Release Occurs: the UO2 is released within the glovebox by container mishandling (1 in 100 years or so) or a localized fire/burnback (1 in 30 years or so). This drives the current FTA.. I included loss of nitrogen in the fire/burnback part of the tree - it came in at about 1 in 5 years - this actually seems optimistic for a non-safety system, but I did not include durations (no design information).

I consider this a rough, order of magnitude estimate but it indicates a significant burnback/HEPA event is not highly unlikely. The FTA provides insight into the interrelationships and indicates that elevation of the intermediate HEPAs or the nitrogen inerting system to a PSSC would significantly reduce the probability of the top event and address the concern at the CAR stage.

I would like to see a letter from FCSS management go to DCS that communicates this and get the proverbial ball rolling - say, something like the following:

"The NRC has been reviewing the issue of potential uranium dioxide burnback at the proposed facility for almost three years, and the staff has had numerous interactions and meetings with DCS on the subject. DCS has recently proposed a safety strategy based upon using high strength, second stage roughing filters to protect the C4 HEPA filters so that the HEPA filters can perform their safety function. The NRC believes this is a positive development and has concluded that the prevention of particles from reaching the final HEPA filters is an acceptable strategy. However, the staff has conducted a number of analyses and has concluded that the information for the contols proposed by DCS for controlling burnback events may not have the ability to be implemented to meet Part 70 requirements (70.61 on Performance Requirements, and 70.64(a) on Baseline Design Criteria 3 and 5 [fire/explosion and chemical]) and, thus, this is not acceptable for the construction authorization phase. Fundamentally, the potential frequency of uranium dioxide powder passing through the second stage roughing filters and reaching the final HEPA filters, in quantities sufficient to impede the safety function of the C4 HEPA filters, is too high."

"Additional information is needed from DCS to address this burnback issue. The staff notes that DCS has identified additional protective features and intermediate HEPA filters in the system that are not identified with safety functions for the burnback event. The staff has concluded adequate assurances of safety could be achieved by crediting one or more of these as part of the safety strategy for the burnback event. In particular, inclusion of the glovebox HEPA filter and/or the nitrogen system as part of the safety strategy would reduce the potential frequency of the event by one or two orders of magnitude and would likely meet Part 70 requirements for the construction authorization phase. "

"This information needs to be submitted to the NRC in a timely manner to allow for adequate review by the staff, preferably within the next 30 days."

A letter like this should be followed up with a phone call on the subject.

Alex.