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White, John

From: Spindler, David
Sent: Monday, November 23, 2009 4:58 PM
To: Barber, Scott; Bamford, Peter; White, John; Brand, Javier
Attachments: prompt investigation.pdf

Gentlemen,

This is a copy of the licensee's prompt investigation for the apparent cause of the airborne problem.

Dave

6/15

ATTACHMENT 2
Event / Issues Report Format

Human Performance Issue Verbal Report Format (TMI-1)

Note: Most verbal reports should take no longer than one minute to complete.

1. Briefly Describe the Event/Issue that is Being Reported:

At approximately 1600, on 11/21 an unexpected increase in airborne radioactive activity developed in the Reactor Building. This was immediately evident by the alarming of local air monitors first in the B D-ring, then in other areas of the Reactor Building. The control room and OCC were notified and all work was stopped. Personnel were then directed to exit the reactor building until conditions could be assessed. Actions were then taken to cover reactor building openings, including lowering of the pre-installed curtain at the construction hatch, and covering the personnel hatch entrance area. RB purge supply fans were secured at 1635 to maximize purge exhaust ventilation flow and reduce air flow out of the construction opening. An Airborne sample taken at the inside of the construction opening at 1830 showed activity levels had reduced to normal levels. The calculated release for this event was 0.7% of the annual limit, equivalent to 0.1 mrem on an annual limit of 15 mrem.

Based on the facts, the most likely cause of this event is airborne contamination was drawn directly from the RCS by a change in RB ventilation (purge flow) through one of the openings in the RCS. The exit flow path from the RCS was most likely in the B D-ring due to the B D-ring AMS-4 alarm and the contamination levels of the workers in the B D-ring as compared to other areas of the reactor building.

The RB purge had been secured at 0458 due to low temperatures at the exhaust damper AH-V-1A approaching the low limit of 60F at the damper. Locally installed heater units required repositioning at the exhaust duct to ensure the NDTT min temp was not exceeded. This activity was completed and a new purge permit generated. RB purge was restarted at 1540.

EP-AA-1009 was reviewed for impact on EALs and no criteria were exceeded.

2. Defenses / Barriers

□ Facts:

The 'A' OTSG had been removed from the D-ring, the B cold leg pipe had been deconned, plugged, and covered and the A cold leg pipe was open with deconners performing a cleaning operation on the drain line.

The cold legs on the 'B' OTSG were cut and slightly separated from the RCS. The hot leg on the 'B' OTSG was cut and weld capped at the OTSG upper head and covered with an aluminum seal plate on the RCS side. The seal plate is not designed to be air tight.

The B OTSG bowl drain cap had just been tack welded prior to this event. The actual welding time was about 10 minutes. Low loose contamination and high fixed contamination were found in the weld area. Due to the low amount of loose contamination associated with this activity, it is unlikely that this was the cause of the event. The non-capped end of the drain line was later found to be covered with a glove, and thus could not be the source of particulate material.

RB purge was started at 1540 and up to full flow by 1550. The exhaust fans were started first followed by the supply fans. This combination could have created a small negative pressure event followed by a pressurization event. The B D-Ring AMS-4 alarmed at 1610. AH-E-3A and B (RB recirculation ventilation fans) are running and have been for most of the outage.

Personnel receiving internal dose were primarily located in the 'B' D-Ring. Those at higher elevations received larger internal dose. Consistent with this is that the contamination smears taken in the D-rings showed increased levels as elevation increased. This was more pronounced in the 'B' D-ring. There were fewer personnel in the 'A' D-Ring, but they did not receive internal dose.

The wet/dry vacuum used for the 'A' OTSG cold leg decon did not contain a HEPA. The operator of the wet/dry vacuum on the 'A' D-Ring cold legs was directly exposed to the vacuum exhaust and was not internally or externally contaminated. Although the wet vacuum was the incorrect tool for performing the decontamination work in the Reactor Building, since no personnel using the vacuum were contaminated, the wet/dry vacuum is not a potential source of this event.

Other RCS openings were at CF-V-5A, the 4 HPI nozzles, the center CRDM, both hot-leg pipe cuts, all 4 cold leg pipe cuts, and the 'B' OTSG upper head cut and manway. A HEPA unit was installed and drawing air from this manway, keeping a negative pressure in the RCS. All other openings were covered or tightly sealed.

Based on the above facts, the most likely cause of this event is that airborne contamination was drawn directly from the RCS by the change in RB ventilation (purge flow) through one of the openings in the RCS. The exit flow path from the RCS was most likely in the B D-ring due to the B D-ring AMS-4 alarm and the contamination levels of the workers in the B D-ring as compared to other areas of the reactor building.

□ **Additional Information:**

- (1) The HEPA unit that was configured to provide the engineering control of airborne activity in the 'B' OTSG skirt was found not operating. Initial observation by RP personnel found that the power source for this was in a 'tripped' status. The ALARA plan was crediting HEPA use for control of airborne activity. Subsequent interviews with RP personnel confirmed that the HEPA unit was operating and being used properly during this welding.
- (2) Since the D-rings are open only at the tops and bottom, the air flows upward through them just due to normal convection. After the OTSG construction opening was created in T1R18, the airflow pattern that was observed in the reactor building was that outside air flowed in through the equipment hatch opening and out through the construction opening due to its higher elevation. The route was through the grating to the basement, into the D-ring, and up to the operating floor, where it then flowed out through the construction opening. A recent estimate of the flow from an anemometer reading was 155,000 cfm. There is also some flow out through the personnel hatch because the Auxiliary Building is maintained at a slight negative pressure. When RB purge was started, this increased the air flow through the building and the D-rings. The result was

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that the increased air velocity was enough to carry localized contamination to the upper levels of the D-rings.

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|---|--|
| <input type="checkbox"/> Procedure Use & Adherence | <input checked="" type="checkbox"/> Radworker Practice |
| <input type="checkbox"/> Pre-Job Brief | <input type="checkbox"/> Placekeeping |
| <input type="checkbox"/> Turnover | <input type="checkbox"/> Housekeeping |
| <input checked="" type="checkbox"/> Planning | <input checked="" type="checkbox"/> Tool / Equipment Use |
| <input type="checkbox"/> Document Preparation | <input type="checkbox"/> Questioning Attitude |
| <input type="checkbox"/> Supervision / Management Oversight | <input type="checkbox"/> Workmanship |
| <input type="checkbox"/> Post-Job Critique | <input type="checkbox"/> Other |
| <input type="checkbox"/> Fundamental Behaviors (i.e., specific behavior from Functional Area and/or Cross Functional Fundamentals per HU-AA-1081 and/or SA-AA-0301) | THU Performance (HU-AA-1212) |
| <input type="checkbox"/> HU Tools & Verification Practices (HU-AA-101): | HU Risk Assessment, Process Risk Assessment, Pre-Job Brief, 3rd Party Review, Post-Job Critique. |
| <input type="checkbox"/> Outside of Procedures, Parameters, or Process (OOPs) | THU Practices (HU-AA-102): |
| <input type="checkbox"/> 3-Way Communications | <input type="checkbox"/> Self-Verification |
| <input type="checkbox"/> Verification Practices | <input type="checkbox"/> Effective Decision-Making |
| <input type="checkbox"/> Self Check / STAR | <input checked="" type="checkbox"/> Questioning Attitude |
| <input type="checkbox"/> Peer Check | <input type="checkbox"/> Risk Management |
| <input type="checkbox"/> Flagging & Robust Operational Barriers | <input type="checkbox"/> Peer Review |
| <input type="checkbox"/> 2-Minute Drill | <input type="checkbox"/> Supplemental Review |
| | <input type="checkbox"/> Independent Review Briefs |
| | <input type="checkbox"/> Technical Task Pre and Post-job Briefs |

3. Immediate Corrective Actions:

All work in the Reactor Building was stopped, and RP personnel promptly ensured a complete evacuation of the reactor building. Personnel are being monitored and released via appropriate processes. Reactor Building purge supply fan operation was stopped and airborne levels decreased to normal levels.

4. Extent of Condition -

Radiological surveys found elevated contamination levels in the upper areas of both D-rings, but more so in the 'B' D-ring. This is consistent with the elevated internal doses for personnel in these upper elevations.

5. Planned Actions - Normally complete a QHPI assignment type or higher (examples listed below, as applicable):

- Control RB purge supply and exhaust fan operation using EST tags to ensure that no starts/stops will occur without careful planning and consideration of radiological risks.
- Add the RB purge exhaust fans to the protected equipment list to ensure that changes to RB ventilation flow are minimized.

- **Inventory all vacuums and HEPA equipment used for breaching or working on the RCS to ensure that the correct equipment is being used and is in proper working order.**
- **Perform a review of all work packages used for breach of the RCS, ALARA plans, and RWP's to ensure that the appropriate engineered controls (including HEPA's and vacuum's) are defined.**
- **Perform air flow surveys within the RB D-rings with and without RB purge operating. (To support or refute conclusion.**
- **Reinforce the proper use of Rad work practices and Engineering controls with plant workers for all work that breach the RCS.**

Timeline info:

- 15:40 RB purge supply fans started
- 15:45 Final severance of RC-P-1C/D cold legs (from OCC status report at 1600)
- 15:50 RB Purge flow increased from 30% to 100%
- 16:00 AMS4 in D-ring basement alarmed.
- 16:15 Multiple air monitors in the RB were alarming.
- 16:35 Secured RB Purge Supply Fans
- 18:30 Air samples at construction opening show normal airborne levels

~~Ex 9~~