UT-BATTELLE

Hg System Decommissioning

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CERN

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OAK RIDGE NATIONAL LABORATORY
U. S. DEPARTMENT OF ENERGY

Day 1 Activities

- **Hg system draining preparations**
  - **Equipment in place (flasks, peristaltic pump, safety equipment, etc)**
  - **Extracted Hg system from solenoid**
    - **Radiation measurement center of snout ~70 μSv**
- **Optical fibers removed except for VP #2**

Day 2 Activities

- **Started Hg draining operations**
  - **Pumped into intermediate container 1st time**
  - **Moved peristaltic pump to container exit to provide Hg sample per CERN request**
  - **During this operation, Hg continued to gravity-feed into container, overflowing it**
    - **Per procedure, sump tank drain valve should have been closed after pump into container**

Spill Conditions

- **Operators and monitoring personnel wearing respiratory protection at all times**
- **Local ventilation in use**
- **Estimate total overflow ~200 ml**
  - **Most contained within tray or within container bucket**
  - **~50 ml fell onto plastic or directly onto floor**

Spill Response

- **Drain valve immediately closed upon condition recognition**
- **Pumped Hg into flask to remove overflow condition from intermediate container, then closed flask**
- **Personnel not wearing PPE requested to leave area**
- **Prepared Hg vacuum cleaner, started cleanup of larger Hg pools then entire local area**
- **Wiped equipment with HgX solution and prepared to continue draining operations**
- **CERN fire brigade responded as required, inspected area, then allowed us to continue cleanup**
- **CERN Chemical Safety inspected operations, allowed draining operations to proceed**

More Day 2 Activities

- **After drain operations continued, syringe pump drained of Hg without incident**
  - **Tilted Hg system as required to maximize fluid removed**
  - **Respirator use & local ventilation continued**
  - **Each full flask weighed and placed back into transport drums**
  - **Left Hg in vacuum cleaner storage canister and in plastic intermediate container**
- **Vacuum cleaner and local ventilation exhaust monitored during cleanup – no vapors detected**

Day 3 Activities

- **Met with CERN Medical personnel**
- **Removed Hg from vacuum cleaner and plastic container, poured into shipping flask**
- **Cleaned floor with HgX solution, let dry ~4hrs, used vacuum to remove remaining liquid**
  - **Hg vapors ~200 µg/m^3 at floor level, ~0 a few cm above floor**
- **Placed Hg-absorbing powder on floor, left overnight**
- **Drained hydraulic fluid from HPU**

Hg Removed From System

- **Includes Hg added from vacuum cleaner and plastic container**
- **Does not include CERN sample volume**
- **Assumed Hg in syringe < 0.5 liter**

	CERN Operations					
	System Fill 10 May 07			System Drain 5 Feb 08		
Flask No	Full (lbs)	Empty (lbs)	Loaded (lbs)	Empty (lbs)	Full (lbs)	Drained (lbs)
1	88.3	25.3	63.0	25.3	77.4	52.1
2	---	---	---	---	---	---
3	86.8	17.1	69.7	17.1	77.4	60.3
4	81.2	13.9	67.3	13.9	80.2	66.3
5	---	---	---	---	---	---
6	86.2	15.3	70.9	15.4	78.0	62.6
7	83.4	15.8	67.6	15.7	75.9	60.2
8	---	---	---	---	---	---
9	---	---	---	---	---	---
10	52.2	16.4	35.8	16.4	85.5	69.1
11	---	---	---	---	---	---
		Mass (lbs)	**374.3**		Mass (lbs)	**370.6**
		Mass (kg)	**169.8**		Mass (kg)	**168.1**
		Volume (liter)	**12.5**		Volume (liter)	**12.4**

Day 4 Activities

- **Blood sample taken by CERN Medical**
  - **Test results available in 2 weeks**
- **Cleaned Hg powder from floor**
  - **Vapor levels decreased by factor of 2 or better**
- **Reapplied powder to floor, will remove at 4pm**
- **Tools monitored and removed from area**
- **Hg system ready for transport**

Day 5 Activities

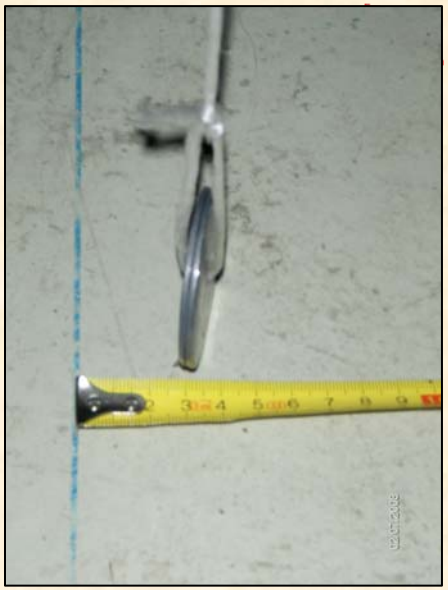
- **Performed final wipedown of spill area floor**
  - **Hg vapor readings ~20 µg/m^3**
  - **Indications from CERN RP are they are satisfied with our efforts**
- **Moved most of equipment out of ISR**
  - **Optical diagnostics crate to be shipped to BNL**
  - **Some large items need to be moved from ISR**

Lessons Learned

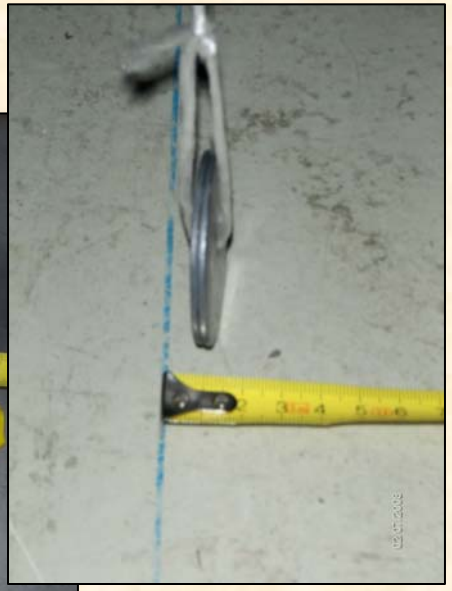
- **Don't deviate from procedure without careful consideration of possible consequences**
- **Perform dry run of operational procedures before real Hg operations**
- **Maximize amount of spill containment area**

Downstream Secondary Window

- **Window OD 11.2cm**
- **Exit point on window approximately (-2.6,2.6) relative to disk center**
- **Horizontal disk center ~3.5cm to side of nominal beam line**
- **Horizontal component of measured exit beam ~1cm to side of nominal beam line**



String Centered on Disk



String on V Mark

Upstream Secondary Window

- **Window OD = 4.83cm**
- **Entrance point on window approximately (-0.2, -1.0) relative to disk center**