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C-A OPERATIONS PROCEDURES MANUAL

10.2 Response to Tritiated Water Spills

Text Pages 2 through 6

Attachments

Hand Processed Changes

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Approved: \_\_\_\_\_ *Signature on File* \_\_\_\_\_  
 Collider-Accelerator Department Chairman Date

E. Lessard

## 10.2 Response to Tritiated Water Spills

### 1. Purpose

This procedure establishes controls for the Collider-Accelerator Support (CAS) Technicians and Water Systems staff to prevent a release of tritiated water to the sanitary system, the recharge basins, or directly on the ground.

#### 1.1 Definitions

- 1.1.1 Primary-water: Several dedicated primary-water cooling-systems are distributed throughout the magnet enclosures, supplying cooling water to magnets and rf cavities. The term primary-water is meant to imply that there is a potential to activate the water. A network of trenches in the experimental areas collects leaks from primary-water systems. Primary water entering the trench system is in most cases conducted to the sanitary sewer system after first being collected in sumps. If primary-water is collected in sumps, then sump-pumps MUST to be turned off in order to analyze primary-water before discharge.
- 1.1.2 Chain-Of-Custody: Before disposal, spilled primary-water must be sampled for radioactivity. Water samples are obtained using “Chain-Of-Custody” formality and are labeled to identify date, building no., and system name.
- 1.1.3 Dissolved radio-gases: Radioactive gases are created in primary-water. Less than a fraction of a percent of the gas will become airborne even if the water is exposed to air. However, water pipes and water vessels represent short-term direct-radiation hazards, if these gases are present in the circulating water. Typical radiation levels near the C-line cooling skid are 200 mrem/h during proton running. Waiting 10 minutes following shutdown of a beamline or shutdown of the accelerators will eliminate the hazard. The following radioactive gases are found in primary water, with O-15 being the most abundant.

Nuclide	O-14	O-15	N-13	C-11
Half life, minutes	1.2	2.1	10	20

- 1.1.4 Tritiated-water-spill: Any unintended release of primary-water. Primary-water in cooling systems may contain 12.3-year half-life tritium and trace amounts of other shorter-lived radioactivity. With the exception of experimental-area cooling towers, primary-water systems are closed and are always sampled before release.

1.1.5 Tritium levels in water systems are tabulated at [http://www.cadops.bnl.gov/AGS/Accel/SND/cooling\\_water\\_radioactivity.htm](http://www.cadops.bnl.gov/AGS/Accel/SND/cooling_water_radioactivity.htm)

**2. Responsibilities**

- 2.1 All CAS personnel who respond to primary-water spills are responsible for following this procedure.
- 2.2 The ESHS Division Staff assigned to C-A must assist in determining the radiological controls needed to prevent the spread of radioactivity either to personnel or to the environment.

**3. Prerequisites**

- 3.1 Personnel working under this procedure must be trained CAS Technicians or trained Water Systems personnel.

**4. Precautions**

None

**5. Procedure**

**Note 1:**

According to DOE, potential for 100 mrem is an event level at which internal dose assessment including bioassay (urine sampling) must be performed when a worker is exposed to contamination. The most active contaminated cooling water at C-A is the V-target cooling water. Drinking 200 gallons of V-target water, will deliver 100 mrem. If you are soaked from head-to-foot with V-target water, your dose from tritium would be much less than 1 mrem.

Tritium taken in the body is eliminated in urine and sweat with a biological half-life of 10 days. Tritium is uniformly distributed throughout all the soft tissue, and it would deliver a whole-body dose. The whole-body dose from a tritium intake is assessed by measuring the tritium output in urine. Accurate estimates of dose can be obtained weeks after an intake, and doses as small as a fraction of a mrem can be easily detected.

**Note 2:**

Public concern has been associated with unintentional release of low-level amounts of tritiated water from C-A. Thus, the following procedure is aimed at controlling tritiated water releases, releases that may be as simple as a few gallons of primary water from a broken water hose.

- 5.1 FOR THE SEM SYSTEM: IF a water mat alarms or IF a magnet power supply trips off on water flow, THEN
  - 5.1.1 confirm the magnet power supply is off, and
  - 5.1.2 valve-off the magnet's water-supply.

**Note:**

Locations for manifolds are shown on the map in [C-A OPM ATT 10.2.a](#). Magnet water supplies can be valved-off at these manifolds.

- 5.2 IF the valve
  - 5.2.1 does not shut the water off, or
  - 5.2.2 the water cannot be safely shut off, or
  - 5.2.3 the leak is at the manifold, or
  - 5.2.4 the leak is in the 4-inch piping that feeds the manifold,
  - 5.2.5 THEN contact the MCR Operations Coordinator (OC) and ask that the pumps to SEM be turned off.
    - 5.2.5.1 IF the MCR is not manned, THEN contact the Water Systems Group Leader, or ESHQ Division Head, or designee.
- 5.3 FOR THE C-LINE COOLING SKID OR AN SEM SYSTEM LEAK: Assess the leak and determine if spilled water is entering a trench or a floor drain.
  - 5.3.1 IF water is entering a trench or a floor drain, THEN turn-off the sump pumps to the sanitary-system lift-stations.

**Note:**

Locations for sump-pump disconnects are shown on the map in [C-A OPM ATT 10.2.a](#). Sump pumps can be turned off at these disconnects.

- 5.3.2 IF SEM is turned off, THEN call in C-A Water Systems personnel.

- 5.4 IF a spill occurred in SEB OR FEB experimental areas, THEN contact the on-duty C-A Radiological Control Technician (RCT) (x4660).
- 5.4.1 HAVE C-A RCT determine if protective clothing is required to clean up the area or perform repair work. Direct contact with C-A cooling water does not represent a contamination hazard due to very low levels of radioactivity. However, simple precautions such as gloves and shoe covers shall be used.
- 5.5 COLLECT a 1 liter sample of the spilled water in a clean container and attach a "Chain of Custody" form. A "Chain of Custody" form is available from the C-A Environmental Coordinator (X7520) or the Radiological Controls Division (RCD) Representative (X4660). Sample containers are available from C-A Water Systems Group or CAS Supervisor.
- 5.6 IF the spill is on the ground OUTSIDE a building, THEN contact the MCR (x4662) and request they implement the checklist in [C-A OPM ATT 10.1.d](#).
- 5.7 DETERMINE if repair work can proceed without causing further releases to the environment.
- 5.8 IF further significant releases to the environment are not likely, THEN MAKE necessary repairs and restore the system for operation as soon as possible.
- 5.9 SAVE and TAG any components replaced for future inspection.

## 6. **Documentation**

- 6.1 Any associated RWP records shall be maintained by the appropriate C-A Radiological Control Coordinator.
- 6.4 IF the checklist in [C-A OPM ATT 10.1.d](#) is used, THEN that checklist shall be maintained by the C-A Environmental Protection Representative.

## 7. **References**

None

## 8. **Attachments**

- 8.1 [C-A-OPM-ATT 10.1.d](#) "Operator Response to C-A Water Spills"
- 8.2 [C-A OPM ATT 10.2.a](#), "Maps Of SEM Manifolds And Sump Pump Disconnects In Building 912."