Room 157 Tritium Recovery System

Fill/Transfer Station (FTS) and Moving Cryostat Transfer Cart (MCTC) Operator Training

Walter T. Shmayda
Radiation Safety Officer
Laboratory for Laser Energetics
University of Rochester
Room 157 TRS treats all vacuum effluent and glovebox gases, reducing tritium to acceptable concentrations.
There are two fundamental technologies deployed in three types of tritium clean-up processes in the Room 157 Tritium Removal System to handle the various types of tritiated gases.

- There are three types of clean-up processes relevant to client operations:
  - Type 1 – Tritium in inert gas vacuum effluent getter bed technology
  - Type 2 – Airborne tritium vacuum effluent “burn and dry” technology
  - Type 3 – Glovebox gases special application of type 1

- Other subsystems
  - secondary containment loop
  - tritium fill station clean-up systems (TFS)
Type 1: Tritium in inert gas vacuum effluent

- Primary loop recycles to continuously reduce tritium concentration
  - drier removes HTO
  - Ni bed cracks organics
  - ZrFe bed removes tritium

- Secondary loop polishes gases prior to discharge to stack
Type 1: Tritium in inert gas vacuum effluent
Type 1: Tritium in inert gas vacuum effluent

- High and low DT manifolds to TCU
  - MCTC backing
  - inserter and passthrough pump out (helium)
- Watch tritium monitors for tritium removal
- Watch pressure/dewpoint for pump-out operations
Type 1: Tritium in inert gas vacuum effluent – problems

- Too high tritium concentration
  - alarm at TMT-8601
  - use care with high volume or high-activity sources

- Air ingress
  - high moisture at inlet (DPT-8601)
  - TCU subsystem automatically shuts down
  - moisture is already in system – potential for bed damage

- Probable causes (air)
  - inserter pump out
  - failed to close valve before disconnecting cart vacuum hose
  - leak into vacuum manifold or suction side of pump
Type 2: Airborne tritium vacuum effluent

- No getter materials employed
- Catalytic reactor oxidizes all forms of tritium
- Mole sieve driers remove oxidized tritium before discharging air to stack
Type 2: Airborne tritium vacuum effluent
Type 2: Airborne tritium vacuum effluent

- Air vacuum manifold
  - MCTC, CS, or interspace pump out
  - passthrough pump out (air)
  - tritium monitor decon

- Regen manifold
  - drier regeneration
  - nickel bed regeneration

- Watch tritium monitors for tritium removal
- Watch dewpoint after primary drier
- High flow can interrupt pumping operation
Type 2: Airborne tritium vacuum effluent – Problems

• Air depletion
  – catalytic reactor needs oxygen
  – check status of air bleed flow
  – monitor TMT-8702 and 8703

• Drier loading
  – monitor dewpoint during large volume pump out

• Loss of cooling water will cause shutdown
Type 3: Glovebox gases

- Drier removes HTO
- Ni bed removes oxygen and cracks organics
- ZrFe bed removes tritium
Type 3: Glovebox gas cleanup
Type 3: Glovebox gas cleanup

- Continuous scrubbing of glove-box gas
- Removes oxygen and moisture that permeates through gloves
- Removes tritium
- Provides glove-box pressure control
- Monitor dewpoint for evidence of in-leakage
Type 3: Glovebox gas cleanup – Problems

- In leakage
  - monitor dewpoint instruments
  - check glove-box pressure control behavior
  - pass-through doors?
  - glove integrity?
- High tritium concentration
  - check instrument loop flow (0.8 cfm)
Other systems and subsystems

- TFS Glovebox Cleanup
  - Type-3 system, same as Room 157 TRS, same concerns

- TFS Process Loop Getters
  - Type-1 system, no drier
  - on-demand system (unlike Room 157, always-on system)

- DTHPS Secondary Containment
  - simple closed loop with ZrFe bed for tritium scrubbing
  - essentially Type-1 (no protective beds due to closed loop)

- Vacuum Pumps GUI
SECCON sequentially removes tritium from secondary containment spaces within DTHPS
SECCON – getter bed only

- single Zr-Fe getter bed
  - system is contained within DTHPS glove box
    (drier and nickel bed not required)

- Has U-bed backup for major DT releases

- Verify “Auto Sequencer” is ON and correctly set
Vacuum Pumps GUI displays status of interconnecting manifolds between pumps enclosure and subsystems.
Pass-through etiquette

- A pass through should always be at vacuum
- Back-fill with appropriate gas
  - air for access from outside getter bed
  - helium for access from getter bed
- Pump down to correct system (most are interlocked)
- Verify door is properly closed after use
- Evacuate – verify TRS is responding correctly
- Leave at vacuum for process safety
Points to remember:

• Are you about to send air or inert gas to the TRS?
• Have you closed valves/doors?
• Verify TRS parameters before initiating any procedure
  – TRS may not be ready for large influx (volume OR concentration)
  – who else is hooked up to the manifold you will use?
• Systems are not fully represented on GUI’s
• Confer with TRS operator before roughing FTS/DTHPS spaces
• Always respond to alarms!