NuMI Radiation and Environmental Protection

NBI2006 - 6th International workshop on
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Environmental Concerns

- Groundwater Protection
  - NuMI tunnel is in an Aquifer
- Surface Water
  - Sump water is pumped from NuMI tunnel to the surface
- Air Emissions
  - Air from Target Chase and Absorber region are vented to the surface
  - This is done after a long passage through the decay pipe to reduce the radioactivity levels of short lived radionuclides
- Component Activation
  - Personnel Protection, Hot Handling, etc.

All of this is important and has our attention

Was expected during the design phase of NuMI

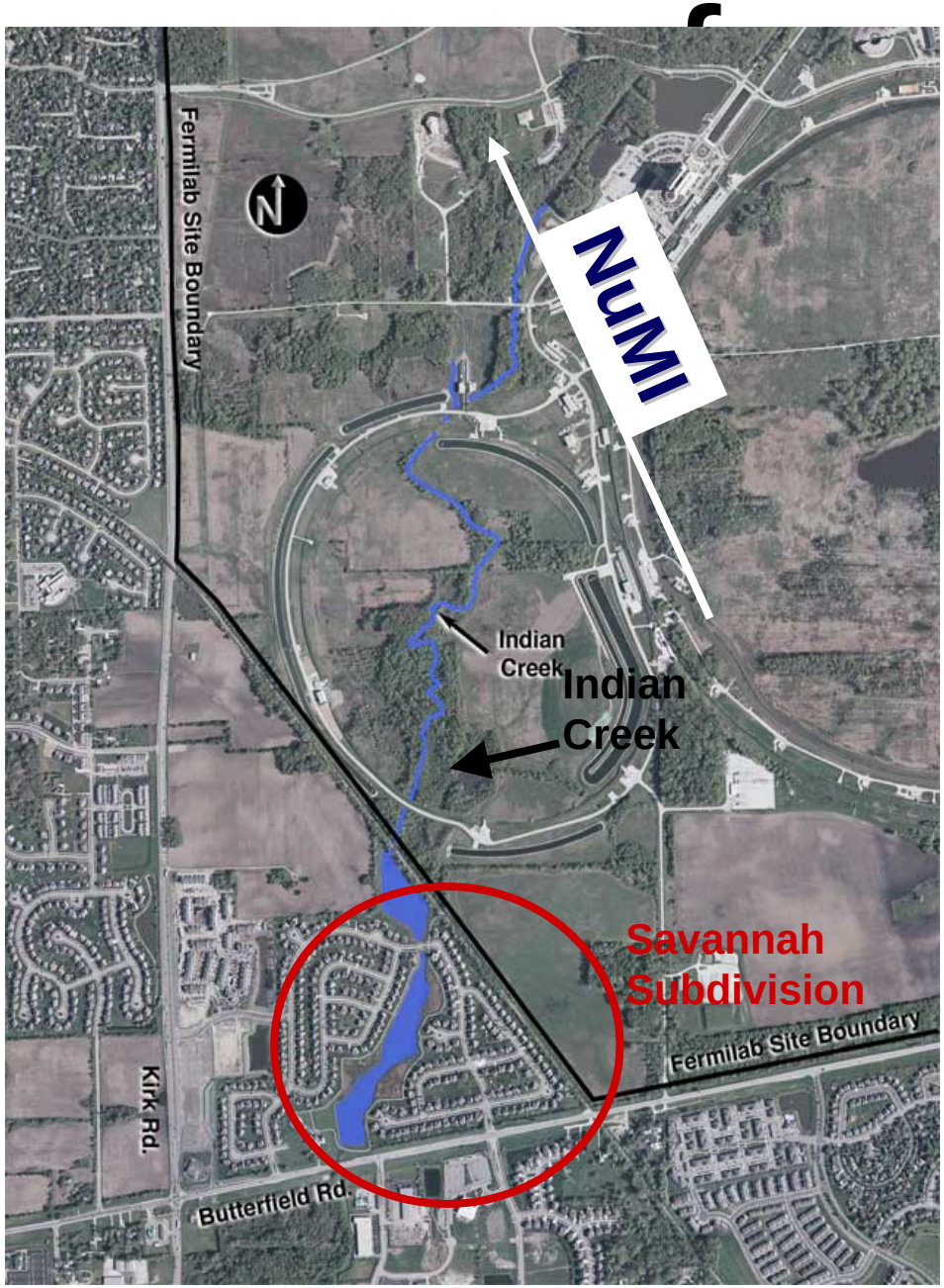
Being re-evaluated for the SNuMI upgrades

Much of this is "Standard Stuff" for ν beamlines

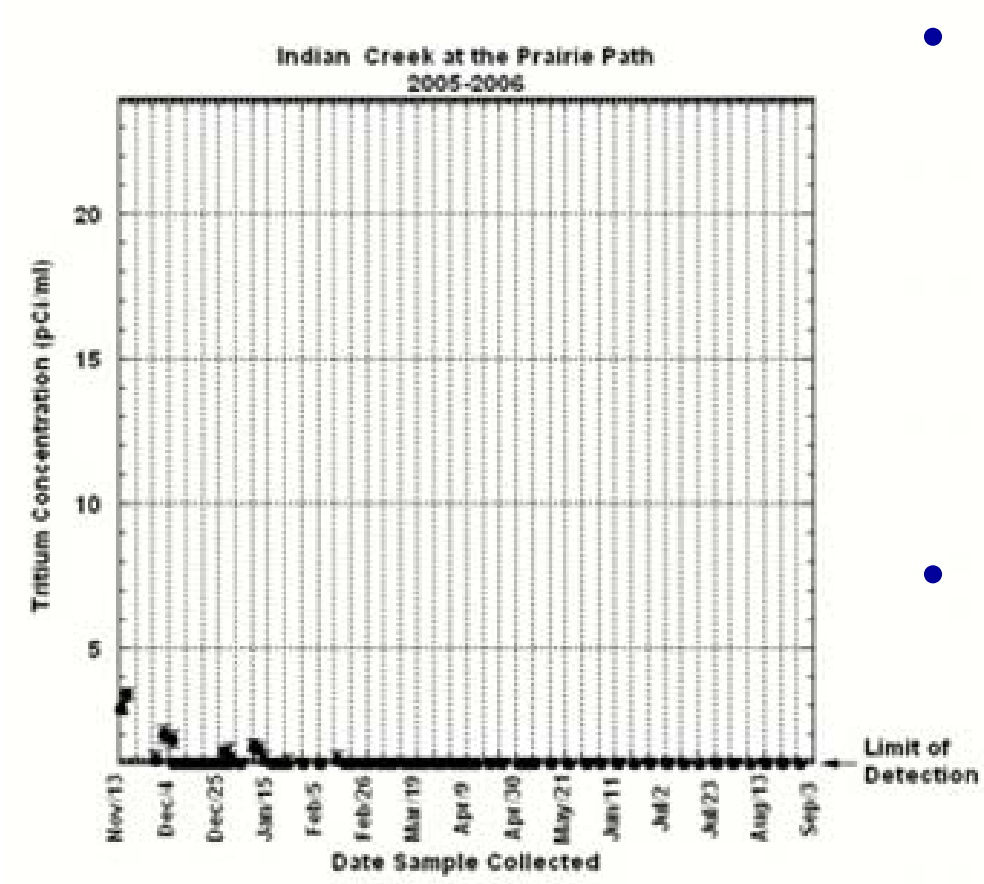
I will say a few words on Tritium Production since this became an important topic as we started NuMI operations

Chronology

- Last November detectable levels of tritium were measured in the Indian Creek discharge from the Fermilab.
  - First observation ever of tritium in any water flowing off our site
  - Indian Creek flows through the Savannah subdivision
  - Measured 3.3 pCi/ml (site boundary)
    - DOE regulatory limit for surface water is 2000 pCi/ml
    - (20 pCi/ml for drinking water)
- Task Force established and mitigation implemented
- Currently measurements are all below the detection limit of < 1 pCi/ml



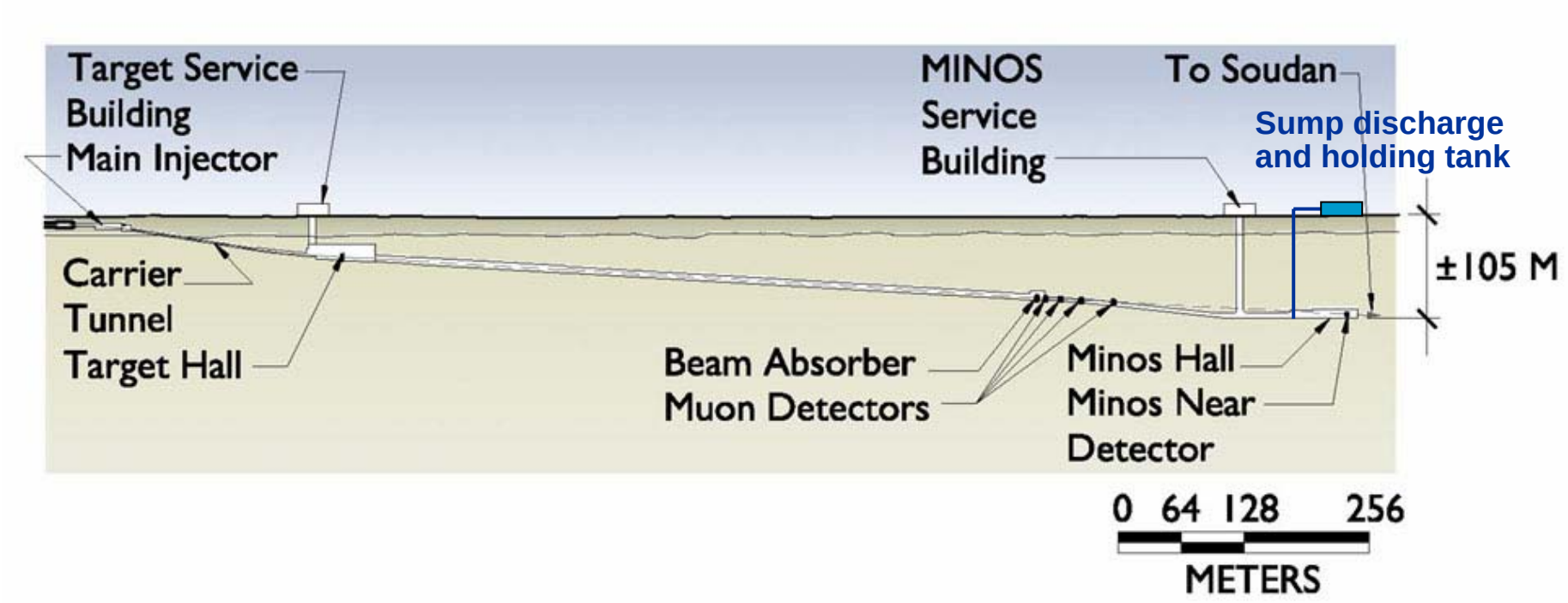
Indian Creek Measurements



- The immediate source of tritium in Indian Creek in November was identified as water leaking into the creek from a damaged pipe connecting Main Injector ponds C and D.
- The pipe was pumped out and blocked off: Currently under repair

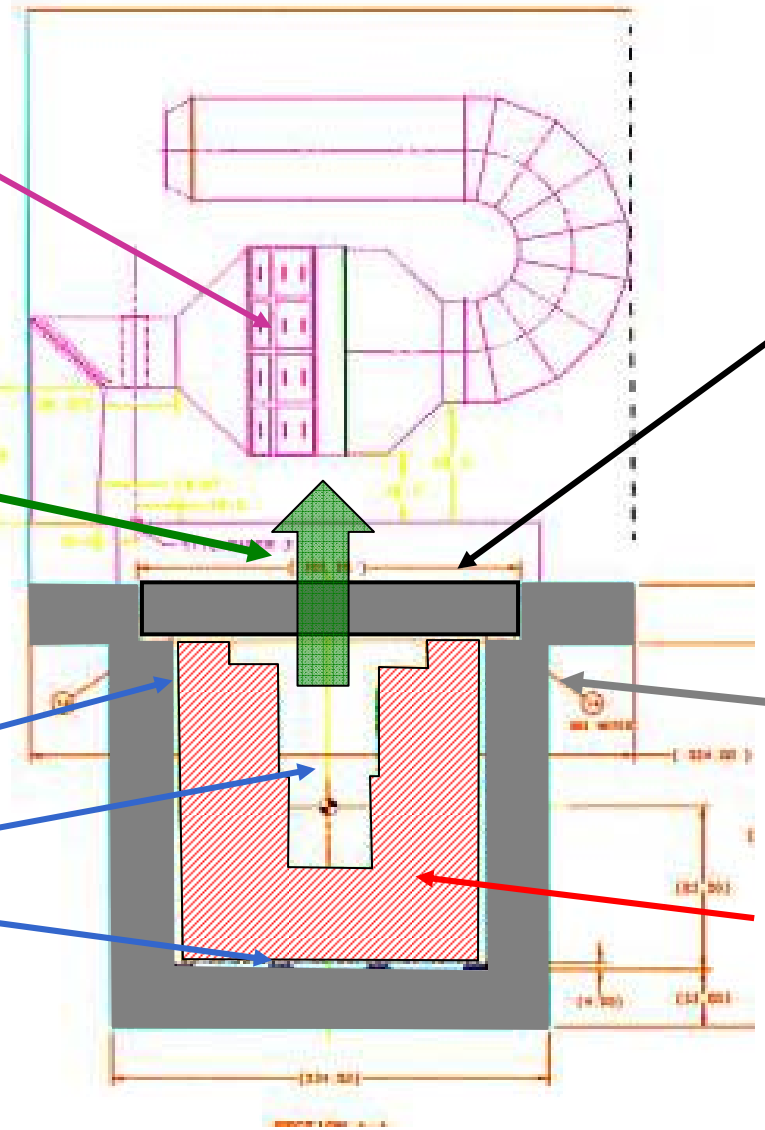
http://www.fnal.gov/pub/about/community/chart.html

NuMI as Source of Tritium



- Water flowing into the NuMI enclosure is collected in the MINOS cavern and pumped to the surface
  - ~175 gallons per minute
  - Design protects the aquifer by bringing tritiated water to the surface

Target Chase Cooling



Chiller Condensate

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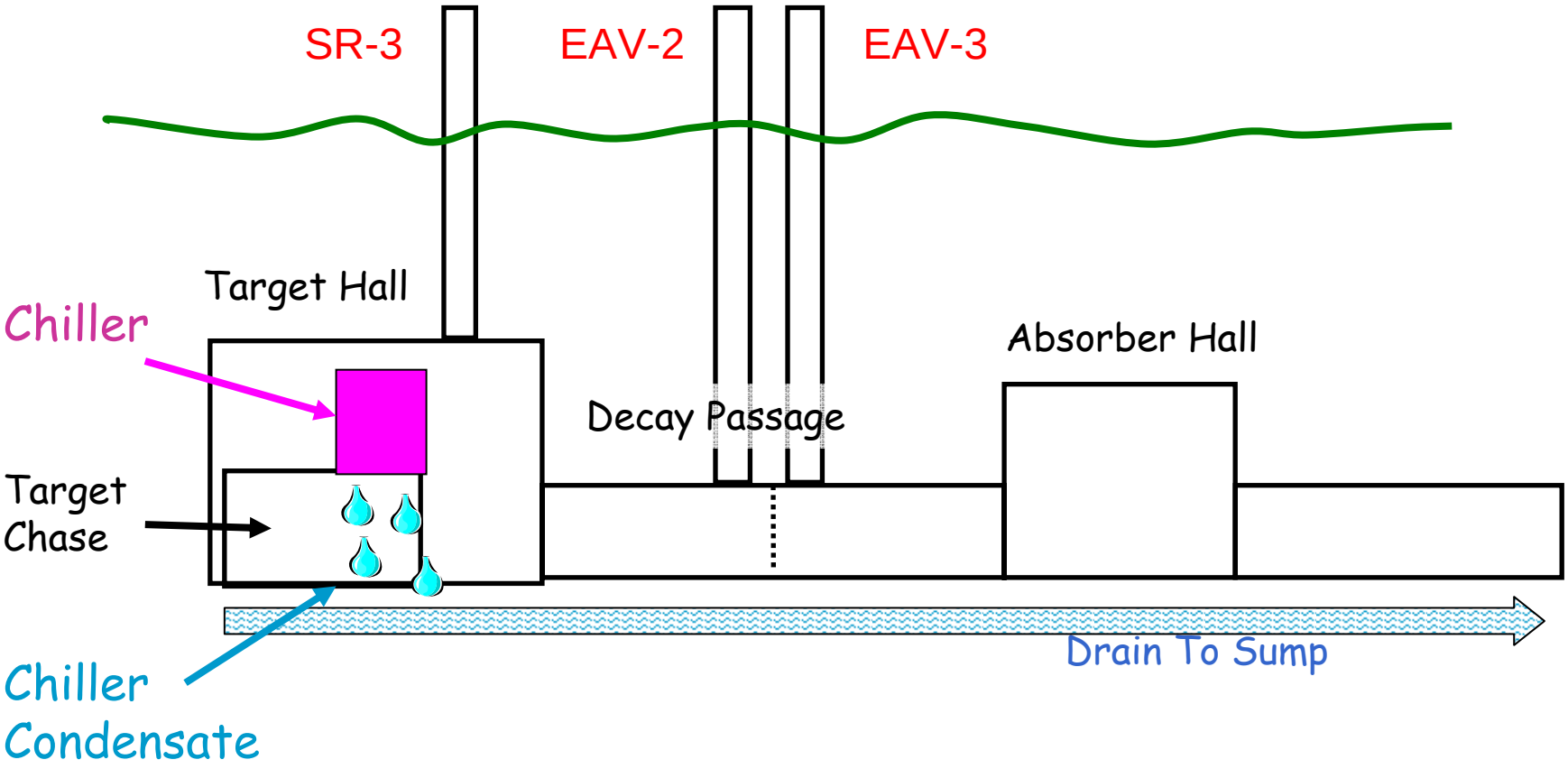
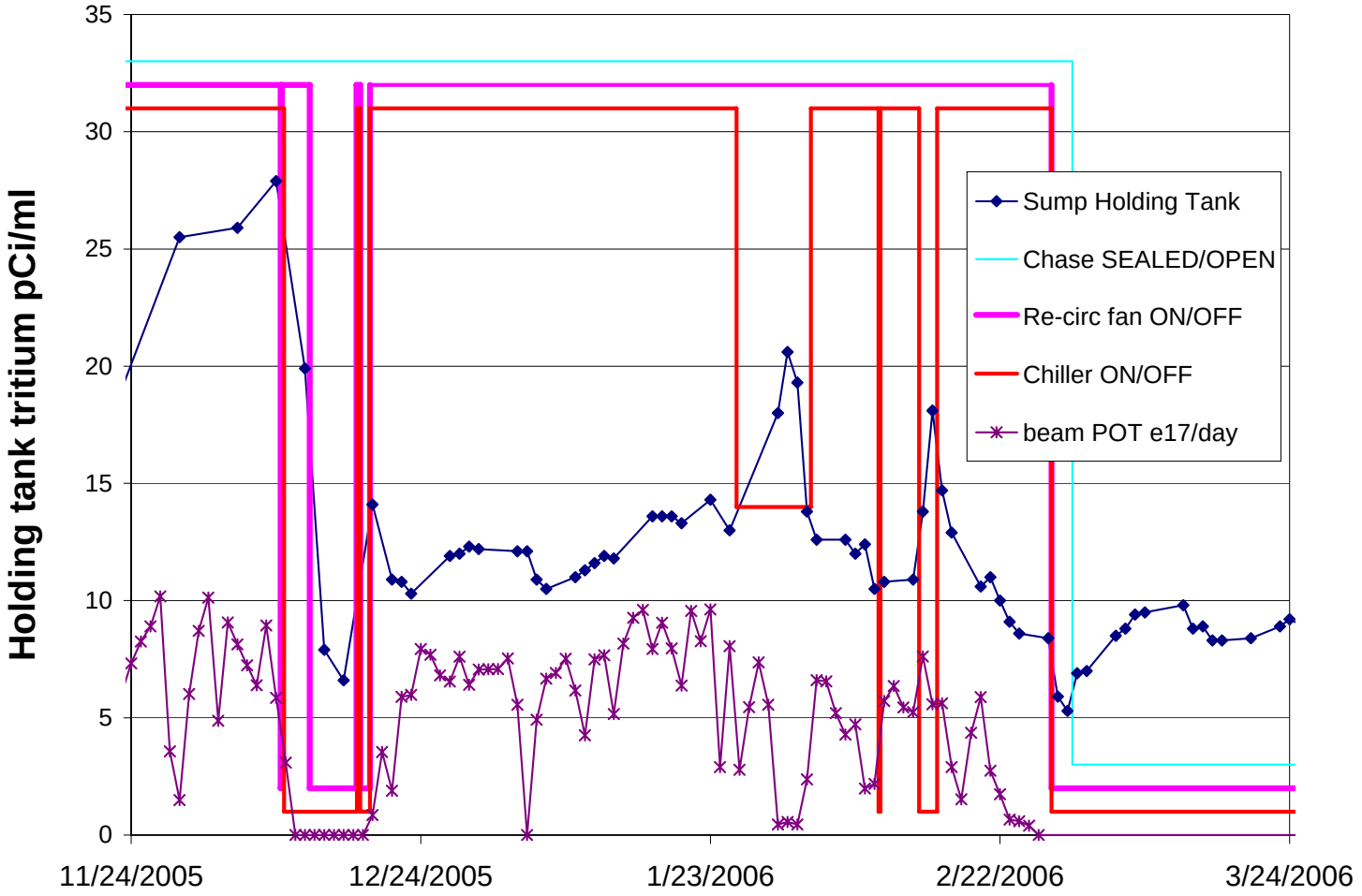


Chiller Condensate Collection

Chiller Condensate Tank

Condensate Collection



Dehumidification

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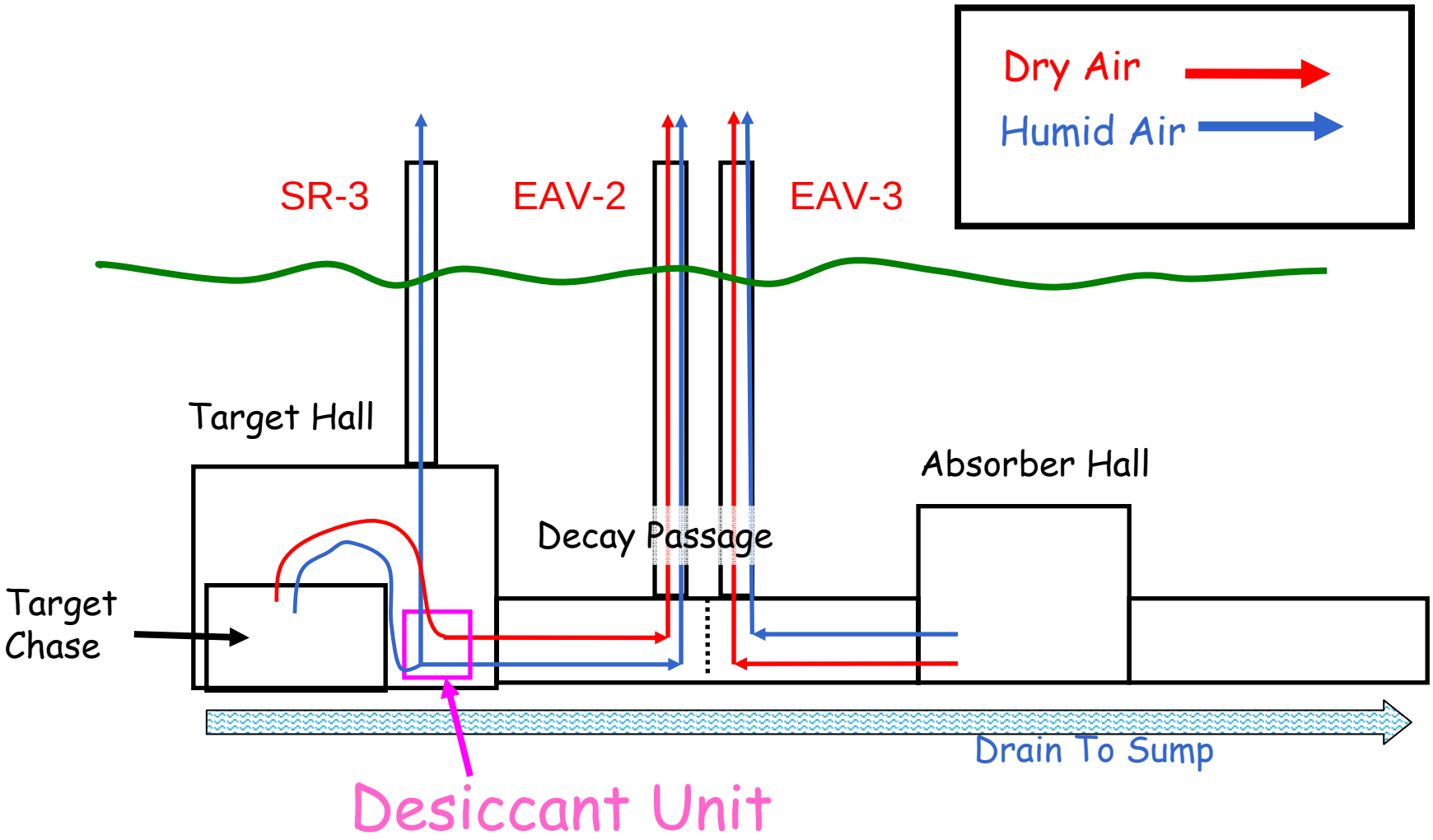
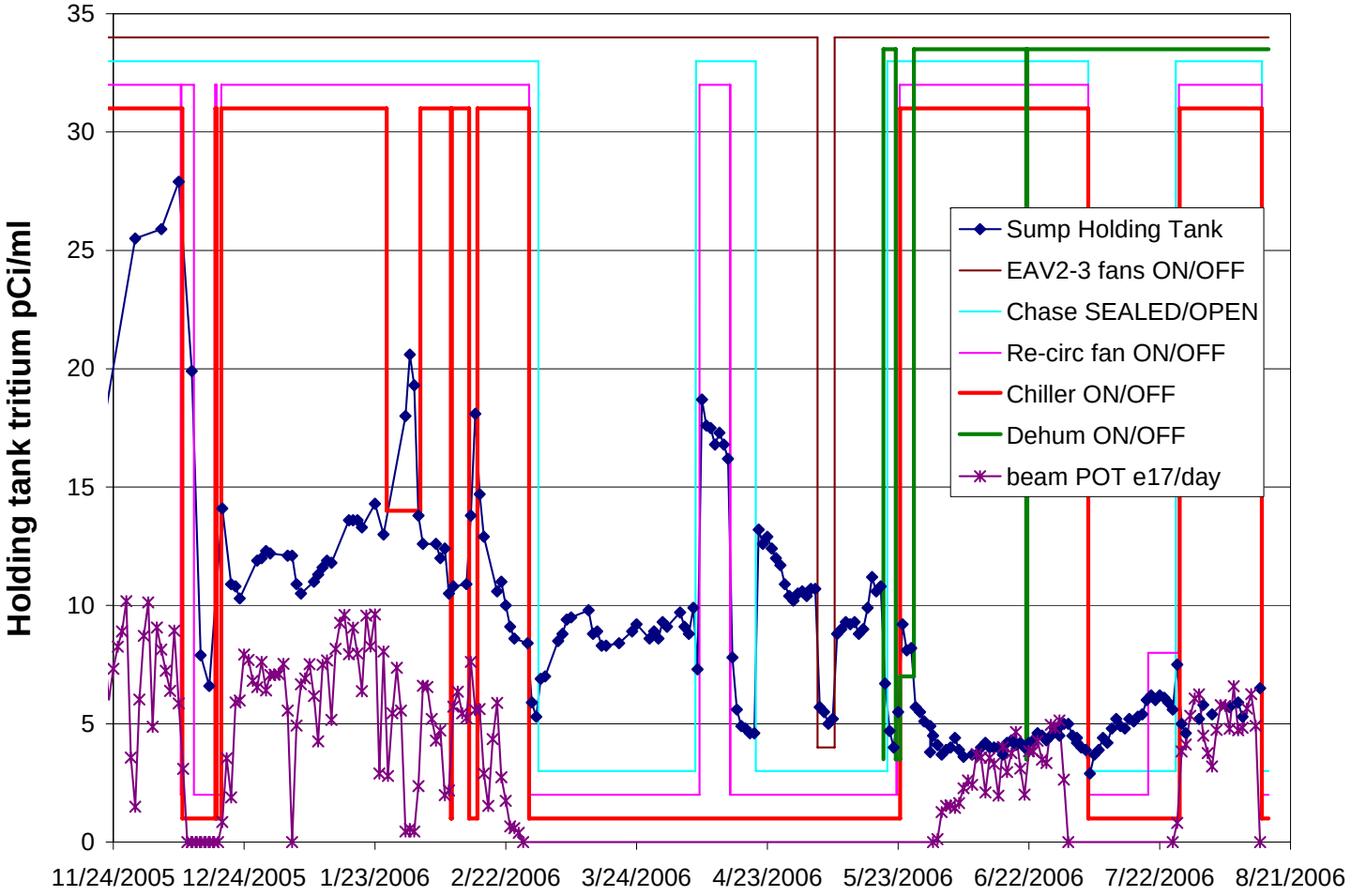


Desiccant Units

Dehumidification Results



Summary of Mitigation

- As of November 2005 the major contributor to tritium within our surface waters is water being pumped out of the NuMI enclosure.
  - 175 gpm @ ~30 pCi/ml in November
  - Result: Essentially all Fermilab surface waters are in 1-5 pCi/ml range
- In December 2005 we identified a major contributor within the enclosure: condensate from an air conditioning unit in the target area.
  - Represents ~60% of the November concentration.
  - Condensate is being collected and disposed (1-2 gph).
  - Result: Holding tank levels between 10-25 pCi/ml.
- In March 2006 installed de-humidifers in the target hall
  - Prevents tritiated humidity from passing through the decay hall and mixing with the tunnel water
  - Result: Holding tank levels are between 5-6 pCi/ml