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Progress Report on Tritium Management

Presentation to Fermilab Community Advisory Board

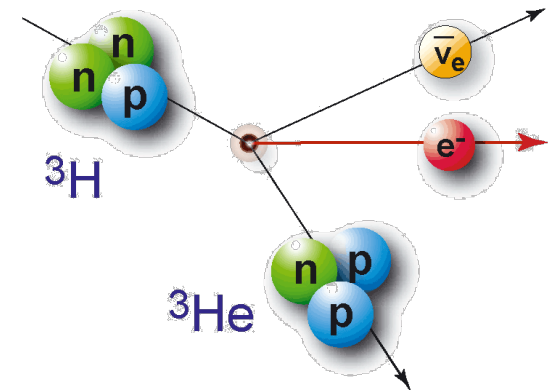
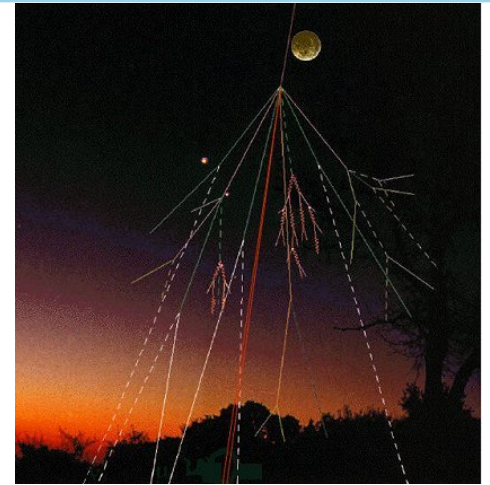
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March 23, 2017

Progress since September 2016

- Tritium Task Force, established in July 2016 in response to an external review in June 2016, now coordinates tritium-related work across divisions and sections.
- 6 panels work on various issues (see overview next slides)
- Submitted 6-month progress report to the Director and DOE-Fermi Site Office on schedule by February 1, 2017
- Planning for follow-up external review in summer 2017.

What is Tritium?

- Tritium (^3H) is a weakly radioactive form of hydrogen with a half-life of 12.3 years.
- In nature, tritium is produced when cosmic particles hit the atmosphere.
- At Fermilab, small quantities of tritium are the byproduct of accelerator operations.
- Its decay emits particles of very low energy that cannot penetrate the skin.
- Tritium can only be harmful if people drink water with high levels of tritium over many years.
- Tritium does not build up in biological tissues; the biological half-life for tritiated water (HTO) is about 12 days.



Work of Panels

Neutrinos at the Main Injector Panel

- NuMI beamline is handling additional beam power very well
- Have twice the beam power than 10 years ago, and yet tritium levels in surface water have stayed very low, pretty much the same.
- Working with other panels on possible connections between NuMI water and sewers.
- Preparing for increased beam powers for future operations, with applicability to optimize LBNF/DUNE design.

Booster Neutrino Beam Panel

- Hired a consultant with a national reputation to advise us on water management; proposed a phased approach:
 - Phase 1: Improve surface water management
 - Phase 2: Explore the idea of installing water extraction wells
 - Phase 3: Install new surface liner, possible “grouting”.

Work of Panels

Accelerators and New Projects

- Working with other panels to review sampling locations and frequencies.
- During summer beam shutdown will install “meters” on most sumps in accelerator to get better information on amount of water pumped out of the accelerator tunnels.

Water Systems

- Gained improved understanding of how water moves about the site.
- Found some places where tritiated water can enter sewers. But this is not yet the complete explanation of the low levels of tritium we measure in the sewer.
- Coordinating with other panels on input to monitoring program.

Work of Panels

Environmental Monitoring

- With other panels, refining identification of monitoring locations.
- Installing an additional “autosampler” in sewer system.
- Optimizing monitoring plan.

Communications

- Reviewed public websites and updated where necessary.
- Posted latest tritium measurements
- Presented at Savannah Homeowners Association mtg on March 7
- Plans for communicating with the public about new identification of very low but measurable tritium concentrations in surface water flowing into Ferry Creek (see next slides).
- Working with the CAB!

Creeks and Surface Water at Fermilab



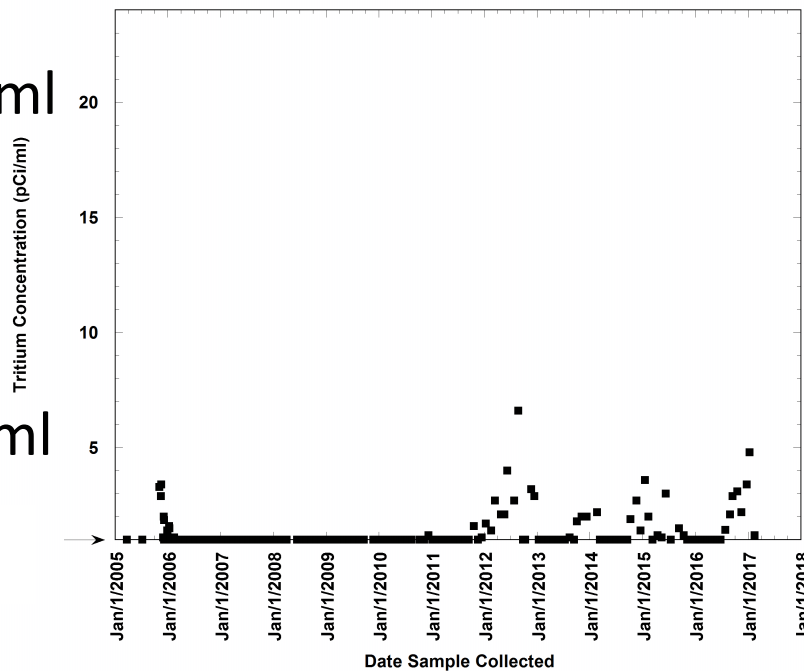
Latest Surface Water and Sewer Results

Indian Creek at the Prairie Path

Indian Creek at the Prairie Path
2005-2017

20 pCi/ml

1 pCi/ml

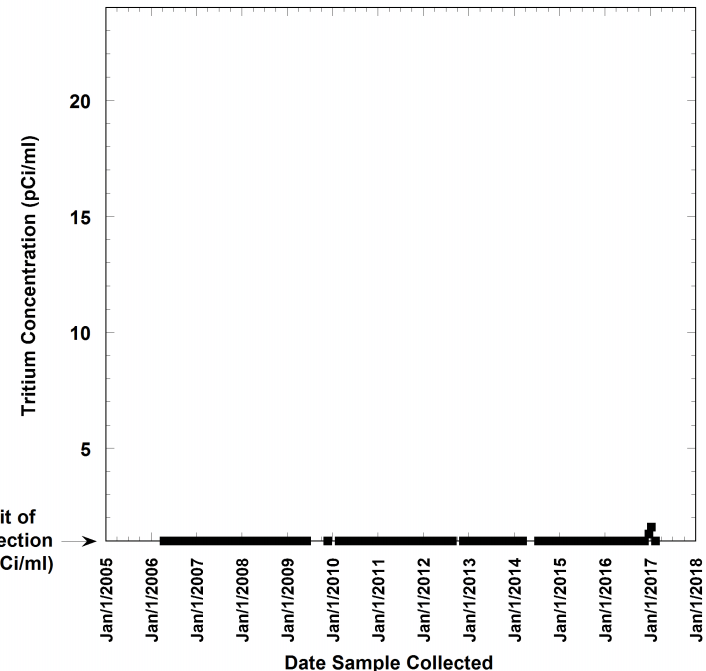


2005

2017

A.E. Sea at Ferry Creek

A.E. Sea at Ferry Creek
2005-2017



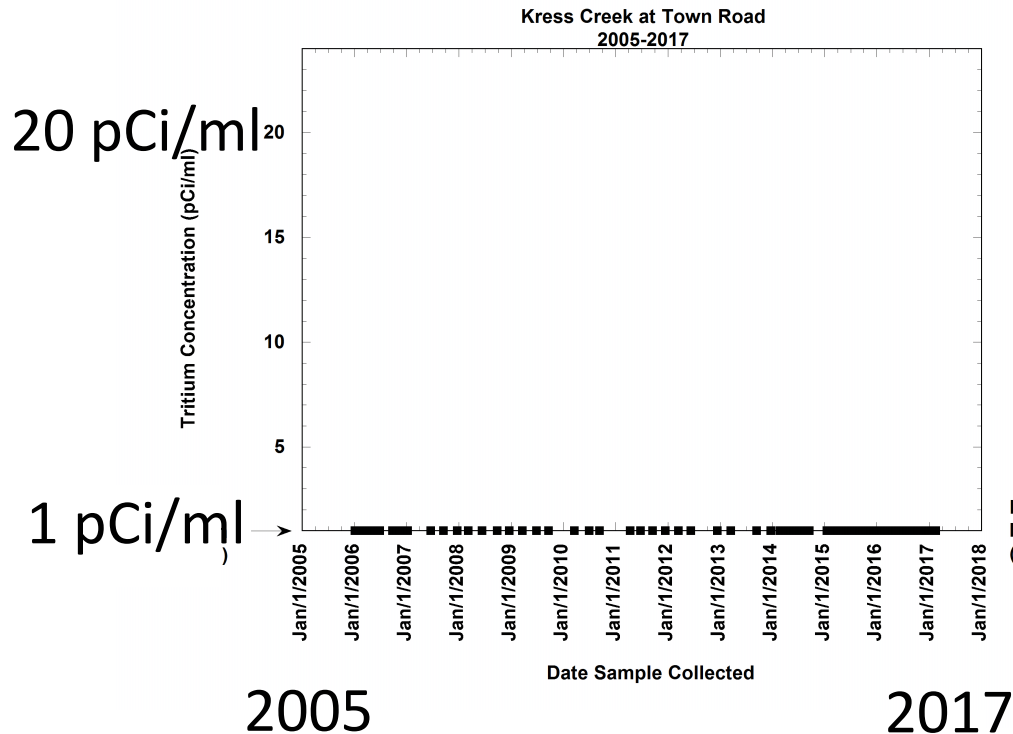
2005

2017

Regulatory limit for surface water: 1,900 pCi/ml

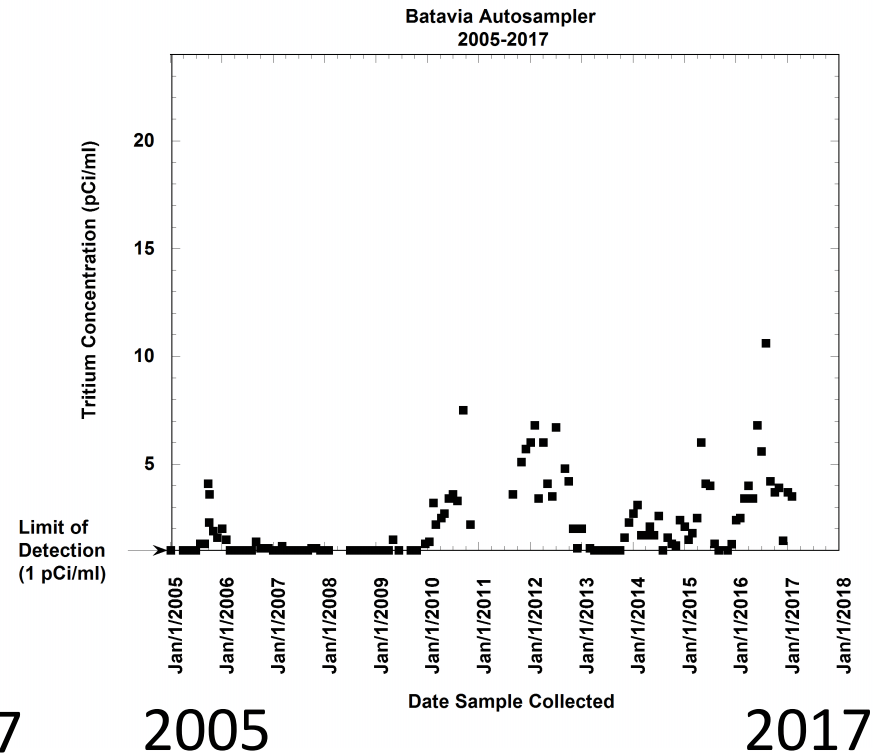
Latest Surface Water and Sewer Results

Kress Creek at Town Road



Regulatory limit for surface water: 1,900 pCi/ml

Sewage water to Batavia waste water facility



Regulatory limit for sewage water: 9,500 pCi/ml

Measurable Tritium in Water Flowing into Ferry Creek

- Highest value seen is 1.6 pCi/ml, still far below the drinking water standard of 20 pCi/ml and far, far below the DOE surface water standard of 1900 pCi/ml.
- Last sample showed a return to being undetectable.
- These values were reported to the Illinois Environmental Protection Agency as required by our state permit.
- Context:
 - Due to higher proton beam powers, have seen an expected rise in the low levels of tritium concentrations in all surface water at Fermilab.
 - Last year more water than usual was pumped to the east side ponds for storage due to an extensive modernization of our industrial cooling water infrastructure. This project is nearing completion.

Outlook

- Fermilab accelerator complex will be shut down for about 3 months this summer for maintenance and improvements.
 - Like in the past, will use the time also to make improvements that will help reduce the low levels of tritium in surface water, keeping levels as low as reasonably achievable
 - Will host external review committee in summer 2017.
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- Questions?