

Update: tritium at Fermilab

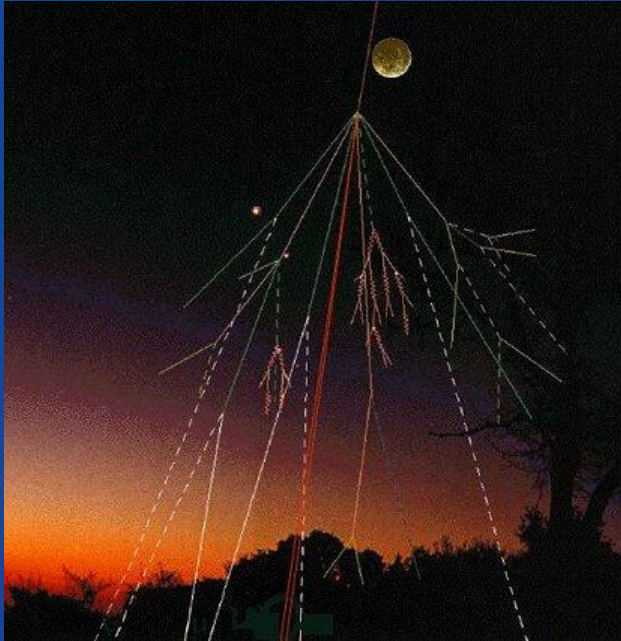
Fermilab Community Advisory Board

January 26, 2012

Kurt Riesselmann, Fermilab



How is tritium produced?



- In nature, tritium is produced when cosmic particles hit the particles in Earth's atmosphere
- Tritium is also produced in small quantities in accelerator operations. When a particle hits another particle, it can create processes similar to those in Earth's atmosphere.

What is tritium?

- Weakly radioactive form of hydrogen
- Has a half life of 12.3 years.
- Becomes part of water molecules like normal hydrogen
- Cannot penetrate skin.
- Does not accumulate in body when ingested.
- But: drinking water with high levels of tritium poses cancer risk.

Looking for tritium at Fermilab

- Fermilab has had a monitoring program for about 35 years.
- In 2005, the program found for the first time tritium in surface water on site.
- Levels are well below regulatory limits

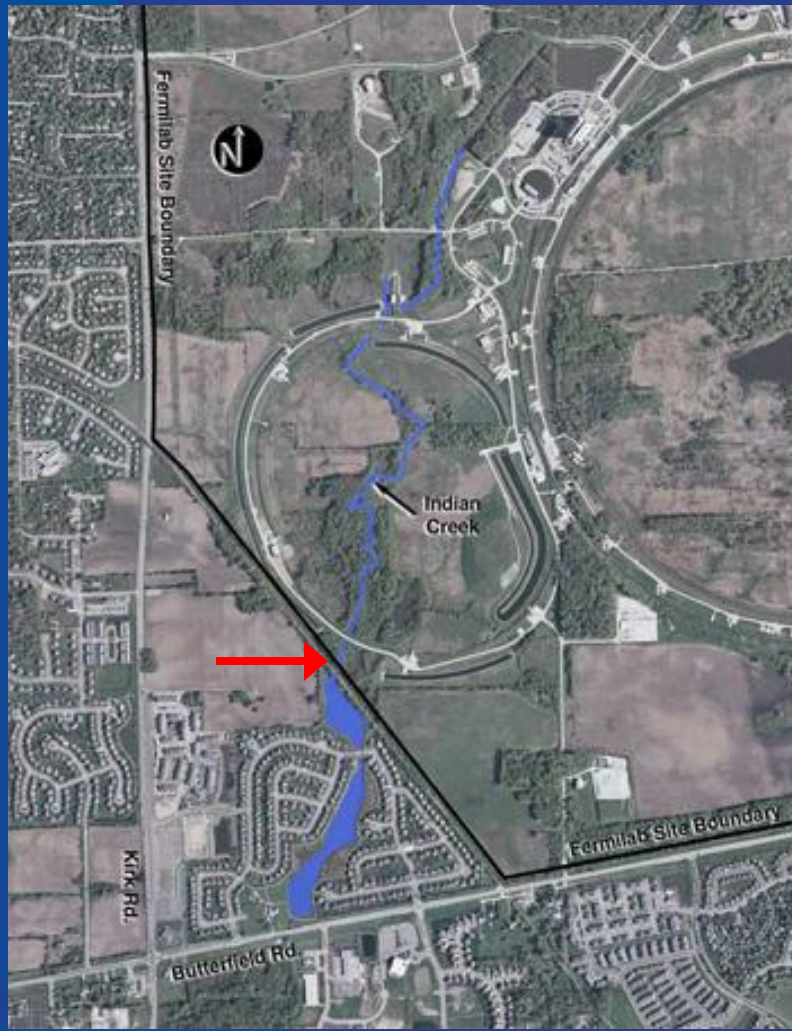
Surface water at Fermilab



The Fermilab site has numerous ponds and is the origin of Indian Creek and Ferry Creek.

Fermilab uses water to cool accelerators and other equipment.

What are low/high levels of tritium?



Surface water limit for DOE:
1900 pCi/ml
(picocuries per milliliter)

Federal drinking water limit:
20 pCi/ml

Our routine testing of surface water at Fermilab revealed low tritium levels in Nov. 2005:
3-4 pCi/ml

Standard detection limit:
1 pCi/ml

Indian Creek in Dec. 2005



In connection with our findings on site, we also detected small amounts of tritium in surface water leaving the Fermilab site in Indian Creek: 3-4 pCi/ml found at site boundary.

Indian Creek runs into a pond in the Savannah subdivision.

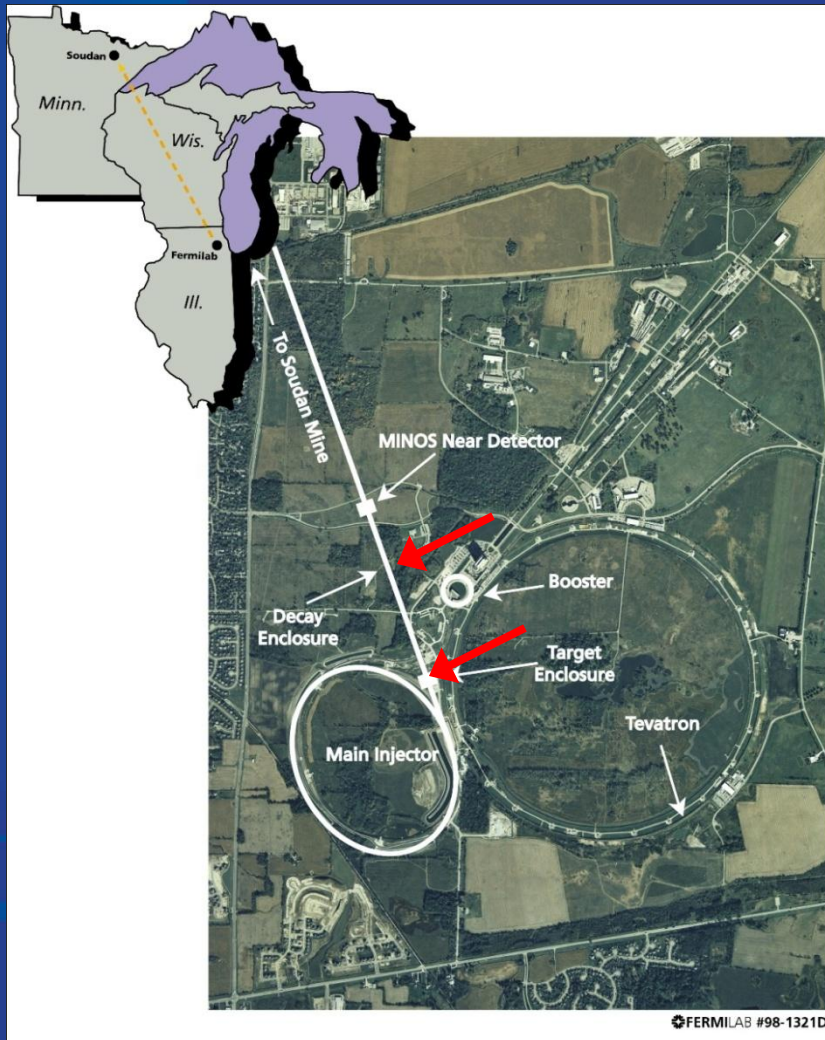
Indian Creek during summer



Indian Creek starts on the Fermilab site.

During dry months, very little water flows off Fermilab site through Indian Creek.

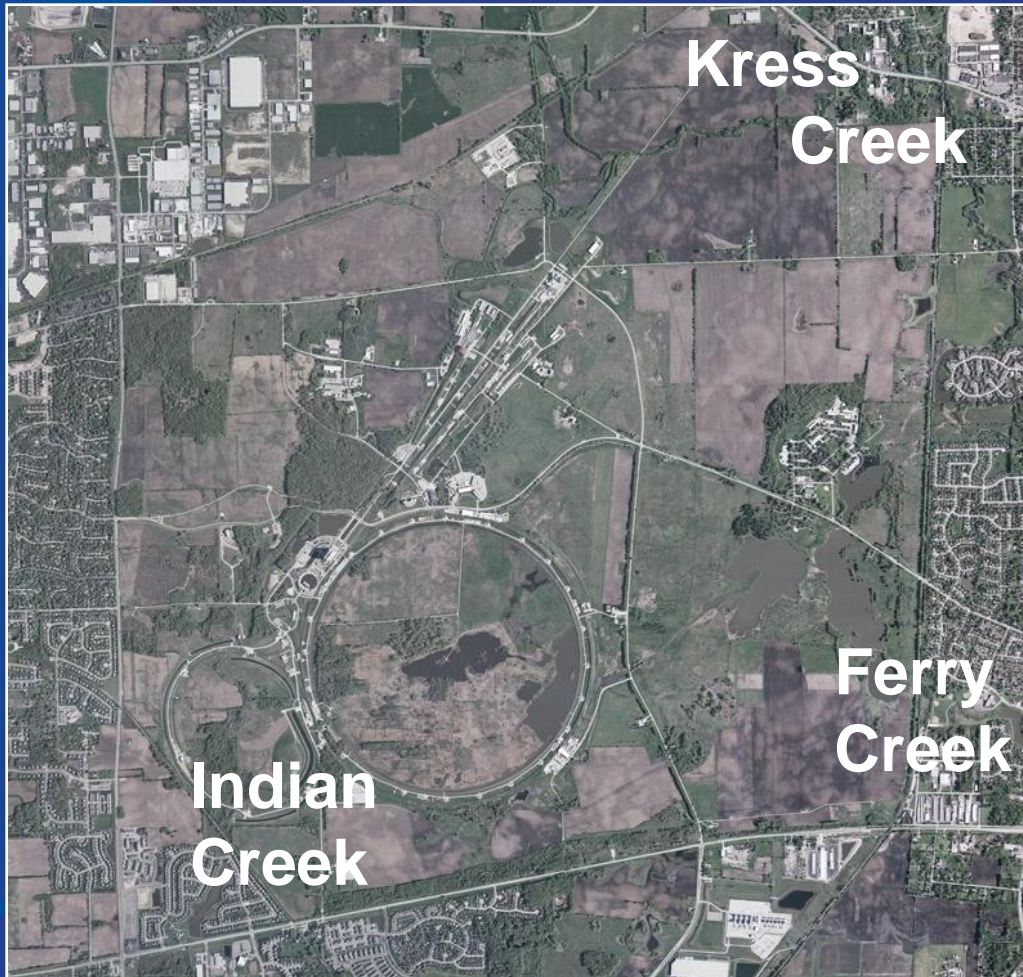
Where is the tritium coming from? Why did it show up in 2005?



In March 2005, Fermilab started operating a new proton beam line to create neutrinos for the MINOS experiment. It is the main source of tritium at Fermilab.

Prior to this, Fermilab had never detected tritium in surface water.

Actions taken



In Dec. 2005:
We informed regulators.

We informed our neighbors
and employees.

Simultaneously, we told the
Community Task Force and
got their advice.

We had an article in Fermilab
Today and created a public
website.

Since then:
We've taken many steps to
reduce the amount of tritium
that can get into water on site.

10 December 2005

In the News

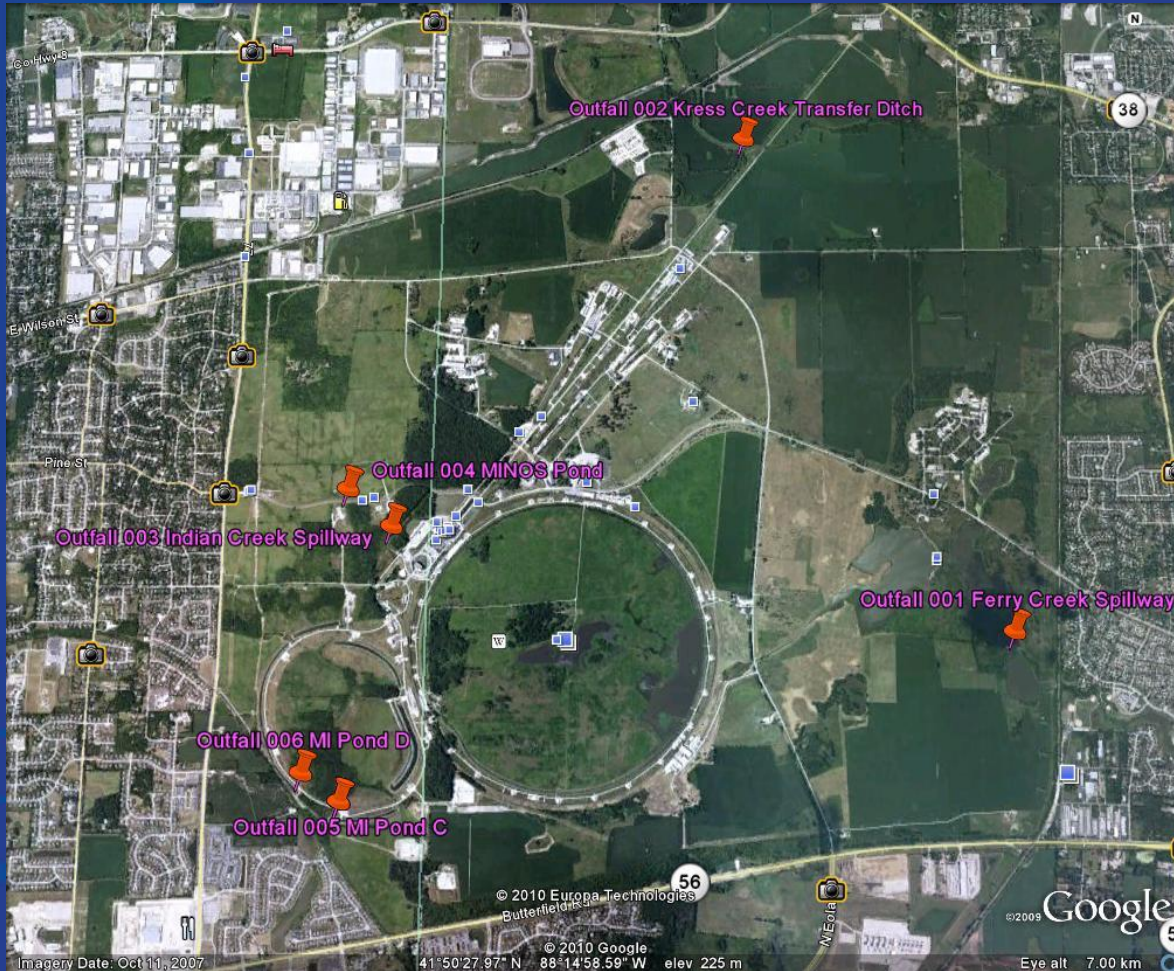
From *The Beacon News*,
December 10, 2005:

Fermilab: No cause for alarm. Small amounts of tritium found in Indian Creek

BATAVIA — Staff members from Fermilab trudged through the falling snow Thursday, delivering letters to every home in the Savannah subdivision on Aurora's northeast side, alerting residents to the presence of radioactive materials in Indian Creek. But don't be alarmed, officials say. There's really nothing to worry about.

Local
newspapers
reported on it.

Extending our monitoring



With regulators, we identified “outfall” points on the Fermilab site that we regularly test and we report those results.

We also do additional measurements at the site boundary for our neighbors and post the results on the Web.

Low-level discharges

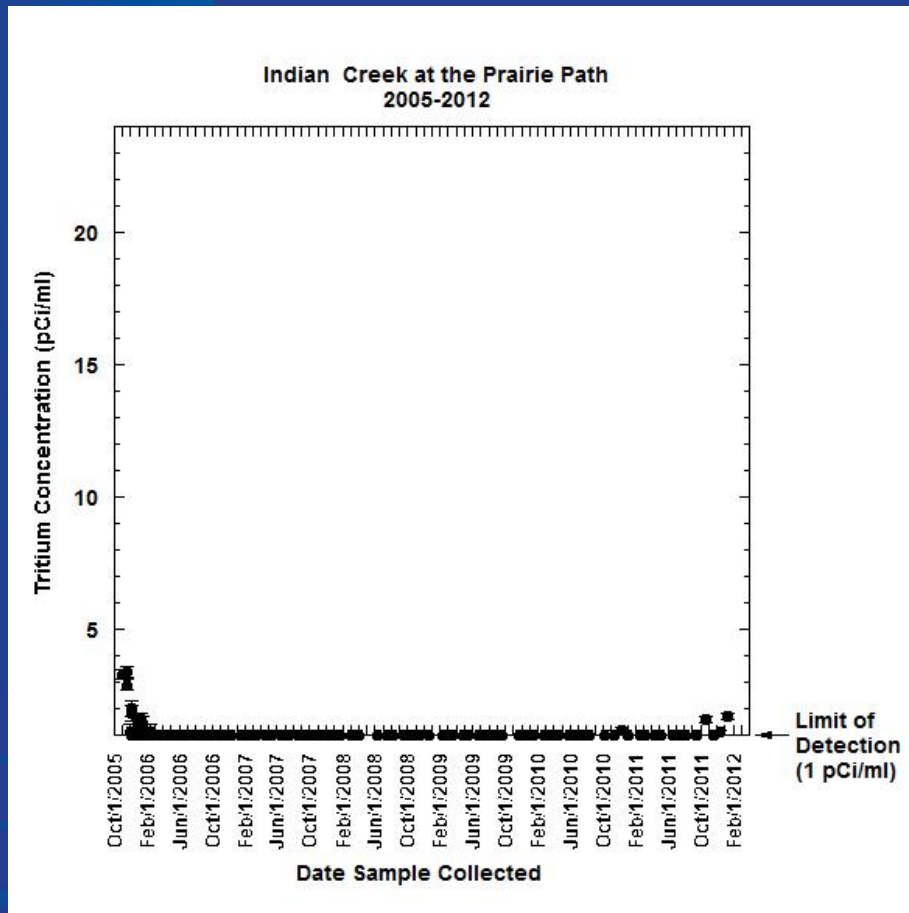


Low-level tritium discharges are always possible.

Level of discharges depend on accelerator operations, water levels in ponds and creeks, circulation of cooling water.

Rainfall and snowfall affect the water levels in the ponds and creeks.

Latest results for Indian Creek

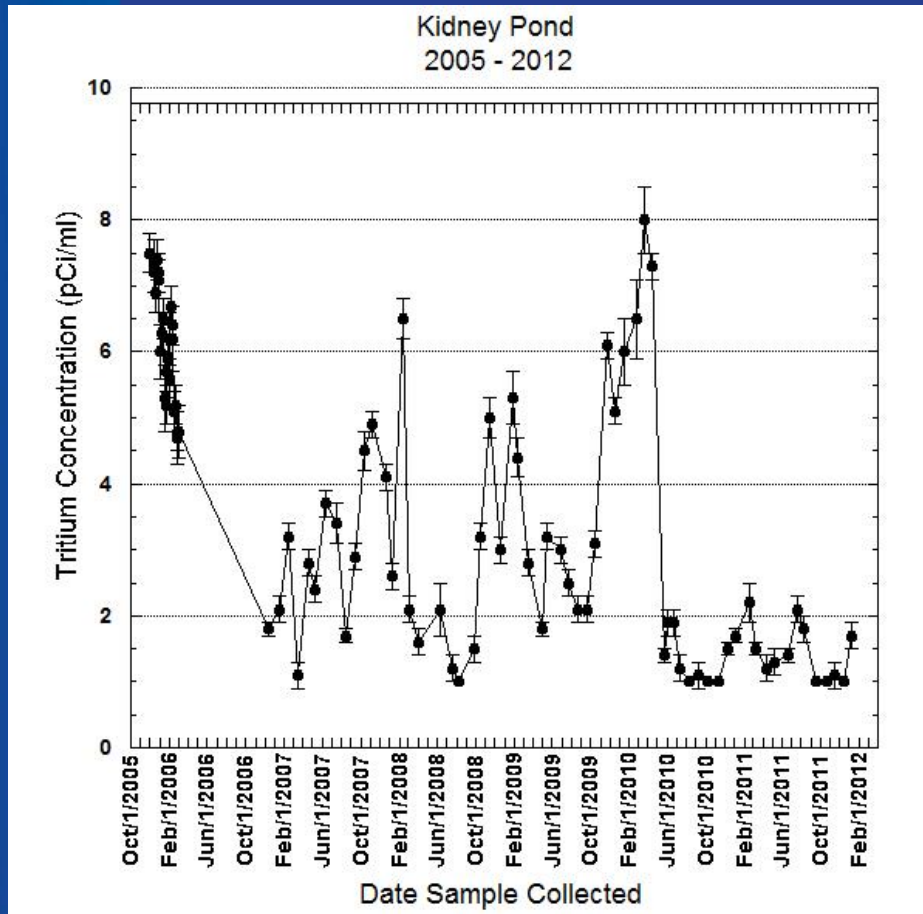


Our steps to reduce tritium levels that enter surface water have been effective. Lower levels in ponds on site despite more beam.

We have seen again low-level discharges at the site boundary (1-2 pCi/ml).

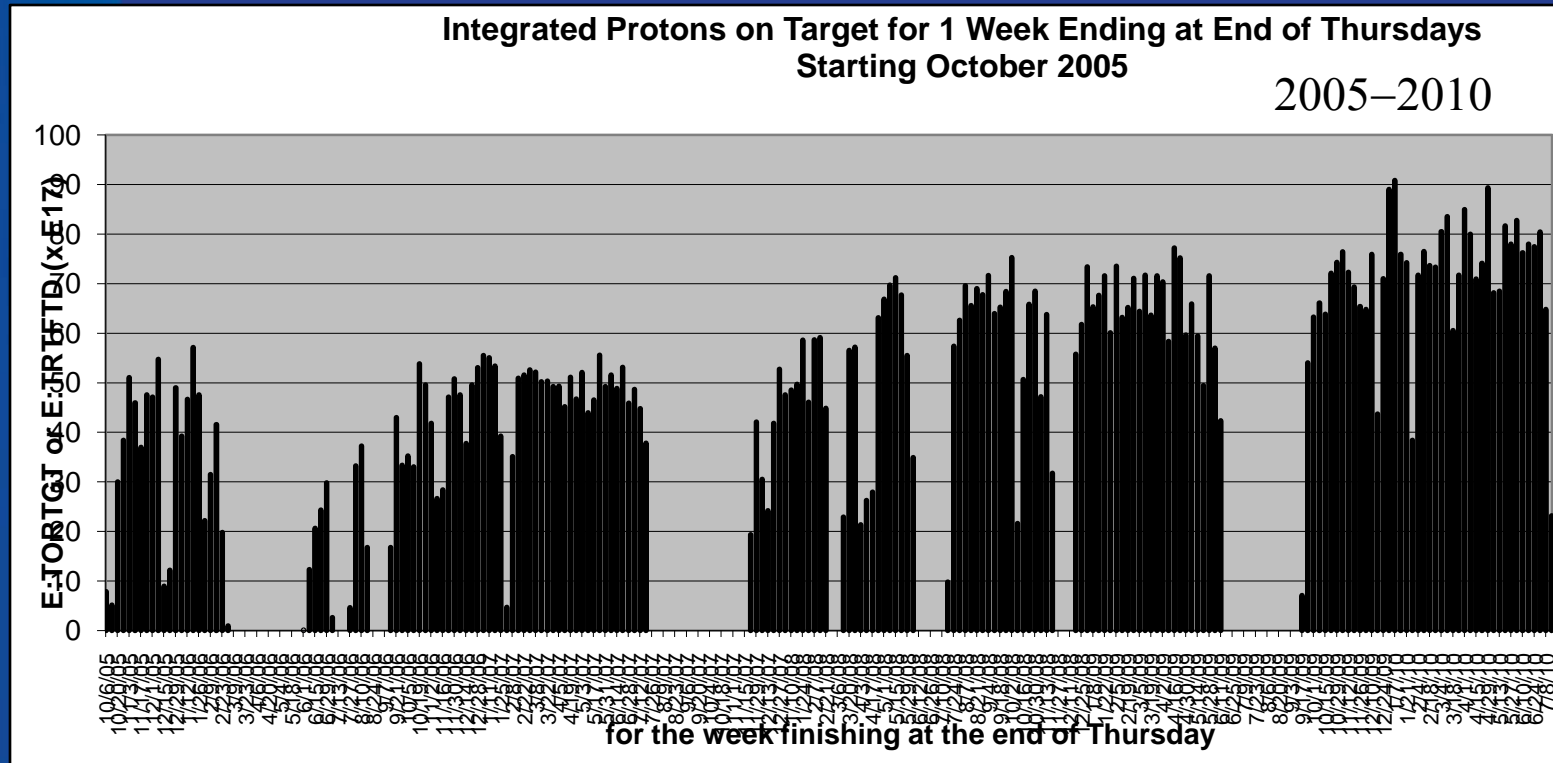
Levels are in compliance with our permit and well below DOE limit (1900 pCi/ml).

More beam, not more tritium



Despite the doubling of the NuMI/MINOS beam intensity, we manage to keep the amount of tritium that enters the Fermilab pond system at Kidney Pond for most of the time below the 2005 levels.

Operating at higher intensity



Since 2005, the proton beam intensity for NuMI/MINOS has approximately doubled. We expect to almost double it again by 2013/14.

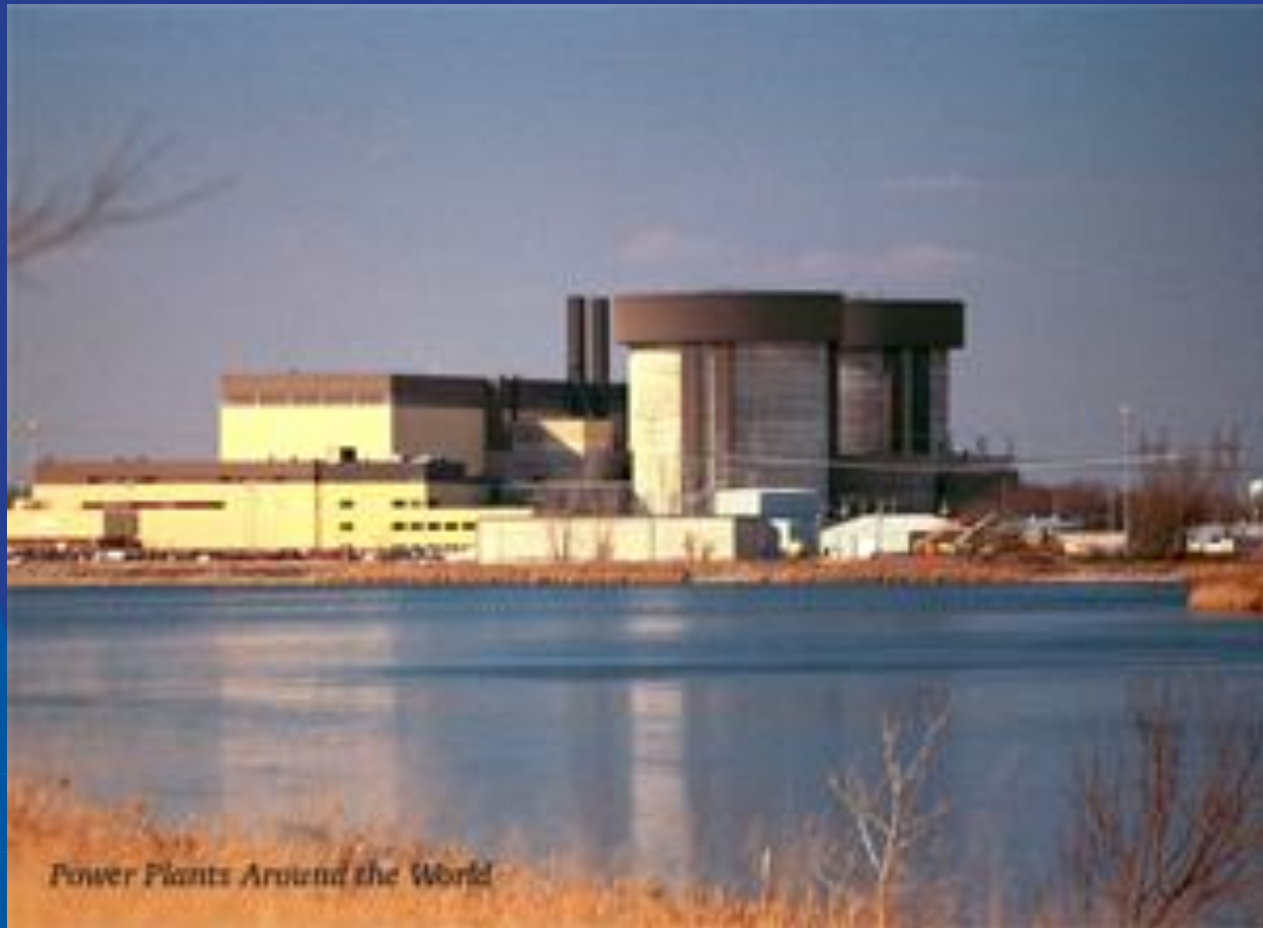
The good news

- We are well below the DOE limit of 1900 pCi/ml.
- Our permit, issued by the Illinois Environmental Protection Agency, is up to date and includes the monitoring of tritium discharges.
- We have come to understand tritium source, water, releases, permits much better.
- We want to do better than just satisfy regulatory limits. We strive to keep the tritium discharges as low as reasonably achievable, keep the public fully informed, and engage the public in the establishment of goals and formulation of plans.

But...

- We continue to increase the intensity of the proton beams and hence the amount of tritium produced.
- We know there is potential for more frequent, low-level discharges of tritium in the future. We make ongoing efforts to keep these discharges small.
- We plan to build new beams and accelerators that will also produce low levels of tritium.
- **We must communicate a long-term tritium message.**

A bad example to keep in mind



Braidwood Nuclear Power Plant, Illinois

Leaks...and lack of trust (Dec 2005)

The **Herald News** SATURDAY February 18, 2006 50 cents

Serving Will and Grundy counties since 1839

More tests in tritium case

Higher-than-normal concentrations of tritium have been discovered in city water, officials said. But anything above 20,000 picocuries is deemed unsafe for drinking water. Company officials revealed their discovery in December and said they would begin a cleanup program. Subsequent tests of the private residential wells closest to the site showed no tritium amounts above the naturally occurring amount. A sample of water from a pond 50 yards north of the plant property had 2,400 picocuries of tritium per liter. The highest concentration of tritium discovered was 226,000 picocuries per liter, in a remote area far from private drinking wells, officials said. One monitoring well, at the Braidwood Dunes, revealed a tritium level of 25,000 picocuries per liter, Exelon officials said. A second well revealed a level of 2,700 picocuries.

Reed-Custer schools: To check for radionuclides in groundwater, the Illinois Department of Public Health, said David Lochbaum, director of nuclear safety for the Union of Concerned Scientists, which advocates safety in the nuclear industry. U.S. Rep. Jerry Weller (R-Ill.) requested NRC inspections last Wednesday, the day Exelon Nuclear announced radioactive tritium had leaked at Dresden Generating Station in Grundy County and Byron Nuclear Generating Station, about 25 miles southwest of Rockford. Earlier, Exelon had disclosed four tritium spills at Braidwood Generating Station in far southwest Will County between 1996 and 2003. As a result, tritium was found in groundwater outside the plant at levels that exceed U.S. Environmental Protection Agency standards. Braidwood, Dresden and LaSalle all are in Weller's district. "All being in the news at the same time... all within a matter of days" that did not threaten public health, said David Lochbaum, director of nuclear safety for the Union of Concerned Scientists, which advocates safety in the nuclear industry.

U.S. orders nuke plant inspections

Inquiry in Illinois to follow leaks, alarm at LaSalle

By Hal Dardick
Tribune staff reporter

After ordering an investigation of a rare emergency Monday at Exelon's LaSalle County nuclear plant, federal regulators said they would inspect all Illinois nuclear power plants because of the company's recent disclosures about radioactive leaks.

The Nuclear Regulatory Commission action came just hours after Exelon Nuclear declared the first "site-area emergency" in the nation since 1991 at LaSalle County Generating Station, about 75 miles southwest of Chicago.

State and federal regulators said no radioactivity was released during the emergency. And the reactor, one of two at the site, remained stable, they said. "All the indications are that it was an instrumentation problem" that did not threaten public health, said David Lochbaum, director of nuclear safety for the Union of Concerned Scientists, which advocates safety in the nuclear industry.

IN BUSINESS
■ CUB backs plan to freeze state electric rates. PAGE 2

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PLEASE SEE NUCLEAR, BACK PAGE

Chicago Tribune, Feb. 21, 2006

TRITIUM

From page A1
And at Exelon's Dresden station near Morris, tritium found last month measured 300,000 picocuries per liter in one test well

Turn to TRITIUM, A9

Exelon kept leaks quiet, files show

By Hal Dardick
Tribune staff reporter

Exelon officials took several steps that for years kept the public in the dark about radioactive tritium spills at a Will County nuclear power plant and the groundwater contamination the spills caused, public records obtained by the Tribune show. Recent company disclosures about four tritium spills between 1996 and 2003 at Braidwood Generating Station came only after the Illinois Environmental Protection Agency pressured Exelon Nuclear to test for contamination, following prodding from the plant's neighbors. The disclosures of spills triggered lawsuits last week by the Will County state attorney, the Illinois attorney

general and neighbors of the plant accusing the company of not being forthcoming. The public documents show Exelon Nuclear officials in 2001 and 2002 opposed public discussion of tritium and the release of documents about tritium spills. They also opposed legislation to mandate groundwater monitoring at

PLEASE SEE EXELON, PAGE 3

Chicago Tribune METRO WEST THURSDAY FEBRUARY 16, 2006

2 more leaks at nuclear sites

Exelon discloses radioactive spills

By Hal Dardick
Tribune staff reporter

Generating Station in Grundy County and Byron Nuclear Generating Station, about 25 miles southwest of Rockford. So far, no tritium has been detected in groundwater off Exelon property near those plants, and the leaks "pose no health or safety threat," Exelon stated in its announcement.

The disclosures come weeks after Exelon publicly revealed water containing tritium spilled four times between 1996 and 2003 from vacuum breakers on an underground pipe at Braidwood Generating Station in far southwest Will County.

Contamination found at two more plants

NEW TRITIUM LEAKS ANNOUNCED

Braidwood plant: Previous tritium leaks

Dresden plant: Previous tritium leaks

Generating Station, Byron, Ill. Employees: 790 Began operating: 1985

Generating Station, Morris, Ill. Employees: 700 Began operating: 1970

Sources: Exelon Corp., U.S. EPA

TRITIUM FACTS
What is it? A radioactive form of hydrogen that forms water when it meets oxygen.
Uses in nuclear military programs, also source of light for safety signs in hospitals and research.
How it enters body: Mostly in the form of water.
Danger: Exposure can increase risk of cancer, birth defects and genetic damage.



Tribune photo by Zbigniew Brzdak

'We drank the water. We bathed in the water. We swam in the water. They never told us.'

—Bob Kea, with his wife, Linda, who live near a Will County nuclear power plant, in an area where elevated tritium levels were found in groundwater

What's next for Fermilab?

- We continue to increase the beam intensity. In May, we will shut down the beam for about 12 months to nearly double its intensity.
- We will start up the more intense beam and the new NOvA neutrino experiment in 2013. The environmental assessment of the project in 2008 led to “finding of no significant impact.”
- We propose to build a new proton/neutrino beam line for the Long-Baseline Neutrino Experiment (LBNE), which would produce low levels of tritium as well.
- We hope to build Project X, which would also increase proton intensity and create more tritium.
- We need to get the tritium issue right to be allowed to do future projects.

Keep public informed

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http://www.fnal.gov/

Pierre Auger

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Particle Physics News

Update on low levels of tritium at Fermilab

Plan for Discovery

What does the future hold for Fermilab? The laboratory's scientific strategy for the next two decades encompasses a suite of experiments and accelerator facilities that keep the laboratory, and the United States, at the forefront of particle physics research.

[Read more](#)

Fermilab Today Jan. 25, 2012

Special Announcement: Fermilab Colloquium with Hugh Montgomery - today

From the Core Computing Division: Greener, better computing

From J/ψ NewsLine: Pushing technology, expanding industry

From symmetry breaking: Scientists finish installation of 80-ton particle thermometer at ALICE detector

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Science in the Neighborhood

Community Advisory Board

Fermilab receives ARRA funding

Applications of accelerators

Featured

Innovation at Fermilab: Liquid Argon Test Facility

Fermilab scientists and personnel gathered on Jan. 23 to break ground for the new Liquid Argon Test Facility. From left: Fermilab Deputy Director Young-Wee Kim, Sima Rameika, PPD, Kevin Bornstad and Jason Whittaker, Whittaker Construction and Excavation, Dixon Bogert, Fermilab; Mike Weis, DOE; Fermilab Director Pier Oddone; Erik Gottschalk, PPD. Photo: Reidar Hahn

We regularly post our tritium measurements on the Fermilab website; a link is on the Fermilab home page.

We inform you, the CAB.

We consider contacting nearby homeowners.

What else should we do?

Questions for the CAB

Members of the Community Advisory Board are one of Fermilab's connections to the community.

- How should we keep the community informed and maintain a dialogue? (A lot of time has passed since the newspaper articles in 2005.)
- Which stakeholders should we keep informed? Can you help us communicate with stakeholders?
- What recommendations do you have, in particular regarding the proposed LBNE, Project X?
- Are we considered a good steward of the Fermilab site?