

## Industry Closely Monitors, Controls Tritium at Nuclear Power Plants

June 2009

### Key Facts

■ Tritium is a radioactive form of hydrogen that is produced naturally in the upper atmosphere. It also is produced commercially for various uses and is a byproduct of nuclear power generation. The U.S. Nuclear Regulatory Commission limit for the maximum release of tritium in water is well within safety ranges. No public health or safety risk has resulted from tritium releases at commercial nuclear power plants.

■ The nuclear energy industry is committed to operating its plants safely and to protecting the environment. A combination of plant design, control systems and radiation monitoring helps prevent unplanned radioactive releases and helps control and contain them in the event that they should occur.

■ Companies that operate nuclear power plants monitor radiation levels at the plant sites and their surrounding areas for possible releases. Companies annually report allowable plant discharges and the results of environmental monitoring to the NRC. In addition, the NRC conducts periodic on-site inspections of

each company's environmental monitoring programs to ensure compliance with the agency's requirements.

■ The industry detected elevated tritium levels in 2005 at some nuclear power plants, but the release posed no health or safety hazard to residents of the surrounding areas or plant employees, according to state and federal officials. However, such releases are inconsistent with the standards of operating excellence the industry has set for itself. Companies whose plants detected elevated levels of tritium have stopped the leaks and, where necessary, are cleaning up contamination.

■ The industry launched an initiative in 2006 to improve the management of situations involving radiological releases to groundwater. Every company that operates a U.S. nuclear power plant has committed to inform local, state and federal authorities of an unplanned release even if it is below the threshold for reporting to the NRC.

### Industry Committed to Safe Plant Operations

The nuclear energy industry is committed to operating its plants safely and protecting the surrounding environment. All

employees of a nuclear power plant actively contribute to the safe operation of the facility. At each plant, radiation protection professionals on staff conduct extensive radiation monitoring of the plant site and the surrounding environment.

Plant design, operations and procedures focus on preventing unplanned releases. Each plant conducts an extensive environmental monitoring program required by the NRC to verify that no unforeseen radioactive releases have occurred. The agency requires the plants to list and describe unplanned releases in an annual report. In the event that one occurs, plant operators and radiation protection staff take immediate steps to stop and contain the release. Next, the affected area is monitored and remediated.

### Background on Tritium

Tritium is a radioactive form of hydrogen. It is produced naturally in the upper atmosphere when cosmic rays strike atmospheric gases. It also is a byproduct of electricity generation at nuclear power plants, and it is produced commercially in concentrated quantities for use in self-luminescent devices such as exit signs, aircraft dials and wristwatches.



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Tritium is a radioactive isotope of hydrogen. Like nonradioactive hydrogen, tritium reacts with oxygen to form water. “Tritiated water” moves through the environment and the human body just as ordinary water does. Tritium decays over time with a relatively short half-life of 12.3 years and is one of the least hazardous radionuclides because it emits weak radiation and leaves the body relatively quickly.

## **NRC Regulates Tritium at Nuclear Power Facilities**

Unintentional leakage of tritium from nuclear plants is possible, so the NRC evaluates the potential impact of such leakage during the initial plant licensing process. The NRC also requires plants to monitor their surrounding areas for possible releases.

The industry routinely monitors the environment around the plant, including surface and ground water; shoreline sediments; and samples from food sources such as milk, fish and other animals. The industry must report annually on the results of this monitoring to the NRC. This information also is provided to state agencies and is made publicly available.

If nuclear plant operators detect elevated levels of tritium, they take steps to identify the cause of the elevated presence and control it. In fact,

there has been no instance at nuclear power plants in which tritium has caused a significant exposure to the public.

## **Industry Responds to Elevated Tritium Readings**

In November 2005, an environmental monitoring program at the Braidwood Generating Station in Illinois found elevated tritium levels in groundwater near an underground pipe inside the plant’s boundary. Elevated tritium levels were also detected outside the plant boundary. These tritium levels did not present a public health or safety risk to anyone in Braidwood or the surrounding area.

During construction excavation, employees of the Indian Point Energy Center in Westchester County, N.Y., discovered a tritium leak from the plant’s used nuclear fuel storage pool in September 2005. This led to the discovery of elevated tritium levels at one monitoring well near the used fuel pool, but not beyond the plant boundary. The leak posed no health or safety risks to plant employees or the surrounding community. Several other nuclear power plants also found higher-than-expected levels of tritium.

In response to these events, the industry launched an initiative to improve the management of situations involving radiological releases in ground-water.

This is intended to provide additional assurance of the safe, effective management of U.S. nuclear plants.

Companies also collected data on their environmental monitoring programs. The industry provided this information to the NRC to help give perspective on the issue.

Following industry guidelines, a nuclear plant will inform local, state and federal authorities of an unplanned release even if the amount of tritium detected is below reportable levels.

## **NRC Tritium Task Force Issues Report**

In October 2006, the NRC released a report on findings of a group of experts from the NRC and the state of Illinois on unplanned releases of radioactive liquids. The task force found no impact on public health from these events, the NRC said.

“We looked at a wide range of releases that go back to 1996, and even included a substantial release from the Hatch plant in 1986, and none of these events led to appreciable radiation doses to people outside the plants,” said Stuart Richards, the NRC senior manager who led the task force.

The group provided 26 recommendations to the NRC. These include a recommenda-

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tion that the NRC update its regulations on monitoring radioactive releases and the environment in and around a nuclear plant to take into account state-of-the-art technologies and practices. The task force also recommended that the companies operating nuclear plants work with local and state agencies to voluntarily report any radioactive liquid releases that fall below the NRC threshold for reporting.<sup>1</sup>

As noted above, the industry already has established such a voluntary reporting program.

### Lessons Learned and Industry Guidance

In February 2007, the industry held a workshop with the NRC and other stakeholders to capture lessons learned from implementing the voluntary industry program. Following the workshop, the industry formed a task group to redraft industry guidance on the program to incorporate the lessons learned. The industry issued the final guidance—"Industry Ground Water Protection Initiative," NEI 07-07—in August 2007. It is available to the public on the NRC Web site at: <http://www.nrc.gov/reactors/operating/ops/experience/tritium/public-meetings.html> (under the Sept. 27, 2007 public meeting).

### Standards for Measuring Tritium

A standard unit for measuring the amount of radioactivity is the curie. Government entities use smaller units in regulations to denote a fraction of a curie. The NRC uses microcuries, which is one-millionth of a curie. Other agencies use the smaller unit of a picocurie, which is one-trillionth of a curie.

For perspective, the amount of tritium in the groundwater at the nuclear power plant with the highest and most extensive levels of tritium is far less than the amount of tritium in a single self-luminous exit sign. Many industrial-grade exit signs contain 10 to 20 curies of tritium gas.

By comparison, the average concentration of tritium in groundwater at nuclear plants is at or below 20,000 picocuries per liter, the Environmental Protection Agency's Standard for tritium in drinking water.

*This fact sheet also is available at* <http://www.nei.org/resourcesandstats/documentlibrary/safetyandsecurity/factsheet/industrycloselymonitorscontrolstritium>.

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<sup>1</sup> NRC press release No. 06-123, Oct. 4, 2006.