

## **Leaks and Spills of Tritium at U.S. Commercial Nuclear Power Plants**

### **Introduction**

This is a list of reactor sites that experienced a leak or spill to the environment at some time since initial startup. The list only includes those leaks or spills where tritium in the leak source or the groundwater sample was greater than 20,000 pCi/L. The term “leaks and spills” includes all types of non-routine releases in which tritium from reactor operation contacted the soil in an unintended fashion.

### **Source of Information**

This information was compiled by NRC staff and is based on available records (e.g., Annual Effluent Reports, Annual Environmental Reports, Groundwater Questionnaires, Preliminary Notifications, Event Notifications, Licensee Event Reports (LERs), NRC Inspection Reports, Special Reports, and other documents submitted by the licensees to the NRC). Although the records search was extensive, extending back to the 1970s, the search was not all inclusive.

### **Purpose**

The NRC has received many questions from the public, the news media, and politicians concerning spills and leaks at power reactor sites. Although most of these questions were similarly focused on groundwater contamination, the questions were different enough to produce significant variations in the responses. This list is intended to be the best single response to those questions involving “numbers” such as:

- How many sites have had leaks or spills of radioactive material?
- What concentrations of tritium were involved?
- What are the current tritium concentrations at each of the sites?

### **Contents**

The tritium concentrations listed are approximate historical maximums, and approximate current concentrations. Some numbers have been rounded off for clarity. Although there may be some data in the historical records showing concentrations slightly different than the values listed, the values shown provide a reasonable indication of the magnitude and extent of the historical leaks and spills as well at the current conditions at these sites.

Onsite and offsite samples were evaluated for inclusion in this list. Samples were collected from both drinking water wells and non-drinking water sample points (e.g., storm drains, man holes, bore holes, piezometer tubes, monitoring wells, surface water, puddles, and rain water). It should be noted that no drinking water wells or municipal drinking water systems appear in this list because no drinking water has been found to contain tritium at concentrations greater than 20,000 pCi/L. As a result, a value of 20,000 pCi/L in this list does not imply the drinking water standard in EPA’s Safe Drinking Water Act has been exceeded.

The current status of these sites reflects the most recently available information as of the date shown at the top of this page. This list will be revised as new information becomes available.

After a radioactive spill or leak, tritium is generally the first radionuclide to be identified in groundwater. This is because tritium travels through the soil faster than other radionuclides. Leaks and spills at some sites (e.g., Indian Point, Braidwood) involved nuclides other than tritium (e.g., Cobalt-60, Cobalt-58, Cesium-134, Cesium-137, Strontium-90, Nickel-63), but those radionuclides are not included in this list.

### **Significant Changes in this Version**

- The current status of each site was added to this list.
- Five reactor sites were added to the list based on recent information.
- Some of the dates for the historical releases were updated (with the month and day).

### **Summary**

There are 65 sites with operating commercial nuclear power plants in the United States. Records indicate 37 of these sites have had leaks or spills that involved tritium in excess of 20,000 pCi/L at some time during their operating history. Fifteen sites are currently reporting tritium, from a leak or spill, in excess of 20,000 pCi/L. Although many sites have had leaks or spills involving tritium, no site is currently detecting tritium in the offsite environment, or in drinking water, in excess of 20,000 pCi/L.

Tritium rapidly disperses and dissipates in the environment, and as a result, tritium from leaks and spills is typically not detected outside the facility boundary. The historical data indicates in only one instance, at Braidwood, was tritium from a leak or spill found in the offsite environment in excess of 20,000 pCi/L. All samples from Braidwood since 2008 indicate tritium is no longer present in excess of 20,000 pCi/L in either the onsite or the offsite environment.

### **Conclusion**

The existing compliment of 104 power reactors, each operating for 20-40 years, represents approximately 3000 reactor years of operation. During that time, leaks and spills involving tritium have occurred at many commercial power reactors in the United States. This list demonstrates that in all of that time, and with all the leaks and spills that have occurred, no drinking water supply has exceeded the allowable level for tritium specified in EPA's Safe Drinking Water Act.

### **Leaks and Spills of Tritium at U.S. Commercial Nuclear Power Plants**

It is imperative that the preceding paragraphs accompany any reproduction of this list so that the information is communicated in the proper context.

| #  | Site              | Approximate Historical Maximum Tritium Concentration, pCi/L | Approx Date of Historical Maximum Tritium | Status Update – Highest Tritium Concentration Currently On Site, pCi/L | Date of Status Update |
|----|-------------------|---|---|--|-----------------------|
| 1  | Braidwood         | 247,000   | 1998                                      | 5,510  | 31-Dec-2009           |
| 2  | Browns Ferry      | 2,050,000   | 7-Apr-10                                  | 2,050,000  | 7-Apr-10              |
| 3  | Brunswick         | 1,300,000   | 2007                                      | 272,000  | 23-Nov-09             |
| 4  | Byron             | 82,000  | 13-Feb-06                                 | 1,360  | 31-Dec-09             |
| 5  | Callaway          | 200,000   | Jun-2006                                  | 814  | 14-Dec-2009           |
| 6  | Catawba           | 42,000  | 8-Oct-07                                  | 47,500   | 31-Dec-2009           |
| 7  | Columbia          | 270,000   | 13-Mar-93                                 | 2,600  | 15-Jun-10             |
| 8  | Davis-Besse       | 37,500  | 23-Oct-08                                 | 8,000  | 31-Dec-2009           |
| 9  | Dresden           | 3,200,000   | 5-Jun-09                                  | 3,110,000  | 31-Dec-2009           |
| 10 | Fitzpatrick, J.A. | >20,000   | 1991                                      | No tritium is detectable from the 1991 event.                          | 2-Jun-10              |
| 11 | Ginna, R.E.       | 20,000  | 1996                                      | No tritium is detectable from the 1996 event.                          | 31-Dec-09             |
| 12 | Hatch, E.I.       | 4,000,000   | 7-Nov-03                                  | 100,000  | 31-Dec-09             |
| 13 | Indian Point      | 600,000   | 2005                                      | 164,000  | 31-Dec-09             |
| 14 | Kewaunee          | >20,000   | 2006                                      | 9,334  | 31-Dec-09             |
| 15 | LaSalle           | 715,000   | 30-Jun-10                                 | 715,000  | 1-Jul-10              |
| 16 | Millstone         | 34,000  | 28-Nov-07                                 | 3,660  | 13-Jan-09             |
| 17 | Monticello        | 21,300  | 12-Sep-09                                 | 21,727   | 31-Dec-09             |
| 18 | Oconee            | 35,400  | 26-Jan-10                                 | 32,700   | 15-Jul-10             |
| 19 | Oyster Creek      | 10,800,000  | 24-Aug-09                                 | 600,000 to 700,000   | 14-Sep-10             |
| 20 | Palisades         | 217,351   | 31-Dec-09                                 | 217,351  | 31-Dec-09             |
| 21 | Palo Verde        | 4,200,000   | 19-Mar-93                                 | Onsite wells show no detectable tritium.                               | 31-Dec-09             |
| 22 | Peach Bottom      | 127,000   | 6-Jul-09                                  | 110,000  | 31-Dec-09             |
| 23 | Perry             | 59,900  | 2006                                      | No tritium is detectable from the 2006 event.                          | 31-Dec-09             |
| 24 | Pilgrim           | 25,552  | 19-Jul-10                                 | 2,790  | 30-Aug-10             |
| 25 | Quad Cities       | 7,500,000   | 2008                                      | 771,000  | 31-Dec-09             |
| 26 | River Bend        | 129,000   | 16-Jan-08                                 | No tritium is detectable from the 2008 event.                          | 31-Dec-09             |

|    |                |            |          |   |           |
|----|----------------|------------|----------|---|-----------|
| 27 | Salem          | 15,000,000 | Apr-2003 | 20,000 to 28,000                                | 6-Apr-10  |
| 28 | San Onofre     | 330,000    | 7-Aug-06 | 1,290   | 31-Dec-09 |
| 29 | Seabrook       | 750,000    | 1999     | 2,130   | 8-Dec-09  |
| 30 | St. Lucie      | 161,000    | 2000     | 14,650  | 31-Dec-09 |
| 31 | Surry          | 31,900     | 2007     | 17,900  | 20-Nov-08 |
| 32 | Susquehanna    | >20,000    | 1995     | No tritium is detectable from the 1995 event.   | 9-Nov-09  |
| 33 | Turkey Point   | >20,000    | 1979     | 4,690   | 31-Dec-09 |
| 34 | Vermont Yankee | 2,500,000  | 8-Feb-10 | 400,000   | 2-Sep-10  |
| 35 | Vogle          | >20,000    | 1990s    | No tritium is detectable from the 1990s events. | 31-Dec-09 |
| 36 | Waterford      | >20,000    | 1997     | No tritium is detectable from the 1997 event.   | 31-Dec-09 |
| 37 | Watts Bar      | 397,600    | 2005     | 3,420   | 31-Dec-09 |