

## **List of Historical Leaks and Spills 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 picocuries per liter (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 including Annual Effluent Reports, Annual Environmental Reports, Groundwater Questionnaires, Preliminary Notifications, Event Notifications, Licensee Event Reports, 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 include (1) the approximate historical maximums and (2) the “current” concentrations. 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.

The approximate historical maximum concentration reflects the result of a single leak or spill at a site. In this way, it is a snapshot of the maximum concentration on the date listed. Although a particular value may remain on this list, in reality it is not stagnant. The maximum concentration begins to decrease immediately, and continues to decrease over time. Additionally, the maximum concentration decreases as the material travels through the soil due to dilution and dispersion. As a result, this report also includes the current concentration of tritium to provide some perspective on how the tritium concentrations decrease over time.

The value listed as the current concentration lists the highest tritium concentration found in the environment, on facility property, at the current time or within approximately the last year. The values listed do not necessarily credit any remediation – such as soil removal – that may have occurred following a leak or spill. This is because the analysis results prior to remediation are typically broadly communicated, whereas the analysis results after remediation may not be readily available or as broadly communicated. As a result, for some sites the actual current

tritium concentration will be less than the value indicated. Even so, the current concentration listed below provides a reasonable approximation of the plume concentration currently on each site. If a value has not been updated within the past year, it indicates the value listed is a good approximation of the current site conditions. 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.

Samples are collected from onsite and offsite locations. Samples are 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). All of these samples are evaluated for inclusion in this list. Although some values in the list exceed 20,000 pCi/L, none of those samples were from a drinking water well or from a municipal drinking water system. In fact, although samples are collected from drinking water wells and municipal drinking water systems, none of those samples have ever exceeded 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.

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 several sites were reviewed and updated accordingly.

### **Summary**

There are 65 locations in the United States where commercial nuclear power plants are or have been recently operating. Records indicate 45 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. Eleven 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 complement of 100 power reactors, each operating for approximately 20-40 years, represents approximately 3,000 reactor years of operation. During that time, leaks and spills involving tritium have occurred at many commercial power reactors in the United States.

### **List of Historical Leaks and Spills 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.

#	Plant	Approximate Historical Maximum Tritium Concentration, pCi/l	Approx Date of Historical Maximum Tritium	"Current" Concentration of Tritium (or highest concentration in approximately the last year), pCi/l	Date of Status Update
1	Beaver Valley	25,583	30-Sep-10	19,200	September 2012
2	Braidwood	247,000	1998	2,430	September 2013
3	Browns Ferry	2,050,000	7-Apr-10	1,013	December 2011
4	Brunswick	19,000,000	Dec-2010	3,539,000	May 2011
5	Byron	82,000	13-Feb-06	911	November 2013
6	Callaway	200,000	June 2006	9,654	March 2011
7	Catawba	47,500	8-Oct-07	11,300	March 2012
8	Columbia	270,000	13-Mar-93	1,300	November 2012
9	Crystal River	360,000	21-Apr-98	Not detectable	July 2014
10	Davis-Besse	37,500	23-Oct-08	1,893	January 2014
11	Dresden	10,312,000	31-Jul-04	40,600	October 2013
12	Duane Arnold	2,150,000	12-Oct-12	3,390	January 2014
13	Fitzpatrick, J.A.	105,000	April 2010	1,300	January 2014
14	Ginna, R.E.	20,000	1995	Not detectable	December 2013
15	Hatch, E.I.	6,840,000	29-Sep-11	5,000,000	December 2012
16	Indian Point	600,000	2005	75,500	February 2013
17	Kewaunee	>20,000	2006	1,257	October 2011
18	Limerick	3,950,000	13-Feb-09	345	October 2012
19	LaSalle	1,180,000	5-July-10	97,400	March 2014
20	Millstone	4,000,000	28-Nov-07	10,600	December 2011
21	Monticello	21,300	12-Sep-09	1,117	February 2014
22	Nine Mile Point	44,000	14-Aug-12	Not detectable	November 2012
23	North Anna	53,300	22-Dec-11	53,300	December 2011
24	Oconee	35,600	Feb-10	45,000	December 2011
25	Oyster Creek	10,000,000	2009	73,000	January 2013
26	Palisades	217,351	31-Dec-09	13,693	March 2013
27	Palo Verde	4,200,000	19-Mar-93	None detectable	December 2012
28	Peach Bottom	196,000	8-Mar-10	6,440	April 2014
29	Perry	59,900	2006	200	December 2012
30	Pilgrim	69,000	Dec-2013	6,000	January 2014

31	Quad Cities	7,500,000	2008	150,000	January 2014
32	River Bend	1,135,000	25-Feb-13	1,135,000	February 2013
33	Salem	15,000,000	Apr-2003	436,000	November 2013
34	San Onofre	330,000	7-Aug-06	3,700	December 2012
35	Seabrook	750,000	1999	5,520	March 2013
36	St. Lucie	161,000	2000	6,270	January 2010
37	Summer	23,000	7-Jul-11	Not detectable	July 2014
38	Surry	31,900	2007	13,400	February 2011
39	Susquehanna	>20,000	1995	Not detected	December 2013
40	Three Mile Island	900,000	1981	5,400	November 2012
41	Turkey Point	>20,000	1979	5,320	December 2010
42	Vermont Yankee	2,500,000	8-Feb-10	19,000	October 2013
43	Vogtle	>20,000	1990s	1,100	December 2011
44	Waterford	>20,000	1997	Not detected	December 2011
45	Watts Bar	550,000	8-Feb-05	13,363	November 2011