Groundwater Contamination from Nuclear Reactors Goes Nationwide

By Bonnie Urfer

The history of accidental, unregulated radiation leaks from nuclear reactors should be enough to slam the door on nuclear power. Among others, the Union of Concerned Scientists (UCS) lists 350 separate incidents since 1961, at 101 of the country's reactors.[1]

Tritium, with a radioactive half-life of 12.3 years, is the unstable form of hydrogen. It leaks from hot uranium fuel, combines easily with and contaminates water. Tritium leaks and consequent contamination of groundwater have become routine at all reactors — shutdown and operating. In addition, the UCS has documented contamination by cesium-137 (half-life: 30 years) and cobalt-60 (half-life: 5.26 years). It takes 10 half-lives for an isotope to decay to other elements.

Nuclear reactors shake, rattle and rumble like a fleet of freight trains from their giant turbines' powerful vibrations. As they age, cracks occur in holding tanks, waste fuel pools and concrete floors. Radioactive water leaks from tanks, flanges, valves, pumps, drums, pits, waste concentrators, tubes and even laundry systems. The pathways are almost unlimited.

Tritiated water has repeatedly leaked into the soil under reactors or waste pools, onto roofs of adjoining buildings and outdoor blacktop areas, and into storm drains and culverts. The Nuclear Regulatory Commission (NRC) has recorded spills of between 20 gallons and 787,000 gallons.

Wisconsin's Kewaunee and Point Beach reactors are no exception. In 1975, Point Beach's Unit 1 leaked approximately 10,000 gallons of radioactively-contaminated water after a steam tube ruptured. The water spilled into a retention pond and from the pond into groundwater. In 1997, another steam tube in the same reactor spilled another 10,000 gallons of radioactively contaminated water that ran eventually into Lake Michigan. That year, Unit 2 had a leaking discharge pipe which also contaminated a stream and Lake Michigan. In 2006, Kewaunee workers found tritium in the groundwater below the site. The NRC said the radiation had infiltrated narrow shafts beneath two buildings. The leak rate was thought to be one gallon every five minutes. The operators could not find the leak's source but were investigating.

In the case of E.I. Hatch, in Georgia, the operator claims a building "settled" in 2006 and that leaks then sprang from buried pipes, from an isolation valve, from failed seals on an outdoor radioactive water storage tank transfer pump, from waste fuel pool expansion bellows and from outdoor radioactive water tanks. The leaks contaminated soil and groundwater.

Accidental releases (in addition to daily "allowable" releases) cumulatively and irreversibly add radioactive pollution to the soil, water and air. Near Braidwood in Illinois, area residents were drinking radioactive water for years until Exelon Corp., the operator, began supplying bottled water, buying up property adjoining the reactor and offering to pay for a municipal water system to replace the private wells it poisoned. Exelon officials were derelict in reporting the tritium contamination which was ongoing for over a decade. The state of Illinois has sued Exelon.

Documented groundwater contamination has occurred at: Palisades in Michigan; Kewaunee in Wisconsin; Limerick in Pennsylvania; Connecticut Yankee near Haddam; San Onofre, Diablo Canyon and Humboldt Bay (still registering contamination from the 1960s) in California; Perry in Ohio; St. Lucie in Florida; Brunswick and McGuire in North Carolina; Catawba in South Carolina; Callaway in Missouri; Watts Bar, Browns Ferry and Sequoyah in Tennessee; Ft. Calhoun in Nebraska; Salem in New Jersey; Palo Verde in Arizona; Indian Point and Ginna in New York; Braidwood, Dresden, Quad Cities and Byron in Illinois; Prairie Island in Minnesota; Seabrook in New Hampshire; and Palisades and Cook in Michigan.

Groundwater contamination at the Cook reactor is just below "safe" limits for drinking. The EPA holds that tritium up to 20,000 picocuries (abbreviated as pCi) per-liter (pCi/l) is "allowable" in drinking water.[2]

At Quad Cities, contamination from a spill 25 years ago still exceeds "allowable" levels of tritium. Millstone, Fermi I, Perry and a myriad of other reactors have leaked tritium into the environment, but their operators claim no current groundwater contamination.

California's San Onofre, shut down since 1992, continues to spread radiation into groundwater and to the nearby beach where a 13-foot deep, 12-foot wide swath was excavated. Twenty-one thousand cubic feet of poisoned sand was shipped to the Hanford H-bomb production site in Richland, Washington for burial. In 2006, San Onofre's Unit 1 had tritium levels of between 50,000 and 330,000 pCi/l.

Tritium is not the only danger from nuclear reactors. Tests at Oyster Creek in New Jersey show elevated levels of cesium-137 in leaf and soil samples near the reactor.

Cesium-137 is a beta and gamma radiation emitter that affects humans in proximity to it, and it does even more damage via ingestion. The isotope has a 30-year half-life and remains in the environment for 300 years.

Notable Releases

* Yankee Rowe, in Western Mass., had numerous leaks that resulted in the excavation of 420 cubic feet of dirt and rock. Shut down in 1992, operators have both resurfaced contaminated asphalt, as well as excavated and dumped it, and even collected and dumped *snow* contaminated with cobalt-60 and cesium-137.

* In Minnesota, Prairie Island workers detected cobalt-60 and cesium-134 in soil which was subsequently excavated and dumped elsewhere.

* Cobalt-60 and cesium-137 contamination has been detected under Browns Ferry, Tennessee in 2006.

* In 2007, Fort Calhoun Unit 1, in Nebraska, had detectable tritium, cesium-137 and antimony-125 (half-life: 2.7 years) in water seeping through an exterior wall. The tritium level was 173,000 pCi/l and increasing.

* An entire concrete floor, along with eight barrels of contaminated soil, at Big Rock Point in Michigan was removed and dumped off-site.

* At Millstone in Connecticut, workers dumped off-site, twenty 55-gallon drums of contaminated soil from an unplanned water and steam discharge.

* Ten years after Georgia's Vogtle reactor tritium leak, it is still detected in groundwater. The leak went on for two years as operators failed to keep it contained. Concrete from the reactor has been dumped off-site as radioactive waste.

* In 1995, concentrations of tritium in test wells at Ginna, New York, reached the maximum allowable 20,000 pCi/l.

* Seabrook had 10 to 30 gallons-per-day of radioactive water leaking from its waste fuel cask "wash pit transfer canal area" from 1999 to 2004, contaminating the groundwater.

* Wolf Creek in Kansas has had three radioactive water leaks from its waste fuel pool since 2001.

* A leak from a steam seal evaporator forced the excavation and off-site dumping of six inches of gravel in an area measuring 100 square feet at the Limerick reactor in Pennsylvania.

* McGuire operators in North Carolina, found very high and dangerous levels of tritium in groundwater — 138,000 pCi/l — near the Unit 2 equipment staging area. In 2006, unsafe levels were measured in the northeast corner of the auxiliary building, and testing in 2006 showed pCi/l contamination: Feb. 14: 35,200; Feb. 15: 33,800; March 10: 33,100; May 1: 31,900; June 1: 33,200; June 21: 30,000; July 2: 30,000; July 17: 26,000; and July 26: 31,700.

* North Anna in Richmond, Virginia, reported 56 occurrences of radioactive water releases. Specific dates and amounts were kept secret. Surry, near Newport News, VA, reported eight incidents. The movement of clean water through contaminated buildings and becoming radioactive and subsequently poisoning the ground was reported numerous times.

* Catawba, near York, South Carolina, has groundwater contamination over double the allowable drinking water limit measuring 42,335 pCi/l.

* Commercial reactors continuously expel radiation as do experimental, research and military reactors. In 1997, the Brookhaven Laboratory High Flux Beam Reactor on Long Island, New York, leaked to the point that groundwater contamination registered 32 times the EPA's drinking water standard. The Oak Ridge High Flux Isotope Reactor in Tennessee has also leaked tritium.

Tritium Hazards

Ingestion, inhalation or absorption of small amounts of radioactive tritium results in irradiation of the internal organs, possibly for long periods of time. According to Dr. Rosalie Bertell, ingestion of tritium quadruples internal damage and disproportionately affects women, children and anyone under age 20. Tritium easily crosses the placenta, so spontaneous abortions, stillbirths, congenital malformations and childhood diseases can be a consequence of exposure to tritium. The young are not only more vulnerable because of an underdeveloped immune system, but also because of their long expected life-span after exposure.

According to Dr. Bertell, tritium spontaneously disintegrates into a helium atom which disrupts chemical bonds in cells. When reproduced, these disruptions cause chronic diseases such as allergies or hormonal dysfunction. Studies have noted a correlation between tritium releases from Canada's Pickering reactors and an increase in the number of fatal birth defects nearby. Down's syndrome increased by 80 percent in Pickering.

The International Agency for Research on Cancer found that nuclear workers exposed to tritium have a higher incidence of radiation related cancer. Childhood leukemia deaths increased by a factor of 1.4 among children born near the Bruce reactor after it opened.

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[1] Groundwater Events Data Base, David Lochbaum, Union of Concerned Scientists, Washington, DC, Jan. 28, 2008, <ucs.org>

[2] The *curie* is a standard measure for the intensity of radioactivity. The basis for the curie is the radioactivity of one gram of radium. An enormous amount of radioactivity, a curie represents 37 billion atomic disintegrations-per-second. A *picocurie* is about one trillionth of a curie. A *picocurie* represents 2.2 disintegrations per-minute.

From your local grocery: candy happily called nuclear sludge. This stuff's got real shelf life.

Footnotes and Sources

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[5] *The Washington Post*, March 28, 1989

[6] *European Journal of Cancer Care,* July 2007, Vol. 16, Issue 4, 355–363, "Meta-analysis of Standardized Incidence and Mortality Rates of Childhood Leukemia in Proximity to Nuclear Facilities," Peter J. Baker, Department of Biometry and Epidemiology at the Medical University of South Carolina, <www.blackwell-synergy.com/doi/abs/10.1111/j.1365-2354.2007.00679.x>.

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