

Overview of Groundwater Monitoring Activities

Vermont Nuclear
Decommissioning Citizens
Advisory Panel
January 28, 2016

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Purpose of Groundwater Monitoring

- ▶ Radioactive materials within the structures, systems and components at Vermont Yankee may leak into or deposit on adjacent soils.
 - ▶ Groundwater can be sampled and analyzed for radioactive materials that exist in the soils and may migrate off-site.
 - ▶ Positive results above background levels may:
 - Indicate what radioactive materials reside in the soils.
 - Reveal new leaks or other sources of contamination.
 - Describe the pace of movement of radioactive materials in soils and elsewhere in the environment.
 - Shed light on potential impacts on public health, the environment, and decommissioning costs.
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Specific Known Sources of Site Contamination

- ▶ Leakage from plant structures, systems & components in the past.
 - ▶ Deposition of fallout from gaseous and particulate discharges from the plant stack and the exhaust of smaller contaminated systems and components during operations.
 - ▶ Accidental spills or runoff of radioactive materials to the ground or other surfaces and destinations.
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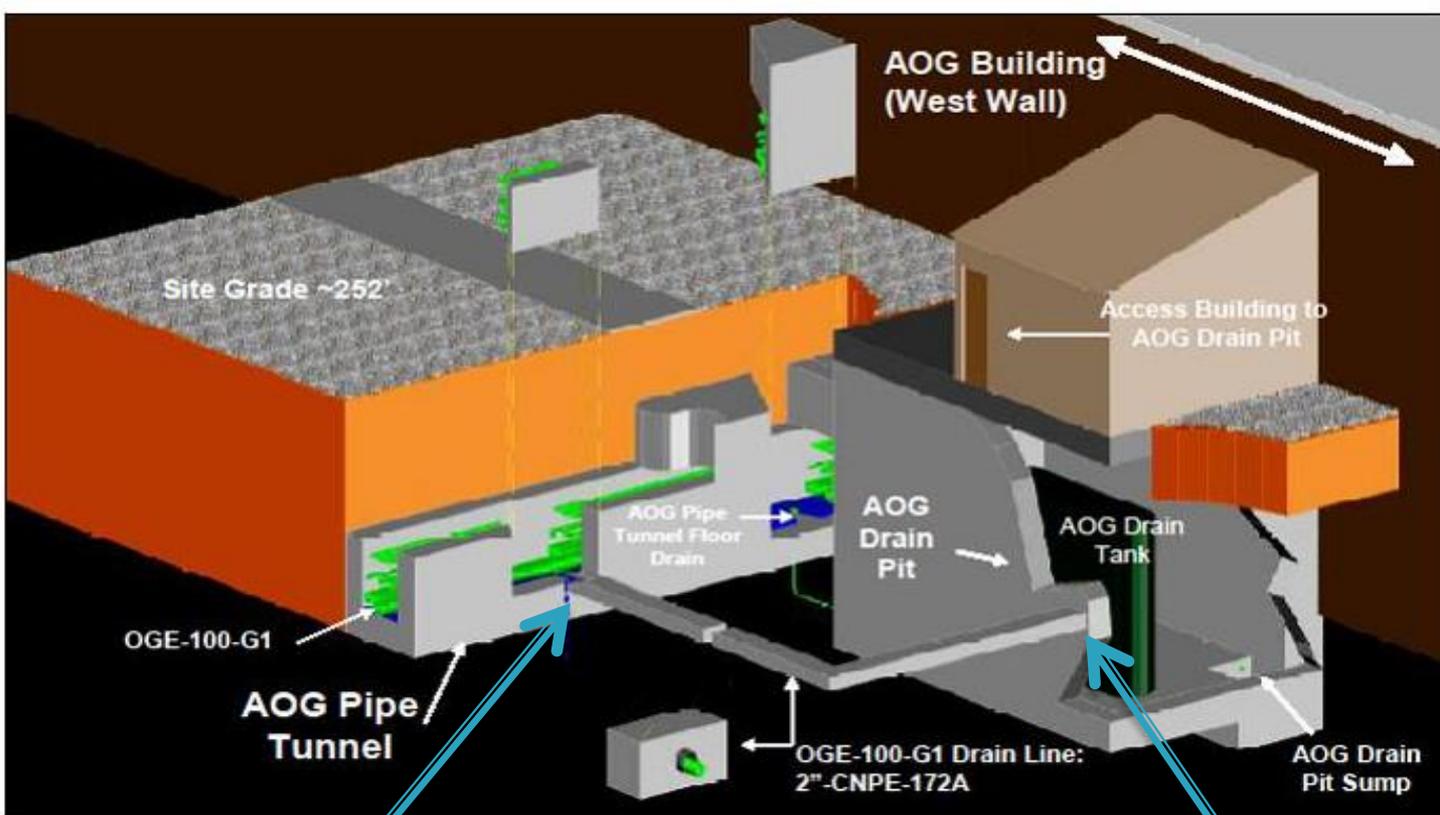
Dominant Plant-Related Radioactive Contaminants

- ▶ Corrosion products
 - Cobalt-60 (5.3 year half-life)
 - Manganese-54 (312 day half-life)
 - Zinc-65 (243 day half-life)
 - Iron-55 (2.7 year half-life)
- ▶ Fission products
 - Cesium-137 (30.2 year half-life)
 - Cesium-134 (2.1 year half-life)
 - Strontium-90 (29.1 year half-life)
- ▶ Hydrogen-3 (tritium)
 - From fission of lithium & activation of deuterium (H-2) in reactor coolant (12.3 year half-life).

Environmental Contamination Incidents in Site Assessment Study

- ▶ 1983 leak of 83,000 gallons of reactor makeup water in condensate storage tank.
- ▶ 1983 discovery of contaminated sand blast media near North Warehouse.
- ▶ 1987 cleanup of contamination from expended resin spills near Rad Waste Building.
- ▶ 1991 leak of drain line from Chemistry Lab; the contamination has been left in place.
- ▶ 1993 discovery of contaminated river sediments near North Storm Drain Outfall; found to come from Turbine Building exhaust.
- ▶ 2010 discovery of AOG Building leaks which may have occurred years earlier, well before monitoring wells were installed.

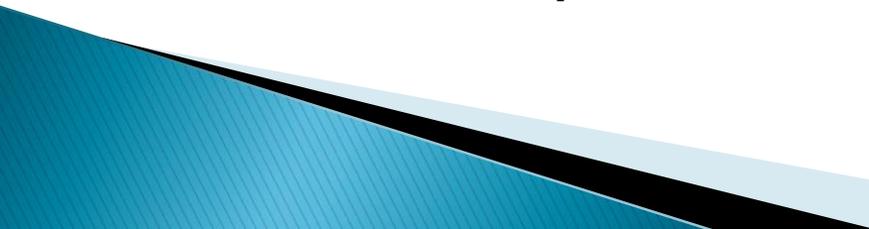
A third source of leaks between the AOG & Rad Waste buildings was identified in January 2011 and terminated by cutting and capping pipes in both buildings.



One source of leaks was identified and stopped in February 2010, at the AOG pipe tunnel.

A second leak was found and eliminated when the reactor was restarted in May 2010, at the AOG drain pit.

Longer Term Build-up from Routine Operations.

- ▶ Remediation of contaminated septic tank bottoms by spreading in field south of cooling towers.
 - ▶ Periodic land disposal of contaminated silt from the West Cooling Tower and the Discharge Structure.
 - ▶ Residual contamination from piles of plowed snow and the past burning of contaminated wood scrap.
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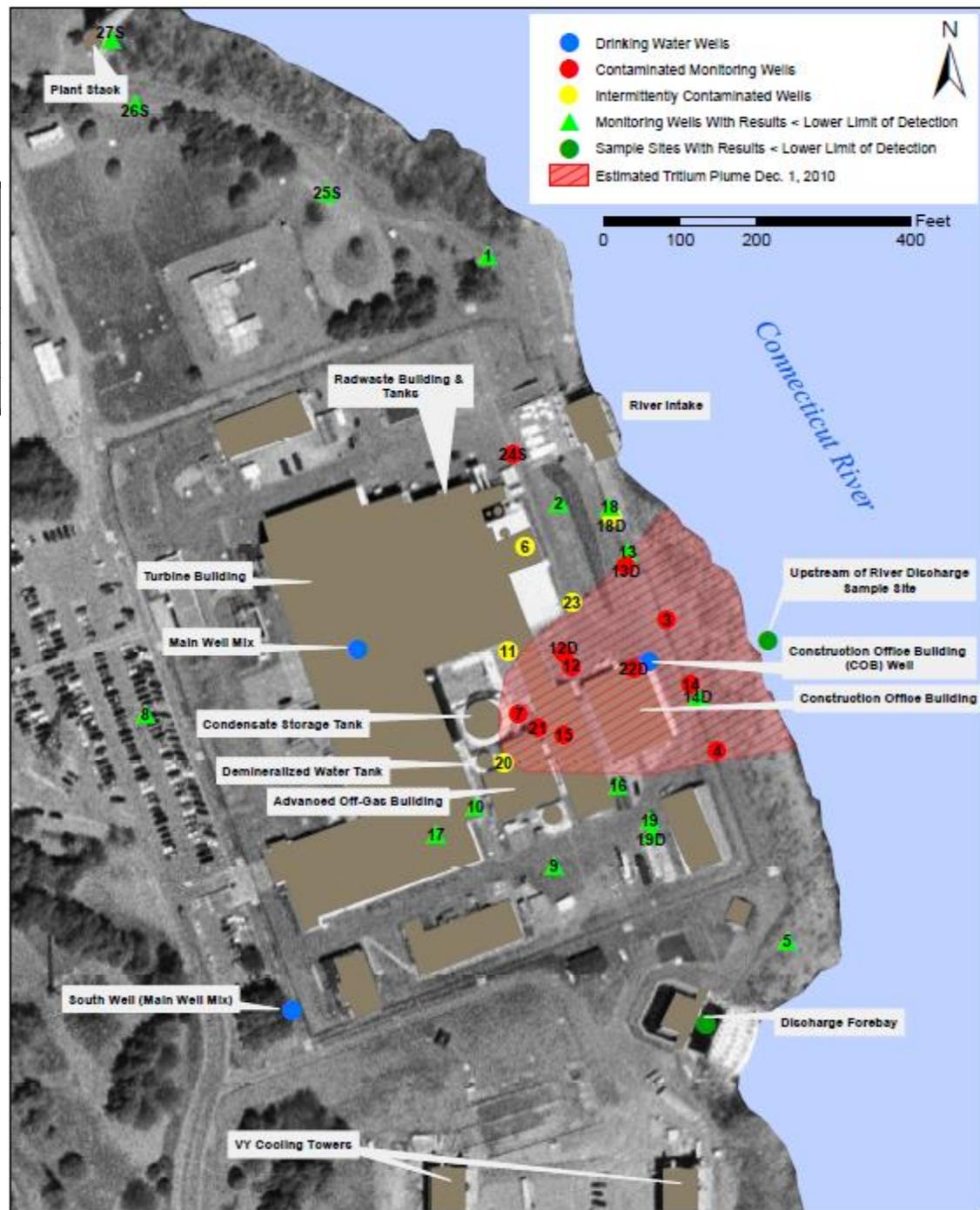
Both VY & Vermont Sample the Environment

- ▶ Both have comprehensive environmental monitoring programs and radiochemistry laboratories to analyze samples.
 - VY sends annual reports to the NRC which are published at: <http://www.nrc.gov/reactors/operating/ops-experience/tritium/plant-specific-reports/vy.html>
 - The Health Department publishes theirs at: http://healthvermont.gov/enviro/rad/vt_yankee.aspx#report
- ▶ Health depends on VY to split samples obtained on-site at VY.
- ▶ The Health Department limits of detection for sample analysis are generally more conservative – we report smaller values, usually because we count samples longer.
- ▶ As the nuclear industry has demonstrated, redundant and independent efforts assure better quality results.

On-site groundwater surveillance has changed over the years.

Date	Onsite Wells	All Water Sampling Sites	Water Samples Analyzed Each Year
Before 2010	3	13	160
2010 - 2012	31	51	1800
2012 - present	31	51	721

- In addition to measuring tritium in on-site groundwater & the river, Vermont has detected strontium-90 above 1.0 pCi/L in 31 samples from 16 wells.
- This is part of a comprehensive environmental monitoring program, some measure of which is valuable throughout decommissioning.



Surveillance During SAFSTOR

- ▶ It is impossible to know what the future may bring.
- ▶ Some contamination sources will not be discovered until the site is fully characterized by extensive sampling of the soils and/or active dismantlement of the facility begins.
 - During other reactor decommissionings, unexpected contaminants have been discovered, including:
 - Underground pools of tritium at Yankee Rowe
 - Large volumes of soils contaminated with strontium-90 or isotopes of plutonium and americium, what are called transuranics, at Maine Yankee & Connecticut Yankee.

Surveillance During DECON

- ▶ There are concerns about the off-site impacts of decontamination and dismantling activities during decommissioning.
 - ▶ This is likely to be the largest industrial activity in Vermont history.
 - ▶ There will be an increased risk of transportation and industrial accidents on- or off-site involving radioactive materials.
 - ▶ There may be airborne radioactive materials, and liquid spills and leaks.
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The Future

- The environmental surveillance program has provided data about the environmental & public health impacts of incidents at VY.
- While the number, type and severity of incidents changed when the reactor was shut down, there remain scenarios that could contaminate the environment.
- Complete & accurate knowledge of the extent of contamination from any radiological incident at VY is important to life in Vermont.

Sample Type	Sites	Number of Tests	Test Type	Results
Direct Gamma Radiation	72	286	Thermoluminescent dosimeters	Less than 20 milliroentgen per year at the land site boundary; no single quarter exceeded 10 milliroentgen.
Air: Particulates, Gases and Vapors	10	129	Total Alpha Radioactivity	Alpha radioactivity within the historical range. No increase observed as a result of operations at Vermont Yankee.
		129	Total Beta Radioactivity	Beta radioactivity within the historical range. No increase observed as a result of operations at Vermont Yankee.
		129	Iodine-131	No iodine-131 was detected in air samples.
		129	Gamma (gas/vapors) Radioactivity	Gamma radioactivity detected was of natural origin.
		4 (quarterly composites)	Gamma (particulates) Radioactivity	Gamma radioactivity detected was of natural origin.
Water	10	119	Total Alpha Radioactivity	Alpha radioactivity within the historical range. No increase observed as a result of operations at Vermont Yankee.
		119	Total Beta Radioactivity	Beta radioactivity within the historical range. No increase observed as a result of operations at Vermont Yankee.
	51	438	Tritium	All off-site, on-site active drinking water locations less than the lower limit of detection. Thirteen (13) on-site groundwater monitoring wells test positive for tritium. All positive wells were less than 20,000 pCi/L by December of 2014.
		437	Gamma Radioactivity	All detected gamma radioactivity of natural origin.
	47	164	Iron-55, Nickel-63, Strontium-90	All off-site, on-site active drinking water locations less than the lower limit of detection. Three (3) on-site groundwater monitoring wells test positive for Strontium-90. All samples less than the lower limit of detection for Iron-55 and Nickel-63.
Milk	2	18	Iodine-131	All samples less than the lower limit of detection.
		18	Gamma Radioactivity	Gamma radioactivity detected was of natural origin.
Vegetation	3	3	Gamma Radioactivity	Gamma radioactivity detected was of natural origin.
Soil	4	4	Gamma Radioactivity	Detected gamma radioactivity attributable to natural, Chernobyl or above-ground nuclear weapons testing origin.
Sediments	18	36	Gamma Radioactivity	Detected gamma radioactivity attributable to natural, Chernobyl or above-ground nuclear weapons testing origin.
Fish	2	4	Gamma Radioactivity	Gamma radioactivity detected was of natural origin.
		4	Iron-55, Nickel-63, Strontium-90	All detected radioactivity attributable to natural, Chernobyl or above-ground nuclear weapons testing origin.
Total number of tests		2170		