

Environmental Performance – Whiteshell Laboratories (WL), 2017 Calendar Year Report

As an ISO 14001:2004 Environmental Management Systems registered organization, Canadian Nuclear Laboratories (CNL) is committed to both studying and continuously improving the low impact of our operations on the environment. The Environmental Protection Program maintains both a comprehensive effluent monitoring program of airborne and liquid emissions and an environmental monitoring program of ambient air, surface water, groundwater, vegetation, soil and sediments, game animals and fish. More than 130 sampling locations are used for both programs.

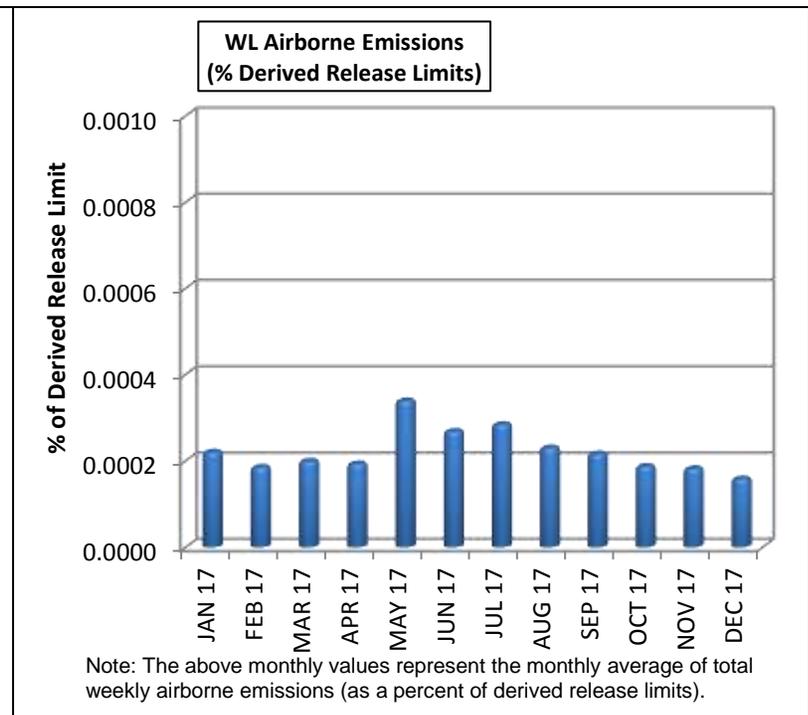
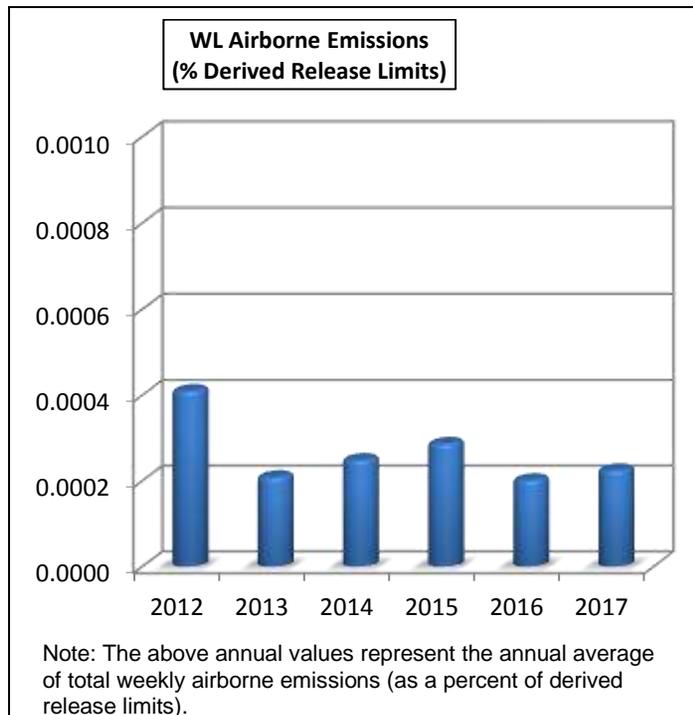
Groundwater samples are analyzed for radionuclides, major ions, trace elements, and a very broad range of organic compounds at 71 groundwater wells across the WL site. The organic analyses include volatile and extractable hydrocarbons, PCBs, DDTs and other organochlorines. Periodic update evaluations of groundwater flow systems around various facilities at Whiteshell Laboratories (WL) are also conducted.

Both the effluent monitoring and the environmental monitoring results are reported in the CNL Annual Safety Reports.

Radiation Exposures to the Public

Airborne and liquid emissions and environmental monitoring results are submitted annually to the Canadian Nuclear Safety Commission (CNSC) as confirmation that we are operating safely. This information is also available to the public upon request and through other community relations initiatives.

(Total maximum allowable regulatory limit = 100% of Derived Release Limit = 1 mSv/year)



Snapshot of Priority Emissions:

Airborne 0.00023 % DRL (Dec 2017)

Liquid 0.252 % DRL (Dec 2017)

Comparison of Everyday Radiation Sources

Source	Amount Per Year (mSv)	Percent of Allowable Regulatory Limit for WL (1 mSv)
Inside the Body (air—radon)	2	200%
Outer Space [Cosmic Rays] (1,524 – 1,829 metres)	0.55	55%
Inside the Body (food and water)	0.40	40%
Medical X-Ray	0.40	40%
Outer Space [Cosmic Rays] (sea level)	0.26	26%
Earth's Crust (sea level)	0.23	23%
Living in stone, brick, or concrete building	0.07	7%
Airline Flight (round-trip cross-country)	0.05	5%
Watching TV	0.01–0.02	1 – 2%
Airline Flight (per 1,609 kilometres flown)	0.01	1%
Computer Terminal	0.001	0.1%
Luminous Wristwatch	0.0006	0.06%
Coal-Fired Power Plant (living within 80 kilometres)	0.0003	0.03%
Nuclear Power Plant (living within 80 kilometres)	0.00009	0.009%
Smoke Detector	0.00008	0.008%

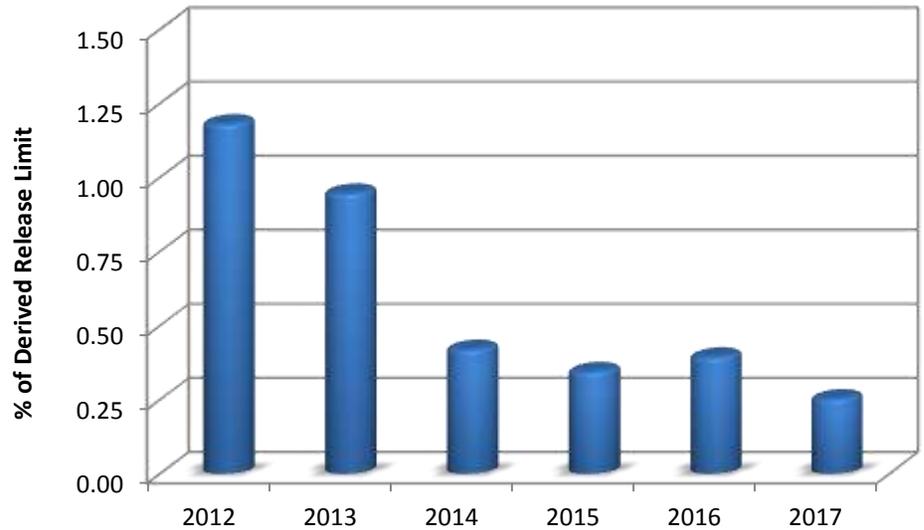
Sources: National Council on Radiation Protection & Measurements, U.S. Environmental Protection Agency, Nuclear Energy Institute.

Radiation Exposures to the Public (continued)

(Total maximum allowable regulatory limit = 100% of Derived Release Limit = 1 mSv/year)

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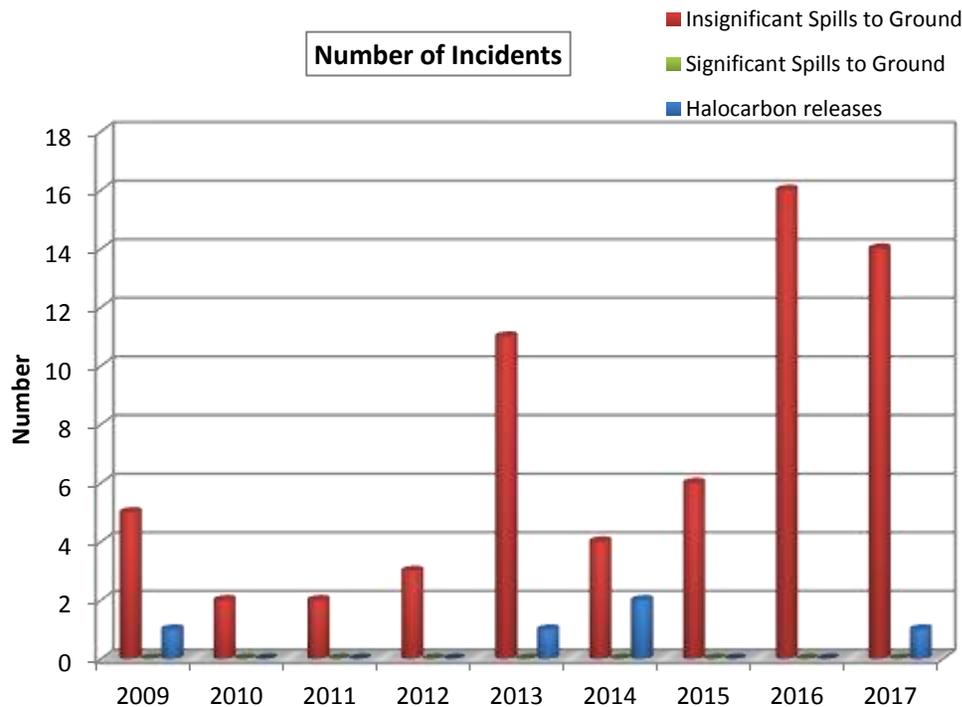
WL Liquid Effluents



Environmental Incidents

The types of incidents on-site at WL include: halocarbon releases (as reported to Environment and Climate Change Canada under the Federal Halocarbon Regulations), insignificant radiological or non-radiological spills to ground (non-reportable with negligible effect on the environment) and significant radiological or non-radiological spills to ground (reportable with some resulting effect on the environment).

The below table indicates the number and type of spills that have occurred at WL over the last nine years.



Note:

There were fourteen insignificant spills to the ground in 2017. The majority of spills ranged from 30 mL to 3.5 litres of either hydraulic fluid, gasoline, diesel, transmission oil or steering fluid to the ground. Most spills were caused by equipment failures. Insignificant spills to ground are spills that are easily remediated with no negative effect on the public or the environment. Efforts are made to prevent spills from occurring. Staff and contractors are required to inspect equipment before use and use spill containment equipment when appropriate. All spills were cleaned up immediately and waste soil was disposed of properly through a registered hazardous waste receiver.

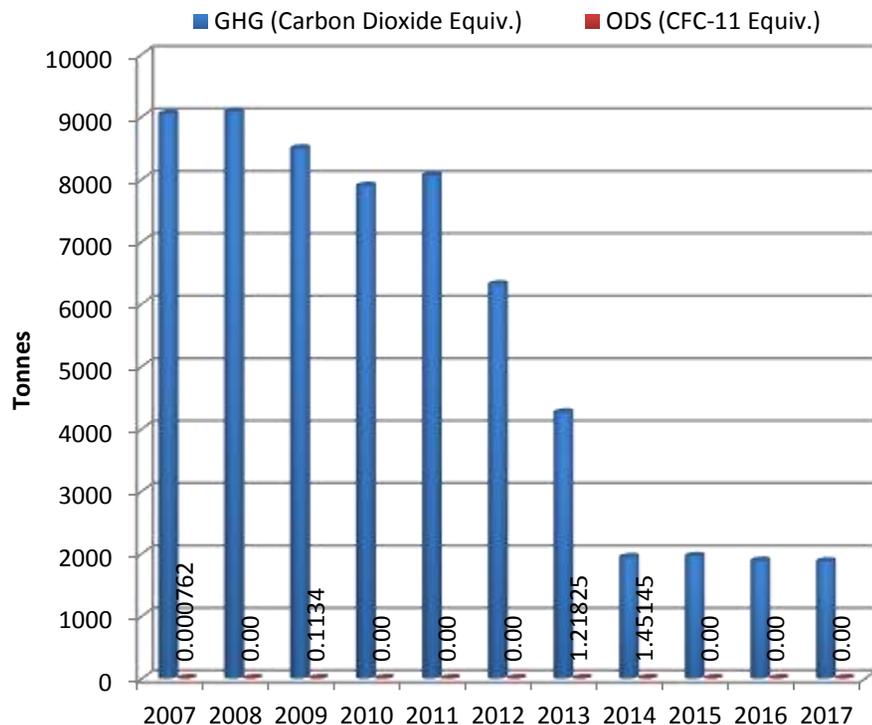
There have been no significant spills to ground for at least the last nine years. Significant spills to ground would be those entering waterways, causing adverse environmental effects and where remediation cannot be carried out immediately.

In 2017, there was one halocarbon release of 12.47 kgs of R-134a from the building 100 chiller which was included in semi-annual reporting to Environment and Climate Change Canada. During evacuation of the unit, for the purpose of replacing relief valves, a loss of halocarbon was found. It is estimated that this loss occurred from oil changes (when very small losses occur). A leak check will be conducted prior to recharging the equipment for the summer months, as per Federal Halocarbon Regulation. R-134a has no ozone depleting potential but is a potent greenhouse gas used in industrial chillers.

Non-Radiological Emissions

Greenhouse gas (GHG) emissions from WL include carbon dioxide (CO₂), methane, and nitrous oxide. Emissions are measured in CO₂ equivalent and are primarily from burning of propane for heating of some buildings on-site. Emissions of ozone depleting substances are measured in CFC-11 equivalent and include releases of chlorofluorocarbon (CFCs) and hydrochlorofluorocarbons (HCFCs). All halon R-1301 was sent off-site for disposal at a registered facility in 2015. CNL does not perform any charging of equipment containing CFC's or halons. Both of these are the most damaging ozone depleting substances.

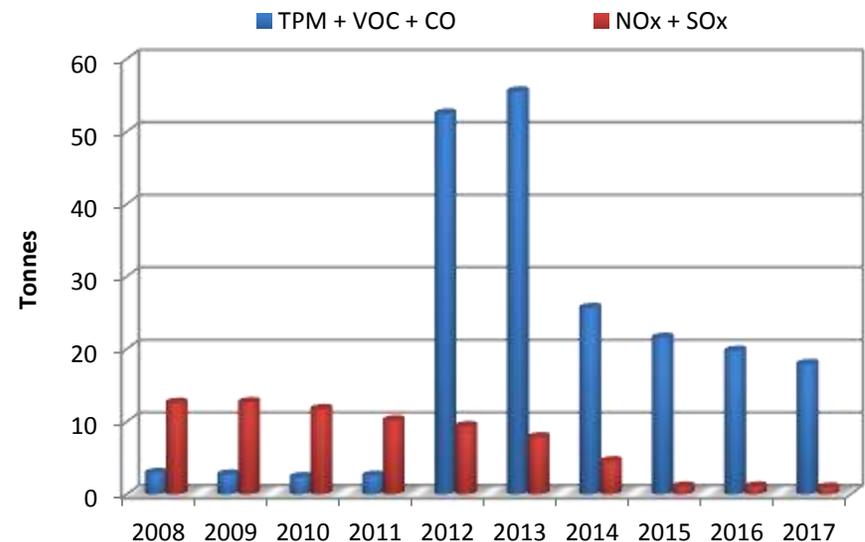
WL Greenhouse Gas and Ozone Depleting Substances Emissions



Note: In 2010 and 2011, emissions from diesel generators, transportation and the landfill were included. From 2012 to 2017, emissions from burning of wood were also included in the calculation.

Criteria Air Contaminants (CAC's) are calculated annually to comply with the Canadian Environmental Protection Act (CEPA). The following contaminants are calculated based on fuel consumption data, using recommended emission factors: carbon monoxide (CO), oxides of nitrogen and sulphur (NO_x and SO_x), total particulate matter (TPM), and volatile organic compounds (VOCs). Whiteshell Laboratories has reduced these emissions by converting from fuel-based heating to electrical heating and cleaner burning propane. The site boiler using Number 2 heating fuel was shut down in the spring of 2013. Starting in 2012, and continuing through 2017, calculations included dust emissions from travel on unpaved roads and sandblasting. In 2014 to 2017, dust suppressant was applied to some unpaved road segments on-site to significantly reduce total particulate matter emissions to air.

WL Criteria Air Contaminants



Note: Large increases of TPM were seen in 2012 and 2013 due to road dust emissions that were not previously included in calculations. Dust suppressant was applied to some unpaved road segments on-site to significantly reduce total particulate matter emissions to air in more recent years.

CO₂ Equivalent: A metric measure used to compare the emissions from various greenhouse gases based upon their global warming potential (GWP). For example, the GWP for methane is 25. This means that 1 tonne of methane is equivalent to 25 tonnes of carbon dioxide.

CFC-11 Equivalent: A metric measure used to compare the emissions from various ozone depleting substances based on their ozone-depleting potential expressed in amounts equivalent to that of CFC-11.