

Environmental Performance – Whiteshell Laboratories (WL), 2021 Calendar Year Report

As an ISO 14001:2015 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 200 sampling locations are used for both programs.

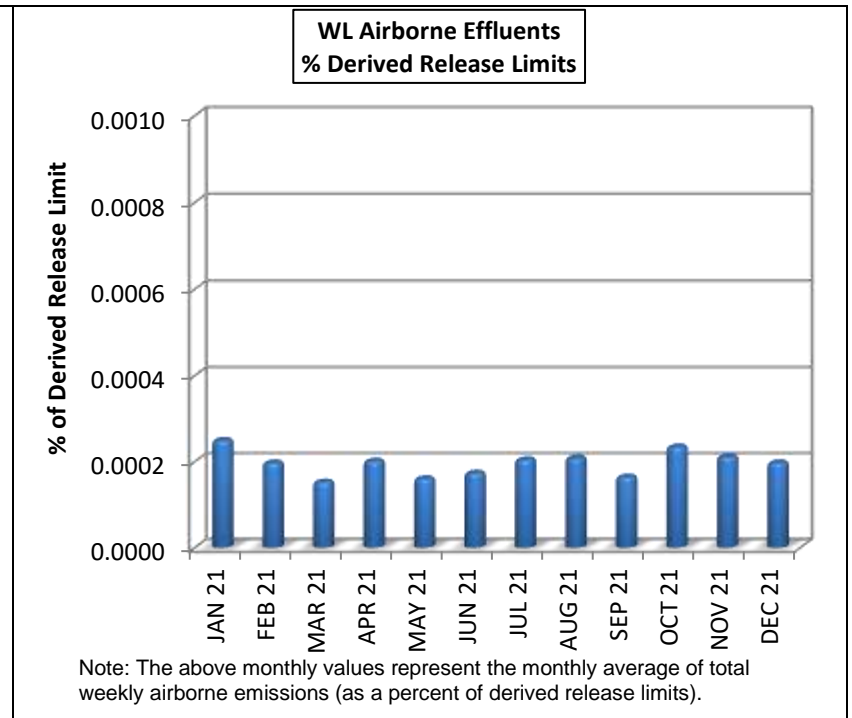
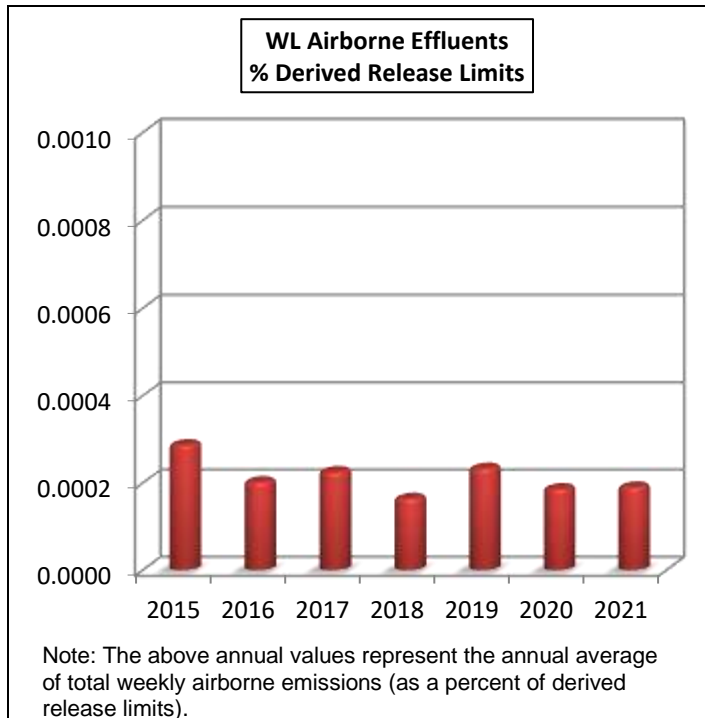
Groundwater samples are analyzed for radionuclides, major ions, trace elements, and a very broad range of organic compounds at 126 groundwater wells across the WL site. The organic analyses include volatile and extractable hydrocarbons, PCBs, DDTs and other organochlorines. Periodic update evaluations 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 Compliance Monitoring 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 0.00019 % DRL (2021)
 Liquid 0.450 % DRL (2021)

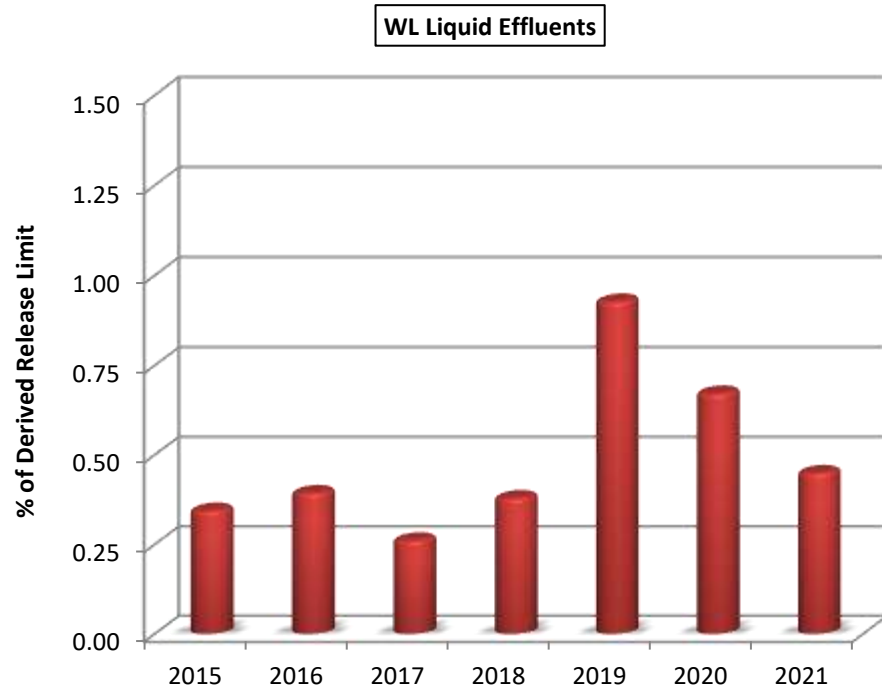
Comparison of Common Radiation Sources

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)

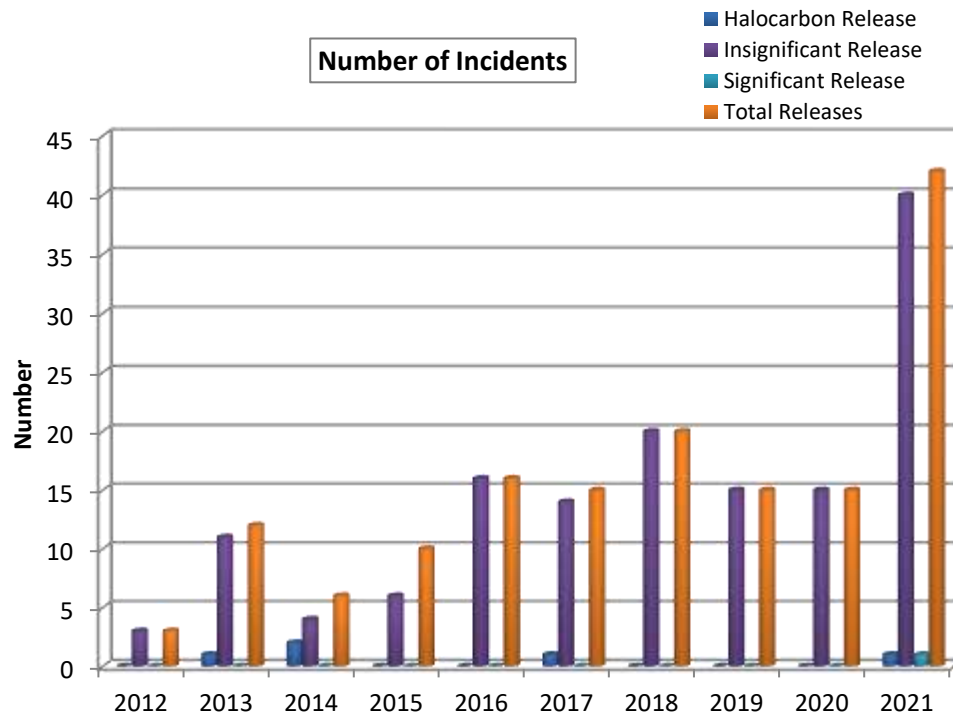
(Total maximum allowable regulatory limit = 100% of Derived Release Limit = 1 mSv/year) Airborne and liquid emissions and environmental monitoring results are submitted annually to the CNSC as confirmation that we are operating safely. This information is also available to the public upon request and through other community relations initiatives.



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 impact on the environment) and significant radiological or non-radiological spills to ground (reportable with some resulting impact on the environment).

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



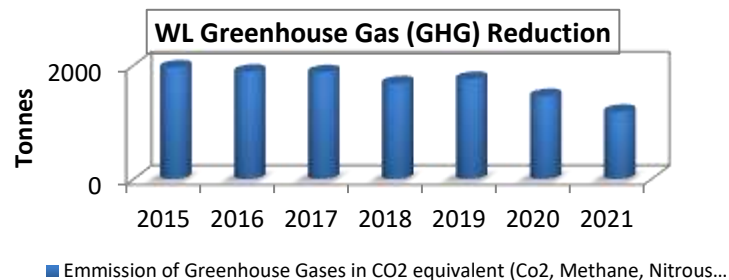
There were 40 insignificant spills to the ground in 2021. The majority of spills ranged from 50 millilitres to 50 litres of either hydraulic fluid, oil, coolant, antifreeze or diesel to the ground. The root cause of these incidents can be attributed to equipment failures and human error. Insignificant spills to ground are spills that are easily remediated with no negative impact 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 secondary spill containment equipment. All spills were cleaned up immediately, and wastes and contaminated soils were disposed of properly through a registered hazardous waste receiver.

There was one significant release to the environment in 2021. Significant spills to ground would be those of large volumes or releases that enter waterways, causing adverse environmental effects and where remediation cannot be carried out immediately. The one significant release was 160 litres of hydraulic fluid from the hyster 550 fork lift. The fork lift was taken out of service until repaired and the spill was immediately cleaned up.

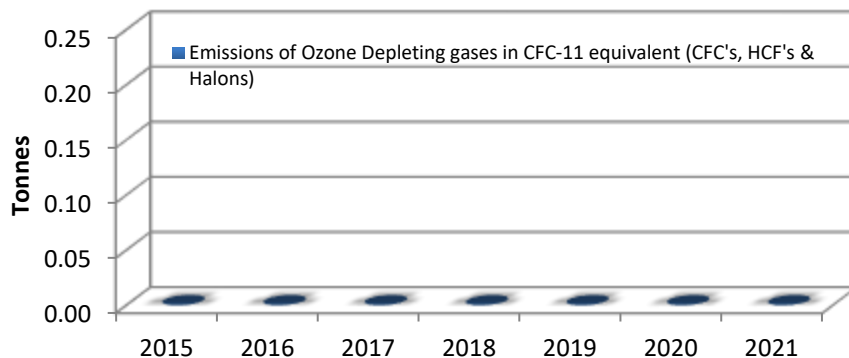
In 2021, there was one reportable halocarbon releases. 15.5 kg of R-134a was released from the B100 chiller in Room 640. This event is reportable to Environment and Climate Change Canada (ECCC) in a semi-annual release report as per Federal Halocarbon Regulation.

Non-Radiological Emissions

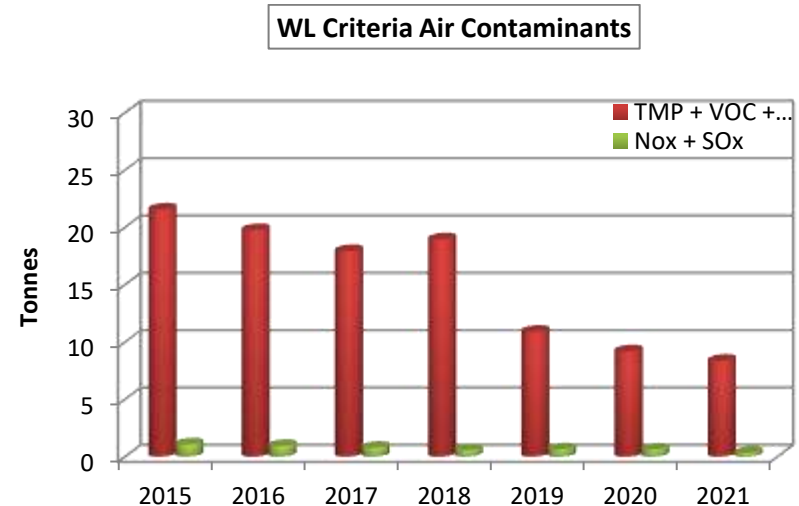
Greenhouse gas (GHG) emissions from WL include carbon dioxide (CO₂), methane, and nitrous oxide. Emissions are measured in CO₂ equivalent and are primarily from burning of propane for heating of some buildings on-site. Emissions of ozone depleting substances are measured in CFC-11 equivalent and include 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



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 2021 calculations included dust emissions from travel on unpaved roads and sandblasting. In 2014 to 2021, dust suppressant was applied to some unpaved road segments on-site to significantly reduce total particulate matter emissions to air.



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.