Environmental Performance – Chalk River Laboratories, 2021 March Report
Availability of emissions data is outlined on each graph.

As an ISO 9001:2015 Quality Management Systems and ISO 14001:2015 Environmental Management Systems registered organization, CNL is committed to both studying and continuously improving the low impact of our operations on the environment. The Environmental Protection Program maintains a comprehensive effluent and environmental monitoring program of more than 400 sampling locations with approximately 30,000 analyses performed each year at our Chalk River Laboratories (CRL). Monitoring is regularly conducted on various media, including ambient air, surface water, vegetation, soil and sediments, and game animals, at various locations on and off the site.

The Groundwater Monitoring Program (GWMP) conducts routine groundwater sampling at about 170 locations across the CRL site. The samples are analyzed for radionuclides, major ions, trace elements, and a very broad range of organic compounds. The organic analyses include bulk parameters (e.g. total organic carbon), analytical suites that include volatile and extractable hydrocarbons and halogenated hydrocarbons, and at targeted locations PCBs, dioxins, and furans. In total, the routine monitoring component of the GWMP provides determinations of the concentrations of about 50,000 parameters per year. The GWMP also includes a schedule of periodic update evaluations of groundwater flow systems around various facilities at CRL.

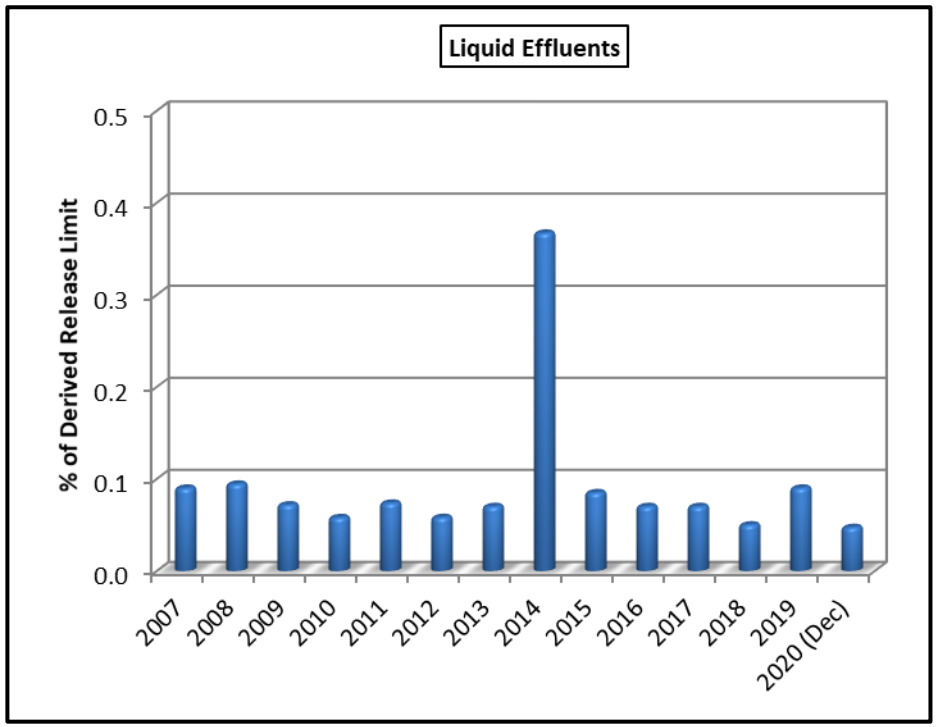
Comparison of Radiation Sources

Snapshot of Priority Emissions at CNL:

Airborne NOx and SOx	64	Tonnes	(2020 Dec)
Airborne Tritium	0.08	% DRL	(2020 Dec)
Waterborne Tritium	0.0008	% DRL	(2020 Dec)

Source	Amount Per Year (mSv)
Inside the Body (air—radon)	2
Outer Space [Cosmic Rays] (5,000-6,000 ft)	0.55
Inside the Body (food and water)	0.40
Medical X-Ray	0.40
Outer Space [Cosmic Rays] (sea level)	0.26
Earth's Crust (sea level)	0.23
Living in stone, brick, or concrete building	0.07
Airline Flight (round-trip cross-country)	0.05
Watching TV	0.01–0.02
Airline Flight (per 1,000 miles flown)	0.01
Computer Terminal	0.001
Luminous Wristwatch	0.0006
Coal-Fired Power Plant (living within 50 miles)	0.0003
Nuclear Power Plant (living within 50 miles)	0.00009
Smoke Detector	0.00008

Sources: National Council on Radiation Protection & Measurements (NCRP), U.S. Environmental Protection Agency (EPA) and Nuclear Energy Institute (NEI)

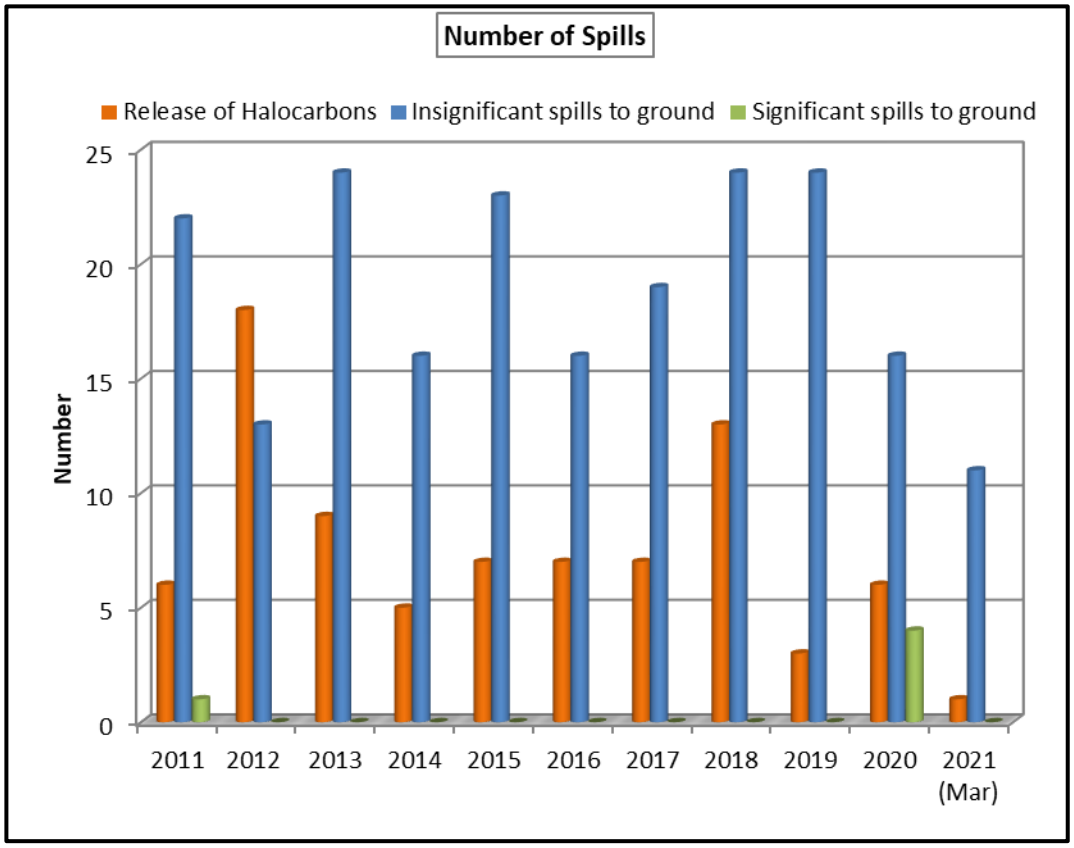


The increase in liquid effluents was related to a known event that occurred at the end of August 2014. The event was not reportable to the CNSC, there were no limit exceedances and negligible impact to the public or to the environment.

Airborne and liquid emissions as well as the results from the environmental monitoring program and the GWMP are regularly submitted 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 Discharges

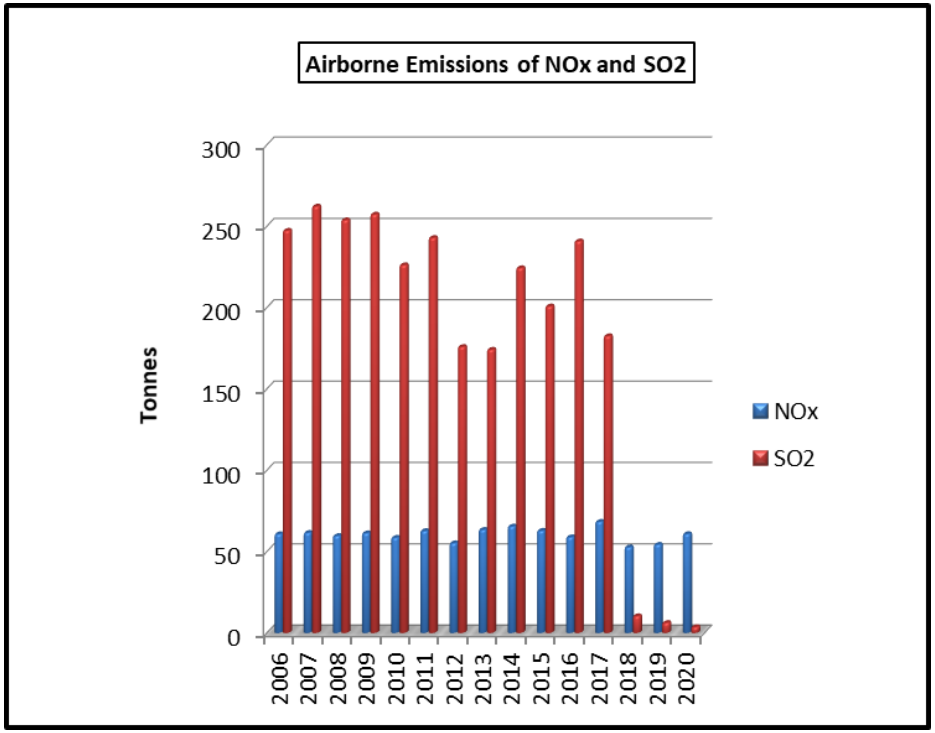
The types of spills onsite at CRL include: Halocarbon Releases (as reported to Environment Canada under the Federal Halocarbon Regulations), insignificant radiological or non-radiological spills, and significant radiological or non-radiological spills to ground (reportable with some resulting effect on the environment).
As part of continual improvement efforts, we regularly update an Environmental Risk Assessment of the CRL site, the objective of which is to quantify, using available data, the potential effects of operations and activities at the site, including effects on and off the site. This Environmental Risk Assessment then feeds into the continual improvement in design of our effluent and environmental monitoring programs.



Noted Trend:
Insignificant Spills to Ground are spills that are easily remediated with no negative effect on the public or the environment. Significant spills are generally those that require reporting to external regulatory bodies and potentially require some effort to remediate. All significant spills to ground are reported to the Canadian Nuclear Safety Commission and Environment and Climate Change Canada as required. Immediate actions are taken in response to all spills in order to minimize the impact to the environment. All areas have been remediated and corrective actions are implemented as appropriate and CNL strives to use the lessons learned from these events to continually improve our performance

Non-Radiological Air Emission Limits Outlined in CRL's Site Licence

The main stationary source of non-radiological emissions to air from CRL in 2017 were from the burning of #6 fuel oil (Bunker C) and Natural Gas at the Powerhouse used to supply district heating and process steam to the main buildings on site. 2017 saw the replacement of #6 fuel oil to Natural Gas later in the year. The use of #6 fuel oil in 2018 is now solely for back-up purposes. The figure below illustrates the NO_x and SO_2 emissions over the past number of years. A decrease in both was observed in the 2017 CY, due to the partial conversion of the use of #6 fuel oil to the use of Natural Gas, with an even greater decrease observed in 2018.

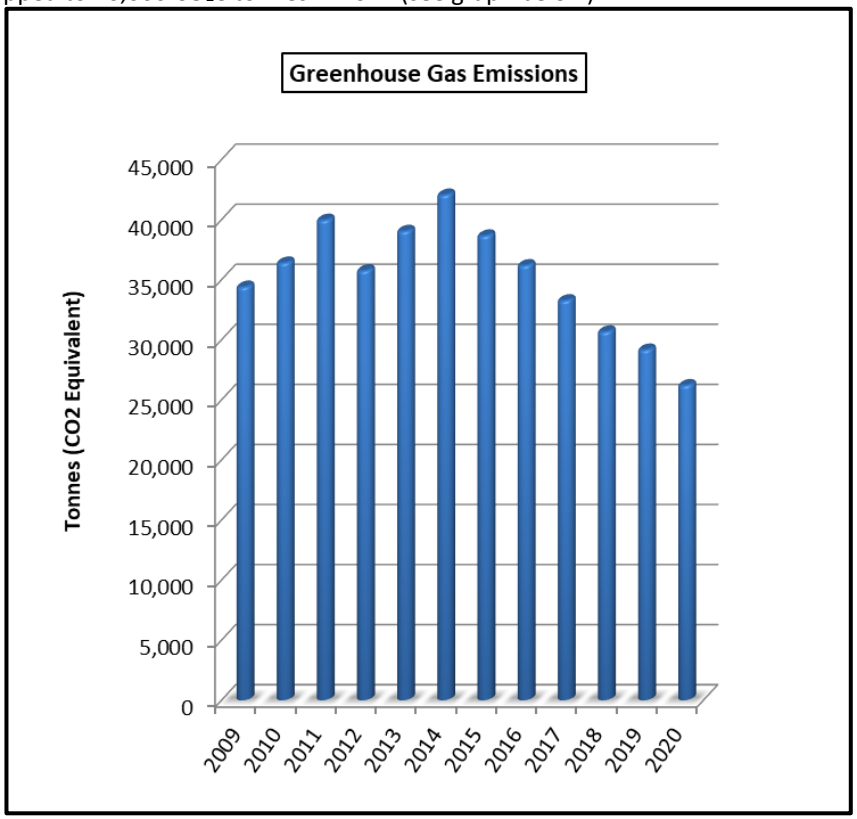


Greenhouse Gases (GHGs)

CRL is required to annually report its Greenhouse Gas (GHG) under the Canadian Environmental Protection Act (CEPA) if the site releases ≥10,000 CO_2e tonnes. This threshold was reduced from 50,000 CO_2e tonnes to 10,000 CO_2e tonnes for the 2017 reporting year.

Greenhouse Gas (GHG) emissions from CRL include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulphur hexafluoride (SF_6) and select hydrofluorocarbons (HFCs). Emissions are measured in CO_2e and are primarily from the combustion of #6 fuel oil and natural gas for onsite heating with more minor contributions from landfills and the on-site transportation fleet. A number of other sources make up other less significant emission sources, including the burning of other fuels, industrial processes etc.

CRL has been reporting our emissions since the under the reporting threshold dropped to 10,000 CO_2e tonnes in 2017 (see graph below).

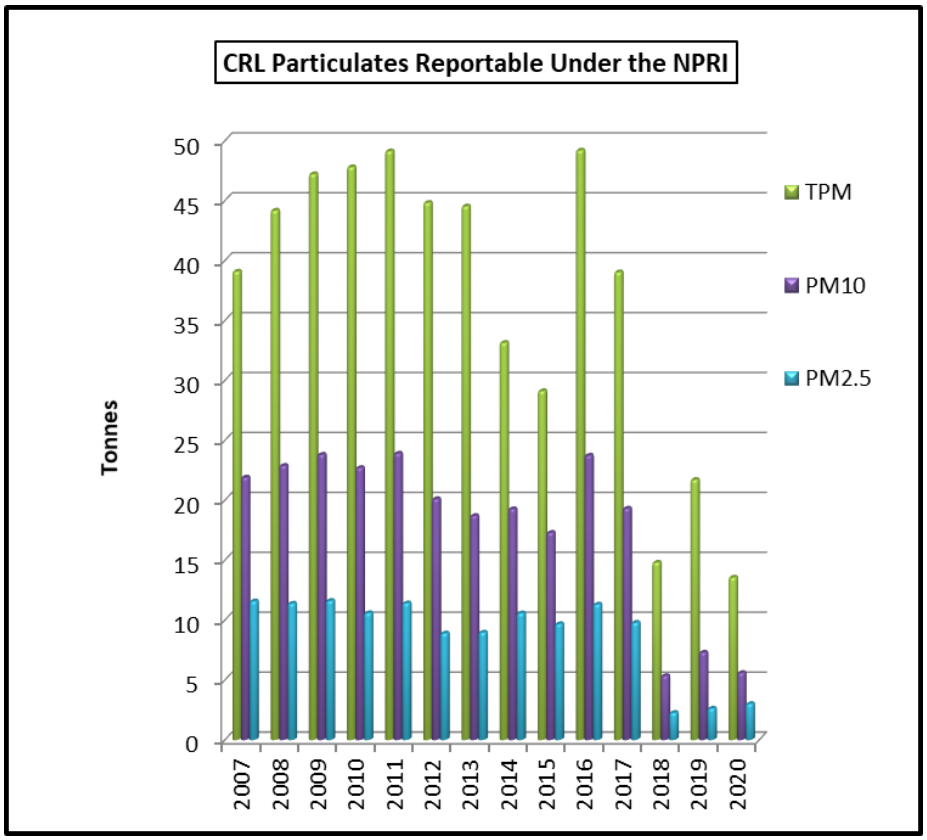


CO_2e (Carbon Dioxide Equivalent): A unit of measure used to compare between gases that have different Global Warming Potentials (GWP). For example, the GWP for methane is 25. This means that an emission of one tonne of methane is equivalent to the emission of 25 tonnes of carbon dioxide.

National Pollutant Release Inventory (NPRI)

CRL reports annually to the National Pollutant Release Inventory (NPRI) as required under the Canadian Environmental Protection Act (CEPA). Criteria Air Contaminants (CACs) of interest under the NPRI which are released by CRL include:

- Oxides of Nitrogen (NOx);
- Sulphur Dioxide (SO2);
- Total Particulate Matter (TPM);
- Particulate Matter of 10 micron or less (PM10);
- Particulate Matter of 2.5 micron or less (PM2.5);
- Carbon Monoxide (CO); and,
- Volatile Organic Compounds (VOCs).



Releases are a result of: the burning of fuels on site for heating and steam production; road dust emissions; diesel generator use; solvent use, and the storage of petroleum fuel. See the graphs below for CRL's emissions which have typically met the NPRI reporting thresholds. Note: 2018 saw both SO2 and TPM emissions drop below their respective reporting limits as a result of (1) the switch from primarily burning #6 fuel oil on site to primarily burning Natural Gas and (2) reduced particulate emissions from unpaved road dust in the 2018 CY.