

Management of Carbon-14 Emissions and Environmental Impacts at Ontario Power Generation Nuclear

Abstract

Ontario Power Generation (OPG) is a Canadian-based electricity generation company whose principal business is the generation and sale of electricity in the province of Ontario, Canada. Apart from hydroelectric and thermal generating assets, OPG also has three nuclear generating stations which use a Canadian technology, CANDU, a heavy water reactor.

One of CANDU by-products is Carbon-14 (C-14). C-14 is produced in various systems of a CANDU reactor, but the dominant source is ^{17}O irradiation in the moderator heavy water (D_2O). The majority of this C-14 is captured on the moderator ion-exchange resins, and is stable. A small fraction of the produced C-14 is emitted, primarily as airborne carbonates. Brief emission excursions have occurred at several stations, generally resulting from an upset in moderator chemistry coupled with increased purging or venting of the moderator cover gas. Waterborne C-14 releases are very small. Our annual airborne and waterborne C-14 emissions are less than 0.1 % and 0.01% respectively of the license limits.

OPG has monitored C-14 emissions and C-14 in the environment since the 1980s and a number of initiatives to reduce C-14 emissions have been successfully implemented over the last ten years. With respect to the dose impact of C-14 to the public, OPG has a comprehensive radiological environmental monitoring program (REMP) to ensure that our estimations of the public doses can be as practical as possible.

The majority of C-14 dose to the public comes from the consumption of terrestrial plants and animal products. C-14 contributed up to 80% of the overall public doses resulting from the operations of OPG nuclear station. However, the calculated maximum dose to a member of the public from emitted C-14 remains less than 0.02 % of the global-average dose from natural sources (2400 uSv), and less than 0.05% of the regulatory limit (1000 uSv).

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