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SURFACE WATER QUALITY ASSESSMENT FOR THE NEAR SURFACE DISPOSAL FACILITY – ERRATUM

232-03710-REPT-010

Revision 0

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GOLDER

TECHNICAL SUPPORTING DOCUMENT

Canadian Nuclear Laboratories

Surface Water Quality Assessment for the Near Surface Disposal Facility - Erratum

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Revision History

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Draft 0	October 20, 2020	Issued to CNL for review and comment	Steve Mitchell John Faithful	Callum Squires Alyson Beal
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TABLES

LIST OF ACRONYMS AND ABBREVIATIONS

Acronym	Definition
CoPC	Constituent of Potential Concern
EDT	Effluent Discharge Target
EIS	Environmental Impact Statement
ESW	East Swamp Weir
OR	Ottawa River
PCO	Perch Lake Outlet
PCW	Perch Lake Weir
PL	Perch Lake
RB	Risk Benchmark
WWTP	Wastewater Treatment Plant

LIST OF UNITS

Units	Definition
Bq/L	Becquerels per litre

1.0 INTRODUCTION

In the Surface Water Quality assessment of the EIS (Section 5.4.2; Golder 2019a) and the associated Technical Supporting Document titled, *Surface Water Quality Assessment for the Near Surface Disposal Facility* (Golder 2019b), the surface water quality modelling used an incorrect effluent discharge target source term for tritium. The GoldSim surface water quality mass balance model used 230,000 Bq/L instead of 360,000 Bq/L, as identified in the *Effluent Discharge Target Document* (CNL 2019). Although the water quality model used the incorrect source term, the correct CoPC effluent discharge target was referenced in Section 3 (Golder 2019b), where the rationale for the tritium discharge target was described. To reiterate, the effluent discharge target for tritium represents that maximum concentration of tritium in the WWTP effluent that will ensure that tritium concentrations in Perch Creek do not exceed 7,000 Bq/L, the drinking water guideline.

As tritium is a constituent of potential concern to human health or the environment, and of particular concern to the public (Golder 2019a; EIS Section 4), this erratum has been prepared to provide an update to the surface water quality assessment through application of the corrected effluent discharge target source term for tritium in the water quality modelling. This erratum provides a projection of tritium concentrations in the downstream receiving environment of Perch Lake and the Perch Creek watershed, and in the Ottawa River downstream of confluence with the Perch Creek outlet. The updated model projections are also evaluated to determine if the revised modelled downstream concentrations change, and if so, provide a revision to the conclusions of the surface water quality assessment.

The Technical Supporting Document (Golder 2019b) also included incorrect units for the radiological parameters in Tables 3-35 (carbon-14), Table 3-36 (caesium-137), Table 3-37 (cobalt-60), Table 3-38 (gross beta [as strontium-90]), and Table 3-39 (tritium). The units for these parameters were shown as “Bg/L” instead of “Bq/L”.

2.0 METHODS

There were minor changes to the methods used in the surface water quality modelling and assessment in this erratum as a result of correcting the effluent discharge target source term for tritium.

The modelling approach, assessment nodes, and modelled scenarios remained the same as described in Section 2 of the Technical Supporting Document (Golder 2019b), with the following adjustments to the modelling inputs and assumptions:

- The effluent discharge target source term for tritium was corrected to 360,000 Bq/L.
- A tritium loading source to the Perch Creek watershed downstream of Perch Lake was added to the modelling to represent tritium inputs to Perch Creek from a groundwater plume.

  The tritium groundwater plume discharging to Perch Creek is from a liquid dispersal pit, Reactor Pit 2, located to the northwest of the NSDF site, which was used for low level radioactive liquid waste storage for several decades till 2000. Tritium is the only contaminant in the groundwater plume that has reached Perch Creek. No other radiological or non-radiological groundwater plume discharges to Perch Creek have been measured or are expected in the future (migration rates of other radionuclides are much slower than tritium due to sorption, and there is no other non-radiological source term). The Reactor Pit 2 source term and contaminant migration from Reactor Pit 2 are described in CNL (2016).

The focus of the modeling remained on the application case for the NSDF Project, which limits the assessment on potential effects from the Project during construction through the operations phase.

3.0 APPLICATION CASE MODEL RESULTS FOR TRITIUM

Model results for tritium are presented by node and model scenario. All concentrations are inclusive of the background concentrations (at nodes where background information was available).

3.1 Tritium

The maximum projected wastewater concentration for tritium (140,000 Bq/L) is lower than the corrected effluent discharge target (360,000 Bq/L). However, for conservatism, source term inputs to the water quality model for the operational discharge scenario used the effluent discharge target.

Existing baseline tritium concentrations in the Perch Creek and Perch Lake Watershed ranged between 355 to 3,600 Bq/L (Table 3-1). A lower existing baseline concentration at East Swamp Weir (ESW) (355 Bq/L) relative to the other assessment nodes in the Perch Lake Watershed and Perch Creek downstream of Perch Lake was evident (2,565 to 3,600 Bq/L). The higher baseline concentration at Perch Creek Weir (PCW) is attributed to the tritium sourced in the creek from the groundwater plume resulting from Reactor Pit 2 inputs to the plume. The existing baseline concentration for the Ottawa River was 6.6 Bq/L.

As a result of the correction to the effluent discharge target, which is higher than the source term used in the previous modelling, the updated tritium concentrations are higher at the assessment nodes in Perch Creek and Perch Lake Watershed for each discharge scenario. The increase is most pronounced at ESW and Perch Lake Inlet #2 (PL2) in Scenario 1, which represents the split discharge from the WWTP to the exfiltration gallery and direct discharge to Perch Lake; this increased projection at ESW and PL2 in Scenario 1 was also discernible in the modelling using the previous effluent discharge target.

The updated modelled tritium concentrations at all assessment nodes for each discharge scenario in the Perch Lake and Perch Creek Watershed remain below the effluent discharge target, including accounting for the groundwater effluent plume tritium inputs downstream of Perch Lake, and well below the risk benchmark (17,400,000 Bq/L). Higher concentrations projected in ESW and PL2 under the combined discharge scenario (especially at ESW) suggest that the assimilation of the treated effluent through the exfiltration gallery is not as pronounced as the direct discharge of treated effluent to Perch Lake.

Tritium was also elevated above baseline levels in Perch Lake (PL) under both modelling scenarios, which then consistently attenuated with distance downstream through Perch Creek. With the exception of the Mean modelled projections in ESW and the 95th Percentile and Maximum modelled projections in ESW and PL2 under the combined discharge scenario, projected concentrations in the Perch Lake and Perch Creek Watershed remain below the Canadian Drinking Water Guideline of 7,000 Bq/L (Health Canada 2020), and therefore well below the no effect concentration.

Modelled concentrations in the Ottawa River remained similar to background concentrations, indicating that any incremental changes in concentration as a result of the NSDF Project in the Ottawa River are expected not to be measurable. The water quality modelling results for tritium are presented in Table 3-1.

Table 3-1: Water Quality Modelling Results for Tritium

Tritium	Units	ESW	PL2	PL[(a)]	PCW	PCO	OR
Criteria	Bq/L	EDT: 360,000; RB: 17,400,000					
Measured Background Concentration	Bq/L	355	2,729	2,565	3,600	3,600[(b)]	6.6
Scenario 1 - 50% to Exfiltration Gallery, 50% Direct Discharge to Perch Lake							
Mean	Bq/L	44,302	5,682	4,493	4,291	4,222	7.0
95th Percentile	Bq/L	127,512	12,248	5,201	4,899	4,794	7.5
Maximum	Bq/L	129,415	12,463	5,206	4,903	4,798	7.5
Scenario 2 - 100% Direct Discharge to Perch Lake							
Mean	Bq/L	355	2,802	4,493	4,291	4,222	7.0
95th Percentile	Bq/L	355	2,802	5,201	4,899	4,794	7.5
Maximum	Bq/L	355	2,802	5,206	4.903	4,798	7.5

(a) The Perch Lake existing baseline tritium concentration is based on a flow-weighted calculation using all available upstream data sources. Existing baseline tritium concentrations in Perch Lake were only available from 2018 (average = 131 Bq/L). The flow-weighted average concentration for PL was preferentially used for the modelling assessment over the lake-specific measured data for conservatism.

(b) PCO existing baseline concentrations were assigned PCW existing baseline concentrations since the PCO location is just downstream of the PCW location.

Bq/L = Becquerels per litre; EDT = effluent discharge target; RB = risk benchmark.

3.2 Prediction Confidence and Uncertainty

Predicted residual effects are not expected to be underestimated for the projected modelled tritium concentrations in the application case because of the conservatism factored in the modelling assessment:

- The maximum projected wastewater tritium concentration (140,000 Bq/L) is lower than the corrected effluent discharge target (360,000 Bq/L); however, the effluent discharge target concentration was used as the WWTP input source in the model.
- In each discharge scenario, the water quality model was run without decay or sorption mechanisms, whereas in actuality concentrations may be subject to chemical, physical, radioactive decay, and biological processes that can remove them from the mass balance as they progress downstream.

These conservatisms in the modelling provide confidence that the projections of tritium in Perch Creek and Perch Lake Watershed, and the Ottawa River are not underestimated.

4.0 CONCLUSIONS

In this erratum, the surface water quality mass balance model source term input for tritium in discharge from the wastewater treatment plant to the downstream receiving environment of Perch Lake and the Perch Creek Watershed was corrected from 230,000 Bq/L to 360,000 Bq/L. The model was also updated to account for a groundwater tritium input source to Perch Creek downstream of Perch Lake from Reactor Pit 2, which was used as low level radioactive liquid waste storage area for several decades up to 2000.

The model assessment for the two discharge scenarios in the application case was repeated for tritium. Incremental changes in tritium were projected under Scenario 1 (50% discharge via the exfiltration gallery and 50% direct discharge to Perch Lake) in ESW and PL2, with limited changes at these locations in Scenario 2 (direct discharge to Perch Lake). Increased concentrations above baseline were modelled for Perch Lake under both scenarios, which then attenuated downstream of Perch Lake to the Ottawa River.

Although the updated modelled tritium concentrations resulted in higher concentrations then reported in Section 5.4.2.of the EIS (Golder 2019a) and the corresponding Surface Water Quality Technical Supporting Document (Golder 2019b), the modelled concentrations in Perch Lake and the Perch Creek Watershed, including Perch Lake, remained below the Canadian Drinking Water Guideline of 7,000 Bq/L (Health Canada 2020), and well below the no effect concentration.

Signature Page

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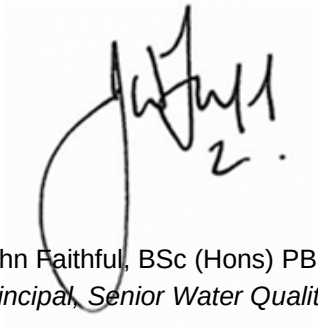

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https://golderassociates.sharepoint.com/sites/10467g/eis report/17. surfacewatertsd-revised/erratum/1547525_cnl_nsdf_surface water quality assessment tsd_erratum_rev0_24nov2020.docx

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