North Atlantic

Appendix 5: Additional Information Related to the Air Dispersion Modelling Assessment

1118 Topsail Road PO Box 8353 Station A
Mount Pearl, NL A1N 5E7
Canada

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**North Atlantic Refining Corp.
29 Pippy Place
St. John's NL A1B 3X2**

**Avalon Isthmus North Atlantic Refining Corp. Green Energy Project
Additional Information Related to the Air Dispersion Modelling Assessment**

GHD Limited (GHD) prepared an air dispersion modelling assessment to evaluate the air quality impacts associated with the Avalon Isthmus North Atlantic Refining Corp. (North Atlantic) Green Energy Project (the Project) in 2025. The modelling report noted:

> *At this stage of Project development, detailed specifications and exact locations of these emission sources are not finalized. For the purposes of this assessment, GHD applied conservative assumptions based on other green hydrogen facilities. These inputs are intended to provide conservative modelling results, such that the actual emissions from Project operations will be less than those modelled.*

The modelling showed predicted exceedances of the ambient air quality standards near the Project fenceline for particulate matter less than 10 microns (PM_{10}), and particulate matter less than 2.5 microns ($PM_{2.5}$), which was associated with the operation of the cooling towers. The cooling towers are emission sources for particulate matter (total suspended particulates (TSP), PM_{10} and $PM_{2.5}$) only. Additional information was requested during the Environmental Preview Report (EPR) process to demonstrate that there would be no potential exceedances during project operations.

More detailed information is now available about the location of the cooling towers, which are located in the southeast section of the Project Area (PA). The 2025 modelling placed the cooling towers in the northern section of the PA, approximately 180 meters (m) from the northwest fenceline. The refined location is a comparable distance from the southern fenceline. A figure showing the approximate location of the cooling towers to the southern fenceline is shown below:

Figure 1 Approximate location of the cooling towers (labelled COOLING_TWR)

While evaluating the location of the cooling towers, GHD has also re-examined the modelled emission rates associated with the cooling towers. The emissions assessment in the 2025 model used the Environment and Climate Change Canada (ECCC) cooling tower tool (ECCC 2024) to estimate total particulate emissions based on the following parameters.

Table 1 Cooling tower estimated emission rates in model

Parameter	Model Value	Comment
Circulating Rate	2303 m^3/hr	per cell(1)
Drift Rate	0.005%	Worst case new tower per ECCC tool
Total Dissolved Solids	12,000 ppmw	AP-42, high dissolved solids
Resulting emission rates:		
Total Particulate Matter	0.384 g/s	Assumed equal to PM_{10} and $PM_{2.5}$ in initial model

Note: (1) Subsequent designs have a circulation rate of 226 m^3/hr per cell, which would result in a lower TSP emission rate.

Although the 2025 model assumed that TSP, PM_{10} and $PM_{2.5}$ emissions were equivalent, the ECCC cooling tower tool provides guidance on estimating emissions of PM_{10} and $PM_{2.5}$. Both the total emissions and the proportion of smaller particulate matter fractions vary based on the total dissolved solids (TDS). The total emissions are expressed as a mass emission rate of TSP (i.e. in tonnes per year) and the emissions of PM_{10} and $PM_{2.5}$ are expressed as a percentage of TSP. In general, a higher TDS translates directly into a higher TSP emission rate because more dissolved solids means more emitted solids. Somewhat counter intuitively, a higher TDS typically results in a smaller fraction of $PM_{2.5}$ and PM_{10} – this is because more TDS tends to form larger particles.

A higher TDS will always result in higher TSP emission rates. Despite the inverse relationship with size fractions, a higher TDS typically yields larger emissions of PM_{10} and $PM_{2.5}$ – these emission rates are expressed as fractions of TSP the increase in TSP tends to result in more emissions (ECCC 2024).

North Atlantic site data from 2023 and 2024 source water measurements shows concentrations with a maximum TDS of 52 ppm. The evaporation processes in a cooling tower naturally concentrate the inlet TDS, often by a factor of 5-10 times. A cooling tower concentration of 520 ppm results in TSP emissions which are less than 5% of the modelled TSP emissions based on the 12,000 ppm concentration used for the 2025 model.

Using the same TDS of 12,000 ppmw, drift rate and circulation rate as was used in the model, the PM_{10} and $PM_{2.5}$ emission rates can be estimated as: 4% and 0.1% of TSP (ECCC 2024). These refined emission rates are much lower than the modelled values and are shown on table 2, below.

Table 2 Refined emissions rates per cooling tower cell

Cooling Tower Emission Rates (per cell)		
TSP	0.384	g/s
ECCC Spreadsheet fractions:		
PM_{10}	4.0%	of TSP
	0.0155	g/s
$PM_{2.5}$	0.1%	of TSP
	0.0004	g/s
ECCC Spreadsheet fractions with 10x safety factor		
PM_{10}	0.1546	g/s
$PM_{2.5}$	0.0040	g/s

Given that the distance between the cooling tower locations and the nearest fenceline is similar, it is reasonable to suggest that a change in impact would be proportional to a change in emission rate. Even if a substantial safety factor were included in the recalculated PM_{10} and $PM_{2.5}$ emissions (i.e.. 10 times the emission rate calculated based on the ECCC method), the resulting emission rates will be substantially lower than the model values.

Table 3 Scaled model results based on refined emission rates for PM_{10} and $PM_{2.5}$

Contaminant	**Averaging Period**	**Background Concentration**	**Limit**	**2025 Model Percentage of Limit**	**Scaled result with ECCC PM_{10} and $PM_{2.5}$ fraction**	**Scaled result with ECCC PM_{10} and $PM_{2.5}$ fraction including a 10x safety factor**
Particulate matter <= 2.5 microns ($PM_{2.5}$)	24-hr	16	25	200.00%	64%	65%
	Annual	5	8.8	76.40%	57%	57%
Particulate matter <= 10 microns (PM_{10})	24-hr	28	50	124.00%	59%	83%
Total suspended particulate matter (TSP)	24-hr	33.57	120	56.30%	unchanged	unchanged
	Annual	12.45	60	23.60%	unchanged	unchanged

The scaled results suggest that, even with conservative assumptions around the cooling tower TDS and drift rate, the air quality impacts at the fenceline can be expected to be below the Newfoundland and Labrador Air Quality Standards (NLAQS).

Although the re-evaluation of the cooling tower locations and PM_{10}/$PM_{2.5}$ emission rates do represent a change from the 2025 model scenario presented in Appendix H2: Air Dispersion Modelling Study, the available evidence suggests that these changes will result in substantially lower predicted air quality impacts associated with the Project.

As indicated in this letter, the 2025 model is conservative in the following ways:

- The cooling tower TDS concentration was 12,000 ppm, which results in much higher than expected TSP emissions.
- The cooling tower circulation rate was estimated at 2303 m^3/hr per cell, which is much higher than the current design of 226 m^3/hr per cell. This difference in circulation rates would result in lower TSP emissions relative to the 2025 modelled TSP emissions.
- The emissions of PM_{10} and $PM_{2.5}$ were assumed to be equivalent to TSP, when standard ECCC methodologies predict that they will be a small fraction of the TSP.

In addition to these very conservative assumptions, the location of the cooling towers has moved within the PA, further from the northern fenceline.

The 2025 model predicted exceedances of PM_{10} and $PM_{2.5}$, but these exceedances stemmed from the assumption that all TSP emissions were equal to $PM_{2.5}$. The scaled results presented in this letter are sufficient to demonstrate that no exceedances of the NLAQS are expected for PM_{10} or $PM_{2.5}$, even with a substantial safety factor and retaining the conservative TDS assumption.

On this basis, GHD believes that the risk of adverse impacts associated with cooling tower emissions is low and does not recommend further dispersion modelling.

Regards,

Aidan Bodsworth
Senior Air Quality Engineer

+1 587 443-1037
aidan.bodsworth@ghd.com

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References:

Environment and Climate Change Canada. (2024). *Wet cooling towers: guide to reporting*. Environment and Climate Change Canada. https://www.canada.ca/en/environment-climate-change/services/national-pollutant-release-inventory/report/sector-specific-tools-calculate-emissions/wet-cooling-tower-particulate-guide.html