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January 16, 2017

RWDI #1700273

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RE: SUMMARY OF DISPERSION MODELLING FOR ENTWISTLE EPEA APPLICATION

Pinnacle Renewable Energy Inc. (Pinnacle) is proposing to operate a new pellet plant located in Entwistle, AB. The facility will produce pellet fuel from waste wood fiber from other sawmills in the region. RWDI was retained by Pinnacle to conduct a dispersion modelling study of emissions from the proposed facility. This memo provides an executive summary of dispersion model results. A full report will be provided at a later date.

The primary concern related to air quality effects from the operation of the plant is emissions of particulate matter (PM) (i.e., airborne particles). All major point sources of PM associated with operations at each site were included in the study. The size fractions considered were particulate matter less than 2.5 µm ($PM_{2.5}$) and total suspended particulate (TSP) as those are particulate species with objectives defined in the Alberta Ambient Air Quality Objectives (AAAQO) published by Alberta Environment and Parks (AEP, 2016).

This refined modelling assessment considers emissions of $PM_{2.5}$ and TSP to show compliance with their respective AAAQOs. Maximum predicted concentrations over all applicable averaging periods and a comparison to the regulatory requirements are provided. The facility will also produce trace amounts of NO_X, CO and SO_2. A screening analysis showed that these emissions would have a negligible effect on local air quality, and were therefore not included in the refined assessment.

All project emissions sources are being discharged through either a wet electrostatic precipitator or a cyclofilter. Wood fibre is dried with heat supplied from the energy system. It is then sent to the hammermill to reduce size and finally passed through the pellet mill to form into pellets. The emissions from both the hammermill and pellet mill are vented to atmosphere through the cyclofilter. Emissions from both the rotary drier and energy system are vented to atmosphere through the WESP. The $PM_{2.5}$ and TSP stack concentrations, flow rates emission rates and stack design parameters were provided by Pinnacle.

Emissions used in the modeling were calculated based on the manufacturer's guarantees for operation of the control equipment and air flow rates. Emission rates were assumed to be constant for all hour of years, and the plant was assumed operate at full permitted concentration and flow rate for the full assessment period.

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The permit emissions rate are defined as total PM, denoted as TPM or TSP (Total Suspended Particulate). For the WESP, it was assumed that all large particles will be removed and that all emissions will be in the $PM_{2.5}$ size range. For the cyclofilter, the $PM_{2.5}$ fractions was estimated based on stack testing from similar equipment operating at Pinnacle facilities in BC. Source emissions and stack parameters used in this assessment are summarized in Tables 1 and 2 below.

Table 1 Permitted Stack Concentrations, Flow and Emissions

Source	Permitted Concentration (mg/m^3)	Permitted Flow Rate (SCM/hr)	TPM Emission Rate (g/s)	$PM_{2.5}$ Fraction (%)	$PM_{2.5}$ Emission Rate (g/s)
Wet Electrostatic Precipitator	50	210,000	2.92	100%	2.92
Cyclofilter	15	210,000	0.88	74%	0.65

Table 2 Summary of Emission Rates and Physical Stack Parameters at the Project

Source	$PM_{2.5}$ Emission Rate (g/s)	TSP Emission Rate (g/s)	Stack Height above grade (m)	Stack Diameter (m)	Exhaust Temperature (°C)	Exit Velocity (m/s)
Wet Electrostatic Precipitator	2.92	2.92	32.0	1.95	349	19.5
Cyclofilter	0.65	0.88	30.0	1.95	313	19.5

Refined modelling was conducted using AERMOD as per the Alberta Air Quality Modelling Guideline. The dispersion modelling was conducted using five years of meteorology for the Entwistle location extracted from the province wide MM5 meteorological database provided by AEP. Receptor locations at which the model predictions were calculated were set in accordance with the AQMG as follows:

- No receptors inside the property boundary;
- 20 m receptor spacing along the property boundary;
- 50 m receptor spacing outside of the property boundary up to 500 m from the property boundary;
- 250 m receptor spacing between 500 m and 2 km from the property boundary, and
- 500 m receptor spacing between 2 km and 5 km from the property boundary.

Existing $PM_{2.5}$ concentrations in the area were estimated using the most recent full year (2015) of data from measured at the Tomahawk monitoring station located approximately 29 km south-southeast from the Project.

There are no recent TSP measurements available, but PM_{10} was measured at Tomahawk until 2009. The most recent year of PM_{10} measurements was used to provide a lower bound estimate of TPM in the region.

The maximum dispersion model predictions for $PM_{2.5}$ and TPM over the relevant averaging periods for which AAAQO exist are provided below in Table 3, along with the background concentrations of $PM_{2.5}$ and TSP used in the assessment. There were no exceedances of AAAQO predicted for the combined effect of predicted increment due to the project emissions added to background concentration.

For $PM_{2.5}$, the maximum predicted increase in the 24-hr average was predicted to be 14.4 µg/m^3, with a background value from Tomahawk of 9.4 µg/m^3. The combined total of the project increment and existing background was thus predicted to be 23.8 µg/m^3, which is approximately 78% of the applicable AAAQO of 30 µg/m3. The maximum predicted 1-hr concentration average was predicted to be 31.8 µg/m^3, with a background value from Tomahawk of 10.0 µg/m^3. The combined total of the project increment and existing background for the 1-hr averaging period was 41.8 µg/m^3, which is approximately 52% of the 1-hr AAAQO of 80 µg/m^3.

For TSP, the maximum predicted increase in the 24-hr average was predicted to be 14.8 µg/m^3, with a background value from Tomahawk of 18.2 µg/m^3. The combined total of the project increment and existing background is thus predicted to be 33.0 µg/m^3, which is 33% of the corresponding AAAQO. The maximum predicted annual average concentration for TSP was predicted to be 1.0 µg/m3, with a background value from Tomahawk of 9.6 µg/m^3. The combined total of the project increment and existing background for the annual average was 10.6 µg/m^3, which is approximately 18% of the AAAQO.

Predictions for both $PM_{2.5}$ and TSP are well below the corresponding AAAQO for all applicable averaging periods. Note that while PM_{10} provides a lower bound estimate for background TSP, even if the background TSP were 2 or even 3 times what was estimated from PM_{10}, the cumulative effect would still be below the AAAGO for TSP.

Table 3 Dispersion Model Results for $PM_{2.5}$ and TPM versus AAAQO, including Background

Pollutant	Averaging Period	Background	Project Increment	Total	AAAQO
$PM_{2.5}$	1HR	10.0	31.8	41.8	80
$PM_{2.5}$	24H	9.4	14.4	23.8	30
TSP	24H	18.2	14.8	33.0	100
TSP	ANN	9.6	1.0	10.6	60

Model result expressed as either the cumulative or relative frequency distribution domain wide maximum show that the values approaching maximum model predictions are rare while the majority of model concentrations are well below the values shown in Table 3.

There were no additional previously existing sources within 3km of the domain for which cumulative effect needed to be assessed.

Respectfully,

Jeff Lundgren, M.Sc.
Technical Director/Principal