

DATE 19 January 2017**REFERENCE No.** 1661112-005-TM-Rev0-3**TO** David A. McCormick
MBA Director Public Relations & Business Development
Port Alberni Port Authority**FROM** Rachel Wyles and Sean Capstick**EMAIL** rwyles@golder.com;
scapstick@golder.com**REPORT ADDENDUM – CANTIMBER BIOTECH INC. OPERATIONS AND EMISSIONS EVALUATION****1.0 INTRODUCTION**

This memorandum provides further information and clarification on certain aspects of the Cantimber Biotech Inc., Operations and Emissions Evaluation report (Golder, 12 December 2016) based on questions received from stakeholders. The topics discussed in this addendum are presented under the same main headings as the report, namely 1) Process Observations, 2) Stack Test Results, 3) Ambient Monitoring and 4) Other Regulatory Considerations.

2.0 PROCESS OBSERVATIONS**Facility Changes Since June Events**

A number of changes have been made to operation and air pollution control devices at the facility that is expected to generally improve (i.e. lower) air emissions from those previously emitted from the facility in June, which resulted in numerous complaints and ultimately the facility ceasing operations.

Since June, two high temperature combustion chambers were added to the carbonization process, meaning that all emissions generated and captured in the carbonization process are combusted at a high temperature prior to discharge through the stack. Previously, given the set-up of the process operations, it would have been possible for syngas produced to be discharged through the stack without being combusted. This is no longer the case, and all captured syngas is now combusted within the carbonization process. Therefore, the addition of the combustion chambers is expected to result in lower emissions of Volatile Organic Compounds (VOCs) in comparison to the previous emissions.

Packing material was added to the wet scrubber systems to improve air flow and particulate removal from the exhaust prior to discharge through the stack.

Cantimber also reported that the carbonization vessel seals have been upgraded to an engineered material to reduce the leakage of fugitive emissions from the carbonization process.

**Golder Associates Ltd.**Suite 200 - 2920 Virtual Way, Vancouver, BC, V5M 0C4
Tel: +1 (604) 296 4200 Fax: +1 (604) 298 5253 www.golder.com**Golder Associates: Operations in Africa, Asia, Australasia, Europe, North America and South America**

3.0 STACK TEST RESULTS

Continuous Carbon Monoxide Monitoring

The stack test results included as Appendix A within the Report (Golder, 2016) included minute by minute concentrations of carbon monoxide (CO) from the carbonization stack, however similar data is not provided for the activation stack. During the testing of the activation stack, levels of CO were found to be above the upper scale of the analyzer, therefore it was not possible to present the minute by minute CO data. Instead, for the activation stack CO was measured from the Summa canisters used to collect organic emissions. These canisters collected emissions over a test run period of 60 minutes. As a result, there is only one concentration that is an average over this time period for each of the three test runs.

Comparison of Cantimber Emissions to Wood Stove Emissions

Emissions from wood stoves depend on a number of factors including the amount of wood burnt, the seasoning of the wood, the density of the wood (species specific), and type of appliance. To provide context, Cantimber particulate emissions have been compared to measured particulate emissions from woodstoves and also to the United States Environmental Protection Agency (US EPA) emission standards for residential wood stove emissions (US EPA 2015). The woodstove emissions data was taken from a compilation of ten studies that directly measured emission factors from conventional woodstoves (OMNI Environmental Services Inc. 2005). A range is provided for the woodstove emissions that represents the maximum and minimum emission levels found across the ten studies. It should be noted that these emissions relate to one conventional woodstove, in the vicinity of the Cantimber facility there may be numerous woodstoves in operation at any one time. In addition, open fireplaces may be in use in the Port Alberni area, and these are generally expected to result in even higher particulate emissions than those presented for conventional woodstoves in Table 1 below. The US EPA emission standards apply to new wood heaters, and therefore do not necessarily represent emissions from existing woodstoves in the Port Alberni area. In summary, based on this comparison, total particulate emissions from the Cantimber facility are within the emission range for conventional wood stoves reported in OMNI Environmental Services Inc. 2005.

Table 1: Comparison of Wood Stove and Cantimber Particulate Emissions

Emission Source	Total Particulate Matter Emission Rate (g/hr)	Data Source
One Conventional Wood Stove	9 to 139 (a range is provided since it incorporates data from 10 different studies)	OMNI Environmental Services Inc. 2005, Table 4
US EPA Emission Standard for new residential wood stove	4.5	US EPA 2015
Cantimber Carbonization Process	30	Golder 2016, Table 1
Cantimber Activation Process ^{Note 1}	4	Golder 2016, Table 1
Cantimber Total Facility	34	Golder 2016, Table 1

Notes:

1. Total particulate emissions representing both activation trains in operation.

4.0 AMBIENT MONITORING

Public Complaints during Stack Testing

This section provides a summary of complaints received during the operation of the facility for the purpose of stack testing. During this period an online system was hosted by Port Alberni Port Authority to receive complaints. These complaints were forwarded to both Cantimber and Golder. During the period, eleven communications were received, a summary of the nature of the communication, and the resolution are provided in Table 1. An additional six communications were received after the stack testing period due to reported difficulties in submitting feedback online, these have also been summarized in Table 1. The complaint investigation process included some/all of the following actions:

- Correlation to facility activities occurring at the time of the complaint.
- Correlation to meteorological conditions at the time of the complaint.
- Correlation to ambient monitoring data.
- Correlation to observations made by Golder staff.

In summary, the data in Table 1 shows that:

- None of the complaints were directly correlated to Cantimber operations.
- Only three of the communications relate to the period when the facility was fully operational (between 7-9 November).
- Out of the 11 communications, three were not directly related to the Cantimber facility emissions, they comprised observations relating to other facilities, comments (not complaints) or posed a question.
- Three of the communications related to a time period when the facility was no longer operational.
- During the four complaints that related to the November 7-9 stack test period (Tracking ID 5, 7, 8 and 11), the residential area was not downwind of the Cantimber facility.

Table 2: Summary of Complaints Received and Resolution

Tracking ID	Location	Date/Time	Nature of Feedback	Resolution
1	APD Parking Lot	5 November 10am	Campfire/wood burning odour, eyes and lungs irritated.	At this time, Cantimber were not using wood as a fuel source, therefore this event is not attributed to Cantimber.
2	Not provided	5 November	Complaint form was used to ask a question about stack emissions.	No specific complaint was made about the Cantimber facility.
3	Catalyst	5 November 8pm to 6 November 3am	Odour noted from Catalyst hog pile smolder. Smells not caused by Cantimber.	No specific complaint was made about the Cantimber facility.
4	Stirling and Melrose Street	6 November	Smoke/steam reported from the Cantimber stack, but no odour. Also reported smoking chimney from residence.	No specific complaint was made about the Cantimber facility.

Tracking ID	Location	Date/Time	Nature of Feedback	Resolution
5	1 st Avenue, 1 st Avenue and Bruce intersection	9 November 8.30am and 13 November 9.30pm	9 November - Strong acrid smell, 13 November noticed identical smell as on the 9 th .	Not directly attributed to the Cantimber facility. The Cantimber facility was not operational on the 13 th , so is not anticipated to be the source of the odour.
6	Residential Area directly to the east of Cantimber facility	3 November/ Time not provided	Noticeable/unpleasant air quality/odour. Couldn't breath and headache. Resident said that they struggle to breathe this time of the year due to neighbour's woodstoves.	At this time, Cantimber were not in operational mode. Initial preheating of one combustion chamber commenced around 8 pm, wood was not used as a fuel source. The residential area was not downwind of the facility on 3 November.
7		7 November/ Time not provided	Noticeable/unpleasant air quality/odour. Couldn't breath and headache. Resident said that they struggle to breathe this time of the year due to neighbour's woodstoves.	The facility transitioned to full operations late in the evening of 7 November. During this time the residential area was not downwind of facility, therefore Cantimber is not anticipated to be the source of the odour.
8		10 November/ Time not provided	Noticeable/unpleasant air quality/odour. Couldn't breathe. Resident said that they struggle to breathe this time of the year due to neighbour's woodstoves.	No further action required. Facility was not operational on 10 November.
9	Not known	Not dated	Report that smoke was rising, no odour.	No specific complaint was made about the Cantimber facility.
10	7 th Avenue	16 November/ Time not provided	Odour on and off, not wood smoke, unable to define the odour.	No further action required. Facility was not operational on 16 November.
11	1 st and Stirling	During Cantimber operation	Sore throat 2 nights, stopped when Cantimber testing stopped.	Since no detailing date and time information was provided it was not possible to correlate ambient monitoring and process information directly to the complaint time, however during the period of full operation for stack testing (7 – 9 November) the residential area was not downwind of Cantimber.

Precipitation Levels and Impact on Ambient Monitoring Results

Meteorological data collected during the stack test period were wind speed and wind direction, since these are considered to be the one of the most important parameters that would affect the local scale transport and dispersion of emissions from the stack, and wind data is generally used in the interpretation of ambient air monitoring data. For example monitors located downwind of an air emission source would be expected to record higher concentrations, than a monitor located upwind of the air emission source.

Precipitation (or rainfall) may affect the ambient air concentrations due to the contribution of precipitation to wet deposition effects, or put more simply the rain acts to wash out the particulate and chemical parameters from the air to be deposited on the ground, which can result in a lower ambient concentrations of the parameters. This effect is more important for larger particulates, than the smaller particulate size fraction (PM_{2.5}) monitored during this study. Therefore the meteorological data summary focussed on wind speed and direction.

In addition, the wind direction during the stack test period (7 – 9 November) meant that the residential area was not downwind of the facility. Therefore no direct correlation between monitoring data and downwind concentrations was possible.

5.0 OTHER REGULATORY CONSIDERATIONS

A request was received to compare the Cantimber emission levels to GVRD (now known as Metro Vancouver) emission limits within the GVRD Boilers and Process Heaters Emission Regulation Amending Bylaw No. 1190, 2013 (GVRD 2013).

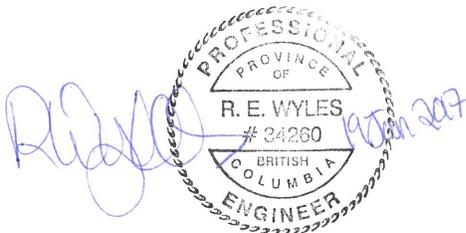
These GVRD regulations only apply to the Metro Vancouver area so would not be directly applicable to a facility in Port Alberni, such as the Cantimber facility. The purpose of the air quality regulatory regime within the Metro Vancouver area is different to that of wider BC, which is to be expected given that air quality considerations within a significant sized urban area are different to concerns in less urban areas. In addition, the regulator for air emissions (Metro Vancouver) is different to that of wider BC (BC Ministry of Environment). Therefore, it is not considered appropriate to provide a direct comparison of Cantimber emissions to GVRD regulations. In addition, given the unique nature of the Cantimber process operations, particularly the carbonization process, it is not currently clear whether the process would meet the definition of a process heater within the bylaw. Specifically, the definition of a “process heater” within the bylaw ‘means any combustion equipment fuelled by natural gas, propane or biomass for the purposes of transferring heat to material being processed other than by direct contact with the flue gas.....’ (GVRD 2013). However, within the carbonization process the flue gas from the carbonization furnaces does under certain operational conditions come into contact with the material being processed (e.g. the wood chips).

6.0 CLOSURE

The reader is referred to the Study Limitations, which follows the text and forms an integral part of this memorandum.

We trust that this provides sufficient information at this time, should you have any questions, please contact the undersigned.

GOLDER ASSOCIATES LTD.



Rachel Wyles, MEng, PEng
Associate, Air Quality Engineer

RW/SC/kp/lis

Attachment 1: Study Limitations

A handwritten signature in black ink, appearing to read "S. Capstick".

Sean Capstick, PEng
Principal

REFERENCES

Golder Associates Ltd. 2016. Cantimber Biotech Inc. Operations and Emissions Evaluation. 12 December 2016.

Greater Vancouver Regional District (GVRD). 2013. Boilers and Process Heaters Emission Regulation Amending Bylaw No. 1190, 2013.

OMNI Environmental Services Inc. 2005. PM2.5 Emission Reduction Benefits of Replacing Conventional Uncertified Cordwood Stoves with Certified Cordwood Stoves or Modern Pellet Stoves. Available at http://www.omni-test.com/publications/Emission_Reduction.pdf

United States Environmental Protection Agency. 2015. Final New Source Performance Standards for Residential Wood Heaters. Available at <https://www.epa.gov/residential-wood-heaters/final-new-source-performance-standards-residential-wood-heaters>.

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