Report number: 2019/30
Project Number: 19004

Land and Water Science
61 Leet Street
Invercargill, 9810

Stephen Parry
Chief Executive
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5th August 2019

Dear Stephen

RE: NH_3 Monitoring Report 01 – 31 July 2019

Gore District Council (GDC) engaged Land and Water Science to conduct continuous monitoring of ammonia (NH_3) gas emissions from the Mataura Mill dross storage site (121 Kana Street, Mataura) from April 2018. GDC require emission values to comply with consent conditions that specify a limit of 5 ppm NH_3 discharged to air. In March 2017, Photonic Innovations (PI) installed two NH_3 sensors for comparison of the indoor and outdoor ammonia levels. Measurements are recorded continuously and reported as a 5-minute average for both the outdoor and indoor sensors.

Weekly summaries of the indoor and outdoor emission results from monitoring between 01 July and 31 July are presented in this report. During this period the maximum NH_3 concentration detected by the indoor sensor was 4.1 ppm (Figure 1 and Table 1) and 10.5 ppm for the outdoor sensor (Figure 2 and Table 2). Mean and median NH_3 concentrations during this period were both 1.7 and 1.6 ppm for the indoor sensor and 1.0 and 0.7 ppm for the outdoor sensor. The maximum ammonia concentration for the outdoor sensor exceeded the consented amount of 5 ppm.

Daily (diurnal) variation in NH_3 concentration shows a consistent pattern in the data. Specifically, NH_3 concentration is strongly correlated with air temperature, reaching maximum values as air temperatures peak during the day and minimum values at night when air temperatures are at their lowest. Although diurnal variation is evident in the data, average air temperature is a greater control over the absolute concentration with maximum concentrations recorded during the warmest months of the year and minimum concentrations recorded during the coolest months of the year. Elevated NH_3 concentrations were detected by the outdoor sensor when minimum temperatures were below or near zero indicating the likelihood of very still atmospheric conditions, such as frost or fog, preventing the NH_3 from dissipating. The correlation between air temperature and NH_3 concentration for this reporting period is displayed in Figure 1 and Figure 2.

Table 1. Summary statistics for the indoor NH_3 sensor, 01 July – 31 July 2019. NH_3 measured in parts per million (ppm).

Date	01- 06 July	07 - 13 July	14 - 20 July	21 - 27 July	28 - 31 July
Mean	1.4	1.1	1.1	1.6	1.7
Standard deviation	0.4	0.6	0.5	0.8	0.5
Median	1.3	1.1	1.0	1.4	1.6
Minimum	0.2	0.0	0.0	0.0	0.5
Maximum	3.6	3.5	2.9	4.1	3.3

Table 2. Summary statistics for the outdoor NH_3 sensor, 01 July – 31 July 2019. NH_3 measured in parts per million (ppm).

Date	01- 06 July	07 - 13 July	14 - 20 July	21 - 27 July	28 - 31 July
Mean	0.7	0.8	0.7	0.7	0.7
Standard deviation	0.6	0.6	0.4	0.4	0.4
Median	0.7	0.7	0.7	0.7	0.7
Minimum	0.3	0.3	0.3	0.3	0.4
Maximum	10.5	8.4	4.8	4.9	5.2

01 - 06 July 2019

During this week, the indoor NH_3 concentration showed consistent diurnal variation for most of the week. Maximum indoor concentration was 3.6 ppm for this period. Mean and median values were 1.4 and 1.3 ppm. The outdoor NH_3 concentration levels showed consistent variation for most of the week with higher concentrations consistent with warmer temperatures. Maximum outdoor concentration was 10.5 ppm for this period. Mean and median values were 0.7 and 0.7 ppm.

07 – 13 July 2019

During this week, indoor NH_3 concentration showed consistent diurnal variation for most of the week. Maximum indoor concentration was 3.5 ppm for this period. Mean and median values were 1.1 and 1.1 ppm. The outdoor NH_3 concentration levels showed consistent variation for most of the week with higher concentrations consistent with warmer temperatures. Maximum outdoor concentration was 8.4 ppm for this period. Mean and Median values were both 0.8 and 0.7 ppm.

14 – 20 July 2019

During this week, indoor NH_3 concentration showed consistent diurnal variation for most of the week. Maximum indoor concentration was 2.9 ppm for this period. Mean and median values were 1.1 and 1.0 ppm. The outdoor NH_3 concentration levels showed consistent variation for most of the week with higher concentrations consistent with warmer temperatures. Maximum outdoor concentration was 4.8 ppm for this period. Mean and Median values were both 0.7 ppm.

21 – 27 July 2019

During this week, indoor NH_3 concentration showed consistent diurnal variation for most of the week. Maximum indoor concentration was 4.1 ppm for this period. Mean and median values were 1.6 and 1.4 ppm. The outdoor NH_3 concentration levels showed consistent variation for

most of the week with higher concentrations consistent with warmer temperatures. Maximum outdoor concentration was 4.9 ppm for this period. Mean and Median values were both 0.7 ppm.

28 – 31 July 2019

During this week, indoor NH_3 concentration showed consistent diurnal variation for most of the week. Maximum indoor concentration was 3.3 ppm for this period. Mean and median values were 1.7 and 1.6 ppm. The outdoor NH_3 concentration levels showed consistent variation for most of the week with higher concentrations consistent with warmer temperatures. Maximum outdoor concentration was 5.2 ppm for this period. Mean and Median values were both 0.7 ppm.

Summary

During the monitoring period (01 – 31 July) indoor NH_3 concentrations reached a maximum of 4.1 ppm, while mean and median concentrations were both 1.7 and 1.6 ppm. Outdoor concentrations were a maximum of 10.5 ppm, while mean and median concentrations were 0.8 and 0.7 ppm. Elevated NH_3 concentrations were detected by the outdoor sensor when minimum temperatures were below or near zero indicating the likelihood of very still atmospheric conditions, such as frost or fog, preventing the NH_3 from dissipating. These values are significantly lower than reported for the summer months and consistent with cooler, wintertime temperatures. Overall, temperature continues to be the most dominant control over NH_3 concentration.

Kind regards

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Land and Water Science Ltd

Dr Clint Rissmann
Director
Land and Water Science Ltd

For public access to the real-time data go to: ***http://35.189.3.224:3000/login***
Log in email: gcc@photonicinnovations.com and use the **password:** Pa5%w0rd

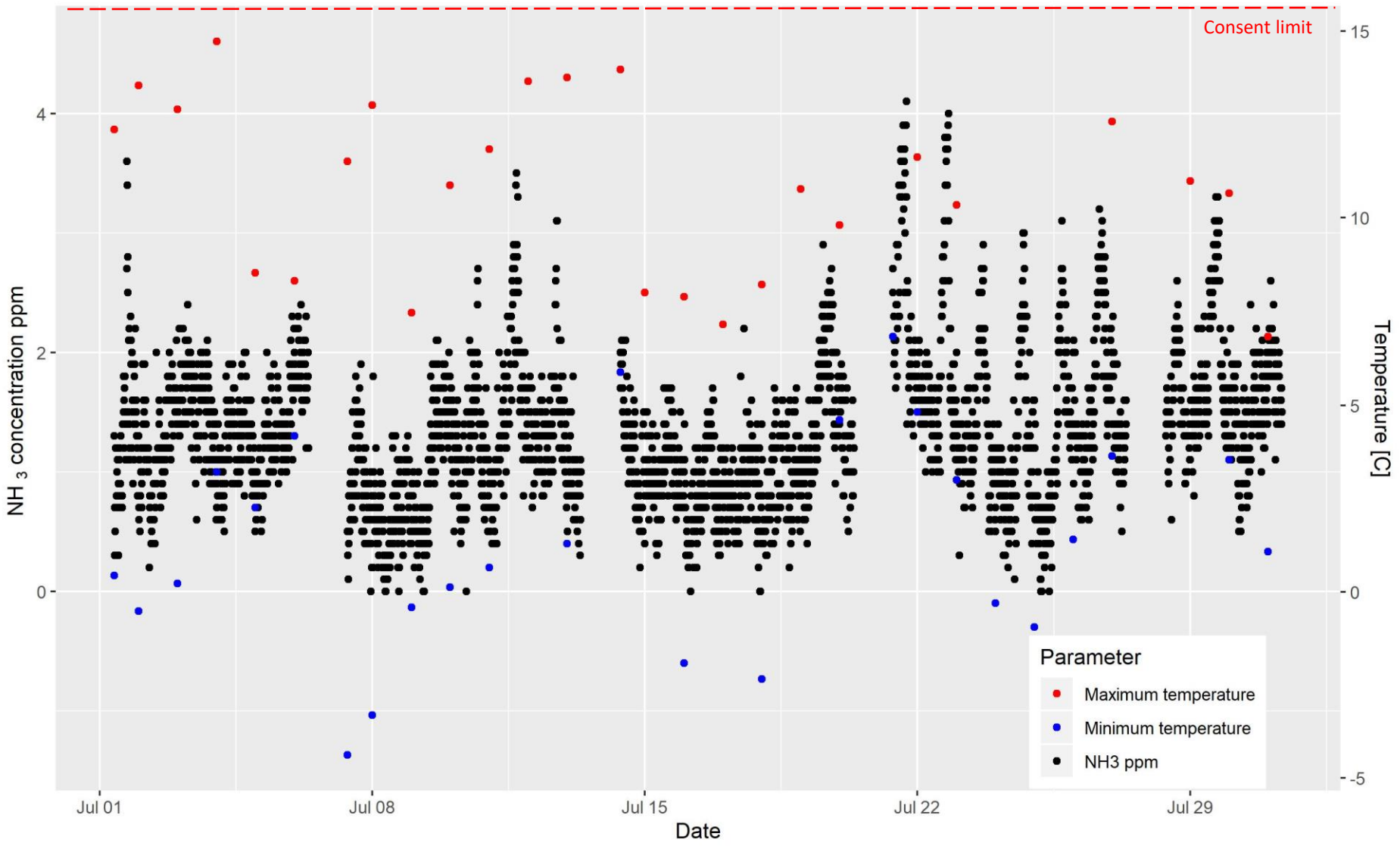

Figure 1: Continuous indoor NH_3 concentration and maximum daily temperature.

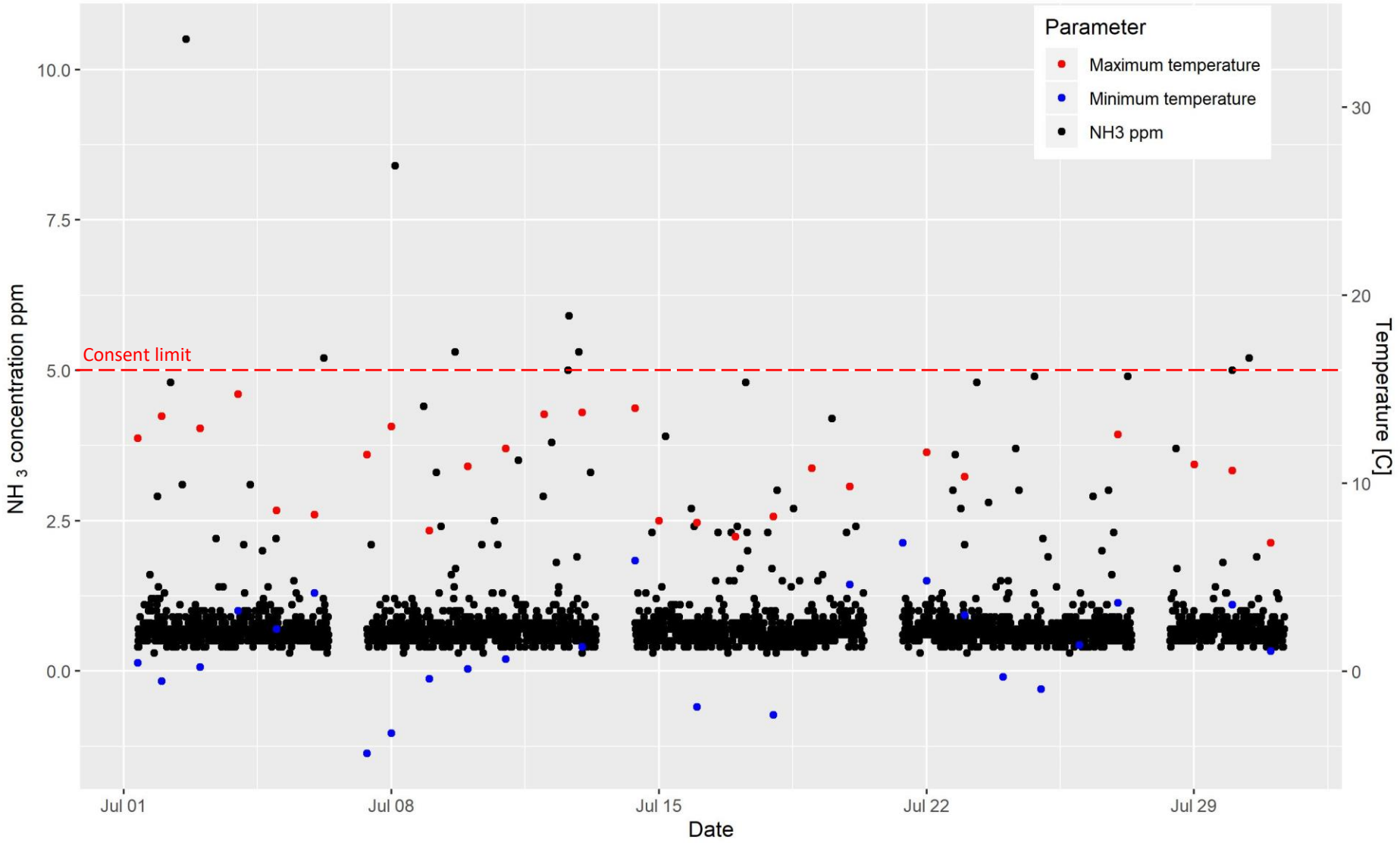

Figure 2: Continuous outdoor NH_3 concentration and maximum daily temperature.