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Stephen Parry
Chief Executive
Gore District Council
PO Box 8
Gore, 9740

Land and Water Science
61 Leet Street
Invercargill, 9810

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Dear Stephen

RE: Weekly NH_3 Monitoring Report 01 – 31 October 2018

In April 2018 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). GDC require emission values to comply with consent conditions that specify a limit of 5 ppm NH_3 discharged to air. In November 2017, Photonic Innovations (PI) installed two NH_3 Sensors for comparison of the indoor and outdoor ammonia levels. The outdoor sensor has been out of service since 18 March 2018. PI have since rectified connectivity issues and the sensor has been re-installed. Measurements are reported for both the outdoor and indoor sensors for the month of October.

Weekly summaries of the indoor and outdoor emission results from monitoring between 01 October and 31 October are presented in this report. During this period the maximum NH_3 concentration detected by the indoor sensor was 10.2 ppm (Figure 1 and Table 1) and 10.1 ppm for the outdoor sensor (Figure 2 and Table 2). Mean and median NH_3 concentrations during this period were 4.7 and 4.3 ppm for the indoor sensor and 0.8 ppm and 0.7 for the outdoor sensor. The maximum ammonia concentration for both the indoor and outdoor sensors exceeded the consented amount of 5 ppm. An increase in NH_3 concentration is expected during the spring and summer months due as air temperatures increase.

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. 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 October – 31 October 2018. NH_3 measured in parts per million (ppm).

Date	01 -07 Oct	08 - 14 Oct	15 - 21 Oct	22 - 28 Oct	29 - 31 Oct
Mean	2.8	2.5	3.0	4.7	2.6
Standard deviation	0.8	1.2	1.3	1.9	1.1
Median	2.7	2.1	2.6	4.3	2.4
Minimum	1.2	0.4	1.0	1.6	1.0
Maximum	6.3	7.0	7.6	10.2	6.3

Table 2. Summary statistics for the outdoor NH_3 sensor, 01 October – 31 October 2018. NH_3 measured in parts per million (ppm).

Date	01 -07 Oct	08 - 14 Oct	15 - 21 Oct	22 - 28 Oct	29 - 31 Oct
Mean	0.7	0.7	0.8	0.8	0.7
Standard deviation	0.5	0.5	0.8	0.7	0.2
Median	0.7	0.6	0.6	0.6	0.6
Minimum	0.3	0.3	0.3	0.3	0.3
Maximum	6.2	5.8	10.1	6.7	2.7

01 -07 October 2018

During this day, maximum indoor concentration was 6.3 ppm. Mean and median values were 2.8 and 2.7 ppm, respectively. The outdoor NH_3 concentration levels showed consistent variation for most of the day with higher concentrations associated with warmer temperatures. The maximum outdoor concentration was 6.2 ppm for this period. Mean and median values were 0.7 ppm.

08 – 14 October 2018

During this week, indoor NH_3 concentration showed consistent diurnal variation for most of the week. Maximum indoor concentration was 7 ppm for this period. Mean and median values were 2.5 and 2.1 ppm. The outdoor NH_3 concentration levels showed consistent variation for most of the week with higher concentrations associated with warmer temperatures. The maximum outdoor concentration was 5.8 ppm for this period. Mean and median values were 0.7 and 0.6 ppm.

15 – 21 October 2018

During this week, indoor NH_3 concentration showed consistent diurnal variation for most of the week. The maximum indoor concentration was 7.6 ppm for this period. Mean and median values were 3.0 and 2.6 ppm. The outdoor NH_3 concentration levels showed consistent variation for most of the week with higher concentrations associated with warmer temperatures. Maximum outdoor concentration was 10.1 ppm for this period. Mean and Median values were 0.8 and 0.6 ppm.

22 – 28 October 2018

During this week, indoor NH_3 concentration showed consistent diurnal variation for most of the week. Maximum indoor concentration was 10.2 ppm for this period. Mean and median values were 4.7 and 4.3 ppm. The outdoor NH_3 concentration levels showed consistent variation for most of the week with higher concentrations associated with warmer temperatures. Maximum outdoor concentration was 6.7 ppm for this period. Mean and median values were 0.8 and 0.6 ppm.

29 – 31 October 2018

During this week, indoor NH_3 concentration showed consistent diurnal variation for most of the week. Maximum indoor concentration was 6.3 ppm for this period. Mean and median values were 2.6 and 2.4 ppm. The outdoor NH_3 concentration levels showed consistent variation for most of the week with higher concentrations consistent with warmer temperatures. The maximum outdoor concentration was 2.7 ppm for this period. Mean and median values were 0.7 and 0.6 ppm.

Summary

During the five-week monitoring period (01 – 31 October) indoor NH_3 concentrations reached a maxima of 10.2 ppm, while mean and median concentrations were 4.7 and 4.3 ppm. Maximum, mean and median indoor temperatures are larger than those for September. Outdoor concentrations reached a similar maxima of 10.1 ppm, while mean and median concentrations were 0.8 and 0.7 ppm. Maximum, mean and median indoor temperatures are smaller than those for September, perhaps due to few days of temperature inversion as ground and air temperatures slowly rise. The highest NH_3 concentrations were recorded on days with higher maximum temperatures. Based on this data, temperature continues to be the most dominant control over NH_3 concentration. Indoor NH_3 concentrations are expected to increase as air temperatures continue to rise. Fewer days of temperature inversion and increasing windspeeds during the warmer months may result in increased dilution of outdoor NH_3 although more data is required to validate this pattern.

Kind regards,

Jessie Lindsay
Environmental and GIS Scientist
Land and Water Science

Dr Clint Rissmann
Director
Land and Water Science

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

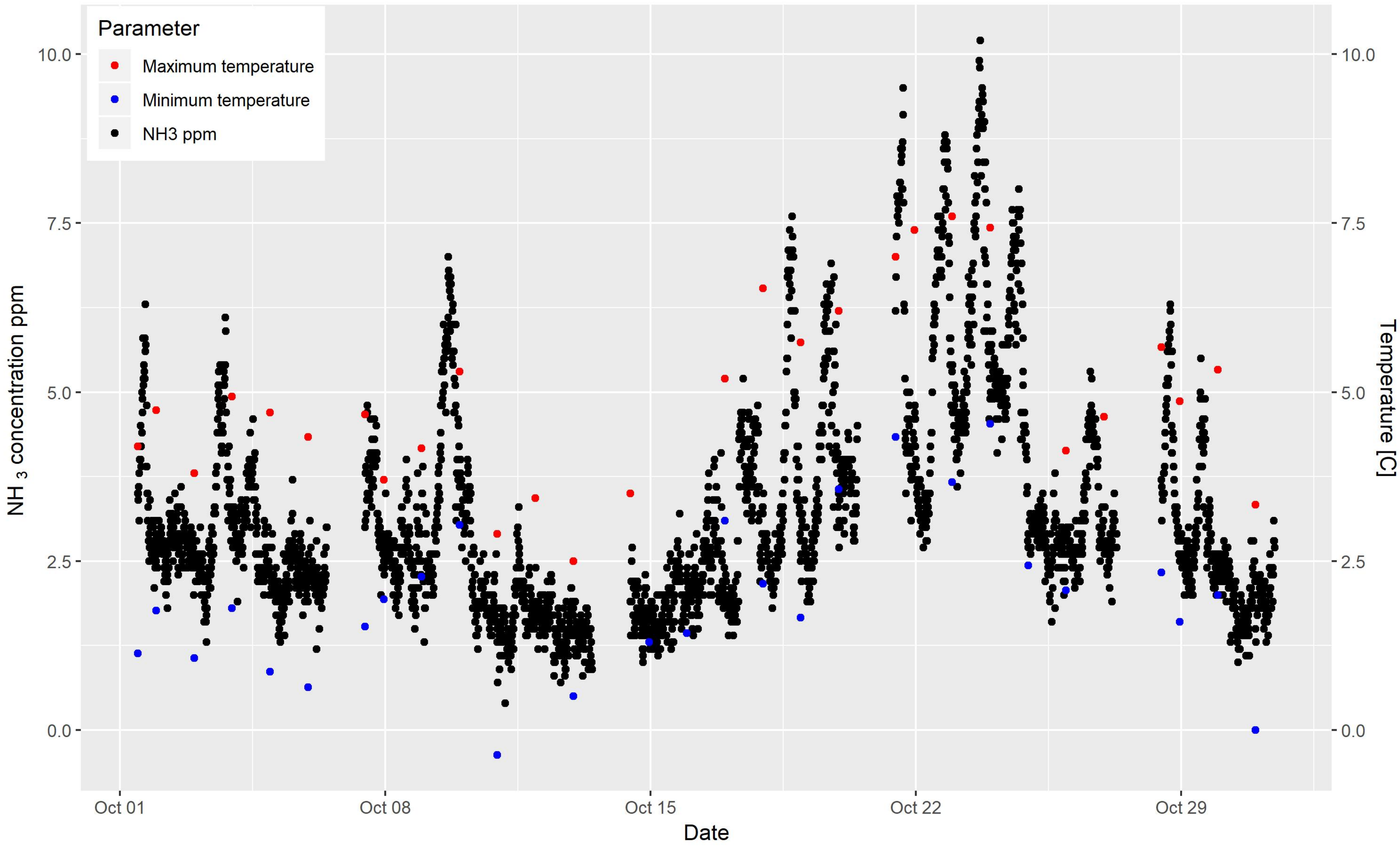

Figure 1: Continuous indoor NH_3 concentration, maximum daily temperature

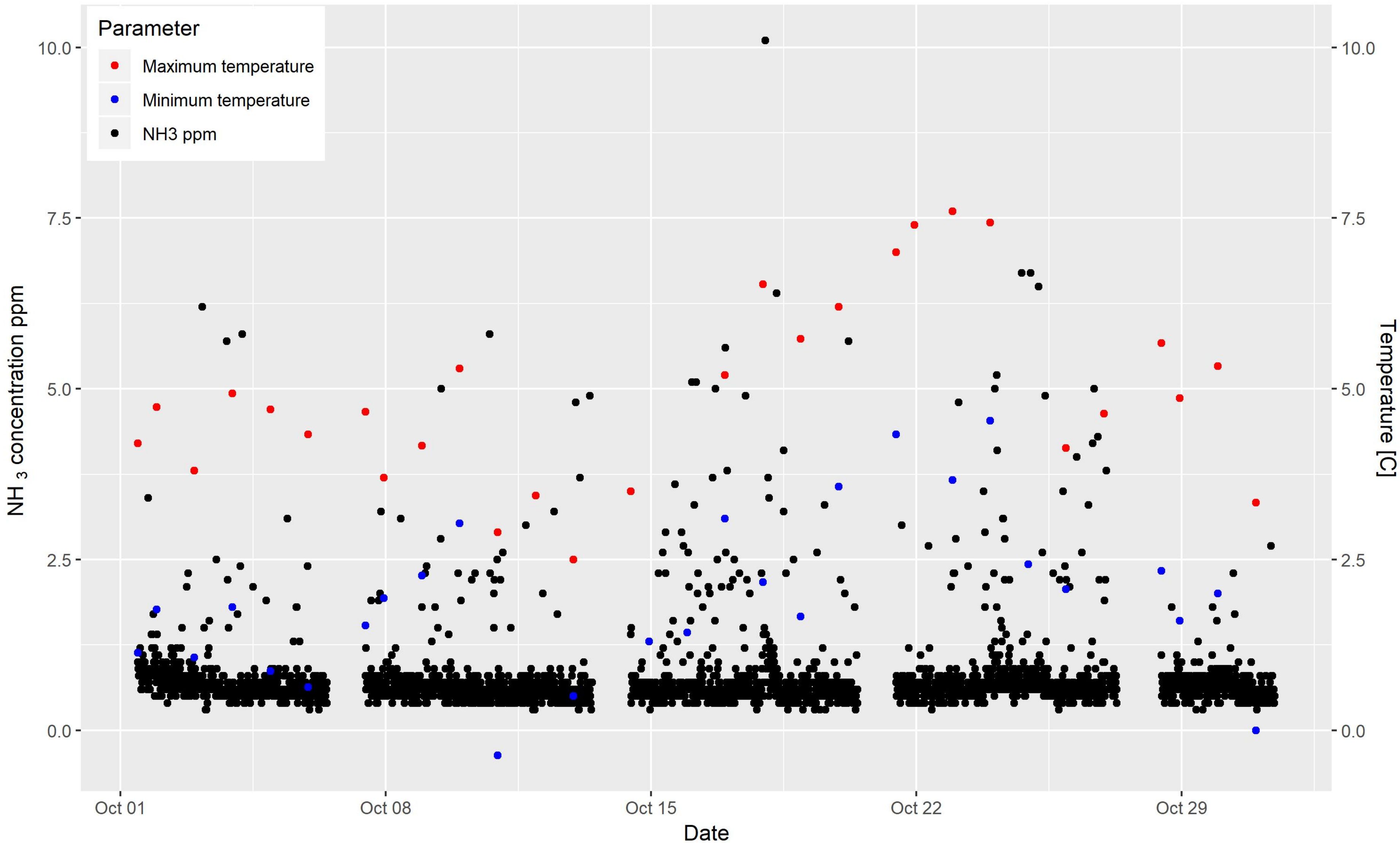

Figure 2: Continuous outdoor NH_3 concentration, maximum daily temperature