



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

Land and Water Science  
61 Leet Street  
Invercargill, 9810

2<sup>nd</sup> September 2019

Dear Stephen

**RE: NH<sub>3</sub> Monitoring Report 01 – 31 August 2019**

Gore District Council (GDC) engaged Land and Water Science to conduct continuous monitoring of ammonia (NH<sub>3</sub>) 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<sub>3</sub> discharged to air. In March 2017, Photonic Innovations (PI) installed two NH<sub>3</sub> 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 August and 31 August are presented in this report. During this period the maximum NH<sub>3</sub> concentration detected by the indoor sensor was 3.0 ppm (Figure 1 and Table 1) and 5.6 ppm for the outdoor sensor (Figure 2 and Table 2). Mean and median NH<sub>3</sub> concentrations during this period were both 1.8 ppm for the indoor sensor and 0.8 and 0.7 ppm for the outdoor sensor. The maximum ammonia concentration for the outdoor sensor exceeded the consented amount of 5 ppm on multiple occasions.

Daily (diurnal) variation in NH<sub>3</sub> concentration shows a consistent pattern in the data. Specifically, NH<sub>3</sub> 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<sub>3</sub> 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<sub>3</sub> from dissipating. The correlation between air temperature and NH<sub>3</sub> concentration for this reporting period is displayed in Figure 1 and Figure 2.

Table 1. Summary statistics for the indoor NH<sub>3</sub> sensor, 01 August – 31 August 2019. NH<sub>3</sub> measured in parts per million (ppm).

Date	01- 03 Aug	04 - 10 Aug	11 - 17 Aug	18 - 24 Aug	25 - 31 Aug
Mean	1.3	1.2	1.2	1.5	1.8
Standard deviation	0.4	0.7	0.5	0.5	0.4
Median	1.3	1.3	1.2	1.6	1.8
Minimum	0.3	0.0	0.0	0.1	0.7
Maximum	2.4	2.9	2.4	3.0	2.8

Table 2. Summary statistics for the outdoor NH<sub>3</sub> sensor, 01 August – 31 August 2019. NH<sub>3</sub> measured in parts per million (ppm).

Date	01- 03 Aug	04 - 10 Aug	11 - 17 Aug	18 - 24 Aug	25 - 31 Aug
Mean	0.7	0.8	0.8	0.8	0.8
Standard deviation	0.5	0.6	0.5	0.5	0.5
Median	0.7	0.6	0.7	0.7	0.7
Minimum	0.4	0.3	0.3	0.3	0.3
Maximum	5.6	5.1	5.6	5.3	5.1

#### 01 - 03 Aug 2019

During this week, the indoor NH<sub>3</sub> concentration showed consistent diurnal variation for most of the week. Maximum indoor concentration was 2.4 ppm for this period. Mean and median values were both 1.3 ppm. The outdoor NH<sub>3</sub> concentration levels showed consistent variation for most of the week with higher concentrations consistent with warmer temperatures. Maximum outdoor concentration was 5.6 ppm for this period. Mean and median values were 0.7 and 0.7 ppm.

#### 04 – 10 Aug 2019

During this week, indoor NH<sub>3</sub> 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 1.2 and 1.3 ppm. The outdoor NH<sub>3</sub> concentration levels showed consistent variation for most of the week with higher concentrations consistent with warmer temperatures. Maximum outdoor concentration was 5.1 ppm for this period. Mean and median values were both 0.8 and 0.6 ppm.

#### 11 – 17 Aug 2019

During this week, indoor NH<sub>3</sub> concentration showed consistent diurnal variation for most of the week. Maximum indoor concentration was 2.4 ppm for this period. Mean and median values were both 1.2 ppm. The outdoor NH<sub>3</sub> concentration levels showed consistent variation for most of the week with higher concentrations consistent with warmer temperatures. Maximum outdoor concentration was 5.6 ppm for this period. Mean and median values were 0.8 and 0.7 ppm.

### 18 – 24 Aug 2019

During this week, indoor NH<sub>3</sub> concentration showed consistent diurnal variation for most of the week. Maximum indoor concentration was 3.0 ppm for this period. Mean and median values were 1.5 and 1.6 ppm. The outdoor NH<sub>3</sub> concentration levels showed consistent variation for most of the week with higher concentrations consistent with warmer temperatures. Maximum outdoor concentration was 5.3 ppm for this period. Mean and median values were 0.8 and 0.7 ppm.

### 25 – 31 Aug 2019

During this week, indoor NH<sub>3</sub> concentration showed consistent diurnal variation for most of the week. Maximum indoor concentration was 2.8 ppm for this period. Mean and median values were both 1.8 ppm. The outdoor NH<sub>3</sub> concentration levels showed consistent variation for most of the week with higher concentrations consistent with warmer temperatures. Maximum outdoor concentration was 5.1 ppm for this period. Mean and median values were 0.8 and 0.7 ppm.

### Summary

During the monitoring period (01 – 31 August) indoor NH<sub>3</sub> concentrations reached a maximum of 2.8 ppm, while mean and median concentrations were both 1.8 ppm. Outdoor concentrations were a maximum of 5.6 ppm, while mean and median concentrations were 0.8 and 0.7 ppm. Elevated NH<sub>3</sub> 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<sub>3</sub> 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<sub>3</sub> concentration.

Kind regards



Jessie Lindsay  
Environmental and GIS Scientist  
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@photoninnovations.com](mailto:gcc@photoninnovations.com) and use the password: Pa5%w0rd

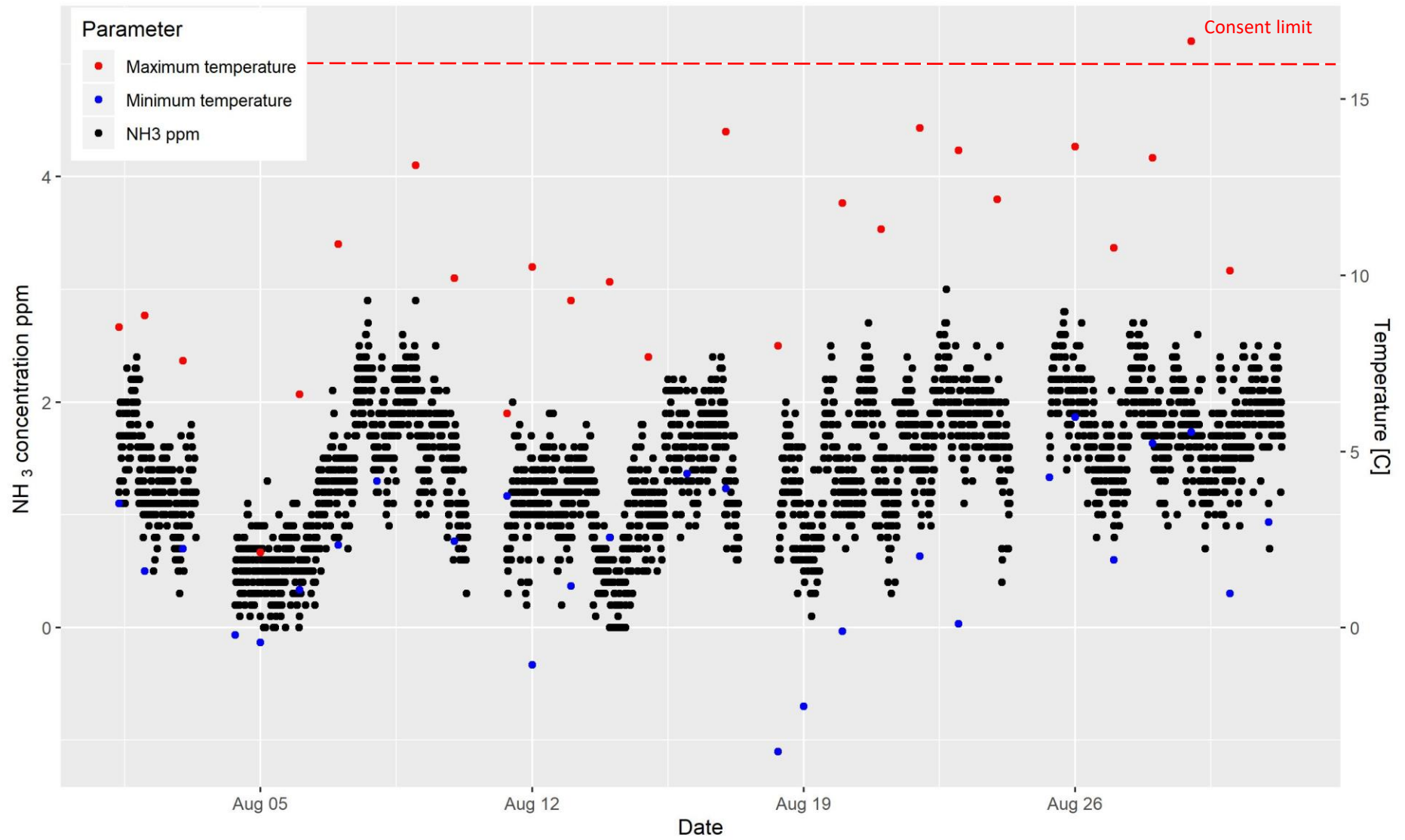


Figure 1: Continuous indoor NH<sub>3</sub> concentration and maximum daily temperature.

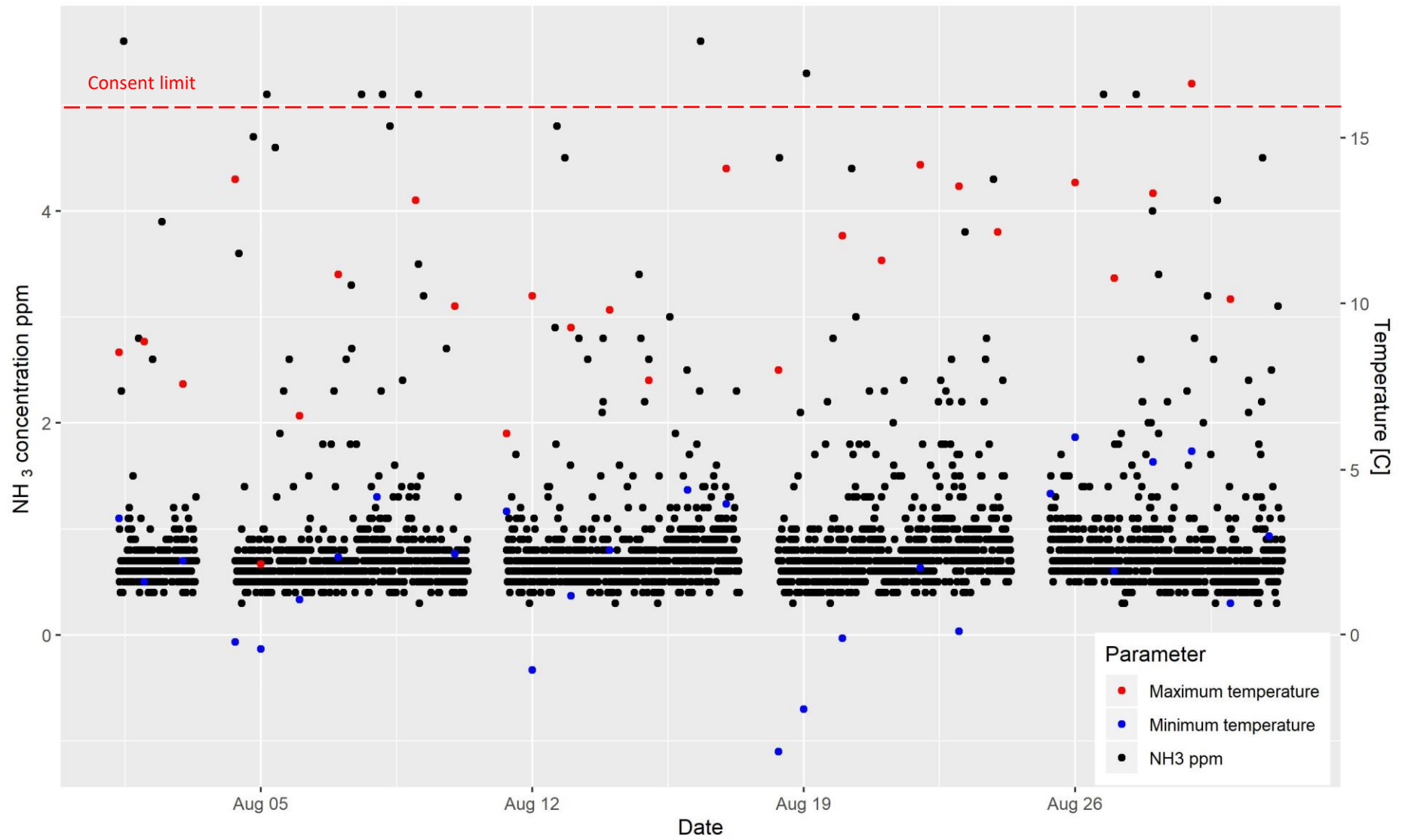


Figure 2: Continuous outdoor NH<sub>3</sub> concentration and maximum daily temperature.