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Chief Executive
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Land and Water Science
61c Leet Street
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2nd March 2020

Dear Stephen

RE: NH₃ Monitoring Report 01 – 29 February 2020

Background

Gore District Council (GDC) engaged Land and Water Science to conduct continuous monitoring of ammonia (NH₃) 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 NH₃ discharged to air. In March 2017, Photonic Innovations (PI) installed two NH₃ 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.

February Summary

During February the maximum NH₃ concentration detected by the indoor sensor was 149.6 ppm (Figure 1 and Table 1) and 9.7 ppm for the outdoor sensor (Figure 2 and Table 2). **The maximum concentration breaches the threshold limit value (25 ppm) and the short term exposure level (35ppm) for occupational exposure to ammonia** (see Appendix for Material Data Sheet section 8). **Although limited to a few transient events, it is recommended that any person needing to enter the building should first check the monitoring sensor prior to ensure concentrations are <25 ppm.** Mechanical venting via manually opening of doors, or other, to allow ventilation prior to scheduled access should result in the rapid dilution of ammonia. Increases in ammonia concentration greater than the threshold occupational exposure limit for ammonia toxicity to humans is often due to the strong relationship between air temperature and ammonia concentration. However, these ammonia concentration extremes do not appear to be temperature correlated. Extreme spikes such as these are possibly the result of disturbances caused by movement, agitation, or moisture affecting the product.

Maximum mean and median NH₃ concentrations during February were 9.4 and 7.6 ppm for the indoor sensor and were 0.8 and 0.7 ppm for the outdoor sensor. The indoor sensor measured above the 5 ppm threshold specified by the consent. The maximum ammonia concentration for both sensors exceeded the consented amount of 5.0 ppm on multiple occasions (Figure 1). The sensor was inactive from 8 am 5th February to 11.40 am 7th February as power was shut off in the area due to flood waters.

Daily (diurnal) variation in NH₃ concentration shows a consistent pattern in the data. Specifically, NH₃ 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 daily air temperature is the greater

control over the absolute concentration with maximum ammonia values recorded during the warmest months of the year and minimum concentrations recorded during the coolest months of the year. The relationship between air temperature and NH₃ concentration for this reporting period is displayed in Figure 1 and Figure 2.

Table 1. Summary statistics for the indoor NH₃ sensor, 01 February – 29 February 2020. NH₃ measured in parts per million (ppm).

Date	01 Feb	02-08 Feb	09-15 Feb	16-22 Feb	23-29 Feb
Mean	3.7	7.3	6.1	9.4	7.9
Std Dev	0.7	13.8	1.9	8.4	2.1
Median	3.7	4.4	5.4	7.6	7.3
Minimum	2.2	2.3	2.8	4.2	4.6
Maximum	4.8	149.6	12.7	89.8	14.1

Table 2. Summary statistics for the outdoor NH₃ sensor, 01 February – 29 February 2020. NH₃ measured in parts per million (ppm).

Date	01 Feb	02-08 Feb	09-15 Feb	16-22 Feb	23-29 Feb
Mean	0.7	0.8	0.8	0.8	0.7
Std Dev	0.3	0.4	0.8	0.3	0.4
Median	0.6	0.7	0.7	0.7	0.6
Minimum	0.4	0.3	0.4	0.4	0.4
Maximum	3.3	5.1	9.7	4.6	3.8

01 – Feb 2020

The indoor NH₃ concentration showed consistent diurnal variation for most of the week. Maximum indoor concentration was 4.8 ppm for this period. Mean and median values were 3.7 and 3.7 ppm respectively. The outdoor NH₃ concentration levels showed consistent variation for most of the week with higher concentrations consistent with warmer temperatures. Maximum outdoor concentration was 3.3 ppm for this period. Outdoor mean and median values were 0.7 and 0.6 ppm respectively.

02-08 Feb 2020

The sensors were inactive from 8 am 5th February to 11.40 am 7th February as power was shut off in the area due to flood waters. The indoor NH₃ concentration showed consistent diurnal variation with intermittent peak recordings reaching a maximum indoor concentration of **149.6 ppm**. This is the highest value ever recorded at the site and doesn't appear to be temperature related. Mean and median values were 7.3 and 4.4 ppm respectively. The outdoor NH₃ 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. Outdoor mean and median values were 0.8 and 0.7 ppm respectively.

09-15 Feb 2020

During this week, indoor NH₃ concentration showed consistent diurnal variation for most of the week. Maximum indoor concentration was 12.7 ppm for this period. Mean and median values were 6.1 and 5.4 ppm respectively. The outdoor NH₃ concentration levels showed consistent variation for most of the week with higher concentrations consistent with warmer temperatures. Maximum

outdoor concentration was 9.7 ppm for this period. Mean and median values were 0.8 ppm and 0.7 ppm respectively.

16-22 Feb 2020

During this week, indoor NH₃ concentration showed consistent diurnal variation for most of the week. Maximum indoor concentration was **89.8 ppm** for this period. As with previous exceedances this month, this peak does not appear to be temperature related. Mean and median values were 9.4 and 7.6 ppm respectively. The outdoor NH₃ concentration levels showed consistent variation for most of the week with higher concentrations consistent with warmer temperatures. Maximum outdoor concentration was 4.6 ppm for this period. Mean and median values were 0.8 and 0.7 ppm respectively.

23 – 29 Feb 2020

During this week, indoor NH₃ concentration showed consistent diurnal variation for most of the week. Maximum indoor concentration was 14.1 ppm for this period. Mean and median values were 7.9 and 7.3 ppm respectively. The outdoor NH₃ concentration levels showed consistent variation for most of the week with higher concentrations consistent with warmer temperatures. Maximum outdoor concentration was 3.8 ppm for this period. Mean and median values were 0.7 and 0.6 ppm respectively.

Summary

During the monitoring period (01 – 29 February) indoor NH₃ concentrations reached a maximum of 149.6 ppm, while maximum mean and median concentrations were 9.4 and 7.6 ppm respectively.

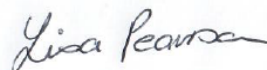
The maximum concentration breaches the threshold limit value (25ppm) and also the short-term exposure level (35ppm) for occupational exposure. Any personnel needing to enter the building should check the monitoring sensor prior to entering and open doors to vent building before working. Rare spikes in ammonia concentration greater than the threshold occupational exposure limit for ammonia toxicity to humans is often due to the strong relationship between air temperature and ammonia concentration. However, these ammonia peaks do not appear to be temperature correlated and are possibly the result of disturbances caused by movement, agitation, or moisture affecting the product.

Outdoor concentrations reached a maximum of 9.7 ppm, while mean and median concentrations were both 0.8 and 0.7 ppm. The indoor and outdoor sensor exceeded the consent conditions of 5.0 ppm on multiple occasions during the month of February. With the exception of the peak ammonia concentrations, temperature continues to be the most dominant control over NH₃ concentration.

Kind regards



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Land and Water Science Ltd



Dr Lisa Pearson
Lead Earth and Environmental Scientist
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@photonicinnoventions.com and use the password: Pa5%w0rd

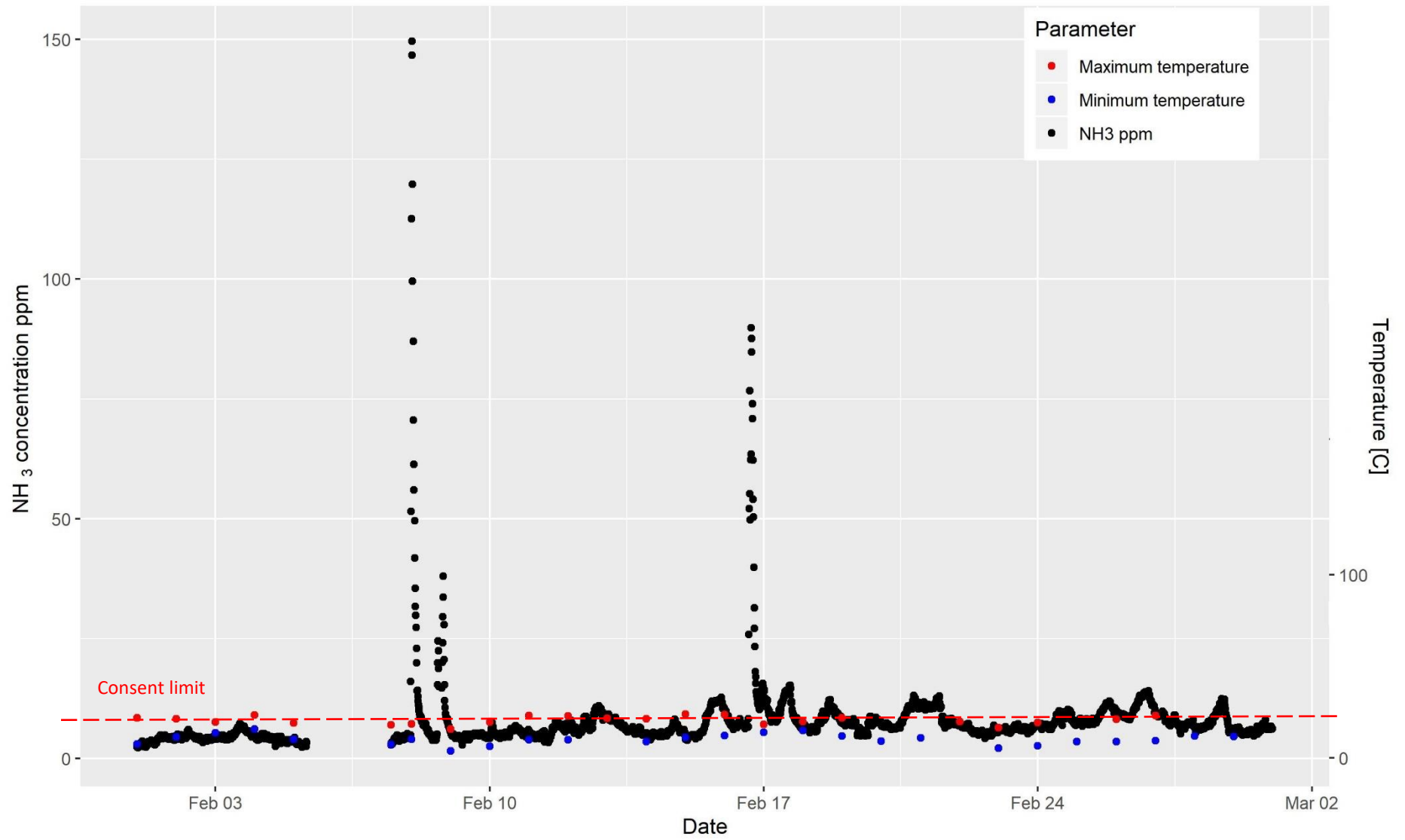


Figure 1: Continuous indoor NH₃ concentration and maximum daily temperature.

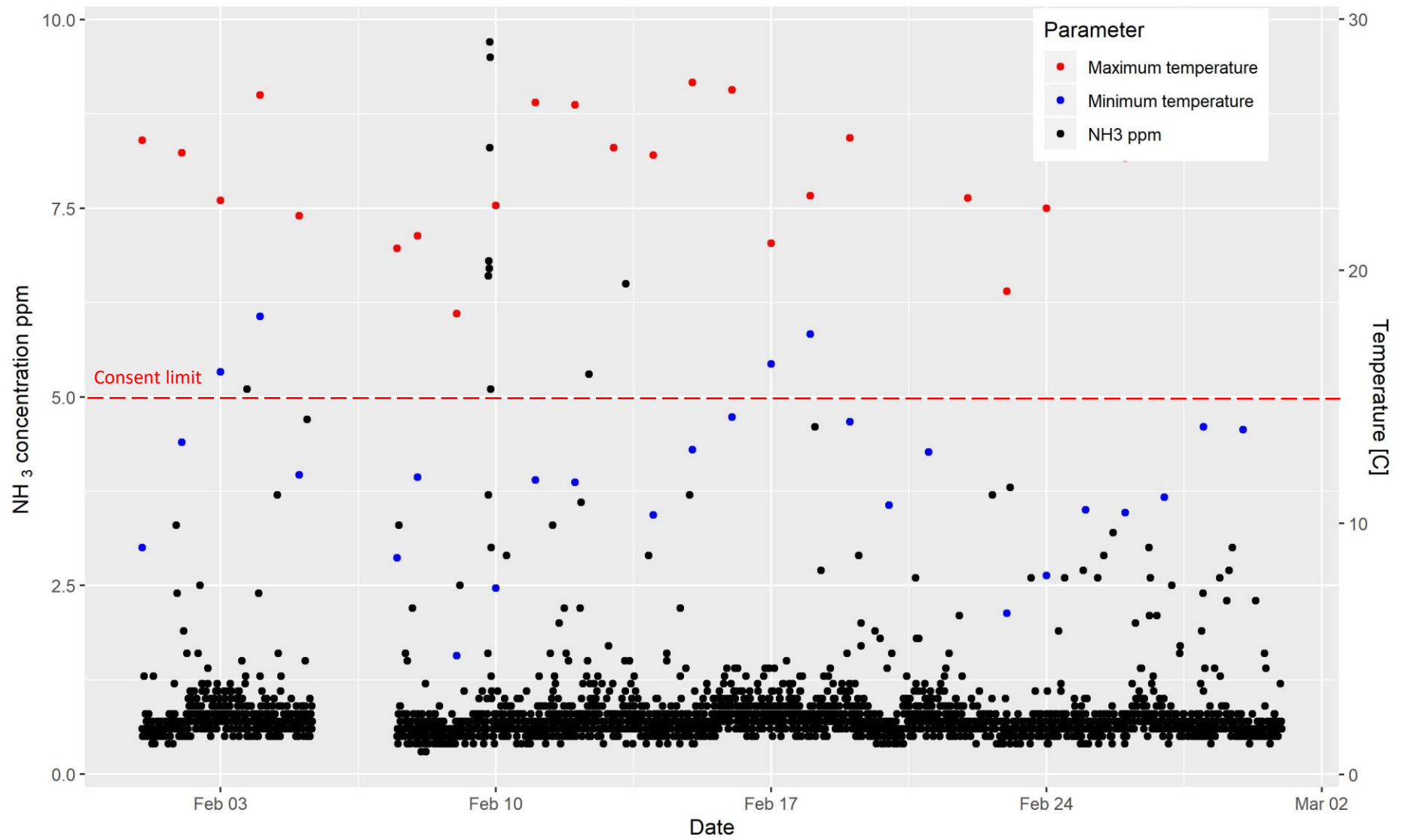


Figure 2: Continuous outdoor NH₃ concentration and maximum daily temperature.