Land and Water Science
90 Layard Street
Invercargill, 9810

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

1st July 2021

Dear Stephen

**RE: $NH_3$ Monitoring Report 1st June to 30th June 2021**

## Background

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 May 2018. GDC require emission values to comply with consent conditions that specify a limit of 5 ppm $NH_3$ discharged to air.

In May 2017, Photonic Innovations (PI) installed two $NH_3$ sensors for comparison of the indoor and outdoor ammonia levels. Measurements were recorded continuously and reported as a 5-minute average for both the outdoor and indoor sensors. A dashboard to access this data is available in real time at http://35.213.230.53/d/CPQFoUvGz/gore-district-council?orgId=1&refresh=1m.

## June Summary

Weekly summaries of outdoor emission results from monitoring between 1 June and 30 June are presented in this report. During this period, the maximum $NH_3$ concentration detected by the outdoor sensor was 5.80 ppm (Figure 1 and Table 1). Maximum mean and median $NH_3$ concentrations during this period were 0.69 ppm and 0.60 ppm for the outdoor sensor. There was 1 exceedance (5.80 ppm) over the limit of the consented maximum ammonia concentration of 5 ppm. The recorded mean and median $NH_3$ concentrations for the indoor sensor during June was 1.76 ppm, and 1.80 ppm, respectively. The maximum $NH_3$ value recorded in June for the indoor sensor was 6.20 ppm (Figure 2 and Table 2).

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. Calm days also impact the maximum $NH_3$ concentrations due to the absence of air movement near the area being monitored. Movement of the material is also likely to increase $NH_3$ concentrations indoors as fine particles are likely to get mobilised, and appropriate safety precautions and PPE should be worn when near the material.

*Table 1. Summary statistics for the Outdoor $NH_3$ sensor, 1 June – 30 June 2021. $NH_3$ measured in parts per million (ppm).*

| Date | 1 - 6 June | 7 - 13 June | 14 - 20 June | 21 - 27 June | 28 -30 June |
|---|---|---|---|---|---|
| Mean | 0.62 | 0.58 | 0.64 | 0.69 | 0.53 |
| Std Dev | 0.29 | 0.30 | 0.35 | 0.28 | 0.25 |
| Median | 0.60 | 0.50 | 0.60 | 0.60 | 0.50 |
| Minimum | 0.20 | 0.10 | 0.20 | 0.20 | 0.20 |
| Maximum | 2.20 | 2.80 | 5.80 | 2.00 | 2.10 |

*Table 2. Summary statistics for the Indoor $NH_3$ sensor, 1 June – 30 June 2021. $NH_3$ measured in parts per million (ppm).*

| Date | 1 - 6 June | 7 - 13 June | 14 - 20 June | 21 - 27 June | 28 -30 June |
|---|---|---|---|---|---|
| Mean | 1.76 | 1.14 | 1.08 | 1.52 | 0.53 |
| Std Dev | 0.49 | 0.45 | 0.70 | 0.95 | 0.36 |
| Median | 1.80 | 1.20 | 1.00 | 1.40 | 0.50 |
| Minimum | 0.20 | 0.00 | 0.00 | 0.00 | 0.00 |
| Maximum | 3.40 | 3.50 | 3.20 | 6.20 | 1.80 |

**01 – 06 June 2021**

Outdoor $NH_3$ concentration levels showed consistent variation for most of the week. Maximum outdoor concentration was 2.20 ppm for this period. Outdoor mean and median values were 0.62 and 0.60 ppm, respectively.

Indoor $NH_3$ concentration levels recorded a mean of 1.76 ppm and a median of 1.80 ppm. The maximum indoor concentration was 3.40 ppm for this week.

**07 – 13 June 2021**

The outdoor $NH_3$ concentration levels were relatively stable at low $NH_3$ concentration during the week which corresponded with the low temperatures. Maximum outdoor concentration was 2.80 ppm for this period. Outdoor mean and median values were 0.58 and 0.50 ppm, respectively.

Indoor $NH_3$ concentration levels recorded a mean of 1.14 ppm and a median of 1.20 ppm. The maximum indoor concentration was 3.50 ppm for this period.

**14 – 20 June 2021**

Outdoor $NH_3$ concentration levels showed little variation except one exceedance at 5.80 occurring in the middle of the week which was consistent with the increasing air temperature. Mean and median values were 0.64 and 0.60 ppm, respectively.

Indoor $NH_3$ concentration levels recorded a mean of 1.08 ppm and a median of 1.00 ppm. The maximum indoor concentration was 3.20 ppm for this week.

**21 – 27 June 2021**

Outdoor $NH_3$ concentration levels were also relatively consistent during the week, no exceedances were detected in this period. The maximum outdoor concentration was 2.00 ppm for this period. Mean and median values were 0.69 and 0.60 ppm, respectively.

Indoor $NH_3$ concentration levels recorded a mean of 1.52 ppm and a median of 1.40 ppm. The maximum indoor concentration recorded at 6.20 ppm which was a highest value recorded in June.

**28 – 30 June 2021**

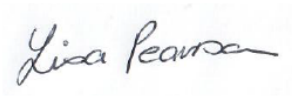
The concentration levels of outdoor $NH_3$ showed little variation during these days. The maximum outdoor concentration was 2.10 ppm for this period. Outdoor mean and median values were 0.53 and 0.50 ppm, respectively.

Indoor $NH_3$ concentration levels recorded a mean of 0.53 ppm and a median of 0.50 ppm. The maximum indoor concentration was 1.80 ppm for this period.

**Summary**

During the monitoring period (1 June – 30 June 2021) the Outdoor $NH_3$ concentrations reached a maximum of 5.80 ppm. This is the only exceedance during this month. The maximum mean and median concentrations were 0.69 and 0.60 ppm, respectively. Overall, temperature continues to be the most dominant control over $NH_3$ concentration. It is recommended to always check the indoor sensor readings prior to any personnel entering the building.

Kind regards



Mary Dang
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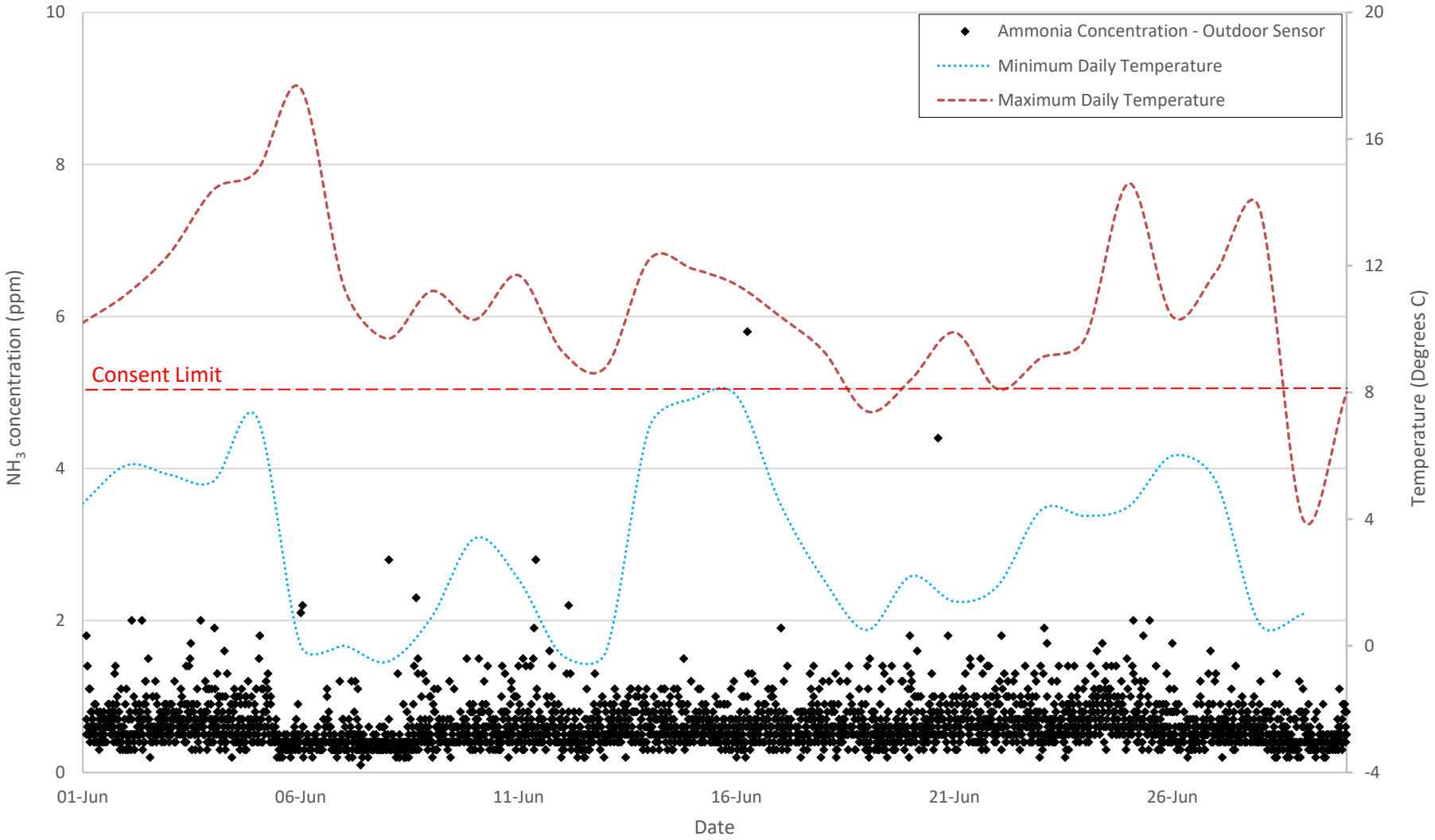


*Figure 1: Continuous outdoor $NH_3$ concentration, minimum and maximum daily temperature. Temperature data is sourced from NIWA climate station AWS Gore 5778.*

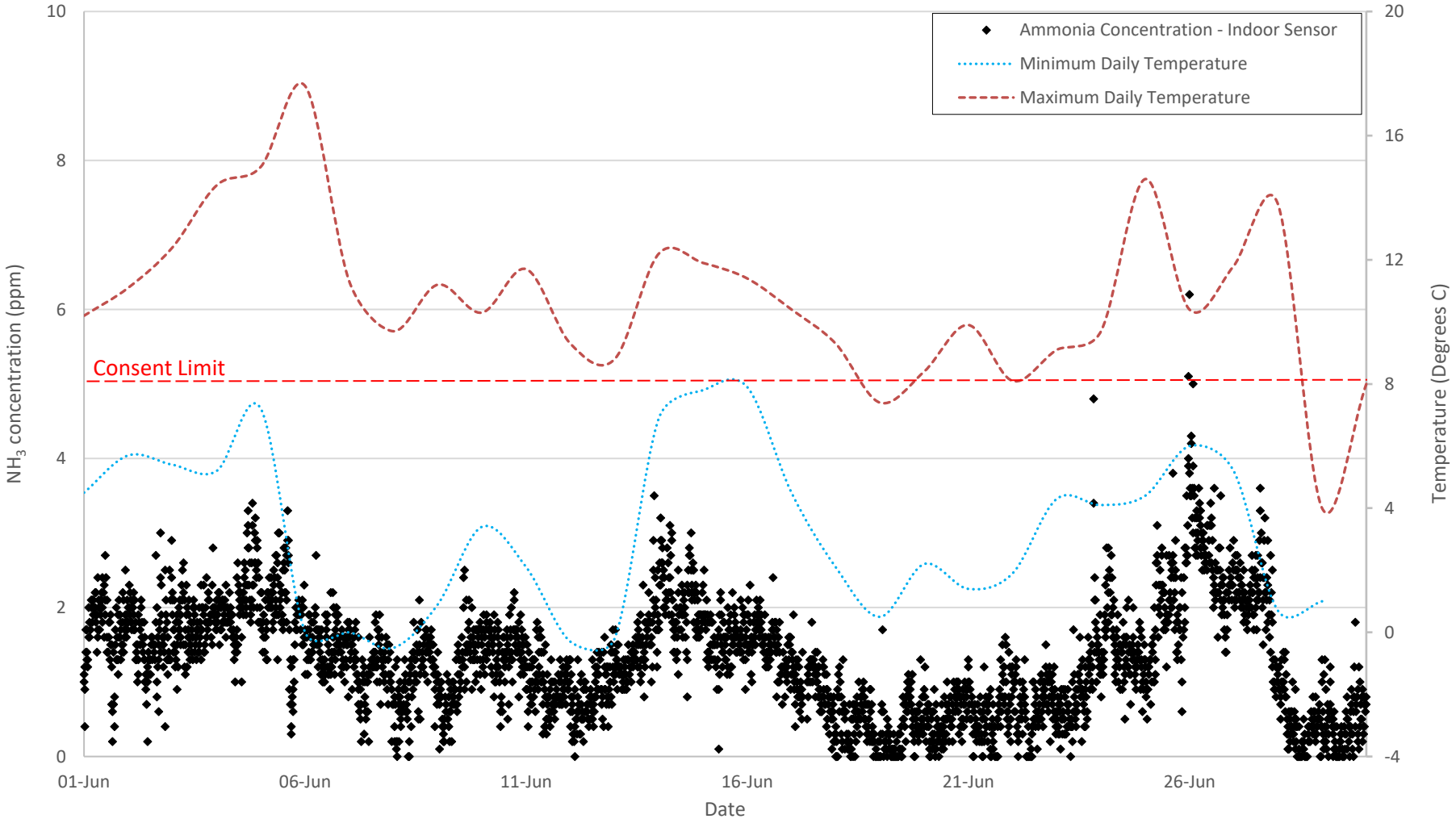


*Figure 2: Continuous indoor $NH_3$ concentration, minimum and maximum daily temperature. Temperature data is sourced from NIWA climate station AWS Gore 5778.*