Land and Water Science
61 Leet Street
Invercargill

Ref: 17130

04 April 2018

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

Dear Stephen

RE: Weekly NH_3 Monitoring Report (Weeks 16– 19)

In October 2017 Gore District Council (GDC) engaged e3scientific Ltd. to scope and assess the ammonia (NH_3) gas emissions from the Mataura Mill dross storage site. 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. A summary of the emission results from weeks 16 – 19 of monitoring are presented in this report.

Graphical records of the weekly observations from the Mataura Mill monitoring sensors for weeks 16-19 are presented in Figures 1-4. Should a member of the public wish to view the real-time monitoring data, instructions are provided below. During this month's monitoring, the maximum NH_3 concentrations detected by the indoor sensor were up to 13.8 ppm, with a mean concentration of 6.5 ppm, and a median concentration of 6 ppm. Temperatures are cooling off as autumn approaches and the diurnal variation of indoor NH_3 concentrations has become more subdued. There was a brief period of warmer weather in week 17 which initiated a few days of stronger diurnal variation.

The outdoor sensor detected daily exceedances of the 5 ppm limit with maximum recorded values of 10.5 ppm, however the mean and median values for this reporting period were 5.5 ppm and 5.4 ppm, respectively. The outdoor sensor continues to show weak diurnal correlation to temperature and humidity changes (Figure 2). The outdoor sensor experienced some periods of disconnection during week 19 and will be serviced during the week of 26 March.

1 Week 16: 18 – 24 February 2018

For the sixteenth week of monitoring there were three periods of variation in indoor NH_3 concentration as temperatures declined towards the middle of the week and then increased again by the 24th March (Table 1). The maximum indoor concentrations of 10.1 ppm were significantly below the maximum for this reporting period. Mean and median values were 6 ppm and 5.5 ppm, respectively. The consented outdoor discharge limits were exceeded as both the mean and median value were 5.4 ppm, with a maximum weekly value of 8.9 ppm.

Table 1. Summary statistics for Week 16 (18 – 24 February 2018). AT - Ambient Temperature; AH - Ambient Humidity; NH3_OUT - outdoor sensor; NH3_IND - indoor sensor. NH_3 measured in parts per million (ppm).

WEEK 16	*AT (°C)*	*AH (%)*	*NH_3_OUT*	*NH_3_IND*
Mean	13.8	57.1	5.4	6.0
Standard error	0.0	0.2	0.0	0.0
Median	13.7	58.5	5.4	5.5
Mode	12.8	61.8	5.4	5.1
Minimum	11.1	44.0	3.1	3.9
Maximum	16.9	65.5	8.9	10.1
Confidence level (95.0%)	0.1	0.4	0.1	0.1

2 Week 17: 25 February – 03 March 2018

During the seventeenth week of monitoring the diurnal variation pattern re-established during a period of warmer temperatures. Mean and median outdoor NH_3 concentrations were 5.7 ppm and 5.5 ppm respectively, with a peak atmospheric concentration of 10.2 ppm. The indoor sensor showed five days of strong diurnal change in concentrations (Figure 2) with peaks at 13.8 ppm and a mean and median of 7.9 ppm and 8.1 ppm respectively.

Table 2. Summary statistics for Week 17 (25 February – 03 March 2018). AT - Ambient Temperature; AH - Ambient Humidity; NH3_OUT - outdoor sensor; NH3_IND - indoor sensor. NH_3 measured in parts per million (ppm).

WEEK 17	*AT (°C)*	*AH (%)*	*NH3_OUT*	*NH3_IND*
Mean	14.5	62.3	5.7	7.9
Standard error	0.1	0.2	0.0	0.1
Median	14.6	61.5	5.5	8.1
Mode	15.7	69.3	5.2	9.4
Minimum	9.9	49.7	2.9	3.1
Maximum	17.7	77.5	10.2	13.8
Confidence level (95.0%)	0.1	0.5	0.1	0.2

3 Week 18: 04 – 10 March 2018

In week eighteen of monitoring the diurnal pattern of indoor NH_3 concentration established in week 17 changed back to a pattern of limited variation (Table 3). Outdoor concentrations peaked at 10.5 ppm with a mean and median of 5.5 ppm and 5.4 ppm, respectively. The indoor sensor detected only one significant diurnal swing in indoor NH_3 concentrations (Figure 3) with a peak value of 13.7 ppm and mean and median of 6.6 ppm and 6.2 ppm, respectively.

Table 3. Summary statistics for Week 18 (04 – 10 March 2018). AT - Ambient Temperature; AH - Ambient Humidity; NH3_OUT - outdoor sensor; NH3_IND - indoor sensor. NH_3 measured in parts per million (ppm).

WEEK 15	*AT (°C)*	*AH (%)*	*NH3_OUT*	*NH3_IND*
Mean	14.0	60.0	5.5	6.6
Standard error	0.1	0.2	0.0	0.1
Median	14.2	60.0	5.4	6.2
Mode	11.9	55.2	5.1	5.5
Minimum	9.9	46.5	2.4	3.4
Maximum	17.5	73.5	10.5	13.7
Confidence level (95.0%)	0.1	0.4	0.1	0.1

4 Week 19: 11 – 17 March 2018

In week nineteen of monitoring, the diurnal pattern of indoor NH_3 concentration established itself again for brief periods (Table 4). Outdoor concentrations peaked at 8.0 ppm with a mean and median of 5.3 ppm and 5.2 ppm respectively. The indoor sensor detected two significant diurnal swings in indoor NH_3 concentrations (Figure 4) with a peak value of 10.4 ppm and mean and median of 5.4 ppm and 5.3 ppm respectively. Connection with the outdoor sensor began to drop off during the end of week 19. PI have been contacted and a technician planned to service the sensor during the week of 26 March.

Table 4. Summary statistics for Week 19 (11 – 17 March 2018). AT - Ambient Temperature; AH - Ambient Humidity; NH3_OUT - outdoor sensor; NH3_IND - indoor sensor. NH_3 measured in parts per million (ppm).

WEEK 15	*AT (°C)*	*AH (%)*	*NH3_OUT*	*NH3_IND*
Mean	13.5	52.4	5.3	5.4
Standard error	0.0	0.2	0.0	0.1
Median	13.7	52.2	5.2	5.3
Mode	13.8	53.3	5.4	3.6
Minimum	10.1	40.5	2.5	2.3
Maximum	15.8	62.9	8.0	10.4
Confidence level (95.0%)	0.1	0.3	0.1	0.1

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If you have any questions regarding the information provided in this letter, please contact Clint Rissmann or Simon Bloomberg.

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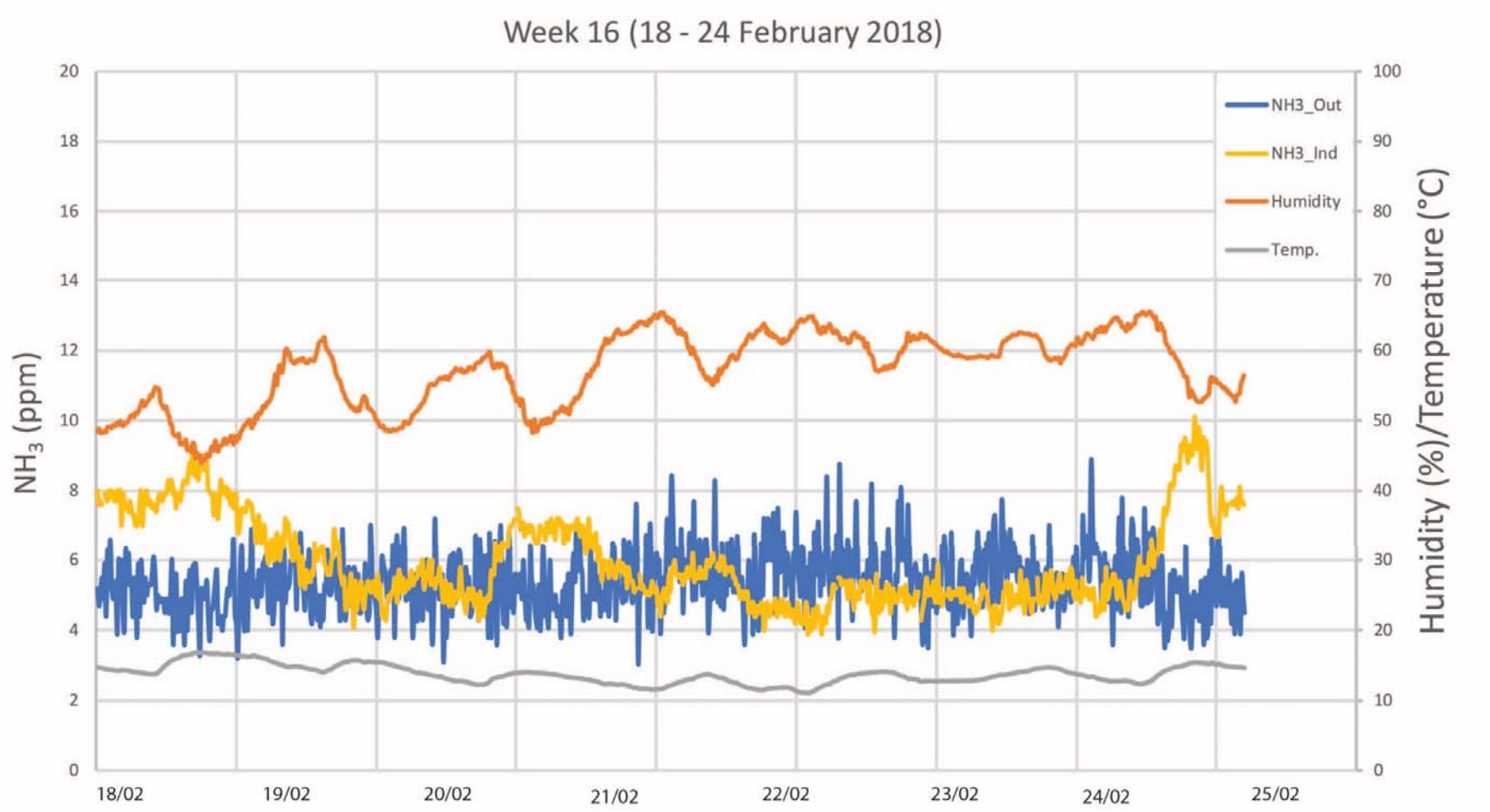

Figure 1: Week 16 of monitoring (18 – 24 February 2018). Both sensors remained connected. Lower temperatures this week reduced the diurnal variation in both indoor and outdoor NH3 concentrations.

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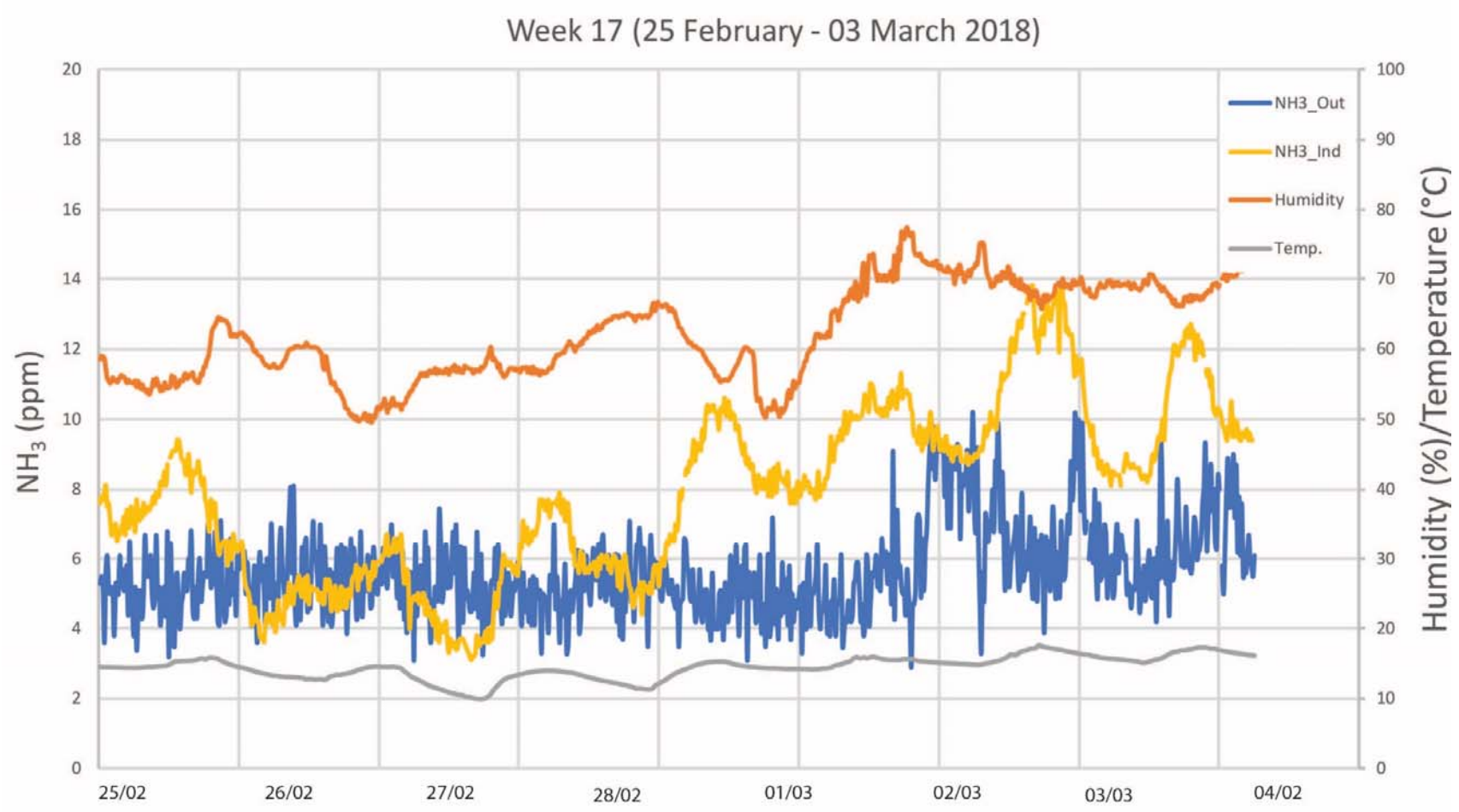

Figure 2: Week 17 of monitoring (25 February – 03 March 2018). Both sensor remained connected. The low temperatures and lack of diurnal related changes continued until the 27th. Later in the week the pattern of diurnal NH3 concentration changes was re-established.

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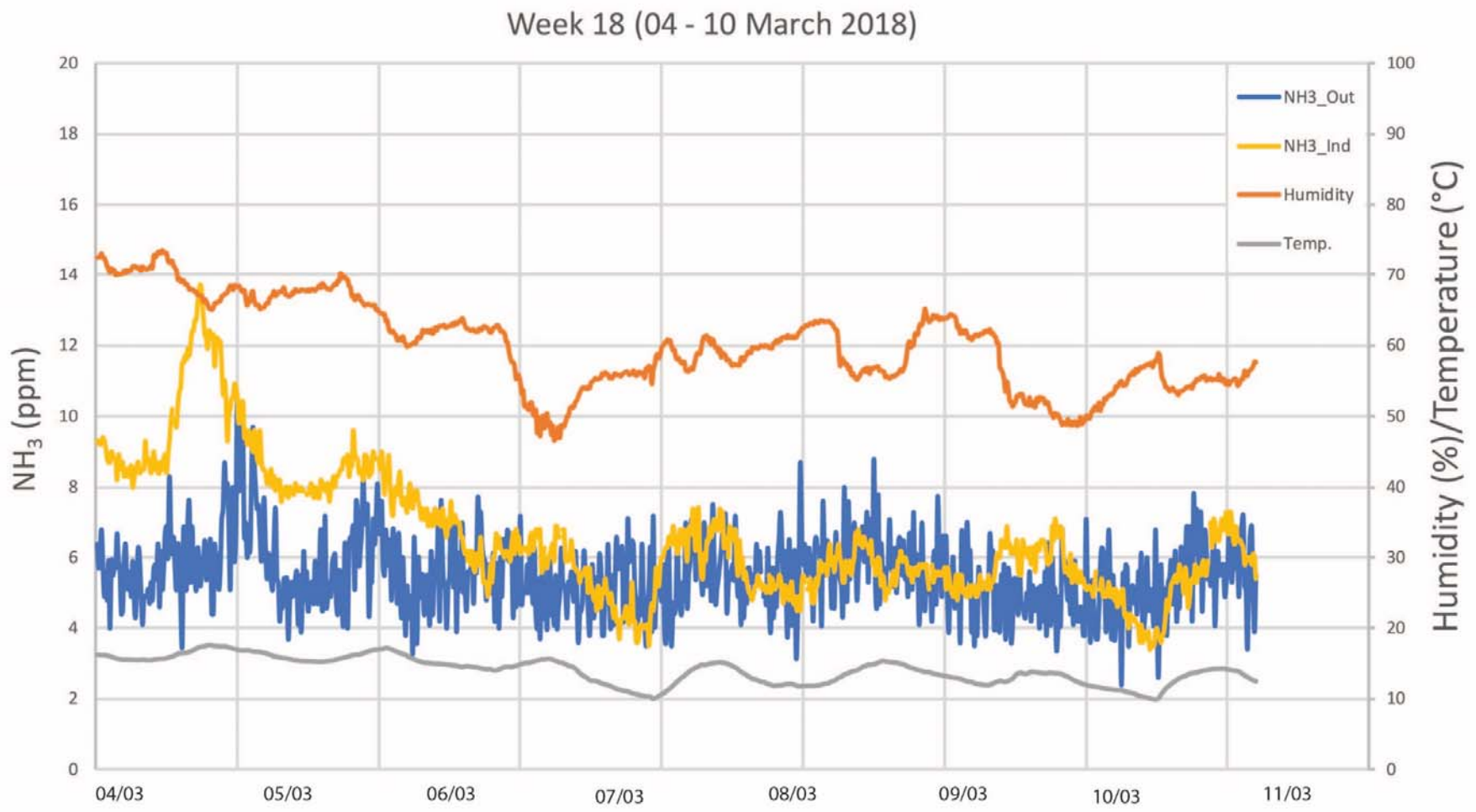

Figure 3: Week 18 of monitoring (04 – 10 March 2018). Both sensors remained connected during this week. Large diurnal swings in temperature and NH3 reduced after the 5th and a more limited variation pattern established itself.

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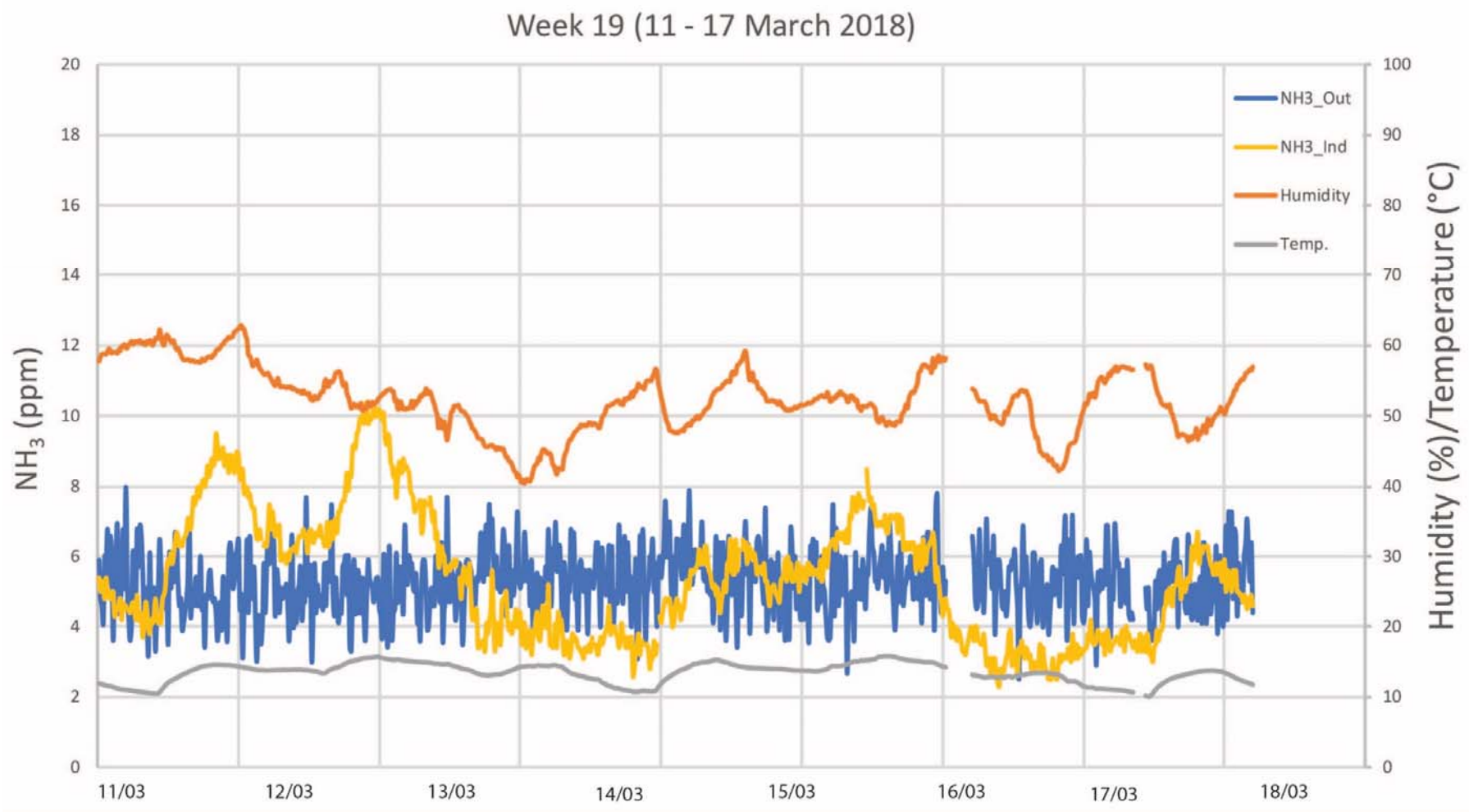

Figure 4: Week 19 of monitoring (11 – 17 March 2018). At the end of this week the outdoor sensor experienced some disconnection. A few diurnal swings in temperature and NH3 levels continued to be detected by both indoor and outdoor sensors.