

25 August 2025

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Orica Australia Pty Ltd

Dear Nathan,

Prill Tower Air Quality Verification Study

1.0 Introduction

The following letter has been prepared to summarise the outcomes of the Air Quality Verification Study (AQVS) undertaken for the No. 1 Ammonium Nitrate (AN) Prill Tower, located on the southern portion (Nitrates Plant) of the Orica Kooragang Island site.

The aim of the AQVS is to demonstrate that the irrigated fibre-bed scrubbing (IFS) technology installed on the existing Prill Tower (the Prill Tower Scrubber) as part of Orica's Ammonium Nitrate Expansion Project Development Consent (08_0129 as modified – the Consent) is operating at a level that aligns with the assumptions of the Air Quality Impact Assessment (AQIA) undertaken as part of the regulatory approvals process. Operation of the Prill Tower Scrubber commenced on 4 to 5 September 2024, with an objective to reduce AN particulate emissions by at least 95 percent.

This has been prepared to address the requirements specified by the Department of Planning, Housing and Infrastructure (DPHI) in Condition 23 of the Consent as noted below.

2.0 Background

The requirements of the AQVS have been specified by DPHI and are reproduced below.

23. *The Proponent shall carry out an Air Quality Verification Study for each relevant stage of the Project to the satisfaction of the Secretary and the EPA. The study shall:*

- a) *be prepared by a suitably qualified expert whose appointment has been agreed to in writing by the Secretary;*
- b) *be based on a minimum of 12 months of monitoring data and be completed during the initial 18 months of operation or as otherwise agreed to in writing by the Secretary;*
- c) *include a verification of actual monitored emissions performance against the assumptions adopted within the EIS, including:*
 - *point source pollutant concentrations;*
 - *point source pollutant mass emission rates; and*
 - *point source emission parameters as relevant to plume dispersion.*
- d) *confirm, through direct measurement, that applicable EPL air emission limits are being complied with; and*
- e) *confirm, using reasonable means, the effectiveness of the implemented emission controls in minimising air quality impacts.*

An AQVS typically consists of a comparison between monitored data and predicted (modelled) data which are then used to justify the planning approvals. The outcomes of an AQVS are generally either:

1. The measured emissions are similar to or lower than the predicted emissions, and measured stack parameters are similar to or more favourable than predicted stack parameters, and no additional investigatory works are needed. A simple letter report is prepared presenting the data compared as part of the assessment, or;
2. The measured emissions are higher than the predicted emissions, and measured stack parameters are less favourable than predicted stack parameters, to such a degree that the conclusions in the approvals documentation may no longer be valid, and further investigation may be necessary.

3.0 Verification data analysis

A comparison has been undertaken between the recent post-commissioning stack emissions testing results for the Prill Tower Scrubber and data assumed for the AQIA dispersion modelling prepared as part of MOD5 of development consent 08_0129 dated 9 August 2025. Details of the analysis have been provided below.

3.1 Monitoring required for EPL 828 Point 40

Current monitoring requirements for EPL 828 Point 40 are presented in Table 1.

Table 1 EPL 828 Point 40 concentration limits

Pollutant	Unit	100 th percentile concentration limit	Reference condition	Averaging period
Total solid particles (TSP)	mg/m ³	20	Dry, 273K, 101.3kPa	1 hour
Ammonia	mg/m ³	0.2	Dry, 273K, 101.3kPa	1 hour

3.2 Stack emissions monitoring

Stack emissions testing of the Prill Tower Scrubber was conducted by Assured Environmental Pty Ltd four times since the commissioning of MOD5:

- Post commissioning stack test 1 – 23 September 2024 (Q3 2024)
- Post commissioning stack test 2 – 19 November 2024 (Q4 2024)
- Post commissioning stack test 3 – 4 February 2025 (Q1 2025)
- Post commissioning stack test 4 – 16 June 2025 (Q2 2025)

The tests were performed over four-quarters (12-months) and during the initial 18-months of operation. All test reports have been appended to this letter as Attachments A to D. No further testing is planned until May 2026, and as such the data set represents the minimum 12 months of data required.

3.3 Compliance with requirements of the Protection of the Environment Operations (Clean Air) Regulation 2022

As required by EPL 828 Section M3 (Testing methods – concentration limits EPL), all sampling and analysis has been carried out in accordance with the requirements of the *Protection of the Environment Operations (Clean Air) Regulation 2022* and its subservient NSW EPA document the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales (2022)*.

Compliance with stack emissions testing requirements is detailed in Attachments A to D.

The stack emissions testing demonstrates compliance with all pollution limits outlined in EPL 828 for Point 40. The results of the tests are summarised in Table 3 and Table 4 in the following section.

3.4 Modelled stack parameters and emission rates used in the AQIA supporting the Modification Application

A Level 2 AQIA was conducted in accordance with the NSW Approved Methods for Modelling and Assessment of Air pollutants in New South Wales (EPA 2022) using the atmospheric dispersion model CALPUFF.

The AQIA included development of an emissions inventory for the proposed changes to the Prill Tower stack. The emissions inventory includes emission rates based on the following operational scenarios:

- Typical emissions levels (expected normal operational emissions)
- Conservative emissions levels (periodic high operational emissions)
- Reasonable worst-case emission levels (maximum expected operational emissions).

Table 2 presents the stack parameters relevant to plume dispersion, pollutant concentrations and pollutant emissions rates for each model scenario.

Table 2 Dispersion modelling assumptions used in the AQIA supporting the Modification Application

Stack parameter	Unit	Typical scenario	Conservative scenario	Maximum scenario
Discharge height	m (AGL)	37.9	37.9	37.9
Stack discharge flow rate	Nm ³ /h (dry)	357,000	490,000	490,000
Stack exit diameter	mm	3250	3250	3250
Stack discharge velocity	m/s	14.6	19.2	20.7
Stack temperature	°C	40	40	48
TSP	mg/Nm ³	0.6	1.5	5.0
	g/s	0.06	0.204	0.681
PM ₁₀	mg/Nm ³	0.6	1.5	5.0
	g/s	0.06	0.204	0.681
PM _{2.5}	mg/Nm ³	0.6	1.5	5.0
	g/s	0.06	0.204	0.681
Ammonia (NH ₃)	mg/Nm ³	0.02	0.02	0.05
	g/s	0.002	0.003	0.007

3.5 Results comparison with AQIA assumptions

This section provides a comparison of modelled stack release parameters and pollutant assumptions presented in Section 3.4 against measurements obtained during four post-commissioning stack testing events discussed in Section 3.2.

Table 3 presents a comparison of the pollutant concentrations and pollutant emission rates used in the AQIA dispersion modelling against the measured pollutant concentrations and emission rates during operation of the Prill Tower Scrubber. Table 3 shows the following:

- Measured stack TSP concentrations and emission rates are higher than the values adopted for the Typical Scenario but were generally lower than the values adopted for the Conservative Scenario and Maximum Scenario; only one measured TSP concentration was marginally higher than the TSP concentration used for the Conservative Scenario.
- Measured stack PM₁₀ concentrations and emission rates are similar to the values adopted for the Typical Scenario. All measured PM₁₀ concentrations and emissions rates are below the values used in both the Conservative Scenario and Maximum Scenario.
- Measured stack PM_{2.5} concentrations and emission rates are similar to the values adopted for the Typical Scenario. All measured PM_{2.5} concentrations and emissions rates are below the values used in both the Conservative Scenario and Maximum Scenario.
- During the first three stack testing events the measured NH₃ concentrations and emissions rates were similar to or higher than the values used in the Maximum Scenario. However, during the most recent testing event the stack concentration and emission rate were below the values used for the Typical Scenario.

Table 4 presents a comparison of the stack release parameters used in the AQIA dispersion modelling against the measured stack release parameters. Table 4 shows the following:

- Three of the four stack gas velocity measurements were below all values used in the AQIA. The stack velocity measurement recorded in February 2025 was higher than the Typical Scenario assumptions and comparable to the Conservative Scenario assumption. Stack velocities used in the dispersion modelling were 14.6, 19.2 and 20.7 m/s, while the average stack gas velocity across the four sampling events was 12.3 m/s.

- The volumetric flow rates measured in September 2024 and November 2024 are similar to the assumptions used in the Typical Scenario, while the measurement obtained in February 2025 fell between the Typical Scenario and the Conservative and Maximum Scenarios. The measurement recorded in June 2025 was 45 percent lower than the Typical Scenario assumption. Volumetric flow rates used in the dispersion modelling were 99 Nm³/sec for the Typical Scenario and 136 Nm³/sec for the Conservative and Maximum Scenarios, while the average volumetric flow rate across the four sampling events was 91.5 Nm³/sec.
- The stack temperature measurements for all four stack testing events were lower than the values used in AQIA dispersion modelling. Stack temperatures used in the dispersion modelling were 40 and 48 °C, while the average temperature across the four sampling events was 27 °C.

Table 3 Comparison of modelled and measured pollutant concentrations and emission rates

Pollutant	EPL concentration limit	Concentration basis	Concentration	Emission rate
			mg/Nm ³	g/s
TSP ¹	20 mg/Nm ³	Modelled values		
		Typical Scenario	0.6	0.06
		Conservative Scenario	1.5	0.204
		Maximum Scenario	5.0	0.681
		Stack testing results		
		September 2024	2.1	0.19
		November 2024	1.3	0.11
		February 2025	1.0	0.12
		June 2025	0.8	0.06
		Average test result	1.3	0.12
PM ₁₀	NA	Modelled values		
		Typical Scenario	0.6	0.06
		Conservative Scenario	1.5	0.204
		Maximum Scenario	5.0	0.681
		Stack testing results		
		September 2024	1.1	0.1
		November 2024	0.9	0.08
		February 2025	0.4	0.05
		June 2025	0.5	0.03
		Average test result	0.7	0.07
PM _{2.5}	NA	Modelled values		
		Typical Scenario	0.6	0.06
		Conservative Scenario	1.5	0.204
		Maximum Scenario	5.0	0.681
		Stack testing results		
		September 2024	0.5	0.04
		November 2024	0.7	0.06
		February 2025	0.1	0.02

Pollutant	EPL concentration limit	Concentration basis	Concentration	Emission rate
			mg/Nm ³	g/s
Ammonia	0.2 mg/Nm ³	June 2025	0.2	0.02
		Average test result	0.4	0.04
		Modelled values		
		Typical Scenario	0.02	0.002
		Conservative Scenario	0.02	0.003
		Maximum Scenario	0.05	0.007
		Stack testing results		
		September 2024	0.08	0.007
		November 2024	0.08	0.007
		February 2025	0.04	0.005
		June 2025	0.02	0.001
		Average test result	0.06	0.005

Table note:

TSP was measured using both the AS4323.2 and M201A test methods; to provide a conservative estimate of the TSP measurement the highest measured value from each test method has been presented.

Table 4 Comparison of modelled and measured stack release parameters

Stack parameter	Model scenario / test event	Value
Stack velocity (m/s)	Modelled values	
	Typical Scenario	14.6
	Conservative Scenario	19.2
	Maximum Scenario	20.7
	Stack testing results	
	September 2024	11.6
	November 2024	11.6
	February 2025	17.0
	June 2025	8.8
	Average test result	12.3
Volumetric Flow Rate (Nm ³ /sec)	Modelled values	
	Typical Scenario	99
	Conservative Scenario	136
	Maximum Scenario	136
	Stack testing results	
	September 2024	88
	November 2024	87
	February 2025	123
	June 2025	68

Stack parameter	Model scenario / test event	Value
	Average test result	91.5
Temperature (°C)	Modelled values	
	Typical Scenario	40
	Conservative Scenario	40
	Maximum Scenario	48
	Stack testing results	
	September 2024	25
	November 2024	28
	February 2025	33
	June 2025	22
	Average test result	27

3.6 Discussion

The stack emissions tests were performed over four-quarters (12-months) and during the initial 18-months of operation, as per the AVQS requirements of the Consent. The stack emissions testing demonstrated compliance with all pollution limits outlined in EPL 828 for Point 40.

The comparison presented in Section 3.6 shows that the pollutant stack concentrations and emissions rates measured during the four post-commissioning stack testing events were lower than the assumptions used for the Maximum Scenario for TSP, PM₁₀ and PM_{2.5}. The average measured NH₃ concentration is marginally higher than the assumption used for the Maximum Scenario.

Although the average measured NH₃ concentration (0.06 mg/Nm³) is marginally higher than the assumption used for the Maximum Scenario (0.05 mg/Nm³), the maximum 99.9th percentile 1 hour average concentration model prediction (as presented in the AQIA) at or beyond the site boundary for the Maximum Scenario accounted for 0.01 percent of the 1-hour NH₃ criteria. Additionally, the average measured NH₃ concentration is significantly lower than the concentration limit of 0.2 mg/Nm³ specified in EPL 828. Therefore, this discrepancy is not expected to result in a material change to the predicted ground level concentrations of NH₃ presented in the AQIA.

The stack velocity, volumetric flow rate and temperature measurements recorded during stack testing events were found to be lower than the assumption used in each of the AQIA model scenarios. Specifically, the average stack exit velocity measurement across the four stack testing events was 2.3 m/s lower than the exit velocity assumed for the Typical Scenario, while the average stack temperature measurement across the four stack testing events was 13 °C lower than the stack temperature assumed for the Typical Scenario.

Stack exit velocity and stack temperature have an impact on pollutant dispersion from point sources; pollutant dispersion typically improves with increases in exit velocities and temperatures. However, the magnitude of the differences between the measured and modelled stack velocity and temperature are relatively low and therefore unlikely to result in significant increases to the predicted pollutant ground level concentrations presented in the AQIA. It is also noted that a lower exit velocity typically results in a lower pollutant mass emission rate which will to a degree counteract any increase in ground level pollutant concentration resulting from a lower exit velocity.

It is also highlighted that the AQIA predicted ground level concentrations at or beyond the site boundary for all pollutants are below the adopted criteria for each respective pollutant by a significant margin. The pollutant with the smallest margin between model prediction and criteria was PM_{2.5}, which accounted for 10.3 percent of the 24-hour average criteria. Therefore, the differences between modelled and measured stack parameters are not considered material and are not expected to change the conclusions of the AQIA.

As the predicted and measured emissions and stack parameters are generally similar, it is considered that the implemented emissions controls have been effective in minimising air quality impacts. More broadly, the performance of the Prill Tower Scrubber has been in accordance with the predicted design and is achieving greater than 95 percent removal of AN particulate emissions.

3.7 Conclusion

The results of post-commissioning stack emission testing undertaken on the Prill Tower Scrubber have been reviewed and compared against assumptions used to inform the dispersion modelling undertaken as part of the AQIA.

The comparison shows that although there are some minor differences between the assumptions used in the AQIA dispersion modelling and measurement data obtained since commissioning of the Prill Tower Scrubber, these differences are negligible and are not expected to result in significant changes to the pollutant ground level concentration predictions presented in the AQIA. Therefore, the findings of the AQIA are considered to remain valid and no further investigation is considered necessary. It is also considered that the implemented emission controls have been effective in reducing AN particulate emissions associated with prilling activities at the Orica Kooragang Island site.

If there are any questions in relation to the above analysis, please contact the undersigned.

Yours faithfully



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Attachments:

- A: Kooragang Island – Prill Tower Emissions Testing – September 2024
- B: Kooragang Island – Prill Tower Emissions Testing – November 2024
- C: Kooragang Island – Prill Tower Emissions Testing – February 2025
- D: Kooragang Island – 2025 Annual Emissions Testing – June 2025