Yara Pilbara Nitrates

Air Quality Management Plan

Technical Ammonium Nitrate Plant

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TABLE OF CONTENTS

1 1

DOCUMENT CLASSIFICATION 3
DOCUMENT APPROVAL 3
REVISION HISTORY 3

1 EXECUTIVE SUMMARY 6

2 INTRODUCTION 7

2.1 BACKGROUND 7
2.2 PURPOSE 9
2.3 SCOPE 9
2.4 PUBLIC AVAILABILITY 10

3 DEFINITIONS AND ACRONYMS 11

4 AIR QUALITY MANAGEMENT 14

4.1 OVERVIEW 14
4.2 TAN PLANT LICENCE 14
4.3 TAN PLANT AIR EMISSIONS 15
4.3.1 Emissions During Normal Operation 15
4.3.2 Emissions During Non-routine Operations 16
4.4 TAN PLANT AIR EMISSION ABATEMENT 16
4.4.1 TAN Plant Emission Performance 17
4.4.2 TAN Plant Air Pollution Control Technology 19
4.5 AIR EMISSIONS IMPACT ASSESSMENT 24
4.5.1 Air Quality Modelling 24
4.5.2 Cumulative Impacts of Air Emissions in the Murujuga Air Shed 27
4.5.3 Impacts on Rock Art 29
4.6 MANAGEMENT MEASURES 32
4.6.1 Point Source Air Emission Licence Limits 32
4.6.2 Ambient Air Quality Trigger Values 32
4.6.3 Advances in Emission Reduction Technology 35
4.7 MANAGEMENT ACTIONS 35
4.8 MONITORING 36
4.8.1 Environmental 36
4.8.2 Meteorological 38
4.9 REPORTING 39
4.10 ADAPTIVE MANAGEMENT AND REVIEW OF THE AQMP 40
4.11 STAKEHOLDER CONSULTATION 41

5 REFERENCES..42

1 Executive Summary

Yara Pilbara Nitrates Pty Ltd (YPN) operates the Technical Ammonium Nitrate (TAN) production facility (TAN Plant) on the Burrup Peninsula, within the Burrup Industrial Estate located near Karratha, in Western Australia.

YPN is owned by Yara International ASA (Yara) and Orica Limited. YPN is the operator of the TAN Plant.

The TAN Plant operates in accordance with the following regulatory requirements:

- Licence L9223/2019/1 granted under Part V of the Western Australian Environmental Protection Act 1986 (EP Act) and administered by the Department of Water and Environmental Regulation (DWER).
- Ministerial Statement 870 (MS 870), including update via MS 1121 to replace condition 5, granted under Part IV of the EP Act and administered by the Environmental Protection Authority (EPA).
- Approval EPBC 2008/4546 (as varied), granted under the Environmental Protection and Biodiversity Conservation Act (EPBC Act) and administered by the Department of Agriculture, Water and the Environment (DAWE).

The purpose of this Air Quality Management Plan (AQMP) is to ensure that during the operational life of the TAN Plant, air emissions are managed to assist in the maintenance of regional air quality, to protect human health and amenity, and to minimise the risk of adverse impacts to rock art on Murujuga.

This AQMP specifically meets all of the requirements of Condition 5-2 and 5-3 of MS 1121, whilst also ensuring that the requirements of other relevant regulatory approvals are complied with. It provides direction on the management measures, monitoring and reporting undertaken by YPN to ensure that the purpose of the AQMP is achieved and that a high standard of environmental performance is maintained.

2 Introduction

2.1 Background

This document is the Air Quality Management Plan (AQMP) for the Yara Pilbara Nitrates Pty Ltd (YPN) Technical Ammonium Nitrate (TAN) Plant (the TAN Plant). The TAN Plant is situated on the Burrup Peninsula near Dampier, in the Pilbara region of Western Australia adjacent to Yara Pilbara Fertilisers Pty Ltd (YPF) Ammonia Plant (Figure 1).

YPN is owned by Yara International ASA (Yara) and Orica Limited. YPN is the operator of the TAN Plant.

The TAN Plant comprises three (3) key manufacturing components:

1. Nitric Acid (NA) plant to convert ammonia and atmospheric air into NA with a daily production capacity of 760 metric tonnes per day (tpd).
2. Ammonium Nitrate (AN) solution plant to convert ammonia and NA into AN solution with a daily production capacity of 965 tpd.
3. TAN prilling plant to convert AN solution (ANSol) into TAN prills (final product) with a daily production capacity of 915 tpd.

Additional supporting facilities include:

- liquid ammonia pipeline and utility services between YPF and the TAN Plant;
- bulk loading system including bagging unit and truck loading facility; and
- storage buildings for bulked and bagged TAN.

The TAN Plant operates in accordance with the following regulatory requirements:

- Licence L9223/2019/1 granted under Part V of the Western Australian Environmental Protection Act 1986 (EP Act) and administered by the Department of Water and Environmental Regulation (DWER).
- Ministerial Statement 870 (MS 870), including update via MS 1121 to replace Condition 5, granted under Part IV of the EP Act and administered by the Environmental Protection Authority (EPA).
- Approval EPBC 2008/4546 (as varied), granted under the Environmental Protection and Biodiversity Conservation Act (EPBC Act) and administered by the Department of Agriculture, Water and the Environment (DAWE).

This AQMP addresses the key environmental factor of ‘Air Quality’, and has been developed to meet all of the requirements of Condition 5-2 and 5-3 in MS 1121 and the relevant Conditions of EPBC 2008/4546.

Figure 1: Location

2.2 Purpose

The purpose of this AQMP is to ensure that during the operational life of the TAN Plant, air emissions are managed to assist in the maintenance of regional air quality, to protect human health and amenity, and to minimise the risk of adverse impacts to rock art on Murujuga.

2.3 Scope

This AQMP specifically meets all of the requirements of Condition 5-2 and 5-3 of MS 1121, whilst also ensuring that the requirements of other relevant regulatory approvals are complied with. It provides direction on the management measures, actions, monitoring and reporting undertaken by YPN to ensure that the purpose of the AQMP is achieved and that a high standard of environmental performance is maintained.

The requirements of Condition 5-2 and 5-3 of MS 1121 and the corresponding section of this AQMP that addresses each approval obligation are detailed in Table 2-1.

Table 2-1 MS 1121 Conditions 5-2 and 5-3 and relevant AQMP sections

Condition No.	Requirement	Relevant AQMP Section
5-2	*Within twelve (12) months of the date of this Statement, unless otherwise agreed by the CEO, the proponent shall prepare and submit to the CEO a revised Air Quality Management Plan that describes how the proponent will meet the following objectives:* *(1) minimise air emissions from the proposal to assist in the maintenance of regional air quality in accordance with applicable air quality standards including, but not limited to, the NEPM so that the environmental values of human health and amenity are protected; and* *(2) minimise air emissions from the proposal as far as practicable to assist in minimising the risk of adverse impacts to rock art on Murujuga.*	This AQMP. (1) Section 4.4 (2) Section 4.4, 4.6 and 4.7

Condition No.	Requirement	Relevant AQMP Section
5-3	*The revised Air Quality Management Plan must:* *(1) specify the expected air emissions for the proposal based on the current air pollution control technology selection and plant design for the proposal;* *(2) include a comparison of the expected air emissions for the proposal against international industry best practice for technical ammonium nitrate production facilities;* *(3) include a comparison of the current air pollution control technology selection and plant design for the proposal against international industry best practice for technical ammonium nitrate production facilities;* *(4) include provisions for monitoring of on-site meteorological conditions including wind speed / direction, temperature, and rainfall rate to enable the data that are collected to be available for use in the forthcoming investigations associated with the Murujuga Rock Art Monitoring Program, with annual reporting to the CEO; and* *(5) identify and describe the measures that the proponent will implement to minimise air emissions, including the adoption of advances in air pollution control technology and process management, and specify:* *(a) the timeframe within which each measure will be implemented; and* *(b) the means to determine the effectiveness of each measure in minimising air emissions.*	(1) Section 4.3 (2) Section 4.4.1, Table 4-5 and Figure 2 (3) Section 4.4.2 and Table 4-6 (4) Section 4.8.2 (5) Section 4.6.3 and Table 4-11

2.4 Public Availability

In accordance with Condition 5-11 of MS 1121, this AQMP is publicly available on Yara Pilbara Nitrates website (www.yara.com.au), or an equivalent website, for the life of the TAN Plant.

Any reports and associated data prepared in accordance with Condition 5-11(2) of MS 1121 are also made available to the public at the above website.

3 Definitions and Acronyms

Table 3-1 Definitions

Term	Definition
Best Available Techniques	Mean the most effective and advanced stage in the development of activities and their methods of operation which indicate the practical suitability of particular techniques for providing, in principle, the basis for emission limit values designed to prevent or, where that is not practicable, generally to reduce emissions and the impact on the environment as a whole.
Ministerial Statement 870	A statement from the Minister for the Environment issued in response to the Environmental Impact Assessment process undertaken for the YPN TAN Plant, and authorising the proposal to proceed subject to a number of environmental conditions.
Ministerial Statement 1121	A statement from the Minister for the Environment issued to amend the implementation conditions applying to the proposal approved under Ministerial Statement 870.
Suitably qualified person	A person who has appropriate technical and/or academic qualifications, training and a history of demonstrated acceptable performance for conducting tasks identified in this OEMP.
Synergi	Yara Pilbara's incident reporting system.
The TAN Plant	When specifying the facility - The Technical Ammonium Nitrate Plant

Table 3-2 Acronyms

Acronyms	Definition
AAQ NEPM	National Environmental Protection (Ambient Air Quality) Measure
AN	Ammonium Nitrate
ANSol	Ammonium Nitrate Solution
AQMP	Air Quality Management Plan
BAT	Best Available Techniques
CEMS	Continuous Emission Monitoring System
DCS	Distributed Control System
DWER	Department of Water and Environmental Regulation – WA

Acronyms	Definition
DAWE	Commonwealth of Australia’s Department of Agriculture, Water and Environment
EP Act	*Environmental Protection Act 1986* administered by Western Australia’s Department of Environment Regulation
EPA	Environmental Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
g	Grams
g/s	Grams per second
GLC	Ground Level Concentration
HNO_3	Nitric Acid
kg	Kilograms
kg/h	Kilograms per hour
MAC	Murujuga Aboriginal Corporation
meq/m^2/y	Milliequivalents per square metre per year
mg/m^3	Milligrams per cubic metre
MS 870	Ministerial Statement 870
MS 1121	Ministerial Statement 1121
NA	Nitric Acid
NATA	National Association of Testing Authorities
NH_3	Ammonia
NH_4NO_3	Ammonium Nitrate
NOx	Oxides of nitrogen
NO_2	Nitrogen dioxide
NO	Nitrogen oxide
N_2O	Nitrous oxide
PER	Public Environmental Review
PM_{10}	Particulate matter (≤10 micrometre)
$PM_{2.5}$	Particulate matter (≤2.5 micrometre)

Acronyms	Definition
SCR	Selective Catalytic Reduction
SO_2	Sulfur dioxide
TAN	Technical Ammonium Nitrate
tpd	Metric tonnes per day
TAN	Technical Ammonium Nitrate
TRP	TAN Recovery Project
TSP	Total Suspended Particulates
Yara	Yara International ASA
YPF	Yara Pilbara Fertilisers Proprietary Limited
YPN	Yara Pilbara Nitrates Proprietary Limited
µm	micrometres
$\mu g/m^3$	Micrograms per cubic metre

4 Air Quality Management

4.1 Overview

Air emissions are managed to assist in the maintenance of regional air quality to protect human health and amenity, to minimise the risk of adverse impacts to rock art on Murujuga, and to ensure compliance with YPN's internal and external environmental standards and regulations.

Air emissions refers to the waste gases and particulates that are discharged to the atmosphere through the stacks and vents in the course of normal operations, start-up, upset and maintenance periods.

The primary air emissions from the TAN Plant are:

- Oxides of nitrogen (NOx) consisting of nitrous oxide (N_2O), nitric oxide (NO) and nitrogen dioxide (NO_2);
- Sulfur dioxide (SO_2);
- Ammonia (NH_3);
- Ammonium nitrate (NH_4NO_3);
- Total suspended particulates (TSP);
- Particulate matter of less than 10 µm in aerodynamic diameter (PM_{10}); and
- Particulate matter of less than 2.5 µm in aerodynamic diameter ($PM_{2.5}$).

Key emissions to air from the TAN Plant include point source emissions, comprising mainly ammonia and particulates (ammonium nitrate) from the Common Stack and oxides of nitrogen and ammonia from the Nitric Acid Plant Stack. There is also the potential for ammonia to be intermittently vented from the Unit 12 (U12) and Unit 31/32 (U31/32) vents during start-up or normal operations.

Exhaust emissions from diesel engines in mobile and fixed equipment contribute a minor proportion to the overall emissions profile from the plant. The operational areas of the lease are paved (bitumen or gravel) and no dust generating activities (i.e. earthworks) are occurring, therefore the risk of dust from the site during operations from traffic movement is considered insignificant.

4.2 TAN Plant Licence

DWER Licence L9223/2019/1 (herein the Licence), issued on 21 April 2020, for the TAN Plant sets limits for discharges to air from the Common Stack and Nitric Acid Plant Stack. These limits are outlined in Table 4-1 and 4-2 below.

Emissions from the Nitric Acid Plant Stack are monitored continuously via a Continuous Emissions Monitoring System (CEMS), whilst emissions from the Common Stack are monitored via stack testing on a quarterly basis, in accordance with Licence requirements.

Table 4-1: Discharges to air Licence limits

Discharge Point	Emission	Limit (mg/m³)
Common Stack	PM	15
	NH_3	10
Nitric Acid Plant Stack	NOx (as NO_2)	103[1]
	NH_3	0.75[1]
	N_2O	196[1]

(1) Emission limits for the Nitric Acid Plant Stack do not apply during Start-up.

Table 4-2: Discharges to air limits – Start-up

Discharge Point	Emission	Limit (mg/m³)	Maximum Period
Nitric Acid Plant Stack	NOx (as NO_2)	1540	2 Hours
	NH_3	11.5	

4.3 TAN Plant Air Emissions

4.3.1 Emissions During Normal Operation

The TAN Plant consists of three major process components which are designed to operate independently of each other. In the PER, normal operations for each component were considered as:

- Nitric acid plant – 95% availability (approximately 345 days per year);
- Ammonium nitrate solution plant - 95% availability (approximately 345 days per year); and
- TAN prilling plant - 90% availability (approximately 329 days per year).

Emission rates for key parameters as considered by the Environmental Protection Authority (EPA) are shown in Table 4-3.

Table 4-3: Atmospheric emissions characteristic of normal operations

Source	NOx (g/s)	NO_2 (g/s) [1]	PM_{10} (g/s) [2]	NH_3 (g/s)
Nitric acid plant	4.2	2.1	0	0.02
TAN prilling tower	-	0	0.8	0.6
Nitric acid storage tank vent A	0.04	0.02	-	-
Nitric acid storage tank vent B	0.04	0.02	-	-
Power generation	2.1	1.1	0.058	0

(1) A 50% conversion of NO to NO_2 was assumed.
(2) Emissions of ammonium nitrate dust from the prilling tower were assessed as PM_{10}

4.3.2 Emissions During Non-routine Operations

Plant shutdowns are required in response to upset conditions, equipment failure or for maintenance, with start-ups then required to restore normal operations. Significant process venting is not required during shutdowns and start-ups. The closed-loop design of the TAN Plant generally only provides for discharges of major emissions through controlled emission sources.

The following non-routine operating scenarios have been considered:

- cold start-up once per year (annual maintenance), with the start-up expected to take approximately six hours duration;
- planned annual maintenance shutdowns;
- biannual shut down of the nitric acid plant for catalyst replacement; and
- emergency shutdown which would result in the majority of emissions being released via the nitric acid plant stack. Emergency shutdowns are anticipated to be rare and are expected to be less than one hour in duration.

Emission rates for key parameters as considered by the EPA for non-routine operations are shown in Table 4-4.

Table 4-4 Atmospheric emissions characteristic of non-routine operations

Source	NOx (g/s)	NO_2 (g/s) [1]	PM_{10} (g/s) [2]	NH_3 (g/s)
Nitric acid plant	39	19.4	0	0.1
TAN prilling tower	0	0	2.4	1.6
Nitric acid storage tank vent A	0.04	0.02	0	0
Nitric acid storage tank vent B	0.04	0.02	0	0
Power generation	2.1	1.1	0.058	0

(1) A 50% conversion of NO to NO_2 was assumed.
(2) Emissions of ammonium nitrate dust from the prilling tower were assessed as PM_{10}

There is also the potential for ammonia to be intermittently vented from the Unit 12 (U12) and Unit 31/32 (U31/32) vents during start-up or (infrequent) normal operations. The frequency of these emissions and total NH_3 emitted is low and was assessed by DWER as not requiring limits and or monitoring.

4.4 TAN Plant Air Emission Abatement

YPN is committed to ensuring that the air emissions from the TAN Plant are minimised as far as practicable, with consideration given to both engineering design and operational process controls. The following section provides a summary of the TAN Plants emission abatement technology, including emission performance since stable operations in May 2020, with reference to international industry best practice for technical ammonium nitrate production facilities.

4.4.1 TAN Plant Emission Performance

Best practice technologies for air emission pollution reduction for technical ammonium nitrate plants are governed by:

- Fertilizers Europe Best Available Techniques for Pollution Prevention and Control in the European Fertilizer Industry Booklet No. 2: Production of Nitric Acid (Fertilizers Europe 2000);
- Fertilizers Europe Best Available Techniques for Pollution Prevention and Control in the European Fertilizer Industry Booklet No. 6: Production of Ammonium Nitrate and Calcium Ammonium Nitrate (Fertilizers Europe 2000); and
- European Commission Reference Document on Best Available Techniques for the Manufacture of Large Volume Inorganic Chemicals – Ammonia, Acids and Fertilisers (European Commission 2007).

The current operating Licence L9223/2019/1 for the TAN Plant includes emission limits (refer to Table 4-1) which are based on guidance from the above European agencies for ammonium nitrate manufacturing, which represent international industry best practice.

A comparison of current air emissions from the TAN Plant during steady state operations against Best Available Techniques (BAT) emission levels, as defined by Fertilizers Europe (2000) and European Commission (2007), and the TAN Plant Licence limits, is provided below in Table 4-5 for the Common Stack and Figure 2 for the Nitric Acid Plant Stack.

Table 4-5 Comparison of Common Stack sample results against BAT emission levels and Licence limits, May 2020-July 2021

Stack Sample Date	PM Concentration (mg/m³)			PM Mass Rate (g/s)	NH_3 Concentration (mg/m³)			NH_3 Mass Rate (g/s)
	BAT Emission Levels (1)	*Licence Limit*	*Actual*	*Actual*	*BAT Emission Levels (1)*	*Licence Limit*	*Actual*	*Actual*
29/05/2020	15	15	1	0.047	10	10	7.5	0.34
13/08/2020	15	15	3.4	9.5	10	10	8.8	25
18/12/2020	15	15	<1	<0.05	10	10	4.3	0.19
30/03/2021	15	15	<1	<0.05	10	10	7.7	0.35
23/07/2021	15	15	2.1	0.093	10	10	6.9	0.32

(1) Ref: Fertilizers Europe Best Available Techniques for Pollution Prevention and Control in the European Fertilizer Industry Booklet No. 6: Production of Ammonium Nitrate and Calcium Ammonium Nitrate, Section 8.1 (Fertilizers Europe 2000)

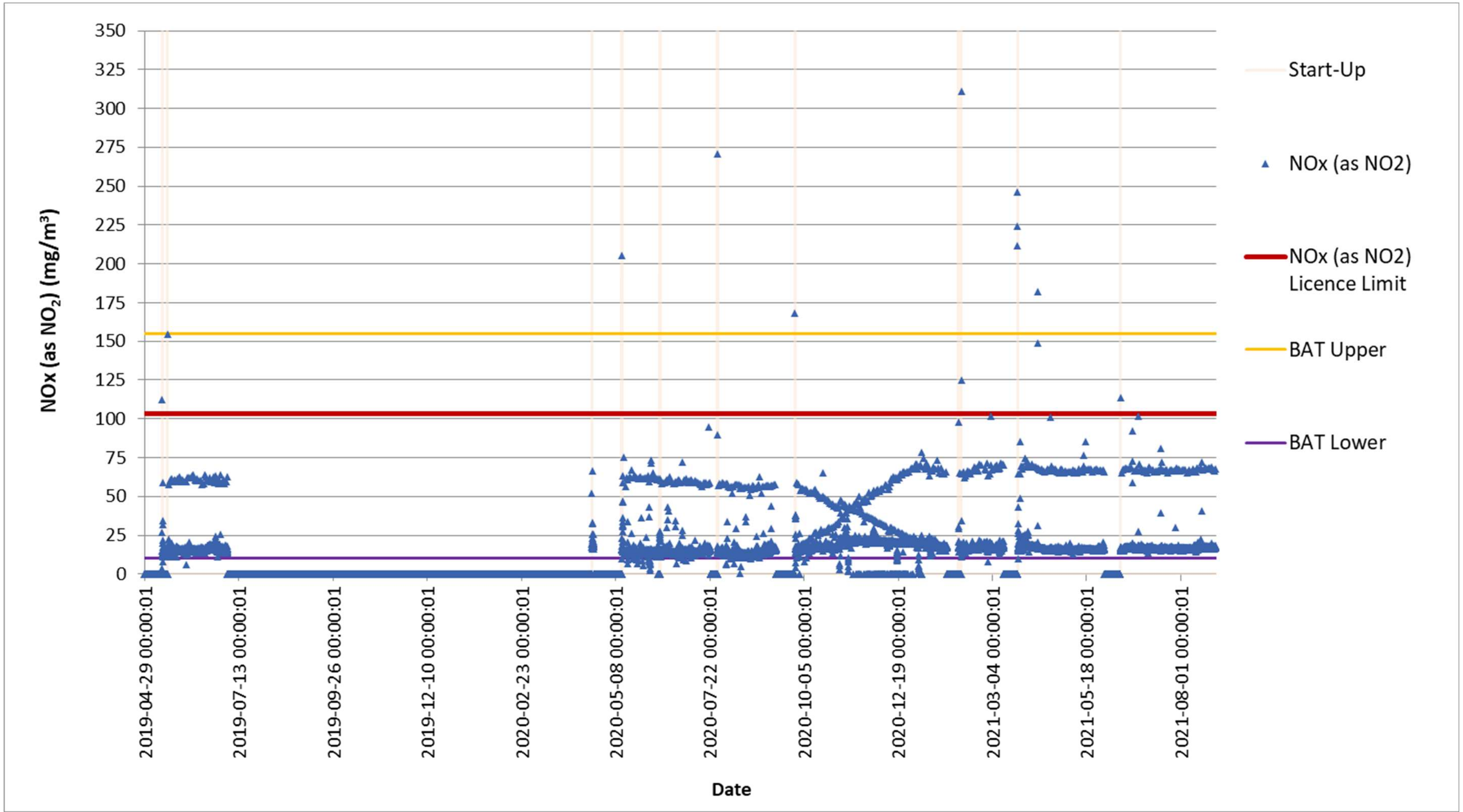

Figure 2: Comparison of Nitric Acid Plant Stack CEMS monitoring results against BAT emission levels and Licence limits April 2019-July-2021

Results of stack testing since the recommencement of production in May 2020 (Table 4-5) have demonstrated that emissions from the Common Stack have been below the Licence limit and in line with expected BAT emission levels. Whilst for the Nitric Acid Plant average NOx emissions during steady state operations are approximately 19 mg/m^3, which is well below the Licence limit of 103 mg/m^3 and within the BAT range of 10 mg/m^3 (5 ppmv) and 155 mg/m^3 (75 ppmv) (European Commission, 2007).

Between the period May 2000 and July 2021, there have been a total of 8 start-ups of the Nitric Acid Plant. These start-ups have occurred for various reasons including the start-up in May 2020 following an extended outage to complete the TRP, process upsets, and routine and non-routine maintenance. Emissions of NOx during each start-up of the NA Plant, defined as the period between the ignition of the Ammonia reactor and the activation of the DeNOx reactor in the NA Plant, were below the Licence start-up limit of 1540 mg/m^3.

Note that there is no defined BAT emission level for NOx during the start-up of nitric acid plants, rather the European Commission (2007) states that "*BAT is to reduce emissions during start-up*".

There have been 2 exceedances of the 103 mg/m^3 Licence limit in 2021, with details of each exceedance provided below:

- On 24 March 2021, during the start-up of the NA Plant there was a malfunction of the DeNOx NH_3 evaporator (12XZV042 - LP steam valve) and as a result there was no NOx abatement until the issue was fixed. Start-up commenced at 02:00, NOx was within start-up emission limits (1540 mg/m^3) until 04:00, however there was an exceedance of the 103 mg/m^3 limit until 04:51. The malfunction was immediately addressed and NOx emissions dropped below the 103 mg/m^3 limit.
- On 9 April 2021 the 12-XZV-012 positioner failed suddenly due to water ingress into the control box from heavy rainfall. This resulted in a loss of NH_3 going to the DeNOx reactor which has caused high levels of NOx from the NA Plant Stack. This exceedance resulted in a maximum NOx emission of 181.99 mg/m^3 for approximately 1 hour. A cover has subsequently been place over the positioner control box to prevent water ingress.

Both exceedances were reported to DWER in accordance with Condition 22 of the Licence.

4.4.2 TAN Plant Air Pollution Control Technology

The TAN Plant design has incorporated BAT air pollution control technology for the management of emissions from the Nitric Acid Plant and the Common Stack. The technology installed on these sources is described below, and Table 4-6 provides a comparison between what is considered BAT and the specific engineering and management controls that are in place at the TAN Plant. The data provided in Section 4.4.1 demonstrates that these technologies are achieving the BAT emission levels.

Nitric Acid Plant Stack

The Nitric Acid Plant stack emits tail gas containing oxides of nitrogen (NOx), NH_3 and nitrous oxide (N_2O). Ammonia is an input for nitric acid generation and essentially controls the extent of NOx emissions (via careful control of the NH_3 oxidation reaction stoichiometry). Nitrous oxide forms as a bi-product of the reaction from NH_3 to NOx within the nitric acid reactor.

The Nitric Acid Plant has been designed with a dual pressure process in accordance with BAT (European Fertilizer Manufacturers' Association, 2000). This process optimises pressure within the ammonia burner and absorption tower to control the NH_3 reaction stoichiometry and maximise HNO_3 formation, minimise N_2O formation and NOx and N_2O emissions.

Selective Catalytic Reduction (SCR) NOx abatement systems (including the DeN_2O platinum catalyst and DeNOx catalytic abatement gauzes) are installed to minimise concentrations of these gases discharged to atmosphere.

The emission abatement systems are fully integrated into the Nitric Acid Plant system and are automatically functional when the Nitric Acid Plant is operational. These technologies are consistent with BAT emissions controls from nitric acid plants.

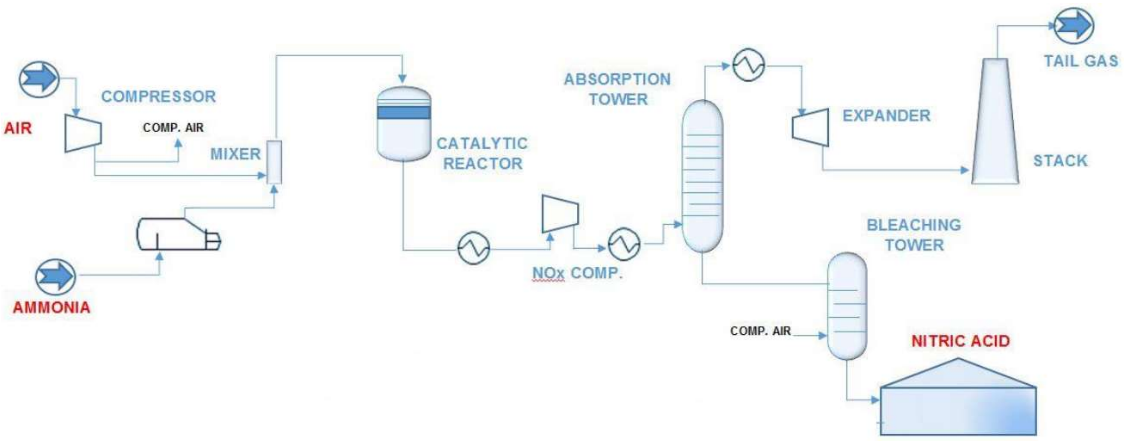

Figure 3: Nitric acid production process

Ammonium Nitrate Prilling Plant "Common Stack"

Prilling is the process of converting ammonium nitrate solution (ANSol) into "prills" by spraying ANSol from the top of the prill tower into a cooled air stream. As the ANSol solution falls it forms solid ammonium nitrate prills approximately 1.2mm in diameter.

Air from the prilling tubes in the prill tower reports to separate wet scrubbers (utilising chilled 5% ammonium nitrate solution) to remove ammonia and ammonium nitrate particulates. Approximately 90% of the cleaned air from the prilling tower is returned to the prilling tower with the remaining 10% of prilling air along with exhaust air from coolers, dryers and venting of other equipment routed to four rotary brush wet scrubbers to remove particulates. The combined air from the brush scrubbers reports to a knock-out vessel whereby the air velocity is decreased to reduce momentum of aerosols (liquid droplets) from the scrubber carryover. The moisture is then removed from the vessel, with the air flow directed to a demister pad before discharge from the Common Stack. Figure 4 below shows the air flow through the prill tower and the associated emission controls.

The above emissions controls are consistent with BAT in respect of use of wet scrubbing technology for removal of particulate emission.

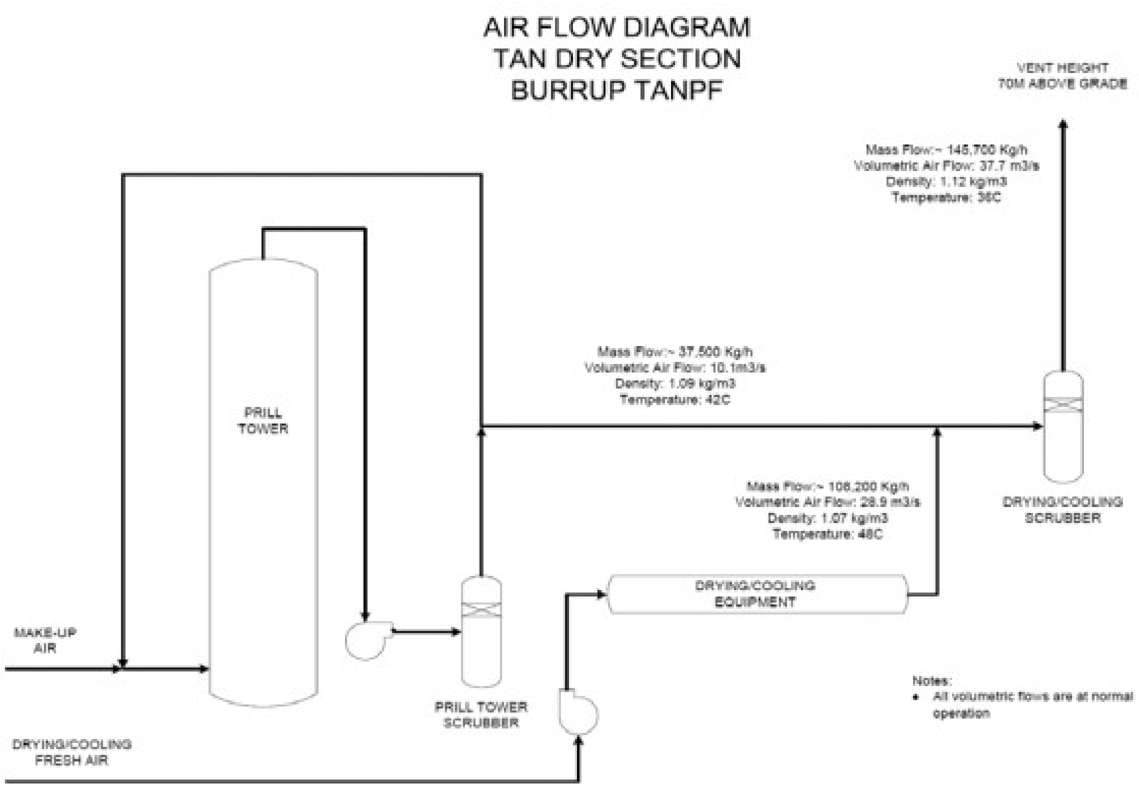

Figure 4: Prill tower air flow diagram showing emissions controls.

Table 4-6 Comparison of BAT air pollution control technology against technologies installed at the TAN Plant

Process	BAT	TAN Plant
Nitric Acid Production	BAT is to reduce emissions of NOx to be between 5 – 75ppmv, by applying one or a combination of the following techniques;[(1)] • Optimisation of the absorption stage • Combined NOx and N_2O abatement in tail gas • Selective Catalytic Reduction • Addition of H_2O_2 to the last absorption stage For new plants in normal operation the emission level for NOx is accepted as 100 ppmv.[(2)]	Dual pressure process plant designed to: • lower operational energy consumption rates from increased combustion efficiency • lower NH_3 consumption during operation • reduce concentration of N_2O in tail gas; and • provide longer equipment life.
		Use of catalytic NOx abatement system to achieve lower NOx concentration in tail gas.
		Continuous monitoring of NOx, NH_3 and N_2O stack emissions from the nitric acid plant stack via CEMS and annual verification testing.
		Average NOx emissions from the NA Plant from May 2020 to July 2021 is 19 mg/m^3 or 10 ppmv.
AN Prill Production	BAT is to reduce ammonia and dust emissions from prilling by scrubbing or optimising the operations conditions of prilling towers and the re-use scrubber liquids on site.[(1)] Ammonium nitrate production when no insoluble solids are present: Prill towers and granulators using molten ammonium nitrate:[(3)]	Three stage scrubbing system used to control NH_3 and AN PM_{10} emissions with the following configuration: • Stage 1 – Prilling air from each prill tower is directed through its own independent scrubber. The prill air is washed with a chilled 5% ammonium nitrate solution. 80-90% of the air is then recycled back through the prill tower. • Stage 2 – The bleed air from each prill air scrubbing system is sent to a pair rotary brush scrubbers (four in total). The rotary brush scrubbers contain wetted spinning brush fibres (polypropylene) in which any dust is captured. Wash water solution is continuously sprayed on the brush and volute casing.

Process	BAT	TAN Plant
	• 15mg/m^3 particulates • 10mg/m^3 ammonia	• Stage 3 – From the rotary brush scrubbers, the air streams are combined and directed to the final scrubber. This scrubber operates like a large "knock-out" vessel. Air enters the bottom of a large diameter vessel and is drawn upwards. The large diameter reduces the air flow velocity slowing gravity to drop out moisture in the air. The air then passes through a demister pad before exiting the scrubber and going to the common stack.
		• Average PM_{10} emissions from the Common Stack is 1.3 mg/m^3 • Average NH_3 emissions from the Common Stack is 7.4 mg/m^3

(1). European Commission Reference Document on Best Available Techniques for the Manufacture of Large Volume Inorganic Chemicals – Ammonia, Acids and Fertilisers (European Commission 2007).

(2) Fertilizers Europe Best Available Techniques for Pollution Prevention and Control in the European Fertilizer Industry Booklet No. 2: Production of Nitric Acid (Fertilizers Europe 2000)

(3) Fertilizers Europe Best Available Techniques for Pollution Prevention and Control in the European Fertilizer Industry Booklet No. 6: Production of Ammonium Nitrate and Calcium Ammonium Nitrate (Fertilizers Europe 2000)

In November 2017, the Minister for Environment requested that the DWER review compliance of MS 870 with reference to Condition 5-1: Air Quality. The purpose of the review was to determine whether contemporary best practice pollution control technology was being implemented at the TAN Plant. Subsequent to a desktop technical review and a site visit in March 2018, the DWER concluded that contemporary best practice pollution control technology has been incorporated in the design of the TAN Plant.

Additionally in September 2019, the EPA published Report 1648, as part of the Section 46 inquiry into Condition 5-1 *(EPA 2019)*, which stated:

"A desktop technical review undertaken by the DWER and completed in March 2018, confirmed that contemporary best practice pollution control technology [e.g. wet scrubbers and an oxides of nitrogen (NOx) reduction unit equipped with a catalyst (i.e. a De-NOx reactor)] has been incorporated into the TANPF and that its performance compared favourably with relevant best practice stack emission concentration criteria under normal operating conditions (DWER 2018)". (EPA Report 1648, p. 5-6).

*"The EPA also notes that the amended licence includes stack emission concentration limits for NOx (as NO_2), NH_3, and nitrous oxide (N_2O) from the TANPF nitric acid plant stack and for particulate matter and NH_3 from the TANPF ammonium nitrate prilling plant common stack that are commensurate with relevant best practice stack emission concentration criteria under normal operating conditions". (*EPA Report 1648, p. 6).

4.5 Air Emissions Impact Assessment

There is potential for air emissions associated with normal and non-routine operation of the TAN Plant to impact on ambient air quality and to cause environmental and public health impacts at nearby sensitive receptors through dispersion in the atmosphere.

The main sensitive receptors located in close proximity to the TAN Plant are the recreational areas of Hearson Cove and Ngarjarli (Deep Gorge), the towns of Karratha and Dampier, and the rock art on Murujuga. Murujuga (the Dampier Archipelago, including the Burrup Peninsula and surrounds) is a unique ecological and archaeological area containing one of the largest collections of Aboriginal engraved rock art (petroglyphs) in the world. The rock art is of continuing cultural, archaeological and spiritual significance for Aboriginal people and also has significant state, national and international heritage value.

Protecting the environmental values of human health and amenity as well as the surrounding rock art on Murujuga are key objectives of this AQMP.

4.5.1 Air Quality Modelling

To assess the potential impacts of emissions from the TAN Plant, air quality modelling was conducted subsequent to the granting of Works Approval W4701 in 2012. The ambient air quality criteria used to assess the emissions are detailed below in Table

4-7. The results of the modelling assessment conducted for the TAN Plant are presented below in Table 4-8 for normal operations and Table 4-9 for non-routine operations.

Table 4-7 Ambient air quality criteria

Parameter	Criteria (µg/m³)	Average	Guideline
NOx (as NO_2)	150.5	1 h	National Environmental Protection (Ambient Air Quality) Measure (AAQ NEPM) 2021 Criteria (µg/m³) adjusted from 0°C and 1 atm to 25°C and 1 atm.
	28	Annual	
SO_2	262	1 h	
	52	24 h	
CO	10300	8 h	
PM_{10}	50	24 h	
NH_3	330	1 h	Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (NSW 2005).
	180	Annual	

Table 4-8 Predicted ground level concentrations (GLCs), including background during normal operations of the TAN Plant

	NO_2 (µg/m³)		SO_2 (µg/m³)			PM_{10} (µg/m³)	$PM_{2.5}$ (µg/m³)		NH_3 (µg/m³)
Averaging Period	1hr	1yr	1hr	24hr	1yr	24hr	24hr	1yr	1hr
Searipple Rd (Karratha)	60.1	6.5	1.6	0.6	0.2	24.9	0.1	1.0	1.0
Balmoral Rd (Karratha)	55.5	6.5	1.2	0.6	0.2	24.6	0.0	0.8	1.1
Dampier	83.9	7.1	6.1	2.1	0.3	26.4	0.1	2.6	1.2
Hearson Cove	88.2	8.7	4.8	1.4	0.3	26.8	0.3	3.0	3.4
Ngajarli	94.3	7.6	5.5	1.7	0.3	26.6	0.2	2.7	2.2
Maximum	186.2	10.2	13.1	3.9	0.7	30.2	0.4	6.4	7.0
Background	45.1	6.3	0.4	0.3	0.2	23.8	N/R	N/R	0.9
Criteria	150.5	28	262	52		50	25	8	330

Table 4-9 Predicted ground level concentrations (GLCs), including background, during non-routine operations of the TAN Plant

	NO_2 (μg/m³)	SO_2 (μg/m³)		PM_{10} (μg/m³)	$PM_{2.5}$ (μg/m³)	NH_3 (μg/m³)
Averaging Period	1hr	1hr	24hr	24hr	24hr	1hr
Searipple Rd (Karratha)	64	1.6	0.6	25	0.1	1.6
Balmoral Rd (Karratha)	64	1.2	0.6	26	0.2	2
Dampier	90	6.1	2.1	26	0.9	2.7
Hearson Cove	155	4.8	1.4	33	0.3	13.5
Ngajarli	131	5.5	1.7	28	0	7.7
Maximum	300	13.1	3.9	38	1.8	31.8
Criteria	150.5	262	52	50	25	330

Results for both normal and non-routine operations indicated that maximum GLCs could result in an exceedance of the NO_2 1-hour criteria; however, modelling did not anticipate an exceedance of any ambient criteria at receptors, except for a minor exceedance of the NO_2 1-hour criteria at Hearson Cove during non-routine operations (Table 4-8 and 4-9). The modelling conducted is extremely conservative as non-routine operations do not occur continuously for a year as modelled and the potential for coincidence of worst-case atmospheric conditions and abnormal operations is extremely low.

With regard to the potential for air emissions from the TAN Plant to cause human health impacts, the assessment also noted the following:

- the contribution of the TAN Plant is less than 1 μg/m³ or approximately 1% of the predicted ambient NO_2 concentration; and
- the contribution of the TAN Plant to the concentration of pollutants in areas of human habitation is small and would not be discernible from natural hourly variation observed during ambient monitoring.

An independent peer review of documents, submitted to the DWER by YPN to support the amendment of Licence L7997/2002/11 in 2018, conducted by Benchmark Toxicological Services *(BTS 2018)*, included an assessment of the modelled GLCs detailed above and concluded that atmospheric emissions from the TAN Plant during either normal or non-routine operations are unlikely to have an adverse impact on the health of people located in the vicinity of the TAN Plant.

Additionally, the AAQ NEPM is not intended as a regulatory tool to manage air emissions from individual facilities; rather the measures are intended to assess the air quality of a region for protection of human health and well-being. Other industries on the Burrup provide significantly greater contributions of NEPM parameters (namely NOx, SO_2 and particulates) to the air shed. The impacts of those emission sources are regulated under their respective licences issued by the DWER under Part V of the EP Act.

Yara engaged JBS&G to undertake revised cumulative dispersion modelling of NOx and NH_3 emission sources at the both the Ammonia Plant and the TAN Plant in order to provide a comprehensive understanding of these emissions from the combined operations. The scope of work for this modelling was developed in consultation with the DWER Air Quality Services Branch and utilised both AERMOD and CALPUFF dispersion modelling.

The dispersion modelling identified YPN as a minor contributor to the cumulative air shed. The modelling did indicate a very low probability (4.95×10^{-6}) of ammonia emissions from YPF's back end vent exceeding the draft DWER Air Guideline Values at sensitive receptors, and an even lower probability (3.5×10^{-7}) of exceeding an assumed odour threshold of 3,000 $\mu g/m^3$; both predictions being associated with peak emission rates during start-up / shut-down conditions. YPF is in the process of evaluating options to mitigate NH_3 emissions from the back end vent.

Should the outcome of any revised air quality modelling have any implications for the management of NH_3 emissions from YPN, especially if the predicted cumulative NH_3 GLCs exceed the applicable criteria at nearby sensitive receptor locations, then this AQMP would be amended where necessary to clearly describe how this will be managed.

On the 6th of September 2022 the Air Quality Services Branch of DWER requested YPF prepare a licence amendment to include NH_3 as a licenced emission from the Back End Vent.

4.5.2 Cumulative Impacts of Air Emissions in the Murujuga Air Shed

An overview of the other contributors of emissions to the ambient air at the Burrup is shown in Figure 5. This includes an indication of the "air shed" in which all emissions can disperse and equilibrate over time in the atmosphere to provide a background air quality that prevails across the area. The significance of individual contributors and their localised impacts can then be assessed in comparison with the background concentrations within the air shed.

The DWER has commissioned a study on the cumulative impacts of air emissions from existing and proposed future industries, shipping, and aggregated sources within the Murujuga airshed. This study includes an assessment of annual air pollutant emission loads from these sources and cumulative air quality modelling to predict air pollutant ground level concentrations, which will be assessed against applicable air quality criteria. The cumulative air quality modelling will also be used to provide information on the deposition of acid gases, ammonium nitrate and urea dust on Murujuga. In accordance with Condition 9A of EPBC 2008/4564 YPN continues to implement its Air Quality Monitoring Program (refer to Section 4.6) and has provided monitoring data to the DWER for input into their study on the cumulative impacts of air emissions within the Murujuga air shed.

The final report on the "Study of the Cumulative Impacts of Air Emissions in the Murujuga Airshed", was published on the DWER website April 2022. Air dispersion modelling for the following Scenarios were completed during the study:

- **Scenario 1** - All emissions, including natural, domestic and commercial sources, but excluding the point and area sources for heavy industry including railways and shipping in the region.
- **Scenario 2** - Scenario 1 plus the point and area sources for heavy industry including railways and shipping in the region.
- **Scenario 3** - Scenario 2 plus proposed future emissions (2030) from all sources.

Overall the study found that NO_2, SO_2, PM_{10} and $PM_{2.5}$ peak GLCs are centred at industrial facilities near or on the Burrup Peninsula, showing that industrial sources and shipping contribute to emissions in the area, but with total air concentrations for these compounds remaining below current air quality standards except for PM_{10} and $PM_{2.5}$ outside of industrial facilities.

A summary of the GLCs for NO_2, NH_3, SO_2, PM_{10}, and $PM_{2.5}$ at several sensitive receptors including Hearson Cove, Ngajarli, Karratha and Dampier, as reported in the study for Scenarios 2 and 3 are provided below in Table 4-10.

Table 4-10 Annual max 1-hour (MDA1) and annual average NO_2, annual max 1-hour (MDA1) and annual max 24-hour SO_2, annual average and annual max 24-hour PM10, PM2.5 Nitrate ground level concentrations (GLCs), and annual max 1-hour (MDA1) NH_3 in the CAMx grid cells that contain Hearson Cove, Ngajarli, Burrup Road, Dampier, and Karratha.

		NO_2 (ppb)		SO_2 (ppb)		PM_{10} (µg/m^3)		$PM_{2.5}$ (µg/m^3)		NH_3 (ppb)
Scenario	Averaging Period	MDA1	Annual Avg	MDA1	Annual Max 24hr	Annual Avg	Annual Max 24hr	Annual Avg	Annual Max 24hr	MDA1
2	Hearson Cove	44.46	5.21	34.33	11.10	31.10	97.66	6.80	18.07	236.34
	Ngajarli	45.45	4.28	29.18	10.61	27.17	91.48	5.79	16.27	268.33
	Dampier	45.23	6.22	53.25	16.31	26.67	102.26	5.60	17.47	68.24
	Karratha	32.86	3.39	13.99	3.78	24.59	86.67	5.09	16.31	31.87
3	Hearson Cove	43.46	5.76	8.48	2.92	31.48	98.10	6.62	17.85	30.28
	Ngajarli	43.56	4.80	7.43	2.81	27.58	91.75	5.64	16.30	21.61
	Dampier	46.40	8.19	20.21	2.57	26.98	102.21	5.31	17.41	10.73
	Karratha	35.85	3.53	4.23	1.92	25.15	87.09	5.10	16.15	7.21

NO_2 annual maximum daily 1-hour (MDA1) and annual average concentrations were predicted to be below the MDA1 standard of 80 ppb and the annual average standard of 15 ppb, with the majority of the contribution to predicted ground level concentrations of NO_2 coming from industry.

SO_2 concentrations stay well below the 1-hr standard (current/future of 100/75 ppb) and the 24-hr standard (20 ppb) at all locations for both Scenarios 2 and 3, with the majority of the contribution to predicted ground level concentrations of SO_2 coming from industry.

PM_{10} exceeds the annual average standard (25 µg/m^3) and the 24-hr standard (50 µg/m^3) at all locations for both Scenarios 2 and 3. $PM_{2.5}$ is predicted to be below the annual average standard (current/future of 8/7 µg/m^3) at all locations for both Scenarios 2 and 3, and the 24-hr standard (current/future of 25/20 µg/m^3). However, there is some uncertainty that the simulation of background PM2.5 is unbiased because of uncertainties in the boundary concentrations.

Annual MDA1 NH_3 concentrations were predicted as highest within Hearson Cove and Ngajarli, but were below the air quality standard of 460 ppb.

Yara is currently working on strategies to reduce ammonia emissions from the YPF plant. This is reflected in Table 4-10, Scenario 3, which sees a reduction in the MDA1 NH_3 concentration by 2030.

4.5.3 Impacts on Rock Art

There are currently no air quality standards that specify a concentration limit or target for assessment of risks to the rock art. As a result of the lack of such criteria, the DWER is partnering with the Murujuga Aboriginal Corporation (MAC) to oversee the development and implementation of a world best practice rock art monitoring program to determine whether the rock art on Murujuga is being subject to accelerated change due to anthropogenic air emissions.

In Report 1648 (EPA 2019), the EPA concluded that:

"…definitive information on whether industrial air emissions, including those from the TANPF, are adversely affecting rock art is currently not available." (EPA Report 1648, p17)".

The purpose of the Murujuga Rock Art Monitoring Program (MRAMP) is to monitor, evaluate, and report on changes and trends in the integrity of the rock art, specifically to determine whether anthropogenic air emissions are accelerating the natural weathering, alteration, or degradation of the rock art. This will enable timely and appropriate management responses by the state government, industry, and other stakeholders to emerging issues and risks.

Condition 10A d) of EPBC 2008/4564 requires that:

d) Ongoing rock art monitoring must be undertaken either:

i. by the person taking the action, using a methodology approved by the Minister in writing: or

ii. through the provision of an annual pro-rata amount for the Burrup Rock Art Monitoring Program or another program administered by the Western Australian Government Department of Water and Environmental Regulation.

In the absence of the state government's MRAMP YPN has, since 2017, been conducting its own annual rock art monitoring program in accordance with Condition 10A of EPBC 2008/4564, with results reported annually to the DAWE. It is noted by YPN, however, that the requirement for it to implement its own rock art monitoring program does not recognise the shared responsibility of all emitters in the region.

Yara provided funding to the MRAMP in 2020, as well as continuing to conduct its own rock art monitoring program in both 2020 and 2021. Yara will continue to provide funding and any relevant monitoring data to the MRAMP as required.

This AQMP will be amended where necessary to be consistent with any management responses (e.g. applicable air quality criteria to protect rock art) that are implemented in the event that the Murujuga Rock Art Monitoring Program determines that industrial air emissions are adversely affecting rock art.

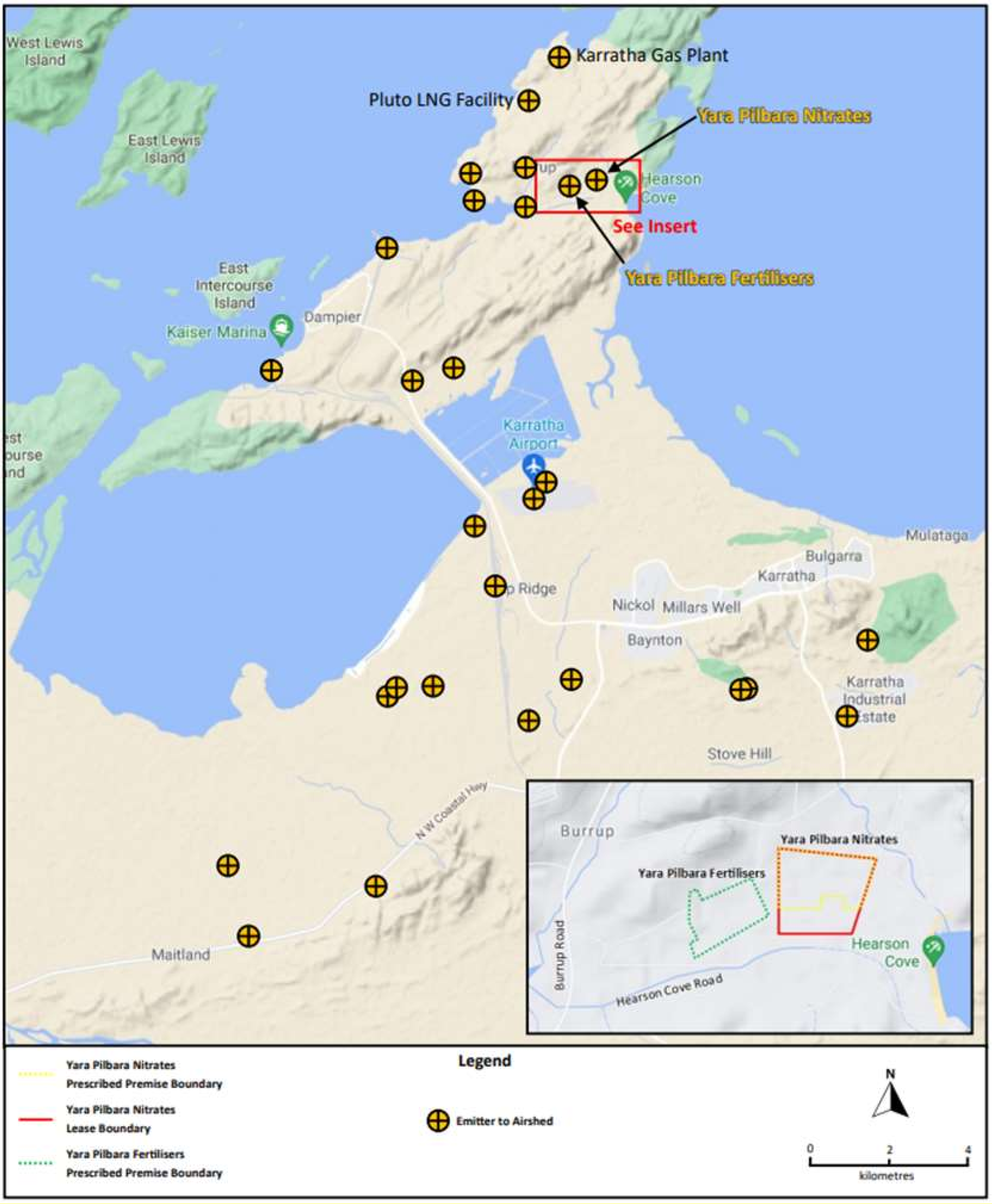

Figure 5: Air shed and location of other emitters to airshed

4.6 Management Measures

4.6.1 Point Source Air Emission Licence Limits

Compliance with Licence point source air emission limits (refer to Tables 4.1 and 4.2) is assessed continuously for the Nitric Acid Plant Stack using CEMS and quarterly for the Common Stack using stack testing. Data from the Nitric Acid Plant Stack CEMS is continuously monitored by the Distributed Control System (DCS) Operator, with alarms in place if limits are exceeded. In the event that a limit is exceeded YPN's process engineer will confirm the exceedance and direct Operations to undertake appropriate measures to prevent continued exceedance of the limit.

If a Licence non-compliance from either the Nitric Acid Stack or Common Stack is confirmed, an investigation into the cause of the exceedance will be conducted and a non-compliance report submitted to the regulator (refer to Section 4.9 for reporting requirements). The incident, including results of the investigation and any corrective actions identified, will be entered into Yara's incident reporting system, Synergi.

4.6.2 Ambient Air Quality Trigger Values

The assessment and subsequent management of potential air quality impacts on rock art is informed by monitoring of ambient air concentrations of NO_2, NH_3, HNO_3 and SO_2, particulate phase deposition rates of certain cations and anions (including ammonium and nitrate ions), and wet deposition rates of those substances dissolved in rain water. Yara has three dedicated offsite Air Quality Monitoring Stations (Sites 5, 6 and 7) which collect this information (locations provided in Figure 6) with monitoring requirements detailed in Section 4.8.

In the absence of air quality standards that specify a concentration limit or target for assessment of risks to the rock art, YPN continues to monitor the change in acid deposition as determined from airborne concentrations of NO_2, NH_3, HNO_3 and SO_2, and concentrations of corresponding cations and anions[1] in rainwater collected at the monitoring stations. It should be noted, however, that the ambient air concentrations of these parameters are a consequence of emissions from all sources, including other industry on the Burrup and not just the TAN Plant (refer to Figure 3 for the location of other emitters in the airshed).

Monthly deposition rates (dry, dust and wet) are calculated from the fortnightly and/or monthly monitoring data collected for each of the four (4) gases (NO_2, SO_2, NH_3 and HNO_3) carried out at Sites 5, 6 and 7. This monthly data is then used to calculate rolling annual total deposition rates.

In order to assess for any changes in dry and dust deposition rates, internal investigation trigger values have been formulated by conducting a statistical analysis

[1] The primary cation of interest in dust deposition samples in ammonium, and anions are nitrite, nitrate and sulfate. The surface chemistry of those and other cations and anions will be of interest when data from rock surface chemistry measurements are compared with the deposition rates of airborne pollutants.

on the baseline monthly and rolling annual total deposition rates with the underlying variability determined, and are detailed below in Table 4-11.[2]

With regard to wet disposition rates, the highly variable nature of rainfall events precludes the calculation and use of rolling annual totals and investigation trigger values to assess significance of variability. Annual total wet deposition rates from the baseline study have been calculated and wet deposition rates from rainfall events compared. Historically, wet deposition constitutes less than one third of the total deposition rate. Changes in that relative contribution continue to be monitored during the operational monitoring program.

Any increase in the deposition rate above the investigation trigger value will trigger a management action to determine the cause(s) of the increases; in particular, whether increases in emissions from YPN operations have occurred. Note, however, that an exceedance of an investigation trigger value does not indicate a significant or material change in potential risk to the rock art has occurred, rather such an event only provides a trigger for investigation as to the reason for the increase in deposition rates.

Table 4-11 Air quality investigation trigger values

Location	Species	Averaging period	Investigation Trigger Value
Offsite – Ambient air criteria			
Site 5, Site 6 & Site 7	TSP	24-hours	No criteria applicable
	Dry Deposition rates for NO_2, SO_2, NH_3 and HNO_3	Rolling annual total (meq/m^2/y) calculated from fortnightly and/or monthly measurements.	Site 5 – 27 meq/m^2/y Site 6 – 46 meq/m^2/y Site 7 – 56 meq/m^2/y Values which exceed the investigation trigger value for the rolling annual total deposition rates will trigger an investigation.
	Dust Deposition (insoluble fraction - gravimetric)	Monthly	No criteria applicable
	Dust Deposition (soluble fraction – speciated cations and anions)	Rolling annual total (meq/m^2/y) calculated from fortnightly and/or monthly measurements.	Site 5 – 27 meq/m^2/y Site 6 – 46 meq/m^2/y Site 7 – 56 meq/m^2/y Values which exceed the investigation trigger value for the rolling annual total deposition rates will trigger an investigation.
	Rain water (wet deposition – speciated cations and anions)	Annual average	No criteria applicable

[2] The baseline study examined data from September 2013 to end December 2016. This period predates commencement of significant periods of TAN Plant operations and provides a baseline to assess the potential impacts from TAN Plant emissions.

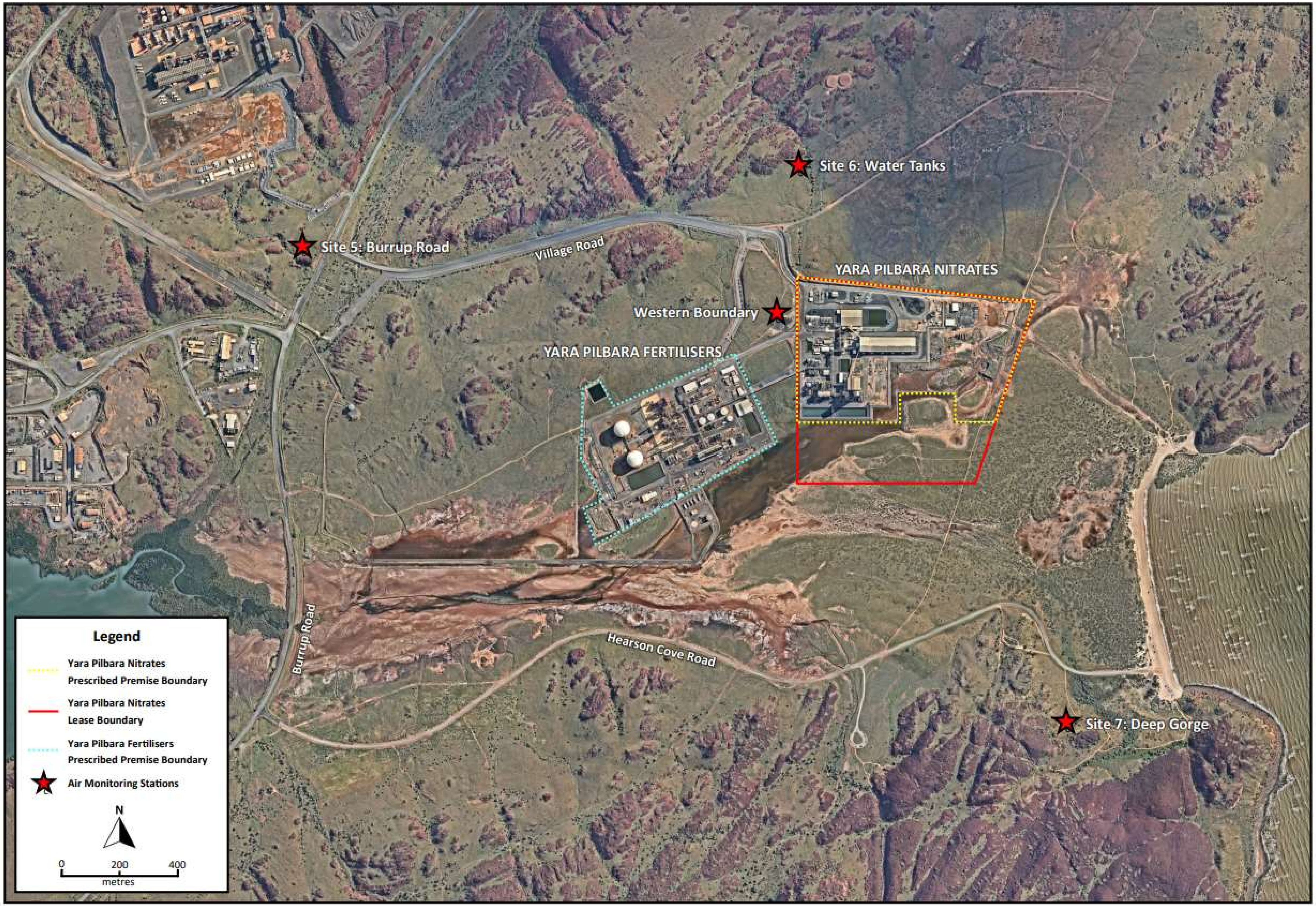

Figure 6: Air Quality Monitoring Stations

4.6.3 Advances in Emission Reduction Technology

YPN continually evaluates emission reduction technology and trends as they become commercially available to further limit air emissions from the TAN Plant. YPN also continuously reviews process operations to identify areas where the operation of the plant can be modified to reduce air emissions.

As a part of the annual business planning process Yara Pilbara considers any advances in BAT for emission abatement. Where improved mitigation techniques and/or abatement technologies are identified, these will be assessed, taking into consideration the definition of “Available” (Fertilizers Europe, 2000):

- Available techniques mean those developed on a scale which allows implementation in the relevant industrial sector under economically viable conditions, taking into consideration the costs and advantages, whether or not the techniques are used or produced inside the Member State in question, as long as they are reasonably accessible to the operator.

If new technologies are considered to be viable, they will be included in our long-term capital investment portfolio and the timeframes within which they can be implemented will be determined. At this point the AQMP will be updated to include the timeframe for implementation of the measure, the expected emission reduction outcome, and how the emission reduction will be measured.

4.7 Management Actions

A summary of the management actions taken in the event of a Licence non-compliance (point source onsite stack emissions), trigger of an investigation trigger value (offsite ambient air monitoring), or identification of improved air pollution control technology, are summarised below in Table 4-12. Note that not all actions may be appropriate or necessary but will depend on the nature of the event.

Table 4-12 Management Actions

Threshold	Management Actions
Stack testing or CEMS monitoring identifies exceedance of DWER licence limits for point source stack emissions (refer to Tables 4-1 and 4.2)	1. Investigate cause(s), including stack emissions performance, scrubber efficiency, maintenance records and TAN Plant operating parameters. 2. Report non-compliance to DWER. 3. Enter incident, including results of investigation and any corrective actions in to Synergi. 4. If an exceedance of licence limit occurs that is statistically significant, then a qualitative risk assessment will be carried out to ascertain if the material risk of adverse impacts at sensitive receptors has increased. If that risk is deemed likely to have increased, then dispersion modelling will be carried out to predict ambient air concentrations and carry out a quantitative risk assessment. . 5. If necessary, make any repairs or carry any maintenance required. 6. Re-test stack emissions to confirm effectiveness of actions.
Monitoring identifies exceedance of an air quality investigation trigger value for dust and dry deposition rates (refer to Table 4-10).	1. Investigate cause(s), including sampling errors, laboratory analysis errors, stack emissions performance, scrubber efficiency and maintenance records. 2. Identify potential contributions of airborne pollutants from other sources in the air shed using meteorological data. 3. Estimate contributions from YPN and/or YPF operations using dispersion modelling of stack emissions. 4. If necessary, make any repairs or carry any maintenance to minimise stack emissions 5. Test stack emissions to confirm effectiveness of actions.
New emission reduction technology identified.	1. Assessment and cost/benefit analysis of new available technology conducted. 2. Business case prepared and submitted. 3. If viable, include option in the long-term capital investment portfolio. 4. Update AQMP with timeframe for implementation and proposed emission reduction. 5. Implement new technology and measure effectiveness.

4.8 Monitoring

4.8.1 Environmental

Monitoring requirements to evaluate the effectiveness of the air quality management measures are described in Table 4-13. Unless indicated otherwise, all ambient air monitoring will be managed and carried out by a member of Yara Pilbara's Environment Team or suitably qualified person. Continuous monitoring of stack emissions is provided by the installed CEMS, operated and managed by the Yara Pilbara operations team. Stack emissions testing is carried out by a NATA accredited stack emissions testing company.

Table 4-13 Air Quality Monitoring Program

Monitoring activity	Objective	Parameter measured	Methodology	Frequency	Location
Stack emissions monitoring	To quantify atmospheric emissions from TAN plant	Volumetric flow rate	CEMS operated as per DWER CEMS Code Stack testing using USEPA methods	Continuous with annual verification[1]	Nitric Acid Plant stack
		Oxides of nitrogen			
		Ammonia			
		Nitrous oxide			
		Ammonia	Stack testing using USEPA methods	Quarterly[1]	AN common stack
		PM			
Ambient air quality monitoring at rock art sites	Compliance with EPBC 2008/4546 Condition 9A and to assess risk to rock art from airborne pollutants	TSP up to 50 µm	MicroVol 1100 (as per AS/NZS 3580.9.9:2006)	24-hour average every 6 days[2]	Site 5 Site 6 Site 7
		Total dust deposition per month (Insoluble Fraction) and Total dust deposition per month (Soluble Fraction)	Dust deposition gauge (AS3580.10.1:2003) with speciation of cations and anions in soluble fraction	Monthly (EPBC 2008/4546 Condition 9A requires minimum of Quarterly)	Site 5 Site 6 Site 7
		Ammonia (NH_3), nitrogen dioxide (NO_2), nitric acid (HNO_3) and sulfur dioxide (SO_2)	Passive gas samplers	Continuous monitoring for at least 14 consecutive days every month	Site 5 Site 6 Site 7
	For wet deposition calculations	Rainfall	Tipping rain gauge, (AS 2292:1987 and AS3580.14 011)	24 hour rainfall total	Site 5 Site 6 Site 7
	For analysis of cations and anions to calculate wet deposition rates	Rain water	Automatic rain water sampler	Monthly or as occurs	Site 5 Site 6 Site 7
	Generate correlation factor for MicroVol TSP	TSP	MicroVol 1100 (as per AS/NZS 3580.9.9:2006)	24-hour average	On-site

Monitoring activity	Objective	Parameter measured	Methodology	Frequency	Location
	referenced to HVAS TSP Carried out every 6 months		High volume air sampler (as per AS/NZS 3580.9.3:2015)	24-hour average	On-site
Rock Art Monitoring	Compliance with EPBC 2008/4546 Condition 10A	Appearance of rock art sites	Methodology approved by DAWE	Annually	6 Sites

1 Annual verification of stack emissions carried out by NATA accredited stack testing company using USEPA methods 7E (for NOx), CTM027 (for NH_3), CTM038 for N_2O, method 17 for particulates with PM_{10} fraction determined from particulate size distribution analysis

2 Six daily sampling is carried out as per recommendation in AS*3580.9.9:2006*

4.8.2 Meteorological

Yara has four dedicated Air Quality Monitoring Stations which continuously record and report various local meteorological conditions (refer to Figure 4). The three stations located off site (Ngajarli (Deep Gorge), Burrup Road and Water Tanks) record wind speed, wind gust, wind direction and rainfall accumulation in real time. In addition to this, they also record temperature as part of passive gas sampling which is continually logged and downloaded every 14 days, see Table 4-14.

The Western Boundary Air Quality Monitoring Station continuously records wind speed, wind gust, wind direction, temperature, relative humidity and rainfall accumulation. Data from the four Air Quality Monitoring Stations is readily available to any interested party when requested and will be reported annually to DWER in accordance with MS 1121 condition 5-3(4).

Table 4-14 Air Quality Monitoring Program

Monitoring activity	Objective	Parameter measured	Methodology	Frequency	Location
Weather monitoring	To assist with acid gas source apportionment calculations	Wind speed/direction	Anemometer (AS 2292 – 1987 and AS 3580.14 011)	Continuous	On site
		Temperature	Temperature sensor, (AS 2292 – 1987 and AS 3580.14 011)	Continuous	On site
		Rainfall rate	Tipping rain gauge, (AS 2292 – 1987 and AS 3580.14 011)	24 hour rainfall total	On site

4.9 Reporting

The reporting requirements relevant to air emissions under each of the regulatory instruments applicable to the TAN Plant are detailed below in Table 4-15.

Table 4-15 TAN Plant regulatory air emission reporting requirements

Regulatory Instrument	Condition	Reporting Requirement	Timing	Reported To
DWER Licence L9223/2019/1	Condition 22	Non-compliance with Condition 3 and 4	Within 7 days of becoming aware of the non-compliance.	DWER
	Condition 23	AACR	No later than 90 days after the end of each annual period.	DWER
	Condition 24	AER	No later than 90 days after the end of each annual period.	DWER
MS 870/1121	Condition 4-5	Any potential non-compliance	Within 7 days of becoming aware of the potential or actual non-compliance.	DWER
	Condition 4-6	Compliance Report	8 October each year	DWER Published on Yara Website
	Condition 5-3 (4)	Meteorological data	Annually	DWER
	Condition 5-5 (1)	Non-compliance with the objectives of Condition 5-2	Report the non-compliance in writing within 7 days of the non-compliance being identified.	DWER
	Condition 5-5 (3)	Non-compliance with the objectives of Condition 5-2	Provide a report within 90 days of the non-compliance being reported as required by condition 5-5(1)	DWER
	Condition 5-11 (1)	Make public the approved Air Quality Management Plan, or any subsequent approved revision	within one (1) month of the relevant plan being approved by the CEO	Publicly available
	Condition 5-11 (2)	the reports referred to in condition 5-3(4) and	within one (1) month of the relevant report	Publicly available

Regulatory Instrument	Condition	Reporting Requirement	Timing	Reported To
		condition 5-6 and associated data	being submitted to the CEO	
EPBC 2008/4546	Condition 3 a)	Compliance Report	6 October each year	DAWE, Published on Yara Website
	Condition 3A	Any potential or actual non-compliance with EPBC 2008/4546 conditions	Within 7 days of becoming aware of the potential or actual non-compliance.	DAWE
	Condition 9B	Non-compliance with Condition 3 and 4 of Licence L9223/2019/1	Within 7 days of becoming aware of the non-compliance.	DAWE
	Condition 14 d)	Air quality monitoring data required by Condition 9A	Within 3 months of collection of each datum.	DAWE, Published on Yara Website
	Condition 14 f)	Rock art monitoring data or reports required by Condition 10A	Within 30 days of the data or reports being provided to the person taking the action.	DAWE Published on Yara Website

4.10 Adaptive Management and Review of the AQMP

In accordance with Condition 5-8, the AQMP will be reviewed and revised every 4 years, or as and when directed by the CEO. Any revision of the AQMP will be submitted to the CEO for approval as per Condition 5-9.

In addition the AQMP will be updated as a result of the following:

- The identification of any new available emission reduction technologies;
- Updates and or changes in expected emissions, including revised dispersion modelling; and
- Changes to existing limits/standards and/or the establishment of new air quality limits/standards, including but not limited to:
  - Changes to the stack emission limits in DWER Licence L9223/2019/1;
  - Changes to the NEPM Ambient Air Quality Standards; and

    The development and implementation of applicable air quality standards to protect rock art within the Murujuga air shed as a result of outcomes of the MRAMP.

YPN will use adaptive management techniques during the revision of this AQMP including:

- Monitoring and evaluating the applied management and mitigation against the outcomes and objectives; and
- Adjusting the management and mitigation measures and monitoring (where required) to meet the outcome or objective, based on what is learnt from:
    - Evaluation of monitoring data or methodology;
    - Review of assumptions and uncertainties;
    - Re-evaluation of risk assessment;
    - Increased understanding of the ecological system; and
    - External changes during the life of the proposal.

4.11 Stakeholder Consultation

This AQMP was developed by Yara's Environmental team in consultation with a third-party qualified Air Quality specialist and the Air Quality Branch of the EPA . Table 4.16 below outlines the history of the correspondence from the EPA and DWER.

Table 4-16 Stakeholder Consultation

Date	Stakeholder	Comments Received	Actions Taken
August 2021	EPA	First review of the revised AQMP.	Revision B provided to the EPA in November 2021.
March 2022	EPA	Request for additional information on the outcomes of dispersion modelling, Ramboll Report, impacts to rock art and clarification of statements.	Revision C provided to the EPA in September 2022 addressing all comments.
October 2022	DWER	Request additional information including commitment to update AQMP if further modelling indicates need for change; and include a section on adaptive management and stakeholder consultation.	All comments addressed in Revision D (this version) of the AQMP

5 References

Author	Year	Document Title
BTS	2018	Independent peer review of documents submitted to the DWER by Yara Pilbara Nitrates Pty Ltd to support the amendment of Licence L7997/2002/11
DWER	2018	Desktop technical review of information previously submitted by Yara Pilbara Nitrates Pty Ltd to satisfy Condition 5-1 in Ministerial Statement 870
EPA	2019	Report 1648 – Technical Ammonium Nitrate Production Facility, Burrup Peninsula – inquiry under section 46 of the Environmental Protection Act 1986 to amend Ministerial Statement 870
European Commission	2007	European Commission Reference Document on Best Available Techniques for the Manufacture of Large Volume Inorganic Chemicals – Ammonia, Acids and Fertilisers
Fertilizers Europe	2000	Fertilizers Europe Best Available Techniques for Pollution Prevention and Control in the European Fertilizer Industry Booklet No.2: Production of Nitric Acid
Fertilizers Europe	2000	Fertilizers Europe Best Available Techniques for Pollution Prevention and Control in the European Fertilizer Industry Booklet No.6: Production of Ammonium Nitrate and Calcium Ammonium Nitrate
NSW EPA	2005	Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales