Decision Report

Application for Licence

Division 3, Part V *Environmental Protection Act 1986*

Licence Number	L9223/2019/1
Applicant	Yara Pilbara Nitrates Pty Ltd
ACN	127 391 422
File Number	DER2019/000564
Premises	Yara Pilbara Nitrates TAN Plant Village Road BURRUP WA 6714 Legal description - Part of Lot 3017 on Deposited Plan 50979 As defined by the coordinates in Schedule 2 of the Licence
Date of Report	20 April 2020
Status of Report	Final

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1. Definitions of terms and acronyms

In this Decision Report, the terms in Table 1 have the meanings defined.

Table 1: Definitions

Term	Definition
AACR	annual audit compliance report
ACN	Australian Company Number
AER	annual environment report
ANZECC	Australian and New Zealand Environment and Conservation Council
Applicant	Yara Pilbara Nitrates Pty Ltd
ATU	aerobic treatment unit
Category/ Categories/ Cat.	Categories of Prescribed Premises as set out in Schedule 1 of the EP Regulations
CEMS	continuous emission monitoring system
CO_2	carbon dioxide
CS Act	*Contaminated Sites Act 2003* (WA)
Decision Report	refers to this document.
Delegated Officer	an officer under section 20 of the EP Act.
Department	means the department established under section 35 of the *Public Sector Management Act 1994* and designated as responsible for the administration of Part V, Division 3 of the EP Act.
DMIRS	Department of Mines, Industry Regulation and Safety
DWER	Department of Water and Environmental Regulation As of 1 July 2017, the Department of Environment Regulation (DER), the Office of the Environmental Protection Authority (OEPA) and the Department of Water (DoW) amalgamated to form the Department of Water and Environmental Regulation (DWER). DWER was established under section 35 of the *Public Sector Management Act 1994* and is responsible for the administration of the *Environmental Protection Act 1986* along with other legislation.
EPA	Environmental Protection Authority (WA)
EP Act	*Environmental Protection Act 1986* (WA)
EP Regulations	*Environmental Protection Regulations 1987* (WA)

EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
Existing Licence	The Licence L7997/2002/11 issued under Part V, Division 3 of the EP Act and in force prior to the commencement of, and during this assessment
GLC	ground level concentration
HNO_3	Nitric acid
Licence Holder	Yara Pilbara Nitrates Pty Ltd
m^3	cubic metres
MDEA	methyl diethanolamine
mg/m^3	milligrams per cubic metre
Minister	the Minister responsible for the EP Act and associated regulations
MS	Ministerial Statement
mtpa	million tonnes per annum
MUBRL	Multi-User Brine Return Line
NEPM	National Environmental Protection Measure
NH_3	Ammonia
Noise Regulations	*Environmental Protection (Noise) Regulations 1997* (WA)
Normal operating conditions	Any operation of a particular process, excluding start-up and shutdown, where the plant is operating.
NO_x	oxides of nitrogen
NO_2	Nitrogen dioxide
N_2O	Nitrous oxide
NO	Nitric oxide
Occupier	has the same meaning given to that term under the EP Act.
OMEMP	Operational Marine Environmental Management Plan
PER	Public Environmental Review
PM	Particulate Matter
PM_{10}	used to describe particulate matter that is smaller than 10 microns (µm) in diameter

Prescribed Premises	has the same meaning given to that term under the EP Act.
Premises	refers to the premises to which this Decision Report applies, as specified at the front of this Decision Report
Risk Event	As described in *Guidance Statement: Risk Assessment*
Shut-down	means the period when plant or equipment is brought from normal operating conditions to inactivity
SO_2	Sulfur dioxide
Start-up – TAN Plant	The period between the ignition of the Ammonia reactor and the activation of the DeNOx reactor in the Nitric acid plant
Steady state production	The continuous operation of the TAN plant for 7 consecutive days with daily production varying by less than 5% from ammonium nitrate solution plant and TAN prilling plant production targets of 965 tpd and 915 tpd respectively
STP	sewage treatment plant
TAN	technical ammonium nitrate
TANPF	technical ammonium nitrate production facility
tpd	tonne per day
TSP	Total suspended particulate
TSS	Total suspended solids
USEPA	United States (of America) Environmental Protection Agency
UDR	*Environmental Protection (Unauthorised Discharges) Regulations 2004* (WA)
$\mu g/m^3$	micrograms per cubic metre
µg/L	micrograms per litre
YPF	Yara Pilbara Fertilisers Pty Ltd
YPN	Yara Pilbara Nitrates Pty Ltd

2. Purpose and scope of assessment

Yara Pilbara Nitrates Pty Ltd (YPN) operates a Technical Ammonium Nitrate (TAN) Plant on part of Lot 3017 Village Road on the Burrup Peninsula, under Existing Licence L7997/2002/11. Licence L7997/2002/11 was issued on 21 April 2015 for operation of the adjacent liquid ammonia plant (Ammonia Plant) operated by Yara Pilbara Fertilisers Pty Ltd (YPF). The licence was amended on 29 June 2018 to include the operation of the TAN Plant under a single licence.

The Existing Licence authorises the TAN Plant to produce 350,000 tonnes per year of solid TAN prills and the Ammonia Plant to produce 950,000 tonnes per year of ammonia. The Existing Licence also authorises treatment of 36 cubic metres per day of sewage via a sewage treatment plant (STP) at the Ammonia Plant.

On 18 October 2019, DWER received separate licence applications from YPN for the TAN Plant, and from YPF for the Ammonia Plant to replace the Existing Licence due to expire on 20 April 2020. The application for the TAN Plant seeks to continue operation of the plant as per current practices with no changes to the premises production capacity sought.

This Decision Report documents the Delegated Officer's risk assessment of emissions and discharges and determination of the application consistent with the DWER's *Guidance Statement: Risks Assessment* (DER, 2017a) and *Guideline: Decision Making* (DWER, 2019) respectively. The purpose of this assessment is for the issue of a new licence for the operation of the YPN TAN Plant. The new licence will replace Existing Licence L7997/2002/11 and will relate only to the operation of the TAN Plant.

This assessment has resulted in the Department issuing Licence L9223/2019/1 which is contained in Attachment 1.

2.1 Application details

On 18 October 2019, YPN submitted an application for a licence renewal for its TAN Plant. Table 2 lists the documents submitted during the assessment process.

Table 2: Documents and information submitted during the assessment process

Document/information description	Date received
Application form and supporting document: Application for new licence. Yara Pilbara Nitrates (DWERDT219728)	18 October 2019
Email correspondence: L9224/2019/1 Yara Pilbara Nitrates – Technical Ammonia Nitrate Plant (TAN Plant) – Additional Information Requested (DWERDT232579)	6 December 2019
Email correspondence: Response to wastewater queries for the assessment of Yara licence applications L9223 and L9224 (DWERDT255236)	17 February 2020
Email correspondence: Yara Pilbara Nitrates TAN Plant Draft Licence and Draft Decision Report – Applicant's Comments (DWERDT271610)	8 April 2020

Table 3 lists the prescribed premises categories that have been applied for. No change has been requested to the approved premises production capacities specified in the Existing Licence.

Table 3: Prescribed Premises Categories in the application for a licence

Classification of Premises	Description	***Premises production or design capacity or throughput***
Category 31	Chemical manufacturing: premises (other than premises within category 32) on which chemical products are	350,000 tonnes per year (TAN Plant)

	manufactured by a chemical process.	

3. Background

YPN (formerly Burrup Nitrates Pty Ltd) owns the TAN Plant located on part of Lot 3017 Village Road, Burrup and holds a lease over that land. The plant is located approximately 11 km northwest of the town of Karratha. A Works Approval W4701/2010/1 was granted on 25 July 2013 to YPN for the construction and commissioning of the TAN Plant. Commissioning of the plant commenced in February 2016 and was completed in 2017.

YPN is a joint venture between parent companies Yara International ASA (50%) and Orica Limited (40%). Yara International ASA is one of the world's largest chemical companies and the world's largest supplier of mineral fertilisers operating technical nitrate production plants in Sweden, Norway, France and Germany, and numerous mineral fertiliser plants worldwide. Yara International ASA and its predecessor companies have been in business since 1905.

Adjacent to the TAN Plant is an Ammonia Plant owned by YPF (formerly named Burrup Fertilisers Pty Ltd) that has been operational since 2006. YPF is a wholly owned subsidiary of Yara Australia Pty Ltd, a wholly owned subsidiary of Yara International ASA. In June 2018 the licence for the Ammonia Plant (L7997/2002/11) was amended to include conditions authorising operation of the TAN Plant. The amended licence was issued to YPN and YPF as joint Licence Holders.

YPN and YPF are seeking separate licences for operation of the TAN and Ammonia plants, although the two premises will continue to be operated under an integrated management framework.

The TAN Plant is categorised as a chemical manufacturing premises and processes ammonia from the Ammonia Plant to TAN prills. The plant was shut down in 2018 to commence the TAN Recovery Project. The purpose of the project was to address issues with engineering design and equipment failures that has compromised the operability and environmental performance of the plant. The project is expected to be complete, and TAN Plant will recommence operation in the first half of 2020.

4. Overview of Premises

4.1 Operational aspects

The TAN Plant is designed to operate 24 hours per day, seven days a week and is capable of producing approximately 350,000 tonnes per year of TAN. The main feedstock for the process is liquid ammonia, which is transferred via pipeline from the adjacent Ammonia Plant.

The TAN Plant features three major process units, each producing a separate product in the manufacturing process:

- A dual pressure process nitric acid plant (760 tpd) to convert ammonia and atmospheric air into nitric acid;
- An ammonium nitrate solution plant (965 tpd) to convert ammonia and nitric acid into ammonium nitrate solution, which is either converted to a TAN prill or sold as a product; and
- A TAN prilling plant (915 tpd) to convert ammonium nitrate solution into TAN prills (final product).

Description of the key stages of the TAN manufacturing process is included below (as taken from the application, Yara 2019) and an indicative schematic of the stages included in Figure 1.

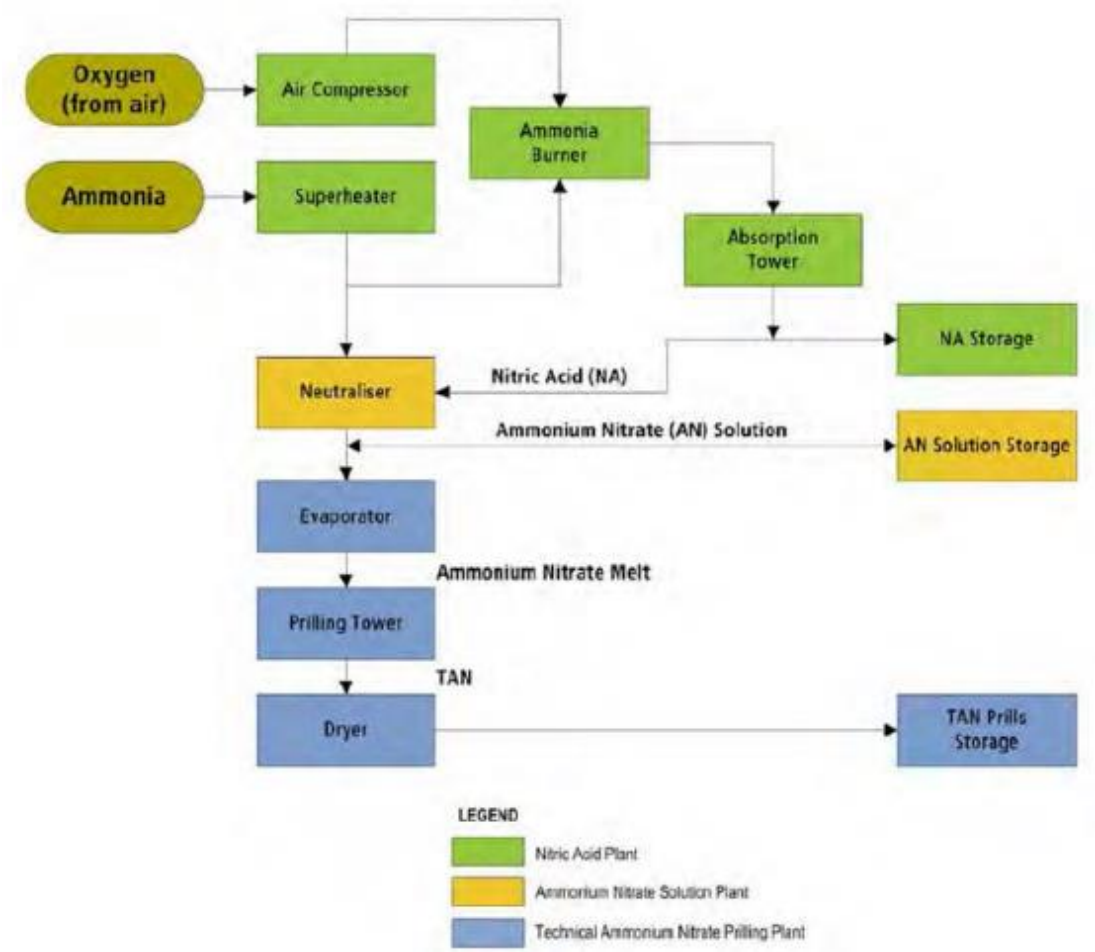

Figure 1: Indicative schematic flowsheet for the TAN production process

Nitric acid plant

The nitric acid plant converts liquid ammonia (from the adjacent Ammonia Plant) and oxygen (air) into nitric acid, which is sent to the ammonium nitrate solution plant onsite.

The liquid ammonia is filtered, vapourised, superheated and mixed with air. The mixture is then oxidised to form nitric oxide (NO) and water. Nitrous oxide (N_2O) and nitrogen (N_2) are also produced. The NO is cooled and oxidised, to produce nitrogen dioxide (NO_2), which is then absorbed with water to produce nitric acid (HNO_3). Nitric acid is stored in two storage tanks within an acid resistant bunded area.

Nitrogen oxides (NOx) are removed from the HNO_3 in the absorber. The gases not absorbed in the absorption tower are released as 'tail gas' and used as a cooling medium for the hot reactor gases from the initial reaction. Prior to discharge into the atmosphere, the tail gas is mixed with ammonia gas and enters a catalytic abatement reactor which reduces NOx in the gas to nitrogen and water resulting in cleaned tail gas being vented to the environment via the nitric acid plant stack.

Heat produced during the nitric acid production process is recycled in the heat recovery circuit where it is used for steam production and electricity generation.

Ammonia can be released from the nitric acid plant vent during start-up to ensure optimal pressure control prior to and in some cases during catalyst 'light-off', when the catalyst is heated to operating temperature. Venting is not required during normal operation.

Ammonium nitrate solution plant

The ammonium nitrate solution plant uses a pressurised reactor to produce ammonium nitrate solution from ammonia (NH_3) and HNO_3. Nitric acid is neutralised using ammonia gas to produce the ammonium nitrate solution and steam. Superheated gaseous NH_3 and preheated liquid HNO_3 are injected into the bottom part of a natural circulation neutraliser. Steam produced by the neutralisation process is reused in the evaporation process.

The ammonium nitrate solution is either sent to the TAN prilling plant, stored for future use, or sold as a product. Ammonium nitrate solution is stored within a bunded 500 tonne storage tank from where it is loaded into trucks within a bunded loading area.

TAN prilling plant

Prilling is the formation of solid porous spheres of ammonium nitrate and is the final product from the process. Prills are manufactured in a prilling tower where ammonium nitrate solution flows by gravity to prilling nozzles which form droplets that crystallise as they fall from the top of the tower. Prills exiting the prill tower are directed to a drying section, which uses rotating drum dryers to reduce excess moisture. Dried prills are screened before being fed to a fluidised bed cooler.

Oversized and fine prills are removed and recycled whilst on-spec material is cooled to optimal storage temperature and directed to a coating drum where anti-caking agents are sprayed on. During the prilling process, some ammonia and ammonium nitrate (as fine particles) become entrained in the air. A scrubber is installed on the exhaust air stream of the prill tower to reduce the majority of ammonia and particulate ammonium nitrate. The air is then scrubbed again at the final scrubber. In parallel to the prilling air scrubber, drying air is also scrubbed through the final scrubber to minimise emissions to the atmosphere from the common stack.

Storage and transport

The prill product leaving the TAN prilling plant is conveyed to a bulk storage building and then either bagged at the bagging facility in 1.2 tonne bags which are stored in blocks of about 300 tonnes or less, or conveyed directly into trucks. The bulk TAN storage building has the capacity to store up to 12,000 tonnes of TAN in separate bulk piles to mitigate fire and explosion risks. The building also has a special roof construction to maintain temperatures within acceptable levels and air conditioning.

Bulk TAN is only transported to consumers by trucks, which are loaded using a system consisting of front-loaders, bucket elevators and silos in combination with a truck weighing system. Approximately 25 trucks operate each day for the transport of product from the premises (including bulk, bagged and liquid products).

Water management

All clean stormwater runoff (comprising runoff from buildings and roads only) is either allowed to infiltrate in unpaved areas or is directed via sealed, drain channels and connecting gravity-flow pipes and pits to two ponds (1 and 2) for storage and evaporation. Water from the ponds can also be discharged to the Ammonia Plant for subsequent discharge to the MUBRL if required. The ponds have been upgraded to include a second HDPE liner and tell-tale leak detection so that, if required, they are also able to receive contaminated water for contingency storage.

A separate contaminated drainage system, comprising sealed surfaces (concrete pads, bunds etc) and conduits such as channels and pipes, collects and transfers potentially contaminated stormwater from process areas to two ponds (4 and 5) for storage and evaporation. The ponds can also receive process effluent. If the ponds reach capacity, water can be pumped to ponds 1 and 2 if required or sent offsite for disposal. Ponds 1, 2, 4 and 5 are double lined with HDPE with tell-tale leak detectors allowing for detection of leaks between the two layers of lining.

Process effluent from the TAN production process is collected via the contaminated water system and undergoes treatment on the premises primarily for oil removal and pH neutralisation

prior to transfer to the Ammonia Plant process effluent pipework. Cooling tower blowdown is transferred to the adjacent Ammonia Plant process effluent pipework. Process effluent from the TAN and Ammonia plants is then combined and discharged to the MUBRL operated by Water Corporation. The MUBRL discharges received effluent into marine waters at King Bay.

Utilities

Electricity for the premises operation is provided by the adjacent Ammonia Plant or is generated from steam from the nitric acid plant.

The TAN Plant's cooling system utilises seawater which is provided by the Water Corporation's Desalinated Water and Seawater Supplies Project. As per the discussion in the Water management section above, cooling tower blowdown is discharged to the Ammonia Plant process effluent pipework for subsequent discharge to the MUBRL.

Domestic wastewater is treated via five aerobic treatment units (design capacity of 10.8 m^3/day). Treated effluent is discharged from the ATUs into two single HDPE lined ponds (3 and 6) for storage and evaporation. The ponds have a combined capacity of over 2,000 m^3.

4.2 Infrastructure

The TAN Plant infrastructure, as it relates to Category 31 activities, is detailed in Table 4 and with reference to the Site Plan in Figure 2.

Table 4: TAN Plant Category 31 infrastructure

	Infrastructure	**Site Plan Reference** **As shown in the premises infrastructure layout plan in Figure 2**
	Prescribed Activity Category 31	
Ammonia is received via pipeline from the adjacent Ammonia Plant and is processed via stages to produce nitric acid, ammonium nitrate solution and TAN prill.		
1	Nitric acid plant (760 tpd)	Nitric acid plant
2	2 x nitric acids storage tanks (total capacity of 3000 m^3)	Nitric acid tanks
3	Ammonium nitrate solution plant (965 tpd);	Ammonium nitrate solution plant
4	TAN prilling plant (915 tpd)	TAN prilling plant
5	Ammonium nitrate solution storage tank (500 tonnes)	Ammonium nitrate solution tank
6	Bulk TAN storage building (12,000 tonnes)	Bulk TAN storage building
7	TAN bagging facility	TAN bagging, storage and staging area
8	Bagged TAN storage building (1,800 tonnes)	
9	Bagged TAN staging area (7000 tonnes)	
10	Truck bulk loading system (TAN and ammonium nitrate solution)	TAN truck loading facility
11	Seawater cooling tower and closed loop cooling system	Seawater cooling tower

	Infrastructure	Site Plan Reference As shown in the premises infrastructure layout plan in Figure 2
12	Treated domestic wastewater ponds 3 (32.8 m x 20.8 m x 2.9 m) and 6 (15.6 m x 10.8 m x 1.5 m) Ponds are single HDPE lined.	Pond 3 and Pond 6
13	Clean/ contingency contaminated water ponds 1 (42.35 m x 32.9 m x 2.9 m) and 2 (51.3 m x 60.8 m x 2.9 m) Sized to accommodate a 1:10 year 24-hour ARI event. Ponds are double HDPE lined with tell-tale leak detectors.	Pond 1 and Pond 2
14	Contaminated water ponds 4 and 5 (both 99.8m x 29.0m x 2.85m) Sized to accommodate a 1:10 year 24-hour ARI event. Ponds are double HDPE lined with tell-tale leak detectors. Sized to accommodate wastewater flow of 9735 t/year and additional flows in connection with tropical cyclones.	Pond 4 and Pond 5
15	Off-spec storage area (for the temporary storage of product that does not meet specification requirements)	Off spec area
16	5 x aerobic treatment units (ATUs)	ATU
17	Process effluent discharge pipeline (to the Ammonia Plant)	Process effluent discharge pipeline
18	Ammonia delivery pipeline	Ammonia delivery pipeline
19	Diesel storage tank	Diesel tank
	Emergency diesel generator	Diesel generator

Figure 2: Premises infrastructure layout map

4.3 Exclusions to the assessment

This assessment relates to the YPN TAN Plant only, therefore does not assess emissions, discharges or risks associated with the operation of the adjacent Ammonia Plant. Wastewater from the TAN Plant is not discharged directly to the environment from the premises, rather it is discharged to the Ammonia Plant premises directly into the Ammonia Plant process effluent pipework, and is then combined with the Ammonia Plant process effluent before discharge to the MUBRL for discharge into marine waters at King Bay. Risk assessment relating to the discharge of wastewater from the TAN Plant via the MUBRL has therefore been undertaken for the Ammonia Plant licence (L9224/2019/1).

Greenhouse gas emissions from the TAN Plant were considered by the EPA for the Part IV assessment of the proposal under the *Environmental Protection Act 1986* (EP Act) (EPA Report 1379) and determined to be sufficiently low that no further evaluation of emissions was required. The total annual greenhouse gas emissions and emission intensity assessed for the proposal are defined in the key characteristics table in Schedule 1 of Ministerial Statement 870 for the TAN Plant thereby limiting emissions. Given greenhouse gas emissions were quantified and considered not to be significant under Part IV of the EP Act the Delegated Officer has determined not to duplicate this assessment in accordance with the *Guidance Statement: Setting Conditions*.

5. Legislative context

Table 5 summarises approvals, excluding those granted under Part V of the EP Act, relevant to the assessment.

Table 5: Relevant approvals and tenure

Legislation	Number	Holder	Approval
Environmental Protection and Biodiversity Conservation Act 1999 (Cth)	EPBC 2008/4546	Yara Pilbara Nitrates Pty Ltd (previously named Burrup Nitrates Pty Ltd)	Conditional approval as issued on 14 September 2011 (EPBC 2008/4546). Variations to the approval were issued on December 2013, 10 February 2014 and 12 September 2017.
Dangerous Goods Safety Act 2004	DGS021976	Yara Pilbara Nitrates Pty Ltd	Dangerous Goods Site Licence issued 19 February 2020. Expiry 23 February 2025.
	SMA000031		Security Sensitive Ammonium Nitrate (SSAN) Manufacture Licence issued 19 February 2020. Expiry 23 February 2025.
	SIE000049		SSAN Import/Export Licence issued 23 October 2017. Expiry 23 October 2022.
	DPL001133		Dangerous Goods Pipeline Registration issued 13 May 2015. Expiry 13 May 2020.
Dangerous Goods Safety (Major Hazard Facilities) Regulation 2007	Approved Safety Report		Safety Report approved by DMIRS on 26 May 2015.
Part IV of the EP Act	Ministerial Statement	Burrup Nitrates Pty Ltd	For construction and operation

Legislation	Number	Holder	Approval
(WA)	Number 870 (MS 870)		of a technical ammonium nitrate production facility within the King Bay/Hearson Cove Industrial Estate on the Burrup Peninsula. Granted 11 July 2011. MS 870 has been subsequently amended under s45C of the EP Act in July 2013 to remove wastewater from the key characteristics table and in June 2017 to decrease the physical scope of the proposal. On 24 December 2019, condition 5 of MS 870 was amended via MS 1121 following a section 46 review of the condition requested by the Minister for Environment.

5.1 Federal legislation - Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

The TAN Plant proposal was referred to the then Commonwealth Department of Environment, Water, Heritage and the Arts in October 2008. The proposal was subsequently determined to be a controlled action under the EPBC Act due to being likely to have a significant impact on National Heritage listed place, listed threatened species and communities, and listed migratory species. Assessment of the proposal was undertaken under the bilateral agreement between the State and Commonwealth environment departments and conditional approval was issued on 14 September 2011 (EPBC 2008/4546). Variations to the approval were approved under the EPBC Act on 10 February 2014 and 12 September 2017. Conditions of the approval relate to:

- discharge criteria for wastewater discharged to the MUBRL with reference to requirements of MS 594;
- restricted application of larvicide and adulticide;
- deterring birds from entering water ponds;
- protection of the Dampier Archipelago (including Burrup Peninsula) National Heritage Place (National Heritage Place) via the implementation of following management plans:
    - Construction Environmental Management Plan;
    - Operational Environmental Management Plan;
    - Aboriginal Heritage Management Plan;
    - Hazardous Materials Management Plan; and
    - Emergency Response Management Plan;
- restricted access with respect to work carried out in the National Heritage Place;
- requirements for undertaking ambient air quality monitoring for specific gases and dust for not less than 24 months from the commencement of construction until the expiry of the approval; and
- requirements for annual surveys of rock art with a 2 km radius of the Premises to identify any changes to be undertaken either by the proponent or through the provision of an annual pro-rata amount for the Burrup Rock Art Monitoring Program.

5.2 Part IV of the EP Act

5.2.1 Background

The proposal to construct and operate the TAN Plant was referred to the EPA under Part IV of the EP Act on 11 November 2008 and was assessed through a Public Environmental Review (PER) assessment process. The EPA released its report and recommendation on the project (EPA Report 1379) in January 2011 and Ministerial approval for the proposal was granted through MS 870 on 11 July 2011. The statement has undergone a number of amendments since it was first issued as described in Table 5.

The EPA's assessment of the TAN Plant proposal considered the following key environmental factors relevant to the construction and operation of the TAN Plant:

- air quality;
- biodiversity;
- surface water and groundwater; and
- liquid waste disposal.

The Part IV assessment considered the impact of atmospheric emissions from the TAN Plant on rock art and concluded that it is unlikely that the relatively small quantities of nitrogen dioxide (NO_2) and ammonia (NH_3) that would be emitted from the TAN Plant would have a significant impact on rock art in the surrounding areas.

An integral component of the operation of the TAN Plant is the supply of seawater and desalinated water, and the discharge of liquid waste to King Bay via the MUBRL, as part of the Water Corporation's Desalination and Seawater Supplies Project. The proposal for the Desalination and Seawater Supplies Project was initially assessed and granted Ministerial Approval via MS 567 on 22 June 2001. The approval was subsequently amended via MS 594 to allow for increased seawater supply, increased brine discharge and for treated wastewater discharge. The approval allows for the use of the MUBRL to supply seawater to industries on the Burrup and to discharge brine and industrial wastewater to King Bay.

5.2.2 Ministerial Statement 870

MS 870 was granted for the construction and operation of the TAN Plant and contains conditions that need to be considered in the assessment of emissions and discharge from the plant and the imposition of regulatory controls. The statement was updated in 2019 via MS 1121 to replace condition 5 with a new condition which includes clear objectives to minimise air emissions to assist in maintenance of regional air quality to protect human health and amenity, and minimise the risk of adverse impacts to rock art on Murujuga. A summary of conditions relevant to the licence application is included in Table 6.

Table 6: Consideration of MS 870 conditions relevant to this application

Condition	Requirement	Delegated Officer consideration
1-1	The proponent shall implement the proposal as documented and described in schedule 1 of this statement subject to the conditions and procedures of this statement.	Specifications detailed in Schedule 1 relate to the design capacity of the plant and specified emission rates and annual limits for emissions to air but does not specify stack emission concentrations. EPA Report 1379 recommends regulation of emissions under Part V of the EP Act. In accordance with the Act, regulation must not be contrary to or otherwise than in accordance with the Schedule or the EPA's assessment. Stack emission concentration limits included

Condition	Requirement	Delegated Officer consideration
		in Part V instruments must be commensurate with use of best practice pollution control technology and emissions as presented in the proposal for the TAN Plant.
5-1	The proponent shall manage the implementation of the proposal to 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 National Environmental Protection (Ambient Air Quality) Measure (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 on rock art on Murujuga.	The Part IV approval requires the Applicant to minimise air emissions to protect human health, the environment and minimise risk to rock art. The Part IV conditions require the Applicant to compare expected emissions with and implemented pollution controls with best practice and identify and consider advances in pollution control that can be incorporated into the TAN Plant. The Delegated Officer therefore considers the requirements of MS 1121 provide for the Applicant to identify and adopt changes which will minimise air emissions and in accordance with the Regulatory Framework will avoid duplication of these requirements. The Delegated Officer notes that conditions in MS 1121 only came into effect in December 2019 and accordingly YPN has not yet revised the AQMP. Therefore, the existing approved AQMP applies and licence conditions must not be contrary to the requirements of the AQMP.
5-2 to 5-4 5-7 to 5-12	Condition 5-2 requires submission of a revised Air Quality Management Plan (AQMP) that meets the objectives of condition 5-1 within 12 months of the date of MS 1121. Condition 5-3 specifies the requirements of the revised AQMP which include: • Specifying expected air emissions based on current plant design • Comparison of expected emissions which best practice emissions for TAN production facilities • Comparison of air pollution control technology and plant design with international best practice for TAN production facilities • Provision for monitoring on-site meteorological conditions to enable data for use in the Murujuga Rock Art Monitoring Program • Measures which will be implemented to minimise air emissions including advances in air pollution control technology and process management. Condition 5-4 specifies requirements for implementation of the revised AQMP and subsequent revisions of the plan. Condition 5-7 to 5-10 allow for revision of the AQMP, specify revision must occur every 4 years or as directed by the CEO and approval and implementation requirements for revisions. Condition 5-11 requires the proponent to make the AQMP and meteorological reports and data collected in accordance with the plan publicly available. Condition 5-12 requires the proponent to implement the current approved AQMP until they receive notification the revised plan meets the	

Condition	Requirement	Delegated Officer consideration
	requirements of MS 1121.	
5-6	Requires the proponent to provide the CEO with copies of all reports and data relating to ambient air quality monitoring and rock art condition / integrity monitoring required under the EPBC Act within one (1) month of their provision to the Commonwealth Government. Condition 5-11 also requires the submitted reports to be made publically available.	
8-3	The proponent shall design, construct, and locate groundwater monitoring bores to the satisfaction of the CEO on advice of the DEC and the Department of Water, having regard for the outcomes of the hydrogeological studies required by condition 8-1 and the Department of Water's Water Quality Protection Note 30 on Groundwater Monitoring Bores.	Groundwater monitoring requirements under MS 870 have been considered in determination of risk associated with potential emissions and discharges.
8-4	The proponent shall sample/monitor all groundwater bores required by Condition 8-3 every six months and shall set groundwater monitoring trigger values at a value of 10% above the baseline contaminant concentrations obtained from the hydrogeological studies required by condition 8-1.	
8-5	In the event that monitoring required by condition 8-4 indicates an exceedance of trigger levels: 1. The proponent shall report such findings to the CEO within 7 days of the exceedance being identified; 2. The proponent shall provide evidence which allows determination of the cause of the exceedance; 3. If determined by the CEO to be project attributable, the proponent shall submit actions to be taken to address the exceedance within 7 days of the determination being made to the CEO; 4. The proponent shall implement actions to address the exceedance and shall continue until such time as the CEO determines that the remedial actions may cease; and 5. The proponent shall submit bi-annually, or at a frequency defined to the satisfaction of the CEO, the results of monitoring required by condition 8-4 to the CEO, until such time as the CEO determines that reporting may cease.	

EPA enquiry under section 46 of the EP Act of Condition 5-1 Air Quality

In November 2017, the Minister for Environment requested the DWER to review compliance of MS 870 with reference to Condition 5-1: Air Quality ("*The proponent shall adopt and implement best practice pollution control technology as determined by the Chief Executive Officer of the Department of Environment and Conservation (DEC) on advice of the CEO to minimise all relevant emissions from the TAN Plant ammonium nitrate prilling plant").*

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, DWER concluded that contemporary best practice pollution control technology (wet scrubbers and a NOx reduction unit equipped with a catalyst) has been incorporated in the design of the TAN Plant and that its performance compares favourably with relevant best practice stack emission concentration criteria under normal operating conditions.

In April 2018, the Minister for Environment requested the EPA to review MS 870 under section 46 of the EP Act. The request was to "*Inquire into and report on the matter of changing implementation condition 5-1: Air Quality in Ministerial Statement 870 for the above proposal to protect rock art".* The potential impacts on two key environmental factors: Air Quality and Social Surroundings were examined by the EPA during its inquiry.

In September 2019, the EPA published Report 1648, which made the following conclusions and recommendations:

- definitive information on whether industrial air emissions, including those from the TAN Plant, are adversely affecting rock art is currently not available;
- licence L7997/2002/11 includes best practice stack emission concentration limits which are an effective means of minimising the risk of air emissions from the TAN Plant impacting on rock art in the absence of conclusive information from the Murujuga Rock Art Monitoring Program in regard to whether industrial air emissions are impacting on rock art. There is no need to duplicate the limits in the Ministerial Statement;
- Commonwealth approval (EPBC 2008/4546) for the TAN Plant contains enforceable and auditable conditions for air quality monitoring and rock art monitoring therefore there is no need to duplicate the monitoring in the Ministerial Statement; and
- as the TAN Plant utilises best practice pollution control technology to minimise air emissions, the risk of damage to rock art due to the operation of the TAN Plant has also been minimised, whilst recognising the lack of full scientific certainty in regard to whether cumulative industrial air emissions within the Murujuga airshed are damaging rock art;
- there is sufficient time for the monitoring and evaluation activities associated with the Murujuga Rock Art Monitoring Program to be undertaken and for definitive information in regard to whether cumulative industrial air emissions within the Murujuga airshed are adversely affecting rock art to be obtained;
- the risk of rock art being damaged by air emissions from the TANPF can be further mitigated through the progressive minimisation of air emissions from the TANPF through the adoption of advances in air pollution control technology and process management.

Based on the conclusions and findings of the review, the EPA concluded the impact to Air Quality and Social Surroundings are manageable, based on the imposition of a new version of condition 5 in place of the original version. The recommended amended condition 5 includes clear objectives to minimise air emissions in order to enable regional air quality to be maintained so that the environmental values of human health and amenity are protected, and to reduce the risk of impacts to rock art on Murujuga (the Dampier Archipelago and Burrup Peninsula).

As part of the section 46 enquiry the EPA also provided other advice to the Minister that "*the Murujuga Ambient Air Quality Monitoring Network and Murujuga Rock Art Monitoring Program (once established) would be the most appropriate overarching systems through which the monitoring on Murujuga should be coordinated regarding ambient air quality monitoring and rock art monitoring. This would ensure that the responsibility for such monitoring is shared amongst all existing and future industrial emitters in an equitable manner*". Recommendations of the EPA in the other advice included:

- prior to the Murujuga Ambient Air Quality Monitoring Network and Murujuga Rock Art Monitoring Program being established, and when the opportunity arises, the ministerial conditions of other existing industrial facilities located on Murujuga should be changed

via section 46 of the EP Act, to include a requirement to reduce the risk of impacts to rock art from air emissions; and

- when the Murujuga Ambient Air Quality Monitoring Network and Murujuga Rock Art Monitoring Program have been established the ministerial statements of existing industries should be changed via section 46 of the EP Act to remove any requirements for the proponents to undertake their own individual ambient air quality monitoring and / or rock art monitoring where necessary and include a requirement for the proponent to contribute to the airshed monitoring activities.

On 24 December 2019, the Minister for Environment implemented the recommended changes to condition 5 of MS 870 through MS 1121; to stipulate that the risk of rock art being damaged by air emissions from the TAN Plant shall be further mitigated through the progressive minimisation of air emissions from the TAN Plant through the adoption of advances in air pollution control technology and process management.

5.3 Legislative framework for assessing and managing potential impacts on Murujuga's rock art petroglyphs

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. The Western Australian Government is committed to the ongoing protection of Murujuga's rock art and is working in partnership with the Murujuga Aboriginal Corporation (MAC), representing the Traditional Custodians of Murujuga, to protect and manage this important area.

In 2002, the Western Australian Government established the Burrup Rock Art Monitoring Management Committee (BRAMMC) in response to concerns about possible adverse impacts on the rock art from industrial air emissions. BRAMMC commissioned a number of independent scientific studies to investigate the possible effects of current and future industrial emissions on rock art. These studies included measurements of air quality, assessment of microclimate, dust deposition, colour change, mineral spectrometry, microbiological analyses, accelerated weathering studies and air dispersion modelling studies. The scientific reports from these studies were independently peer reviewed by international experts in relevant disciplines.

In 2009, subsequent to the review of the investigation findings, BRAMMC concluded there was no scientific evidence of any measurable impact of industrial emissions on the rate of deterioration of the Burrup rock art and recommended establishing a technical working group to replace BRAMMC, and for annual monitoring of colour contrast and spectral mineralogy monitoring of rock art for a period of ten years (subject to review after five years). The Burrup Rock Art Technical Working Group (BRATWG) was established to oversee the colour change and spectral mineralogy monitoring program and other studies between September 2010 and June 2016. The monitoring program was funded with contributions from industry on the Burrup Peninsula. The then Department of Environment Regulation managed the monitoring program from the expiry of BRATWG's tenure in June 2016 until the formation of DWER on 1 July 2017.

The methodology used and conclusions of some of the research studies and monitoring undertaken since 2004 has been subject to some criticism. Independent reviews of the monitoring programs conducted on the Burrup Peninsular were subsequently commissioned by DWER which recommended redesign of the rock art monitoring program based upon well-established principles of experimental design to provide more robust, replicable and reliable information about the impacts of air emissions on the rock art.

In September 2017 the Western Australian Government released the draft Burrup Rock Art Strategy for public comment. The draft strategy established a long-term framework to protect Aboriginal rock art on the Burrup Peninsula. In September 2018 the Minister for Environment

established the Murujuga Rock Art Stakeholder Reference group (MRASRG) to facilitate engagement between the MAC and key government, industry and community representatives on the development and implementation of the renamed Murujuga Rock Art Strategy. The reference group is currently chaired by Dr Ron Edwards and includes representatives from the MAC, the Australian Government and state government departments, the Pilbara Ports Authority, the Western Australian Museum, the City of Karratha, industry and scientists.

In February 2019 the Minister for Environment released the Murujuga Rock Art Strategy which was finalised in consultation with the MRASRG. The purpose of the strategy is for the protection of aboriginal rock art located on Murujuga from the potential impacts of anthropogenic emissions.

The strategy establishes long-term framework for the management and monitoring of environmental quality to protect the rock art on Murujuga from the impacts of anthropogenic emissions. The framework outlined in the strategy is intended to address the shortcomings in the design, data collection and analysis of the rock art monitoring program that were identified by independent reviewers. The strategy builds on previous studies and provides a transparent, risk-based and adaptive approach to deliver a scientifically rigorous approach to the monitoring and management to protect the rock art.

The scope of the strategy is to:

- establish an Environmental Quality Management Framework, including the derivation and implementation of environmental quality criteria that are based on sound scientific information;
- develop and implement a robust program of monitoring and analysis to determine whether change is occurring to the rock art on Murujuga;
- identify and commission scientific studies to support the implementation of the monitoring and analysis program and management;
- establish governance arrangements to ensure that:
    - monitoring, analysis and reporting are undertaken in such a way as to provide confidence to the Traditional Owners, the community, industry, scientists and other stakeholders about the integrity, robustness, repeatability and reliability of the monitoring data and results; and
    - government is provided with accurate and appropriate recommendations regarding the protection of the rock art, consistent with legislative responsibilities; and
- develop and implement a communication strategy in consultation with stakeholders.

DWER is responsible for the day to day implementation of the Murujuga Rock Art Strategy in partnership with the MAC and in consultation with the MRASRG. DWER and the MAC are working in partnership to oversee the development and implementation of a scientific monitoring and analysis program (Murujuga Rock Art Monitoring Program) under the strategy that will determine whether the rock art on Murujuga is subject to accelerated change. MAC is the central organisation for developing and managing all research within Murujuga. The Murujuga Research Protocols have been developed by the MAC as a set of governing principles and guidelines to ensure that research is conducted in a respectful and culturally appropriate manner.

The Murujuga Rock Art Monitoring Program will be undertaken in close consultation with a team of national and international experts in relevant disciplines and the MAC will be involved in all aspects of the monitoring program. The development and implementation of the monitoring program will be informed by the findings and lessons from scientific studies and monitoring of

the rock art on Murujuga, as well as information available in the scientific literature to deliver a scientifically rigorous approach to monitoring and analysis.

The scientific monitoring and analysis program will monitor, evaluate and report on changes and trends in the condition of the rock art and whether the rock art is showing signs of accelerated change to determine whether anthropogenic emissions are accelerating the natural weathering/alteration/degradation of the rock art. Independent peer review processes will be in place to provide assurance that the best scientific information is available to guide management actions. A contract was awarded to Puliyapang Pty Ltd, a joint venture between Calibre Ventures Pty Ltd and Tocomwall Pty Ltd, for the Murujuga Rock Art Monitoring Program in February 2020. Funding for the monitoring program is being provided by Woodside Energy, Rio Tinto and Yara Pilbara.

In addition to the Murujuga Rock Art Monitoring Program, the strategy provides for establishment of an atmospheric deposition network which will be established to provide data on the composition and concentration of contaminants that are potentially transferred from the atmosphere to the rock surfaces. The strategy also acknowledges that the Western Australian Government is considering establishment of a long-term coordinated ambient air quality network on Murujuga and the surrounding areas to increase inform decision making relating to ambient air quality in the region.

Information on monitoring and analysis of the Murujuga rock art will be published on DWER's website. This will include the strategy, annual reports detailing the results of data collection and analysis, reports from scientific studies, the reports of independent peer reviewers and annual reports on the implementation of the strategy.

Table 7 below includes a summary of current legislative framework relevant to the Murujuga rock art.

Table 7: Summary of State and Commonwealth legislation targeted at protecting rock art

Mechanism **(and responsible government)**	**Date**	**Protections**
Murujuga National Park (WA)	17 January 2013	Murujuga National Park is owned in freehold by the MAC. The land is leased back to the Western Australian Government as national park and is jointly managed by the MAC and DBCA in accordance with the policy direction provided by the Murujuga Park Council (MPC). MPC comprises representatives from the MAC, DBCA and a representative appointed by the Minister for Aboriginal Affairs. Increased protection of rock art is provided by applying the provisions of the *Conservation and Land Management Act 1984* (CALM Act) to formally protect the park's values. The Park is operated in accordance with the Murujuga National Park Management Plan 78 (2013) and the Murujuga Cultural Management Plant (2016) which focuses on protection and awareness of the cultural and natural values of the area. The Rangers of Murujuga Land and Sea Unit (MLSU) conduct the practical management of the Park and the surrounding sea country and islands along with DBCA staff.
Aboriginal Heritage Act 1972 (WA)	NA	Specific localities on the Burrup have been declared Protected Places under the *Aboriginal Heritage Act 1972*. Consent is required from the WA Minister for Aboriginal Affairs for any activity which will negatively impact Aboriginal heritage sites.

Mechanism (and responsible government)	Date	Protections
Burrup and Maitland Industrial Estates Agreement (WA)	January 2003	The State Government entered into the Burrup and Maitland Industrial Estates Agreement (the Burrup Agreement) with three Aboriginal groups (Ngarluma-Yindjibarndi, the Yaburara-Mardudhunera and the Woon-Goo-Tt-Oo). This agreement enabled the State Government to compulsorily acquire native title rights and interests in the area of the Burrup Peninsula and certain parcels of land near Karratha. The Burrup Agreement allows for industrial development to progress across southern parts of the Burrup Peninsula, provides for the development of a conservation estate (Murujuga National Park) and ensures the protection of Aboriginal heritage. The Department of Jobs, Tourism, Science and Innovation is the lead agency for the development of the Burrup Strategic Industrial Area and LandCorp is the estate manager.
Burrup and Maitland Industrial Estates Agreement Additional Deed (WA)	16 January 2003	The State Government committed to organise and fund a minimum four-year study into the effects of the industrial emissions on rock art within and in the vicinity of part of the industrial estate on the Burrup Peninsula. The four-year scientific rock art monitoring program, included: - Two studies for the monitoring of ambient concentrations of air pollutants and microclimate and deposition undertaken by CSIRO Atmospheric Research; and - Two further programs for artificial fumigation of rock surfaces and fieldwork on rock surface colour changes undertaken by CSIRO Manufacturing and Infrastructure Technology. Following completion of these studies, in 2009 the Burrup Rock Art Monitoring Management Committee recommended that the studies on ambient air quality and rock microbiology monitoring be suspended and only recommenced if warranted by a major increase in emissions or if evidence becomes available to require further monitoring.
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) – Listing of the Dampier Archipelago (which includes the Burrup Peninsular) as a National Heritage place (Cth)	3 July 2007	The Dampier Archipelago was assessed by the Australian Heritage Council in 2007 and found to meet five of the eight criteria for national heritage listing under the EPBC Act. The listing of the Dampier Archipelago 'recognised the extraordinary extent, diversity and significance of petroglyphs, standing stones and circular stone arrangements of the place'. National heritage listing means that any proposed action that could have a significant impact on the National Heritage listed portion of the Burrup Peninsula must be referred to the Commonwealth Minister for the Environment as a matter of national environmental significance for assessment and decision. Actions that commenced prior to 16 July 2000 (being the commencement date of the EPBC Act) are exempt from the assessment and approval provisions of the EPBC Act. The Ammonia Plant was referred to the Minister for Environmental and Heritage in March 2001 under the EPBC Act. The Minister decided that the proposal to construct and operate the Ammonia Plant on the Burrup Peninsula was not a controlled action and therefore not subject to further assessment or approval.

Mechanism (and responsible government)	Date	Protections
EPBC Act Conservation Agreements (Cth)	2007	At the time of listing on the National Heritage List, EPBC Act Conservation Agreements were signed by the then Commonwealth Minister for the Environment and Water Resources with Woodside Energy Ltd, and Rio Tinto (Hamersley Iron Pty Ltd and Dampier Salt Ltd). Under the Conservation Agreements, these companies provide funding for research, management and monitoring of the National Heritage values of the place.
The Deep Gorge Joint Statement (DGJS) (Cth)	July 2017	The DGJS, signed by the Australian Government, Woodside and Rio Tinto, reaffirms the commitments made under each of the bilateral Conservation Agreements to support the ongoing protection, conservation and management of the National Heritage values of Murujuga and the wider Dampier Archipelago.
Yara Pilbara Nitrates Pty Ltd EPBC Act Approval (EPBC 2008/4546) for the construction of the Technical Ammonium Nitrate Facility (Cth)	14 September 2011 (variations approved in 2013, 2014 and 2017)	The Commonwealth Minister for the Environment determined the proposal for the construction of the TAN Plant was a controlled action under the EPBC Act for likely impacts to the National Heritage Place. The Commonwealth Minister for the Environment approved the proposed action, with conditions relating to the protection of the National Heritage Place, including: • contribution of funds toward implementation of baseline rock art monitoring and public reporting of results; • contribution of funds toward implementation of an ongoing rock art monitoring program or engagement of a suitably qualified person to undertake the rock art monitoring using methodology approved by the Minister and public reporting of results; • undertaking a baseline ambient air quality monitoring program (NH3, NOx, SOx and TSP) and public reporting of results; • ongoing ambient air quality monitoring program (NH3, NOx, SOx and TSP) and public reporting of results; • compliance with limits set in the Part V licence issued under the EP Act; and • providing the Department of the Environment and Energy (DoEE) with a management plan in the event that accelerated changes in the rock art are detected.
Woodside Energy Ltd approval for Pluto Liquefied Natural Gas Development (WA)	December 2007	Offsets package for Pluto LNG required the rehabilitation/ restoration of degraded areas that fall both outside of the lease and outside of areas of potential industrial development. The program initiated as a result of this requirement aims to rehabilitate and restore degraded areas on the Burrup Peninsula. The program includes rock art site rehabilitation and restoration.

5.4 Contaminated sites

On 7 December 2018, the TAN Plant premises (part of Lot 3017) was classified as possibly contaminated – investigation required under the *Contaminated Sites Act 2003* (CS Act). The classification relates to an accidental release of ammonium nitrate solution in 2017, along with leakage of corrosion inhibitor from a sub-surface pipe, and suspected leaks of ammonium nitrate contaminated wastewater (further details on these events are provided in section 5.7.5). Remedial works were undertaken at the locations of the releases, however, due to access being

restricted by infrastructure at the site, impacted soil remains present beneath the infrastructure.

Nitrates and ammonia were subsequently found to be present in groundwater and surface water at concentrations exceeding site specific trigger levels developed in accordance with the requirements of MS 870. Nitrogen and ammonia, were present in groundwater at concentrations exceeding assessment levels for freshwater and/or marine aquatic ecosystems, as specified in the guideline *'Assessment and management of contaminated sites'* (Department of Environment Regulation, 2014). These are relevant criteria as the supratidal flats immediately adjacent to the TAN Plant are hydraulically linked to the Murujuga National Park ephemeral streams and intertidal zones of Hearson Cove and King Bay.

A series of soil, sediment, groundwater and surface water investigations have been carried out since the detection of contaminants in groundwater, and are ongoing to assess the extent of nutrient contamination beneath the premises. A risk assessment undertaken for substances present in soil, surface water and groundwater has indicated a low risk is posed to the receiving environment. A Detailed Site Investigation was prepared in June 2019 and reviewed by an accredited auditor under the provisions of the CS Act, who determined that the investigations are being conducted at a sufficient standard to assess any risk posed by contaminants to health and environmental receptors.

Further investigations into soil, groundwater and surface water contamination and sedimentation are to be carried out in accordance with the Department's Contaminated Sites Guidelines and the *National Environment Protection (Assessment of Contamination) Measure 1999* (NEPM). A Detailed Ecological Risk Assessment is scheduled for completion in June 2020 and will include reference to site specific trigger criteria due to be set by the EPA in accordance with Condition 8 of MS 870, following commencement of the operation phase.

A remediation action plan is being developed to address the elevated nutrients impacting groundwater beneath the TAN Plant.

5.5 Other relevant approvals

5.5.1 Planning approvals

The TAN Plant is currently zoned strategic industry under the City of Karratha Planning Scheme No.8. A planning application for the TAN Plant was referred to the Shire of Roebourne (now City of Karratha) on 2 August 2012. The application was referred to the Pilbara Joint Development Assessment Panel and approval was granted on 31 October 2012. Approval was subject to conditions relating to a range of aspects, including visual impact, pest management, landscaping, noise, lighting, vehicle parking and access, erosion, areas to be sealed and drained, mosquito management, air quality including dust management and cultural heritage.

Of particular note is the requirement for Yara to comply with the recommendation in EPA Bulletin 1077 for an aspirational noise level of 45dB(A) at Hearson Cove to be achieved to preserve the recreational and environmental amenity of the location during operations. EPA Bulletin 1077 was produced as a result of the EPA's assessment in 2002 of a proposal by Methanex Australia Pty Ltd to establish a methanol complex on the Burrup Peninsula. This proposal was abandoned and never commenced.

5.5.2 Department of Mines, Industry Regulation and Safety

Due to storage of large volumes of dangerous goods and the potential for a major safety incident to occur at the Premises (explosion, fire or chemical release), it is considered a Class A Major Hazard Facility and is subject to the requirements of the *Dangerous Good Safety (Major Hazard Facilities) Regulations 2007*. The TAN Plant is also subject to the requirements of various licences and registrations issued under and the requirements of the *Dangerous Goods Safety Act 2004* (DGS Act), *Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007* (DGS Regulations), and the *Dangerous Goods Safety (Security Sensitive*

Ammonium Nitrate) Regulations 2007 relating to the storage and handling of dangerous goods including TAN prills, ammonia (delivery pipeline), nitric acid, ammonium nitrate solution, and hydrocarbons.

5.6 Key findings for TAN Plant legislative context

Key Findings: The Delegated Officer has reviewed the legislative context for the TAN Plant (excluding requirements under Part V of the EP Act) and has found:

1. There are multiple industries (including shipping within the Dampier Port) located on the Burrup and surrounds with discharges to air which could potentially have an adverse impact on the rock art on the Burrup Peninsular.
2. The EPA has recommended to the Minister for Environment that the Murujuga Ambient Air Quality Monitoring Network and Murujuga Rock Art Monitoring Program (once established) would be the most appropriate overarching systems through which the monitoring on Murujuga should be coordinated regarding ambient air quality monitoring and rock art monitoring
3. The Murujuga Rock Art Strategy has been finalised and is being implemented. The strategy establishes a long-term framework for the monitoring and analysis of changes to rock art on Murujuga and describes the management responses which will be triggered in the event adverse impacts on the rock art are identified.
4. Monitoring for impacts to the rock art will be implemented through the Murujuga Rock Art Monitoring Program. A contract has been awarded for the implementation of the monitoring program.
5. The monitoring program will be subject to independent peer review and information on monitoring and analysis of the Murujuga rock art will be made publically available via DWER's website.
6. The conditions of EPBC approval 2008/4546 as amended, for the YPN TAN Plant are another regulatory tool for monitoring and reporting of potential impacts on the Murujuga rock art and ambient air quality.
7. The regulatory framework described is appropriate for assessing and managing potential impacts to rock art as there are multiple industries located on Murujuga and surrounds which could potentially impact rock art, therefore a coordinated approach is most appropriate. The Murujuga Rock Art Strategy establishes the long term basis for coordinated monitoring and analysis of changes to rock art on Murujuga and, if appropriate, implementation of management or mitigation measures. Information from the monitoring will be used to determine whether further regulation of emissions from industries operating on Murujuga and surrounds is required.
8. Investigation and remedial action relating to the contamination of groundwater beneath the premises is being managed by the Department under the requirements of the CS Act.
9. DMIRS is the primary regulatory authority for regulating public health risks associated with the storage and handling of dangerous goods and major hazard facilities. Subject to DMIRS remaining the primary agency for regulating safety risks, there are no requirements to assess safety risks (including explosion risks) in this Decision Report or insert conditions on the licence to regulate these risks. Where the requirements of the regulatory instruments issued for the Premises for the storage and handling of dangerous goods contain controls which also sufficiently minimise environmental risks associated with storage and handling of these materials, the Delegated Officer has determined not to duplicate the controls in the licence in accordance with DWER's

Guidance Statement: Setting Conditions.

5.7 Part V of the EP Act

5.7.1 Applicable regulations, standards and guidelines

The overarching legislative framework of this assessment is the EP Act and EP Regulations.

The guidance statements which inform this assessment are:

- *Guidance Statement: Regulatory Principles (July 2015)*
- *Guideline: Decision Making (July 2019)*
- *Guidance Statement: Risk Assessments (February 2017)*
- *Guidance Statement: Environmental Siting (November 2016)*
- *Guidance Statement: Setting Conditions (October 2015)*
- *Guidance Statement: Licence Duration (August 2016)*

5.7.2 Works approval and licence history

Table 8 summarises the works approval and licence history for the Premises.

Table 8: Works approval and licence history

Instrument	Issued	Nature and extent of works approval, licence or amendment
W4701/2010/1	25 July 2013	Works approval for the construction and commissioning of the TAN Plant. Amendment Notices were issued to extend the duration of the works approval to allow sufficient time to complete commissioning following delays.
	Amended 23 June 2016	
	Amended 10 November 2016	
	Amended 30 November 2017	
L7997/2002/11	Amended 29 June 2018	Licence L7997/2002/11 which was first issued on 21 April 2015 for the adjacent Ammonia Plant operated by Yara Fertilisers was amended to include the operation of the TAN Plant constructed and commissioned under W4701/2010/1, and changes to the prescribed premises boundary to incorporate both the Ammonia Plant and the TAN Plant..
	Amended 2 April 2019	Amendment to the licence in the form of an amendment notice to extend the date associated with TN and TP limits for discharges from the Ammonia Plant STP from 1 April 2019 to 30 November 2019.
L9223/20191	20 April 2020	New licence issued to replace L7997/2002/11 which expires on 20 April 2020. The new licence is issued for the TAN Plant only. L9223/2019/1 will take effect from 21 April 2020.

5.7.3 Key and recent works approvals

Works Approval W4701/2010/1 was granted on 25 July 2013 to YPN for the construction and commissioning of the TAN Plant. On 19 February 2016, Yara submitted the compliance document required by the works approval certifying that the works had been constructed in accordance with the conditions of the works approval.

Commissioning of the TAN Plant commenced on 22 February 2016. The works approval was amended on 23 June 2016, 10 November 2016, and 13 December 2017 to extend the duration of the works approval following delays in the commissioning. The extended duration allowed Yara to complete commissioning and for DWER to complete the licence amendment process (see below).

On 19 September 2017, Yara notified the DWER that practical completion of commissioning of the TAN Plant was completed on 15 September 2017. On 29 September 2017, Yara submitted the report (Commissioning Report) in accordance with the conditions of the works approval.

5.7.4 Key and recent licence amendments

On 30 March 2016, Yara applied to have licence L7997/2002/11, initially issued to YPF for the operation of the Ammonia Plant, amended to include the boundary and operation of the TAN Plant under a combined licence. After the submission of the Commissioning Report, YPN confirmed that the market conditions had changed and that the TAN Plant will not be operating on campaign basis rather will be operating continuously. The assessment of the licence L7997/2002/11 amendment considered continuous operations and was issued with YPF and YPN and joint holders on 29 June 2018.

Yara submitted two separate licences applications, one for each of the plants; TAN and Ammonia, on 18 October 2019 to supersede licence L7997/2002/11 which expires on 20 April 2020.

5.7.5 Compliance and complaints history

DWER's Incident and Complaints Management System (ICMS) is used to record complaints received and non-compliances requiring investigation.

Yara reported four incidents during commissioning of the TAN Plant:

- 27 April 2016 – an estimated 1.2m^3 of nitric acid was released from a leak on a valve flange on the nitric acid absorption tower resulting in NOx vapours being detected in the plant area. Monitoring did not detect NOx outside the premises boundary. The released nitric acid was contained within the hardstand area;
- 30 April 2016 - elevated NOx emissions from the nitric acid plant stack. NOx concentrations averaged 1436 mg/m^3 for 4.5 hours;
- 6 March 2017 - spill of approximately 2.18 tonnes of ammonium nitrate solution adjacent to the contaminated surface water pond. Groundwater monitoring results have shown elevated nitrates, which Yara indicates may be a result of this spill; and
- 30 June 2017 - leak of unknown quantity of ammonium nitrate contaminated water from Pond 2.

A community complaint was also received during the commissioning of the TAN Plant in relation to visible NOx emissions in the form of yellow/orange smoke from the Nitrate plant Unit 12 Vent. The event occurred during start-up of the plant.

Further incidents which have been reported to DWER since the completion of commissioning of the plant include:

- 9 January 2018 – an inspection of contaminated water ponds 4 and 5 identified that nitrate contaminated water was present between the upper and lower HDPE liners of both ponds. Relining of the infrastructure has occurred subsequent to this event; and
- 29 September 2018 – approximately 780 kL of cooling water comprising demineralised water and up to 0.3% corrosion inhibitor was discharged to land via a leak in a subsurface pipe that is part of the cooling water circuit. Impacted soils were removed and the pipework repaired and ongoing monitoring of groundwater on the premises is

occurring.

As per section 5.4, potential contamination of soils and groundwater resulting from the above events is being managed through requirements under the CS Act and Regulations.

The Existing Licence requires the submission of an AER and AACR. Noting that the TAN Plant was added to the Existing Licence half way through the 2018 AER and AACR reporting period of 1 January – 31 December, a review of the report has been undertaken for this assessment to confirm complaints and non-compliances reported relating to the TAN Plant. The review confirmed there were no non-compliances reported in the AACR relating to the TAN Plant. Two complaints were received by YPN relating to an occurrence of ammonia odour at the Pilbara Port. These complaints occurred during start up and venting of ammonia at the TAN plant.

6. Modelling and monitoring data

6.1 Air emissions

6.1.1 TAN Plant air emissions considered for Part IV and works approval W4701/2010/1 assessments

The assessment of the TAN Plant proposal undertaken by the EPA under Part IV of the EP Act (EPA Report 1379) considered air emissions from the plant as presented in the Public Environmental Review (PER) document.

Based on the assessment, the EPA concluded in EPA Report 1379 that the expected NOx stack emission concentration from the nitric acid plant stack was consistent with the best practice emission concentrations listed in the:

- 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) *(*EFMA Booklet No. 2); and
- European Commission Reference Document on Best Available Techniques for the Manufacture of Large Volume Inorganic Chemicals – Ammonia, Acids and Fertilisers (European Commission 2007).

However, the EPA also concluded that the expected NH_3 and PM_{10} stack emission concentrations from the TAN prilling plant common stack would be above the best practice emission concentrations listed in the *EFMA Best Available Techniques for Pollution Prevention and Control in the European Fertilizer Industry Booklet No. 6: Production of Ammonium Nitrate and Calcium Ammonium Nitrate* (EFMA Booklet No. 6); and the European Commission, 2007 reference document.

Based on the outcomes of the assessment the EPA recommended that:

- YPN adopted and implemented best practice pollution control technology to minimise NH_3 and particulate emissions from the TAN prilling plant common stack; and
- the TAN Plant stack emissions are regulated through Part V of the EP Act commensurate with the use of best practice pollution control technology.

As per section 5.2.2 condition 5-1 was subsequently included in MS 870 requiring the proponent to implement best practice pollution control technology in the TAN Plant ammonium nitrate prilling plant to minimise emissions. The DWER undertook a technical review of compliance with the condition which found best practice pollution control had been included in the plant design and construction, and performance of the pollution control equipment compares favourably with relevant best practice stack emission concentration criteria under normal operating conditions. The subsequent section 46 inquiry and review of condition 5-1 undertaken by the EPA (EPA Report 1379) also noted that the Existing Licence *"includes stack emission concentration limits*

for NO_x (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".

Normal operation of the TAN Plant

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:

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

Emission rates for key parameters as considered by EPA are shown in Table 9.

Table 9: Atmospheric emissions characteristic of normal operations of the TAN Plant (as considered in the EPA assessment)

Source	NO_x (g/s)	NO_2 (g/s) (1)	PM_{10} (g/s) (2)	NH_3 (g/s)	CO (g/s)
Nitric acid plant	4.2	2.1	-	0.02	1.3
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[3]	2.1	1.1	0.058	-	0.66

Note 1: A 50% conversion of NO_x to NO_2 was assumed.
Note 2: Emissions of ammonium nitrate dust from the prilling tower were assumed as PM_{10}.
Note 3: Emissions associated with power generation at the adjacent Ammonia Plant therefore are not further considered in this assessment.
Note 1: Although modelled, CO is not generated in the production of nitric acid.

Nitric acid emissions can produce off-vapours from the neutralisation reactor in the TAN Plant. These are designed to be condensed back into the process, therefore, no emissions are expected from this source.

Non-routine operation of the TAN Plant

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

The following non-routine operating scenarios were considered in the PER:

- Cold start-up once per year (annual maintenance), with the start-up expected to take approximately six hours duration;
- Planned annual maintenance shut downs;
- 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. Maximum emissions from the nitric acid plant stack during emergency shutdowns are expected to comprise up to 39 g/s of NO_x and 0.1 g/s of NH_3.

Emission rates for key parameters as considered by EPA are shown in Table 10.

Table 10: Atmospheric emissions characteristic of non-routine operations of the TAN Plant (as considered in the EPA assessment)

Source	NOx (g/s)	NO_2 (g/s) [1]	PM_{10} (g/s) [2]	NH_3 (g/s)	CO (g/s)
Nitric acid plant	39	19.4	-	0.1	1.3
TAN prilling tower	-	-	2.4	1.6	-
Nitric acid storage tank vent A	0.04	0.02	-	-	-
Nitric acid storage tank vent B	0.04	0.02	-	-	-
Power generation[3]	2.1	1.1	0.058	-	0.66

Note 1: A 50% conversion of NO_x to NO_2 was assumed.
Note 2: Emissions of ammonium nitrate dust from the prilling tower were assumed as PM_{10}.
Note 3: Emissions associated with power generation at the adjacent Ammonia Plant therefore are not further considered in this assessment.

6.1.2 2012 air quality modelling update

YPN initiated a revised air quality modelling assessment for the TAN Plant based on the expected emissions resulting from implementation of emission controls at the plant (ERM 2012). The *Draft Burrup Peninsula Technical Ammonium Nitrate Production Facility Air Quality Assessment Update Report, reference:0086269*, *dated August 2012, authored by Environmental Resources Management Australia for Burrup Nitrates Pty Ltd* (Updated Report), was submitted for the amendment of L7997/2002/11 to include operation of the TAN Plant. The report was not provided for the works approval application for the TAN Plant (which instead considered the information submitted in the PER).

As part of the assessment for the licence amendment the air quality assessment was reviewed by DWER's air quality experts (DWER 2018). The air quality assessment used a different model (CALPUFF) to that used for the earlier air quality assessment included in the PER (Ausplume). Similar to the PER assessment, modelling considered both normal and non-routine operating scenarios and modelled the non-routine emission rates as occurring continuously rather than short duration events occurring over a number of hours, therefore the modelling was considered to be conservative.

Predicted GLCs of NO_2 and NH_3 were lower in the 2012 assessment compared to the assessment included in the PER. Use of the CALPUFF model is one contributor to the lower predictions as the modelling took into account reactions that occur in the atmosphere to breakdown NO_2 and NH_3.

The assessment also considered the contribution of various industrial sources on the Burrup to predicted NO_2 levels for a location that coincides with human habitation (Dampier). The assessment concluded that:

- the contribution of the TAN Plant is less than 1 µg/m^3 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.

Normal operation of the TAN Plant

Emission rates for key parameters considered in the 2012 modelling assessment for normal operation of the TAN Plant are included in Table 11 and modelled GLCs predicted to occur at receptors based on emissions during normal operation of the plant are included in Table 12. A number of modelled species did not have emission rates for the key sources in the table however were modelled with concentrations being generated by the dispersion model through chemical algorithms. The modelling assessment indicated that for normal operations predicted concentrations for all modelled species were below the adopted health assessment criteria.

Table 11 Atmospheric emissions characteristic of normal operation of the TAN Plant

Source	Stack Height (m)	Stack Diameter (m)	Exist velocity (m/s)	NO_2 (g/s)	SO_2 (g/s)	TSP (g/s)	PM_{10} (g/s)	$PM_{2.5}$ (g/s)	NH_3 (g/s)	N_2O (g/s)
Nitric acid plant	54	1.5	23.2	2.85					0.014	3.7
Ammonium nitrate plant /TAN prilling tower	70	2	11.9			0.5[1]			0.326	
Nitric acid storage tank vent A	15	0.5	1	0.057						
Nitric acid storage tank vent B	15	0.5	1	0.057						
Power station[2]	30	2.6	16.9	3.25	0.009	0.054	0.054	0.052		

Note 1: Emissions of ammonium nitrate dust from the prilling tower were assumed as TSP.
Note 2: Emissions attributed to the power station occur at the adjacent Ammonia Plant therefore are not further considered in this assessment.

Table 12: Predicted ground level concentrations (including background) during normal operations of the TAN Plant (from ERM 2012)

	NO_2		SO_2			TSP	PM_{10}	$PM_{2.5}$		NH_3	HNO_3
	µg/m³		µg/m³			µg/m³	µg/m³	µg/m³		µg/m³	µg/m³
Averaging Period	**1-hr**	**1-yr**	**1-hr**	**24-hr**	**1-yr**	**1-yr**	**24-hr**	**24-hr**	**1-yr**	**1-hr**	**1-hr**
Background	**45.1**	**6.3**	**0.4**	**0.3**	**0.2**	**18.9**	**23.8**	**N/R[4]**	**N/R[4]**	**0.9**	**0.9**
Criteria	**246[1]**	**62[1]**	**571[1]**	**229[1]**	**57[1]**	**90[2]**	**50[1]**	**25[1]**	**8[1]**	**330[2]**	**90[2]**
Searipple Rd (Karratha)	60.1	6.5	1.6	0.6	0.2	19.0	24.9	0.1	1.0	1.0	1.4
Balmoral Rd (Karratha)	55.5	6.5	1.2	0.6	0.2	18.9	24.6	0.0	0.8	1.1	1.2
Dampier	83.9	7.1	6.1	2.1	0.3	19.0	26.4	0.1	2.6	1.2	2.7

	NO_2		SO_2			TSP	PM_{10}	$PM_{2.5}$		NH_3	HNO_3
	µg/m³		µg/m³			µg/m³	µg/m³	µg/m³		µg/m³	µg/m³
Hearson Cove	88.2	8.7	4.8	1.4	0.3	19.2	26.8	0.3	3.0	3.4	4.0
Deep Gorge	94.3	7.6	5.5	1.7	0.3	19.1	26.6	0.2	2.7	2.2	9.0
Maximum	186.2	10.2	13.1	3.9	0.7	19.3	30.2	0.4	6.4	7.0	22.3

Note 1: NEPM Ambient Air criteria
Note 2: Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales.
Note 3: GLC values include background concentrations modelled.
Note 4: N/R = Not Reported

Non-routine operation of the TAN Plant

Modelled emission rates for non-routine operation of the TAN Plant are included in Table 13 and modelled GLCs predicted to occur at receptors during non-routine operation of the plant are included in Table 14. Nitric acid storage tank and power generation emissions are not included in the table as there is no change to emissions from the normal operating conditions modelled scenario.

Modelling predictions for non-routine operations indicated that maximum GLCs could result in an exceedance of the NO_2 one-hour criteria at a range of hills to the south of the premises however, modelling did predict concentrations will not exceed the criteria at any of the sensitive receptors (Table 14). Non-routine operations were expected to occur for up to six non-continuous hours per year but were modelled continuously. Therefore, the potential for coincidence of worst-case atmospheric conditions and non-routine operation of the TAN Plant is considered to be low. Annual criteria were not assessed given non-routine operating conditions only occur for a fraction of the year in response to plant upset and maintenance requirements.

Table 13 Atmospheric emissions characteristic of non-routine operation of the TAN Plant

Source	Stack Height (m)	Stack Diameter (m)	Exist velocity (m/s)	NO_2 (g/s)	TSP (ammonium nitrate) (g/s)	NH_3 (g/s)	N_2O (g/s)
Nitric acid plant	54	1.5	23.2	38		0.101	103.9
Ammonium nitrate plant /TAN prilling tower	70	2	11.9		3.3	1.66	

Note 1: Emissions of ammonium nitrate dust from the prilling tower were assumed as TSP.

Table 14: Predicted ground level concentrations during non-routine operations of the TAN Plant (2012 Updated Modelling)

	NO_2	SO_2		PM_{10}	$PM_{2.5}$	NH_3	HNO_3
	µg/m³	µg/m³		µg/m³	µg/m³	µg/m³	µg/m³
Averaging Period	**1-hr**	**1-hr**	**24-hr**	**24-hr**	**24-hr**	**1-hr**	**1-hr**
Background	**45.1**	**0.4**	**0.3**	**23.8**	**N/R[4]**	**0.9**	**0.9**
Criteria	**246[1]**	**571[1]**	**229[1]**	**50[1]**	**25[1]**	**330[2]**	**90[2]**
Searipple Rd (Karratha)	63.73	1.6	0.6	25.3	0.1	1.6	1.7

	NO_2	SO_2		PM_{10}	$PM_{2.5}$	NH_3	HNO_3
	$\mu g/m^3$	$\mu g/m^3$		$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$
Balmoral Rd (Karratha)	64.33	1.2	0.6	26	0.2	2	1.3
Dampier	89.63	6.1	2.1	26.5	0.9	2.7	3.6
Hearson Cove	154.63	4.8	1.4	32.9	0.3	13.5	2.5
Deep Gorge	130.63	5.5	1.7	27.7	0	7.7	11.1
Maximum	300.03	13.1	3.9	38.5	1.8	31.8	31.6
Criteria	**246[1]**	**523[1]**	**209[1]**	**50[1]**	**25[1]**	**330[2]**	**90[2]**

Note 1: NEPM Ambient Air criteria
Note 2: Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales.
Note 3: GLC values include background concentrations modelled.
Note 4: N/R = Not Reported

6.1.3 Cumulative assessment

Given the proximity, and interconnectedness of the TAN Plant and adjacent Ammonia plant, consideration is given to the cumulative impact of emissions to air from the plants when both are operating under normal operating conditions. The applicant has determined cumulative impacts by assuming that the modelled maximum GLCs for normal operation of each plant, adjusted for the difference between measured and modelled emission rates for the plant, will occur simultaneously at the receptors.

Maximum predicted GLCs from concurrent normal operation of the TAN and Ammonia Plants which were calculated through this method are shown in Table 15. The results shown are the sum of maximum predicted GLCs from 2012 modelling of the TAN Plant (ERM) and from 2015 modelling of the Ammonia Plant (Environ), which were scaled from maximum modelled GLCs based on differences between measured and modelled plant emission rates. The Delegated Officer has noted that the assessment of the cumulative impact of emissions was not consistent with the *Department of Environment Air Quality Modelling Guidance Notes (2006)* in that locations where maximum GLCs are predicted were not identified and the meteorological conditions that gave rise to the predicted maxima were not described.

However, the simultaneous occurrence of maximum predicted GLCs is unlikely to occur as the emission sources from each plant are separated by at least 390 m. Even for times of wind blowing along the axis of those stacks, the emissions from the stack nearest to the wind will already be diluted before the emissions from the next stack interact with the plume. The potential for maximum GLCs to occur from both sources at the same time and at the same location is considered unlikely. As such the Delegated Officer considers the assessment of the cumulative impact of emissions provided by the applicant provides a sufficiently conservative estimate of potential air quality resulting from concurrent normal operation of the TAN and Ammonia Plants.

Table 15: GLC from cumulative emissions at Ammonia Plant and TAN Plant – normal operating conditions (DWER 2018)

Emission	Criteria (µg/m^3)	Averaging period	Deep Gorge	Dampier	Karratha	Hearson Cove	Maximum of criteria (%) excluding background	Background[1]	Maximum of criteria (%) including background
NOx (as NO_2)	246	1-hour	41	29	14	86	35	45	53.3
	61	Annual	0.97	0.42	0.11	2.51	4.1	6.3	14.4
SO_2	520	1-hour	1.56	1.25	0.62	4.37	0.8	0.4	0.9
	226	24-hour	0.31	0.12	0.06	0.94	0.4	0.3	0.5
	56	Annual	0.03	0.01	0.002	0.08	0.1	0.2	0.5
CO	10300	8-hour	49	17	9.4	99	1	N/R	1
NH_3	330	1-hour	14	3.2	1.06	27	8.2	0.9	8.5
	180	Annual	0.37	0.07	0.01	1.48	0.8	N/R	0.8
TSP	90	24-hour	1.21	0.76	0.36	2.85	3.2	18.9	24.2
PM_{10}	50	24-hour	0.60	0.38	0.18	1.42	2.8	23.8	50.4

Note 1: Background figures are taken from the *Burrup Peninsula Technical Ammonium Nitrate Production Facility Air Quality Assessment Update* (ERM 2012).
Note 2: N/R: Not reported. No background concentrations considered

6.1.4 Air quality assessment for 2018 licence amendment

The assessment undertaken for the amendment of licence L7997/2002/11 in 2018 considered the results of emission monitoring conducted during commissioning of the TAN Plant (as presented in the TAN Plant Commissioning Report). The assessment also included an independent review of the commissioning data, air quality modelling and potential human health impacts associated with air emissions from the TAN Plant. DWER engaged Benchmark Toxicology Services (BTS) to undertake the independent peer review. The full independent review is included in Appendix 4 for reference.

A summary of findings from the assessment is included below as taken from the L7997/2002/11 Decision Report (DWER 2018). Due to the shut-down of the TAN Plant for the recovery project in 2018, no further monitoring data was available to update the commissioning monitoring information at the time of this assessment.

- Emission rates for NH_3 and NOx derived from monthly stack testing during commissioning are between 1.2 g/s and 2.2 g/s for NOx, and 0.003 g/s and 0.02 g/s for NH_3. These numbers compare favorably with those assessed at the works approval stage (and as discussed in sections above);
- Statistical analysis of NOx emission rates derived from continuous emission monitoring system (CEMS) time series data, excluding non-operational periods, concludes:
    - Emission rates were 1.48 g/s as the 95th percentile value, and 6.61 g/s as the 99th percentile. The value of 4.2 g/s used in the original modelling study to represent normal operations is between the 98th and 99th percentile, indicating that for this period, the plant was producing lower emissions than those assumed in the previous assessment; and
    - The maximum emission rate was 81 g/s, which is much higher than the maximum emissions used to characterize abnormal operations. There would be potential for short-term elevated GLCs if these concentrations were to occur post commissioning. However, it is noted that these high concentrations occurred in the early commissioning period and were much higher than adjacent readings; the hourly averages were also comparable to the maximum emission rates modelled.
- Statistical analysis of the CEMS data shows that emission rates considered in the original modelling assessment were conservative; and
- Statistical analysis of the time series data shows that higher emissions during abnormal operations are likely to be produced for less than 0.01% of time. Also, the higher emission rates noted are for periods of less than an hour. Modelling scenarios comprised startup emission rates for the entire year, which is the standard and conservative approach to a modelling assessment. This validates the modelling assumptions.
- Nitrogen dioxide emissions from the TAN Plant during normal operations are expected to result in ambient air concentrations below ambient air quality guidelines. This is supported by monitoring data obtained during commissioning and updated air modelling undertaken by ERM in 2012.
- Stack emissions are not an appropriate health risk measure as there is no consideration of dose or exposure.
- The assessment and conclusions of the independent review conducted by BTS were consistent with the assessment of the risk associated with air emissions documented in L7997/2002/11 Decision Report (DWER 2018).

6.1.5 2019 Assessment of Ammonia venting

The plant design includes two primary vents for venting of ammonia to maintain safe operation of the plant during both normal and non-routine operation. Venting from these vents was described in the initial design documentation for the TAN Plant.

The Unit 31/32 vent is located at the ammonium nitrate solution plant /TAN prilling plant and is designed to operate once per day for 10 minutes with a NH_3 design emission rate of 0.2 kg/hr (equates to total emissions of 33 g/day with one 10 minute venting event). The Unit 12 vent is located at the nitric acid plant. The vent is used during start-up only to assist with pressure control and does not have emissions during normal operating conditions. The vent has a NH_3 design emission rate of 2.5 kg/hr with total emissions during a start-up event estimated to be 40 kg.

A review of emissions performance has been undertaken during the TAN Recovery Project which identified that NH_3 venting from Unit 31/32 and Unit 12 vents differs from the design described above. The review found that NH_3 emission rates from Unit 31/32 during normal operations are higher than the design emission rate of 0.2 kg/hr and occur more frequently than the design frequency of once per day.

Ammonia is vented from Unit 31/32 during blowdown of a weak ammonia/water mixture from the ammonia stripper which results in ammonia vapours requiring venting due to the pressure drop which occurs. Blowdown currently occurs two to five times per day and lasts between 5 to 10 minutes duration based on the frequency of draining the ammonia/water mixture from the ammonia evaporators to the ammonia stripper. During a blowdown event NH_3 emissions are initially higher and progressively reduce until the blowdown ceases. In order to minimise NH_3 emissions from the Unit 31/32 vent, the control protocol for ammonia stripping has been revised.

The revised control protocol will maximise stripping of ammonia from the ammonia/water mixture to reduce the amount that is boiled off during blowdown. The strategy involves increasing the ammonia stripper temperature from 50ºC to 90ºC±10ºC. This strategy is anticipated to recover and recycle the majority of NH_3 vented from blowdown of the evaporators and the purge stripper. A trial of the revised strategy demonstrated that the maximum NH_3 emission rate during blowdown events is expected to be 4.5 g/s with emissions expected to be 50 kg/day but could reach a maximum of 115 kg/day depending on the blowdown frequency and water content in ammonia. The applicant has proposed to undertake monitoring of ammonia venting from Unit 31/32 Vent during normal operating conditions to confirm the expected emission rate of 4.5 g/s is accurate.

As venting of NH_3 from the Unit 31/32 Vent is significantly higher than the design rate, YPN undertook revised modelling for NH_3 concentrations based on a discharge rate of 4.5 g/s from the vent. The model predicted GLC of NH_3 at key sensitive receptors are summarised in Table 16.

The modelling indicates that only the modelled maximum 1-hour average GLC at Deep Gorge exceeds the assessment criteria with the second highest, 99.9 and 99.5 percentile 1-hour average GLC all less than 63% of the criteria. The modelled GLCs are based on a conservative calculation of the ammonia emission rate and assume the emission occurs for the full hour, whereas the peak emission rate is predicted to occur for less than 10 minutes for each venting cycle. As such, the actual hourly average GLCs are highly likely to be lower than the maximum modelled prediction.

Table 16 Predicted maximum ammonia GLCs based on revised emission rate for Unit 31/32 venting during normal operations

Averaging period	Criteria ($\mu g/m^3$)[1]	Deep Gorge ($\mu g/m^3$)	Hearson Cove ($\mu g/m^3$)	% Criteria for highest GLC at sensitive receptors
Max 1 hr	330	361	115	109

2nd highest 1 hr	330	207	110	63
99.9 %ile	330	37	52	16
99.5 %ile	330	15	22	7
Annual	180	1	1	0.6

Note 1: Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales.

The review of emissions performance also resulted in development of a modified venting protocol for start-up of the nitric acid plant to reduce start-up emissions. The new protocol results in no venting on NH_3 being required from the Unit 12 vent during start-up events. The revised control protocol involves reducing ammonia flow rates to achieve required pressure control which removes the need for ammonia venting for pressure control. Therefore, it is predicted that there would not be any NH_3 emissions from the Unit 12 Vent during start-up. However, in the event pressure control cannot be achieved through the revised control protocol, some venting of ammonia could still be required to ensure the safety of the plant and personnel. The TAN Plant control system monitors and records NH_3 venting from Unit 12 during start-up through recording of the vent valve position which will remain closed unless venting occurs. No revised modelling of NH_3 emissions associated with start-up and Unit 12 venting was undertaken as the revised start-up protocol will result in reduced NH_3 emissions during non-routine operations.

6.2 Groundwater monitoring

YPN established a network of five groundwater monitoring wells on the premises prior to construction in accordance with the requirements of condition 8 of MS 870. The condition required YPN to undertake detailed hydrogeological studies prior to construction to determine baseline water quality, depth and flow direction, and subsequent use of this information to locate groundwater monitoring wells and establish groundwater monitoring trigger values. The baseline assessment indicated groundwater flow direction to be to the south-east.

A groundwater quality monitoring program was undertaken prior to and throughout the construction and commissioning of the TAN Plant and results were submitted to the DWER in a Commissioning Report in 2017 in accordance with the requirements of Works Approval W4701/2010/1. Water quality monitoring was undertaken at five monitoring wells (two up hydraulic gradient and two down hydraulic gradient of the plant) for metals, anions and cations, hydrocarbons and general water quality parameters on a six-monthly basis from April 2011 to July 2017. The monitoring results showed concentrations of many of the parameters were highly variable across the bores and monitoring period, depicting no consistent trends. Variances in groundwater quality are thought to be due to the natural variability in groundwater chemistry.

An upward trend in nitrogen species concentration commenced in November 2016 at all five monitoring wells. Prior to this nitrogen species were consistently below 10 mg/L. In response to this, amongst other investigative measures, YPN installed an additional upstream monitoring well and eight additional downstream monitoring wells in 2017/18. Trigger values have not yet been established for the new monitoring wells but should align with the requirements of condition 8.4 of MS 870 (10% above baseline contaminant concentrations).

6.3 Noise emissions

An assessment of cumulative measured noise emissions relating to the operation of the TAN Plant and adjacent Ammonia plant was undertaken for the amendment of L7997/2002/11 to include operation of the TAN plant (DWER 2018). Cumulative assessment of noise from the two plants is relevant given their proximity to each other and in order to assess the impact of noise emissions associated with operation of the two plants.

The cumulative assessment was based on the results of noise monitoring undertaken between

30 May 2016 and 17 May 2017 during commissioning of the TAN Plant, when the Ammonia Plant was also operating, and is therefore representative of cumulative emissions.

The monitoring was reviewed by DWER's noise experts who concluded that the TAN Plant and Ammonia Plant are considered contributors to noise levels at Hearson Cove and that it is probable that the TAN Plant is the major contributor as it is closer; however, the noise monitoring information available does not confirm this

The assessment compared ambient noise monitoring results at Hearson Cove to an aspirational target of 45 dB(A) at Hearson Cove based on a recommendation in EPA Bulletin 1077 which was related to an abandoned project. Approximately 62% of results from the monitoring program exceeded the aspirational target and it was estimated that approximately 41% of the exceedances were influenced by external noise sources.

Internal Department advice was sought regarding the relevance of the aspiration goal and the advice confirmed the goal is no longer relevant. The internal advice also recommended that ambient noise levels at Hearson Cove Beach could be minimised by ensuring that all industrial facilities located in proximity incorporate noise attenuation measures on all identified significant noise sources to reduce noise levels, as far as practicable, at their respective plant boundaries to below the 65 dB(A) specified noise level in the *Environment Protection (Noise) Regulations 1997* (EP (Noise) Regulations).

The majority of ambient noise monitoring results at Hearson Cove during the commissioning of the TAN plant were below 65 dB(A). On the few occasions exceedances did occur at Hearson Cove measured noise levels at the TAN Plant boundary were below 65 dB(A) indicating the ambient noise levels at Hearson Cove were influenced by other sources. Monitoring results at the south east boundary of the TAN Plant exceeded 65 dB(A) on one occasion during the monitoring period.

Noise monitoring results indicated the TAN plant nitric acid plant compressor was the primary source of noise that may impact Hearson Cove and subsequently installation of external acoustic insulation to the compressor air inlet duct was undertaken in August 2017.

To monitor performance against the recommended 65 dB(A) boundary noise level, the Existing Licence included a condition requiring quarterly noise monitoring at four locations at the north, east, south and west boundaries of the TAN and Ammonia Plant premises. The results of monitoring undertaken at the licence specified locations are discussed in the risk assessment for noise emission in section 9.8. The recommended 65 dB(A) boundary noise level was also included as a limit within the licence. No exceedances of the limit have been recorded during the monitoring events conducted and all results are more than 5 dB(A) below the specified limit. Due to the operational down time of the TAN and Ammonia plants since monitoring was included in the Existing Licence, limited monitoring records are available, with only one noise monitoring event occurring when both plants were operating.

6.3.1 Key Findings

Key findings: The Delegated Officer has considered information relating to noise emissions and has found:

1. the TAN Plant and adjacent Ammonia Plant are major contributors to noise levels at Hearson Cove, a popular recreational area for residents of Karratha and Dampier. Cumulative noise resulting from concurrent operation of the two plants will therefore be considered in the risk assessment;
2. ensuring industrial facilities in proximity of Hearson Cove achieve noise levels below 65 dB(A) will minimise the likelihood of ambient noise impacting on amenity at this location;
3. the Existing Licence conditions require noise monitoring and compliance with a

65 dB(A) limit at the Premises boundary; and

4. to date, outside the commissioning period for the TAN Plant, only one monitoring event has occurred when the TAN and adjacent Ammonia Plant were operating concurrently.

7. Consultation

The application for a licence was made available for public comment on DWER's website on 13 November 2019 and was advertised in *The West Australian* on 18 November 2019.

Eight direct interest stakeholders were notified of the application including the City of Karratha, Department of Biodiversity, Conservation and Attractions, Department of Mines, Industry Regulation and Safety, Water Corporation, Friends of Australian Rock Art, Hon. Robin Chapple MLA, Murujuga Aboriginal Corporation, and Dr John Black.

Submissions closed on 5 December 2019. Eight public submissions were received by DWER regarding the application. A summary of the public submissions and stakeholder comments is included in Appendix 3.

8. Location and siting

8.1 Siting context

The TAN Plant is located 11 km northwest of Karratha on the Burrup Peninsula within the Burrup Strategic Industrial Area, a heavy industrial estate. Non-industrial land to the north and south of the premises form part of the Murujuga National Park (and the Dampier Archipelago National Heritage Listed Place), which is recognised for its cultural significance and ecological and biological diversity. Other industrial premises immediately adjacent to the TAN Plant include the YPF Ammonia plant and a desalination plant (not operational) owned by the Water Corporation. Other major industrial premises are located within the Burrup Strategic Industrial Area.

8.2 Residential and sensitive receptors

The distances to residential and sensitive receptors are detailed in Table 17.

Table 17: Receptors and distance from activity boundary

Residential, industrial and sensitive premises	Distance from the premises
Hearson Cove beach (recreational area) (zoned conservation recreation and natural/landscapes City of Karratha Planning Scheme No.8)	550 m south east
Deep Gorge (recreational area) (zoned conservation recreation and natural/landscapes City of Karratha Planning Scheme No.8)	1,200 m south
Industrial receptor – Pilbara Port Authority lease area (multiple users) including ammonia loading facilities (zoned strategic industry City of Karratha Planning Scheme No.8)	1,800 m west
Industrial receptor – Pluto LNG Project (zoned strategic industry City of Karratha Planning Scheme No.8)	1,600 m north west

Residential, industrial and sensitive premises	Distance from the premises
Industrial receptor – Karratha Gas Plant (zoned strategic industry City of Karratha Planning Scheme No.8)	2,500 m north west
Industrial receptor – Parker Point Iron Ore Port (zoned strategic industry City of Karratha Planning Scheme No.8)	4,800 m south west
Residential Premises – Dampier townsite	7.5 km south west
Residential Premises – Karratha townsite	11.3 km south-south east

8.3 Specified ecosystems

Specified ecosystems are areas of high conservation value and special significance that may be impacted as a result of activities at, or Emissions and Discharges from the Premises. The distances to specified ecosystems are shown in Table 18. Table 18 also identifies the distances to other relevant ecosystem values which do not fit the definition of a specified ecosystem.

The table has also been modified to align with the *Guidance Statement: Environmental Siting.*

Table 18: Environmental values

Specified ecosystems	Distance from the Premises
Parks and Wildlife Managed Lands and Waters	Murujuga National Park - Borders Lot 3017 to the east, 350 m from the boundary of the TAN Plant to the north and 800 m to the south. Deep Gorge, a popular site frequented by tourists containing rock art, is located 1.2 km south (measured from the Contaminated Water Ponds to the Deep Gorge car park).
Threatened Ecological Communities and Priority Ecological Communities	Several priority ecological communities have been identified in the area. Priority 1 ecological communities exist within 5 km of the TAN Plant including the Burrup Peninsula rock pool and rock piles communities. The Burrup Peninsula rock pile communities consist of short-range endemic land snails.
Biological component	**Distance from the Premises**
Threatened/Priority Flora	No threatened or priority flora have been identified on the premises.
Threatened/Priority Fauna	State and Commonwealth listed threatened species of fauna have been identified within a 10 km radius of the Premises. Twenty four migratory species have also been identified. Most threatened species within the area include marine animals which may use areas off Hearson Cove for feeding, breeding, nesting or resting (EPBC Referral, 2008).
Other relevant ecosystem values	**Distance from the Premises**
King Bay – mangroves and marine ecosystem	A supratidal flat is located directly adjacent to the premises boundary to the south and east. Mangrove community is located 600 m east. The waters of King Bay are afforded a high level of ecological protection with the exception of a one hectare area surrounding the MUBRL outfall, where industry

Specified ecosystems	Distance from the Premises
	discharges occur in King Bay and the surrounding Mermaid Sound. These areas have been afforded a low level of ecological protection and moderate level of ecological protection respectively (DoE 2006b).
Hearson Cove – marine tidal ecosystem	800 m south east
National Heritage Listed place – Dampier Archipelago (including the Burrup Peninsula) (ID 105727)	The Dampier Archipelago including the Burrup Peninsula is listed on the National Heritage List due to the presence of rock engravings and other Aboriginal heritage sites such as stone arrangements. The nearest rock art is within 100 m of the premises.

8.4 Groundwater and water sources

The distances to groundwater and water sources are shown in Table 19.

Table 19: Groundwater and water sources

Groundwater and water sources	Distance from Premises	Environmental value
Surface water (supra-tidal flat between King Bay and Hearson Cove)	The supra-tidal flat between King Bay and Hearson Cove is subject to flooding from storm surge events. A 1:100 year storm is expected to result in a storm surge of 5 mAHD. The premises is elevated to protect against storm surge.	Supra-tidal flats which connect to King Bay. Mangrove community located 600 m east of the boundary of the TAN Plant.
Groundwater	Depth to groundwater at the premises is generally shallow and follows surface topography ranging from 0.5 and 8 metres below ground level. Depth to groundwater decreases towards the tidal flat. Variation is driven by tidal variation and rainfall. Groundwater flow is in a southerly to east south easterly direction toward the supratidal flats. The TAN Plant is located within the Pilbara Groundwater Area and Pilbara Surface Water Area (proclaimed under the *Rights in Water Irrigation Act 1914*).	Groundwater is located predominantly in fractured rock aquifers. The upper aquifer in this region is the low permeability, unconfined Pilbara Fractured Rock Aquifer. Groundwater recharge occurs when rainfall events infiltrate the fractured surface rock or from surface water flows. Water is not used for potable or industrial use. Groundwater monitoring indicates that groundwater salinities follow topographical gradients. Salinity is brackish (1,000 mg/L) in the north and increases towards the tidal flats (>40,000mg/L). Groundwater flows towards the supra-tidal flats which connect to King Bay. A mangrove community is located 600 m east of the premises boundary.

8.5 Soil type

The Premises is partially located within a supra-tidal salt flat that forms an east-west trending valley at approximately 4 mAHD that divides the Burrup Peninsula into two separate units from King Bay in the west to Hearson Cove in the east. The invert of this valley is comprised of marine

sediment. Soils in the area are generally alkaline due to high carbonate content originating from marine sands and underlying calcrete bedrock (SKM 2001). In and around the Premises, the landform includes hill slopes, occasional small rock outcrops (Gidley Granophyre), and tidal flats.

The TAN Plant has been constructed at the toe of a hilly landscape with the northern portion of the premises cut during construction to use as fill for the southern part of the premises.

The general soil stratigraphy of the premises is as follows:

- silty or clayey sand: red brown, fine to medium grained, sub angular sand, poorly sorted with gravel being more frequent in the northern area of the Site and occasional cobbles being present, extending from between 0.5 m and 4.0 m; and
- granophyre: pale grey, generally weathered with rock becoming fresher and less fractured with depth extending to the maximum depth of 5.0 m with dolerite intrusions.

Table 20 details soil types and characteristics relevant to the assessment.

Table 20: Soil and sub-soil characteristics

Groundwater and water sources	Distance from Premises
Acid sulfate soil (ASS) risk	Located within an area of high to moderate and moderate to low risk of ASS within 3 m of the surface

8.6 Meteorology

8.6.1 Wind direction and strength

Wind roses generated using meteorological data from Karratha Airport are presented below.

Figure 3 shows the annual wind rose based on the five year average annual wind direction and strength.

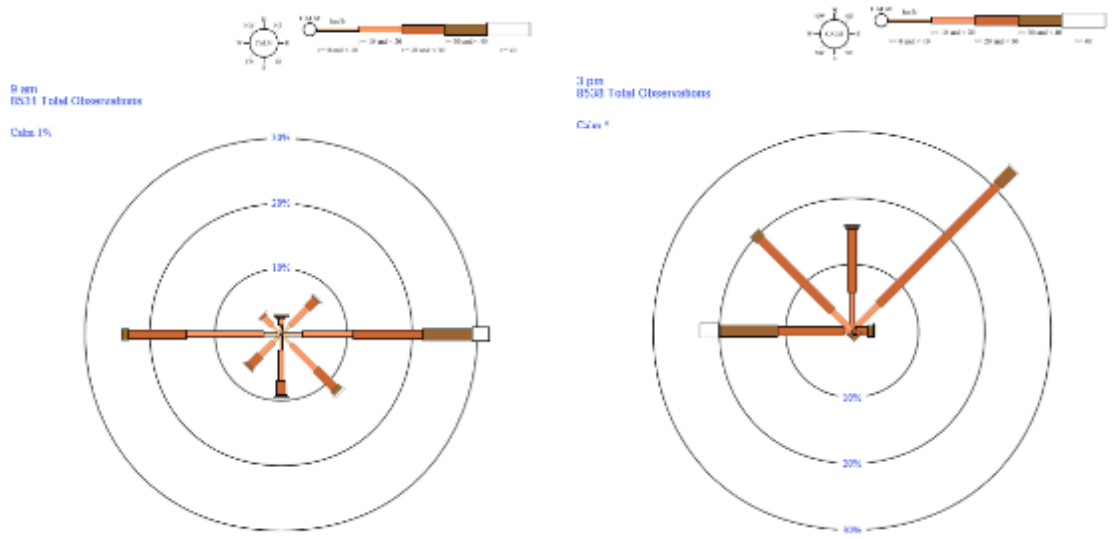

Figure 3. Wind Rose, Karratha Airport based annual average

(Sourced from www.bom.gov.au on 19 February 2020)

As shown in Figure 3, the predominant wind direction is from the west indicative of onshore coastal breezes. During summer and spring, winds are typically from the west but are predominantly from the east and north east in winter. Autumn is characterised by variable winds

from all directions.

The highest wind speeds are associated with winds from the west and west-northwest. Lowest speeds are associated with winds from southerly directions and mostly occur during the night and early morning.

On average, two cyclones cross the Pilbara coast per year in summer. During cyclones, damaging winds, heavy swells and torrential rain causing flooding can be experienced. It is important to note that this wind rose shows historical wind speed and wind direction data at the Karratha Airport weather station and should not be used to predict future data.

8.6.2 Rainfall and temperature

The climate experienced at the Premises is typical of the Pilbara, being fine and warm from May to November with low rainfall. The summers are typically hot with periodic rainfall heavy during cyclonic conditions from December to March, with warmer winds from the northwest and southwest.

The nearest Bureau of Meteorology climate station to the project area is at Karratha airport (approximately 9 km south of the premises). Mean monthly maximum temperatures at Karratha range from 36.2 °C in March to 26.24 °C in July and mean minimum temperatures range from 26.9 °C in January to 13.8 °C in July. Mean monthly rainfalls vary from 0.4 mm in October to 75.4 mm in February. Mean annual rainfall is 292.4 mm. Annual evaporation is approximately 3,200 mm.

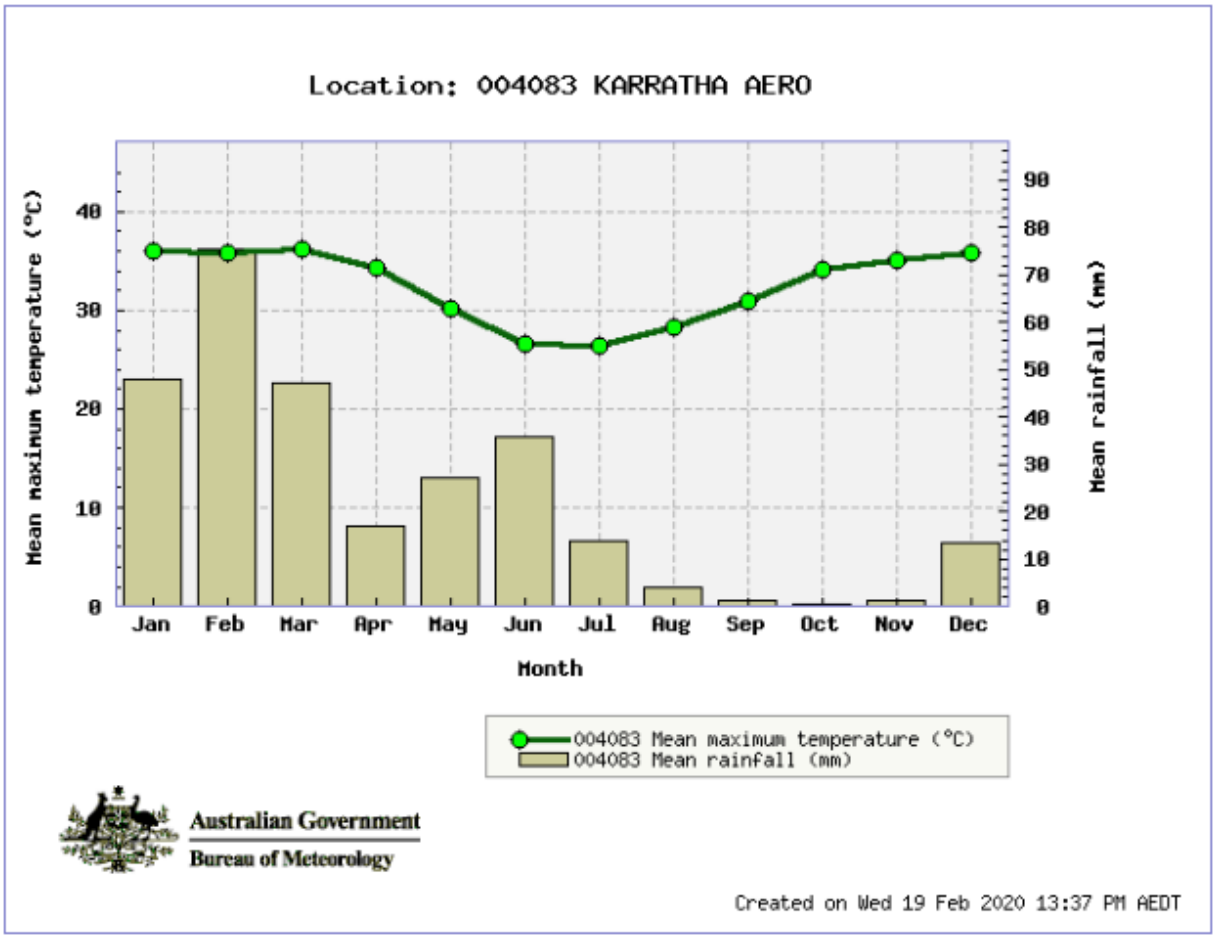

Figure 4. Mean temperature and rainfall at Karratha airport

9. Risk assessment

9.1 Determination of emission, pathway and receptor

In undertaking its risk assessment, DWER will identify all potential emissions pathways and potential receptors to establish whether there is a Risk Event which requires detailed risk assessment.

To establish a Risk Event there must be an emission, a receptor which may be exposed to that emission through an identified actual or likely pathway, and a potential adverse effect to the receptor from exposure to that emission. Where there is no actual or likely pathway and/or no receptor, the emission will be screened out and will not be considered as a Risk Event. In addition, where an emission has an actual or likely pathway and a receptor which may be adversely impacted, but that emission is regulated through other mechanisms such as Part IV of the EP Act, that emission will not be risk assessed further and will be screened out through Table 21 and Table 22.

The identification of the sources, pathways and receptors to determine Risk Events are set out in Table 21 and Table 22 below.

Table 21: Identification of emissions, pathway and receptors during normal operation of the TAN Plant

Risk Events (normal operations)						Continue to detailed risk assessment	Reasoning
Activities/Sources		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
Normal operation of the TAN Plant (comprising a Nitric acid plant, Ammonium nitrate solution plant and TAN prilling plant)	Nitric acid plant • Tail gas from nitric acid plant stack tail gas • Nitric acid storage tank vents (A and B)	Point source emissions to air • NH_3, NO_x (as NO_2), N_2O	Hearson Cove (600 m south east) and Deep Gorge (1.2 km south) - recreational areas. Residential areas at Dampier (7.5 km south west) and Karratha (11.3 km south-south east). Industrial workforce at King Bay Industrial Estate, Pilbara Port Authority (1.8 km west) and Woodside facilities (1.8 km north	Air/ wind dispersion	Public health and amenity impacts	Yes	See detailed risk assessment in section 9.4 Note: SO_2 emissions will occur; however these are not expected to be significant when compared to assessment criteria (<1%). Therefore emissions of SO_2 have not been considered further.
	Ammonium nitrate solution plant and TAN prilling plant (via common stack)	Point source emissions to air • NH_3, PM (ammonium nitrate)					

Risk Events (normal operations)						Continue to detailed risk assessment	Reasoning
Activities/Sources		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
	Unit 31/32 Vent	Point source emissions • NH_3	west).				
	Nitric acid plant stack, Nitric acid storage tank vents, Common stack, Unit 31/32 vent	Point source emissions to air: • NH_3, NO_x (as NO_2), N_2O, PM (ammonium nitrate)	National Heritage Listed place – Dampier Archipelago (closest rock art engravings are 100 m from the premises)		Acceleration of natural weathering/ alteration/ degradation of the rock art	No	The Delegated Officer has determined that the regulatory framework described in section 5.3 is appropriate for assessing and managing potential impacts to rock art as there are multiple industries located on Murujuga and surrounds which could potentially impact rock art, therefore a coordinated approach is most appropriate. The Murujuga Rock Art Strategy establishes the long term basis for coordinated monitoring and analysis of changes to rock art on Murujuga and, if appropriate, implementation of management or mitigation measures. Information from the monitoring will be used to determine whether further regulation of emissions from industries operating on Murujuga and surrounds is required.

Risk Events (normal operations)						Continue to detailed risk assessment	Reasoning
Activities/Sources		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
	Operating equipment within the premises including operating plant and ancillary equipment, vehicles, and generators, fans, pumps and compressors	Noise	Hearson Cove (600 m south east) and Deep Gorge (1.2 km south) - recreational areas. Residential areas at Dampier (7.5 km south west) and Karratha (11.3 km south-south east). Industrial workforce at King Bay Industrial Estate, Pilbara Port Authority (1.8 km west) and Woodside facilities (1.8 km north west).	Air/ wind dispersion	Public health and amenity impacts	Yes	See detailed risk assessment in section 9.8
	Operating light sources within the TAN Plant during night time operation	Light	Hearson Cove (600 m south east) and Deep Gorge (1.2 km south) - recreational areas. Terrestrial species including reptiles, amphibians, birds and mammals present in surrounding areas	Air	Amenity impact Disruption and disorientation of terrestrial species active at night	No	The Delegated Officer has determined that light emissions during operation are not likely to cause impact to the amenity of receptors, or have a significant impact on terrestrial species in the surrounding area considering the location and presence of other industrial premises in the vicinity.

Risk Events (normal operations)						Continue to detailed risk assessment	Reasoning
Activities/Sources		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
Storage and handling of TAN prills	• TAN prilling plant • Bulk TAN storage building • TAN bagging facility • Bulk truck loading system • Off-spec storage and treatment area	Fugitive emissions to air • PM (ammonium nitrate)	Hearson Cove (600 m south east) and Deep Gorge (1.2 km south) - recreational areas. Residential areas at Dampier (7.5 km south west) and Karratha (11.3 km south-south east). Industrial workforce at King Bay Industrial Estate, Pilbara Port Authority (1.8 km west) and Woodside facilities (1.8 km north west).	Air/ wind dispersion	Public health and amenity impacts	Yes	See detailed risk assessment in section 9.6

Risk Events (normal operations)						Continue to detailed risk assessment	Reasoning
Activities/Sources		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
			National Heritage Listed place – Dampier Archipelago (closest rock art engravings are 100 m from the premises)		Acceleration of natural weathering/ alteration/ degradation of the rock art	No	The Delegated Officer has determined that the regulatory framework described in section 5.3 is appropriate for assessing and managing potential impacts to rock art as there are multiple industries located on Murujuga and surrounds which could potentially impact rock art, therefore a coordinated approach is most appropriate. The Murujuga Rock Art Strategy establishes the long term basis for coordinated monitoring and analysis of changes to rock art on Murujuga and, if appropriate, implementation of management or mitigation measures. Information from the monitoring will be used to determine whether further regulation of emissions from industries operating on Murujuga and surrounds is required.
		Contaminated stormwater or flushing water runoff (elevated nitrates and suspended solids)	Groundwater (0.5-8 mbgl) and dependent ecosystems	Direct discharge to land and infiltration to groundwater	Groundwater contamination	Yes	Contaminated runoff from the TAN prill storage and handling areas may lead to emissions to land and the marine environment. See detailed risk assessment in section 9.7.
			Tidal flats immediately south and east of the premises which connect to a mangrove community (600 m east) and King Bay (west)	Overland flow to tidal flats and connected mangrove community and King Bay	Degradation of ecosystem health (mangroves and King Bay) and degradation of marine water quality		

Risk Events (normal operations)						Continue to detailed risk assessment	Reasoning
Activities/Sources		**Potential emissions**	**Potential receptors**	**Potential pathway**	**Potential adverse impacts**		
Contaminated water management	Contaminated water storage in ponds 4 and 5 The contaminated water ponds receive: • Contaminated stormwater from process areas; • Flushing water from process areas; • Air condensate for instrument air; • Mixed bed regeneration; and • Rejected clean process condensates.	Stormwater and wastewater potentially containing elevated: • suspended solids • hydrocarbons • nutrients (nitrates)	Groundwater (0.5-8 mbgl) and dependent ecosystems	Direct discharge to land and infiltration to groundwater	Groundwater contamination	Yes	Loss of containment of contaminated water may lead to emissions to land and the marine environment. See detailed risk assessment in section 9.7.
	Contaminated stormwater runoff from plant areas.						
	Contingency storage of contaminated water in ponds 1 and 2		Tidal flats immediately south and east of the premises which connect to a	Overland flow to tidal flats and connected mangrove	Degradation of ecosystem health (mangroves and King Bay) and degradation of		

Risk Events (normal operations)						Continue to detailed risk assessment	Reasoning
Activities/Sources		**Potential emissions**	**Potential receptors**	**Potential pathway**	**Potential adverse impacts**		
Sewage treatment and disposal	• ATUs • Sewage effluent ponds 3 and 6	Treated wastewater containing elevated nutrients (TN and TP), BOD, TSS and and E.coli.	mangrove community (600 m east) and King Bay (west)	community and King Bay	marine water quality		
		Odour	Hearson Cove (1.2 km south east) and Deep Gorge (1 km south) - recreational areas	Air / wind dispersion	Public amenity impacts	No	The Delegated Officer has determined that odour emissions arising from evaporation of treated effluent are not likely to impact public amenity due to the distance to the nearest receptors.
Storage and handling of environmentally hazardous substances	Two nitric acid storage tanks with a total capacity of 3000 m^3	Nitric acid	Groundwater (0.5-8 mbgl) and dependent ecosystems	Direct discharge to land and infiltration to groundwater	Groundwater contamination	Yes	Loss of containment of hazardous substances or wastes may lead to emissions to land and the marine environment. See detailed risk assessment in section 9.7.
	Ammonium nitrate solution tank (500 tonnes)	Ammonium nitrate solution					
	Diesel storage (approximately 70 m^3)	Hydrocarbons	Tidal flats immediately south and east of the premises which connect to a mangrove community (600 m east) and King Bay (west)	Overland flow to tidal flats and connected mangrove community and King Bay	Degradation of ecosystem health (mangroves and King Bay) and degradation of marine water quality		
	Ammonia delivery pipeline	Ammonia					

Risk Events (normal operations)						Continue to detailed risk assessment	Reasoning
Activities/Sources		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
Solid waste management	TAN prill processing activities generating: • components of off-spec prills, specifically organic matter, which cannot be recycled (120 kg/day);	TAN (soluble nitrates) Heavy metals Hydrocarbons	Groundwater (0.5-8 mbgl) and dependent ecosystems	Direct discharge to land and infiltration to groundwater	Groundwater contamination		

Risk Events (normal operations)						Continue to detailed risk assessment	Reasoning
Activities/Sources		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
	• catalysts from the nitric acid plant; • heat exchanger and nitric acid process equipment sludges • oil residue and sludge from ammonia stripper; • sludge from contaminated stormwater ponds; and • Domestic waste & Commercial Waste comprising recyclable, organic and residual materials.		Tidal flats immediately south and east of the premises which connect to a mangrove community (600 m east) and King Bay (west)	Overland flow to tidal flats and connected mangrove community and King Bay	Degradation of ecosystem health (mangroves and King Bay) and degradation of marine water quality		

Risk Events (normal operations)						Continue to detailed risk assessment	Reasoning
Activities/Sources		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
Power generation	Electricity (up to 8.5 MWh) is supplied from the adjacent Ammonia Plant or generated onsite using process steam from the nitric acid plant (3.5 MWh)	NA	NA	NA	NA	No	Electricity for the premises operation is provided by power generation infrastructure at the adjacent Ammonia Plant, or is generated from steam from the nitric acid plant onsite (emissions associated with operation of the nitric acid plant have been assessed and detailed earlier in this table). Therefore, the Delegated Officer has determined that there are no additional emissions associated with power generated from the nitric acid plant requiring assessment and that power generation occurring on the adjacent Ammonia Plant premises has been subject to risk assessment and associated regulation for the Ammonia Plant Licence L9224/2019/1.

Table 22: Identification of emissions, pathway and receptors - TAN Plant start-up, shutdown and upset conditions

Risk Events (non-routine operation - startup, shutdown and upset conditions)						Continue to detailed risk assessment	Reasoning
Activities/Sources		**Potential emissions**	**Potential receptors**	**Potential pathway**	**Potential adverse impacts**		
Start-up and shut-down of the TAN Plant	Unit 12 vent	Point source emissions to air • NH_3,	Hearson Cove (600 m south east) and Deep Gorge (1.2 km south) - recreational areas. Residential areas at Dampier (7.5 km south west) and Karratha (11.3 km south-south east). Industrial workforce at King Bay Industrial Estate, Pilbara Port Authority (1.8 km west) and Woodside facilities (1.8 km north west).	Air/ wind dispersion	Public health and amenity impacts	Yes	See detailed risk assessment in section 9.5
	Tail gas from nitric acid plant stack tail gas	Point source emissions to air NH_3, NO_x (as NO_2), N_2O					
	Ammonium nitrate solution plant and TAN prilling plant (via common stack)	Point source emissions to air NH_3, PM (ammonium nitrate)					

Risk Events (non-routine operation - startup, shutdown and upset conditions)						Continue to detailed risk assessment	Reasoning
Activities/Sources		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
	Nitric acid plant stack, Common stack, Unit 12 vent	Point source emissions to air: NH_3, NO_x (as NO_2), N_2O, PM (ammonium nitrate)	National Heritage Listed place – Dampier Archipelago (closest rock art engravings are 100 m from the premises)		Acceleration of natural weathering/ alteration/ degradation of the rock art	No	The Delegated Officer has determined that the regulatory framework described in section 5.3 is appropriate for assessing and managing potential impacts to rock art as there are multiple industries located on Murujuga and surrounds which could potentially impact rock art, therefore a coordinated approach is most appropriate. The Murujuga Rock Art Strategy establishes the long term basis for coordinated monitoring and analysis of changes to rock art on Murujuga and, if appropriate, implementation of management or mitigation measures. Information from the monitoring will be used to determine whether further regulation of emissions from industries operating on Murujuga and surrounds is required.

9.2 Consequence and likelihood of risk events

A risk rating will be determined for risk events in accordance with the risk rating matrix set out in Table 23 below.

Table 23: Risk rating matrix

Likelihood	Consequence				
	Slight	Minor	Moderate	Major	Severe
Almost certain	Medium	High	High	Extreme	Extreme
Likely	Medium	Medium	High	High	Extreme
Possible	Low	Medium	Medium	High	Extreme
Unlikely	Low	Medium	Medium	Medium	High
Rare	Low	Low	Medium	Medium	High

DWER will undertake an assessment of the consequence and likelihood of the Risk Event in accordance with Table 24 below.

Table 24: Risk criteria table

Likelihood		Consequence		
The following criteria has been used to determine the likelihood of the Risk Event occurring.		**The following criteria has been used to determine the consequences of a Risk Event occurring:**		
			Environment	**Public health* and amenity (such as air and water quality, noise, and odour)**
Almost Certain	The risk event is expected to occur in most circumstances	Severe	• **onsite impacts**: catastrophic • **offsite impacts local scale**: high level or above • **offsite impacts wider scale:** mid-level or above • Mid to long-term or permanent impact to an area of high conservation value or special significance^ • Specific Consequence Criteria (for environment) are significantly exceeded	• Loss of life • **Adverse health effects:** high level or ongoing medical treatment • Specific Consequence Criteria (for public health) are significantly exceeded • **Local scale impacts:** permanent loss of amenity
Likely	The risk event will probably occur in most circumstances	Major	• **onsite impacts**: high level • **offsite impacts local scale**: mid-level • **offsite impacts wider scale**: low level • Short-term impact to an area of high conservation value or special significance^ • Specific Consequence Criteria (for environment) are exceeded	• **Adverse health effects:** mid-level or frequent medical treatment • Specific Consequence Criteria (for public health) are exceeded • **Local scale impacts**: high level impact to amenity
Possible	The risk event could occur at some time	Moderate	• **onsite impacts**: mid-level • **offsite impacts local scale**: low level • **offsite impacts wider scale**: minimal • Specific Consequence Criteria (for environment) are at risk of not being met	• **Adverse health effects:** low level or occasional medical treatment • Specific Consequence Criteria (for public health) are at risk of not being met • **Local scale impacts:** mid-level impact to amenity
Unlikely	The risk event will probably not occur in most circumstances	Minor	• **onsite impacts**: low level • **offsite impacts local scale**: minimal • **offsite impacts wider scale**: not detectable • Specific Consequence Criteria (for environment) likely to be met	• Specific Consequence Criteria (for public health) are likely to be met • **Local scale impacts:** low level impact to amenity
Rare	The risk event may only occur in exceptional circumstances	Slight	• **onsite impact**: minimal • Specific Consequence Criteria (for environment) met	• **Local scale**: minimal to amenity • Specific Consequence Criteria (for public health) met

^ Determination of areas of high conservation value or special significance should be informed by the *Guidance Statement: Environmental Siting.*

* In applying public health criteria, DWER may have regard to the Department of Health's *Health Risk Assessment (Scoping) Guidelines.*
"onsite**"** means within the Prescribed Premises boundary.

9.3 Acceptability and treatment of Risk Event

DWER will determine the acceptability and treatment of Risk Events in accordance with the Risk treatment Table 25 below:

Table 25: Risk treatment table

Rating of Risk Event	Acceptability	Treatment
Extreme	Unacceptable.	Risk Event will not be tolerated. DWER may refuse application.
High	May be acceptable. Subject to multiple regulatory controls.	Risk Event may be tolerated and may be subject to multiple regulatory controls. This may include both outcome-based and management conditions.
Medium	Acceptable, generally subject to regulatory controls.	Risk Event is tolerable and is likely to be subject to some regulatory controls. A preference for outcome-based conditions where practical and appropriate will be applied.
Low	Acceptable, generally not controlled.	Risk Event is acceptable and will generally not be subject to regulatory controls.

9.4 Risk Assessment – point source emissions to air during normal operation of the TAN Plant

9.4.1 Description of point source emissions to air during normal operation of the TAN Plant risk event

Key point source air emissions from the TAN Plant during normal operation include NH_3 and particulate matter (PM) (ammonium nitrate) from the common stack, and NOx (as NO_2 and N_2O) and NH_3 from the nitric acid plant stack. Minor amounts of NOx are also emitted from the nitric acid storage tank vents. Ammonia is intermittently vented from the Unit 31/32 Vent of the TAN prilling plant during normal operation.

Emissions from the stacks and vents are transported through the atmosphere via dispersion and can impact on air quality potentially causing adverse health impact to nearby sensitive receptors.

9.4.2 Identification and general characterisation of emission

Nitric acid is produced from raw materials of ammonia and oxygen within the nitric acid plant. The process produces a tail gas comprising mainly NOx which is mixed with NH_3 gas in a catalytic abatement reactor to reduce NOx to nitrogen and water. Some NOx and minor emissions of N_2O remain in the cleaned tail gas and are discharged to the atmosphere via the nitric acid plant stack during normal plant operation.

Ammonium nitrate and TAN prills are produced from raw materials of nitric acid and ammonia within the ammonium nitrate solution plant and TAN prilling plant, respectively. The ammonium nitrate production process occurs in a pressure reactor and therefore does not produce

emissions. During the prilling process, some NH_3 and ammonium nitrate (as fine particles) become entrained in the air. Exhaust air from the prill tower undergoes a three stage scrubbing process (refer to section 9.4.5 for further details) to reduce the majority of entrained NH_3 and ammonium nitrate particulate. Minor amounts of remaining NH_3 and ammonium nitrate particulates are discharged to air from the Common Stack.

Stack sampling was conducted during commissioning of the TAN Plant. A summary of the monitoring data, as reported in the TAN Plant Commissioning Report dated 29 September 2017, is included in Table 26 below. All monitored emission rates are lower than those included in the 2012 modelling assessment of the impact of emissions from normal operation of the plant (refer to Table 11).

Table 26: Identification and general characterisation of emission during normal operating conditions

Emissions	Nitric acid plant stack limits (mg/m^3)	Nitric acid stack measured concentrations		Common stack limits (mg/m^3)	Common stack measured concentrations	
		mg/m^3	g/s		mg/m^3	g/s
NOx as NO_2	103	50-92	1.2-2.2	NA		
NH_3	0.75	<0.1-0.68	<0.003-0.02	10	<0.6-3.6	<0.021-0.13
N_2O	196	15-25	0.67-1.1	NA		
PM	NA			15	2.4-3.7	0.087-0.12

Model predicted maximum GLCs resulting from normal operation of the TAN Plant are discussed in section 6.1.2 (Table 12). Cumulative predicted GLCs associated with normal operation of both the TAN and Ammonia plants are also discussed in section 6.1.3 (Table 15).

The modelling results indicate GLC at sensitive receptors are not predicted to exceed the ambient air quality criteria during normal operation of the TAN Plant or when the TAN Plant and adjacent Ammonia Plant are operating concurrently under normal operating conditions.

As described in section 6.1.5, NH_3 venting occurs from the Unit 31/32 Vent on the ammonium nitrate solution plant /TAN prilling plant during blowdown of a weak ammonia/water mixture from the ammonia stripper. Venting occurs a number of times per day (up to 5) for a period of 5-10 minutes at an estimated rated of 4.5g/s. The venting rate slows over the period of the blowdown event.

Due to operational venting rates being higher than were predicted during the initial design and modelling of the plant, separate modelling was undertaken in 2019 to predict maximum NH_3 GLC resulting from venting from Unit 31/32. The modelling results (as presented in Table 16) predict the ambient air quality criteria for NH_3 could potentially be exceeded in the worst modelled case at Deep Gorge although modelling was inherently conservative so this scenario is not likely to occur.

The Existing Licence includes discharge limits for normal operations (Table 27) which are considered to represent best practice stack emission concentration limits.

Table 27: Discharge to air limits

Discharge point	Emission	Limit (mg/m^3)
Common stack	PM	15
	NH_3	10
Nitric acid plant stack	NO_x (as NO_2)	103

	NH_3	0.75
	N_2O	196

9.4.3 Description of potential adverse impact from the emission

There is potential for air emissions associated with normal operation of the TAN Plant to impact on ambient air quality and to cause environmental and public health impacts through dispersion in air. The potential adverse health impacts from exposure to point source air emissions from the TAN Plant are described below.

Nitrogen oxides

Both short-term exposure and long-term exposure to increased levels of NOx may cause respiratory irritation and associated effects. The short-term effects of NOx are mainly associated with the respiratory system, generally in combination with other pollutants such as irritant gases and particulates. The effects include wheezing, cough, sputum production in asthmatics and people with chronic inflammatory lung disease. At higher concentrations it can contribute to illness (morbidity) and mortality of especially sensitive sub groups, such as children, asthmatics and people with chronic lung disease such as chronic bronchitis. NO_2 can also react with VOCs in the presence of sunlight to form photochemical smog. NO_2 has an odour and is an acidic gas which can contribute to acid rain.

Particulate Matter (ammonium nitrate)

Particulate matter has the potential to impact human health as it can affect the respiratory and cardiovascular systems following both long and short-term exposures. Long term repeated exposure to fugitive dust is more detrimental than short term sporadic exposure. The most severe effects being reduced life expectancy due to long-term exposures. PM_{10} and $PM_{2.5}$ pose greater health risks as they may be drawn deep into the lungs, while larger particles are typically trapped on the nose, mouth or throat. In addition to particle size, the health impacts of particulate matter are influenced by the chemical composition of the particles, mass concentration of airborne particles and duration of exposure.

Particulate matter emitted from the TAN Plant process is assumed to mainly comprise of ammonium nitrate particulates and some coating materials. Elevated concentrations of ammonium nitrate can cause impacts including headache, dizziness, and eye and skin irritation.

Ammonia

Ammonia is a colourless gas that has an intense and irritating odour (detectable at levels as low as 5 ppm), and is corrosive. Potential health impacts associated with exposure include irritation to eyes, the throat and nose at low concentrations of 5-25 ppm. Higher concentrations may cause severe irritation and breathing difficulty and overexposure can be fatal (>1,000 ppm).

9.4.4 Criteria for assessment

The NEPM sets ambient air quality standards for NO_2 and PM for the protection of human health and well-being. These standards are outlined in Table 28. The NEPM criteria are considered by the Delegated Officer to be relevant to the assessment of risk to public health and therefore apply to human receptors located outside the premises.

Table 28: NEPM (Ambient Air) assessment criteria

Pollutant	Averaging period	Maximum concentration		Goal (maximum allowable exceedances)
		ppb	µg/m^3	
NO_2	1-hour	120	246	1 day a year
	Annual	30	62	None
Particulates as PM_{10}	24-hours	-	50	Exceptional events (as per NEPM)
	Annual	-	25	None
Particulates as PM2.5	24-hours	-	25	Exceptional events (as per NEPM)
	Annual	-	8	None
[1]NH_3	1-hour	460	330	NA

Note 1: In the absence of a NEPM criteria for NH_3, criteria has been taken from the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*

9.4.5 Applicant controls

Specific engineering and management controls adopted by the applicant for the TAN Plant, and considered by the Delegated Officer are summarised in Table 29.

Table 29: Applicant's engineering and management controls for point source air emissions

Infrastructure	Engineering/ Management controls
Nitric acid plant	Dual pressure process plant design 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 emission abatement system to achieve lower NOx concentration in tail gas.
	Designed to recover waste heat from the exothermic process which is recycled through the steam system which reuses steam to generate electric power therefore minimising emissions from the adjacent Ammonia Plant which supplies power to the premises.
	NOx, NH_3 and N_2O stack emissions from the nitric acid plant stack are monitored using CEMS and annual verification testing.
Ammonium nitrate solution plant	Uses pressure reactor technology and is designed to produce no emissions to the atmosphere.

Infrastructure	Engineering/ Management controls
Tan prilling plant	A three stage scrubbing system is used to control NH_3 and ammonium nitrate particulate emissions (PM_{10}) from the ammonium nitrate prilling plant common stack. The following configuration of scrubbers is used in the TAN Plant: • 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 of rotary brush scrubbers (four in total). The rotary brush scrubbers contain wetted spinning brush fibers (polypropylene) in which any dust is captured. Wash water solution is continuously sprayed on the brush and volute casing. • 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 allowing 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.
	NH_3 and particulate stack emissions from the Common stack are monitored quarterly using stack testing.
Unit 31/32 vent	• Significant venting requirements were eliminated in the plant design. • The control protocol for blowdown from the ammonia stripper is intended to reduce entrained ammonia and subsequently reduce the amount of NH_3 vented from Unit 31/32 during normal operation to a maximum emission rate of 4.5 g/s. • The applicant has committed to undertake monitoring of NH_3 vented from Unit 31/32 when the TAN Plant achieves steady state production to confirm proposed maximum emission rate of 4.5 g/s can be achieved. • The applicant has committed to undertake modelling of ground level concentrations of NH_3 based on the results of the Unit 31/32 emission monitoring to confirm the impact of emissions at sensitive receptor locations.
Nitric acid storage tanks	• Manufacturer's guarantee of emissions from the two stacks is 339 mg/m^3 NOx (as NO_2). • NOx (as NO_2) emissions from nitric acid storage tanks will be monitored using headspace testing and evaluation of air losses.
NH_3 monitors	• The premises has ambient electrochemical NH_3 gas detectors which trigger an alarm in the control room if NH_3 is detected above a threshold (15 ppm high alarm and 25 ppm high-high alarm). Gas detectors are installed at identified risk areas throughout the TAN Plant as well as around the premises boundary. Handheld gas detectors are also available onsite and are used to conduct perimeter, source and offsite checks in the event of a complaint to establish the presence of NH_3.

9.4.6 Key findings

The Delegated Officer has reviewed the information regarding point source emissions to air during normal operation and has found:

1. Consistent with the requirements of the Part IV approval and Works Approval W4701/2010/1, the TAN Plant has been designed to comply with best practice emission concentrations, through implementation of best practice emission controls, as listed in the:
    - *EFMA Best Available Techniques for Pollution Prevention and Control in the European Fertilizer Industry Booklet No. 2: Production of Nitric Acid*

(EFMA Booklet No. 2);

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

2. Based on monitoring data reported in the TAN Plant Commissioning Report modelling inputs used in the air quality assessment are appropriate;
3. Review of NH_3 emissions from the TAN prilling plant Unit 31/32 Vent found they are higher than the initial design emissions for the vent. Subsequent modelling at the proposed maximum emission rate predicts there is potential for exceedance of NH_3 air quality criteria at Deep Gorge. Due to the TAN Plant not being in operation during, or prior to this assessment actual emission rates from the vent have not been measured therefore the Applicant has proposed monitoring of NH_3 emissions and re-modelling of ground level NH_3 concentrations to confirm proposed emission rates and impact on ambient air quality.
4. The Premises has a network of ambient NH_3 monitors which can detect and alert the control room to potentially harmful concentrations both within the plant area and around the premises boundary; and
5. Model predicted GLCs of key contaminants during normal operation of the TAN Plant are not insignificant when compared with relevant assessment criteria (NOx (NO_2, N_2O) and NH_3).

9.4.7 Consequence

Air quality modelling results indicate the sensitive receptors likely to experience the greatest impact to air quality as a result of emissions from the TAN Plant are Deep Gorge and Hearson Cove. The following assessment is based on predicted air quality impact at these receptors as presented in the various modelling and assessment described in section 6.1. The most impacted receptor depends on the contaminant being considered with GLC being higher at Deep Gorge for some and Hearson Cove for others.

The modelling indicates that, amongst the receptors considered, the highest 1-hr and annual GLC of NO_2 are predicted to be 38% and 14% of the assessment criteria at Deep Gorge, respectively when considering background concentration. Excluding background concentrations from the assessment, the contribution of the TAN Plant in isolation is 20% and 4% of the1-hr and annual criteria, respectively. The highest cumulative impact of point source emissions (excluding background) associated with normal concurrent operation of the TAN and Ammonia Plants predicted for sensitive receptors was 35% and 4% of the 1-hour and annual criteria, respectively.

Including background concentrations, GLCs of NH_3 at the most impacted sensitive receptor are predicted to be <1% of the relevant 1-hr assessment criteria during normal operation of the TAN Plant in isolation, and 8% during normal concurrent operation of the TAN and Ammonia Plants.

Modelling based on revised predicted emission rates of NH_3 from the Unit 31/32 Vent however predicts in the worst-case scenario GLCs during venting will be 109% of the 1-hour assessment criteria at Deep Gorge. Modelling was however conservative and the second highest GLC was predicted to be 63% of the 1-hour assessment criteria at Deep Gorge. Concentration of NH_3 at Hearson Cove was predicted to be no more than 35% of the assessment criteria for the worst modelling case.

The TAN Plant is predicted to contribute <6% of the ambient air quality criteria of PM_{10}. Background GLC of PM_{10} is predicted to be approximately 48% of the criteria therefore normal operation of the TAN Plant does not significantly increase concentrations.

Considering the assessment above the Delegated Officer has determined the consequence of point source emissions to air from normal operation of the TAN Plant as set out below:

Ambient air quality criteria for NOx are at risk of not being met. There is the potential for low level health impacts. The Delegated Officer considers the consequence of NO_X emissions to be **Moderate**.

Ambient air quality criteria for NH_3 are at risk of not being met due to venting of NH_3 from the Unit 31/32 Vent. There is the potential for low level health impacts. The Delegated Officer considers the consequence of NH_3 emissions to be **Moderate**.

The contribution of the TAN Plant to ambient PM_{10} concentrations is not significant and ambient air quality criteria for PM_{10} are likely to be met however given the chemical characteristics of the particulates from the TAN Plant (ammonium nitrate) emissions may have low level adverse health impacts. The Delegated Officer therefore considers the consequence of PM_{10} emissions to be **Minor**.

9.4.8 Likelihood of Risk Event

The likelihood of impact to public health or exceedance of relevant criteria is dependent on meteorological conditions occurring which are conducive to poor dispersion and directed towards receptors. The Delegated Officer considers the likelihood for impact to public health or exceedance of relevant criteria as a result of point source emissions to air under normal operations to be:

- NOx: **Possible**
- NH_3: **Possible**
- Particulates: **Unlikely**

9.4.9 Overall rating of emissions to air during normal operation of the TAN Plant risk event

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 23) and determined that the risk rating of point source emissions to air causing environmental or public health impacts during normal operations for NOx, NH_3 and particulates is **Medium risk.**

9.5 Risk Assessment – point source emissions to air during non-routine TAN Plant operating conditions (start-up, shut-down and upset conditions)

9.5.1 Description of point source emissions to air during non-routine operating conditions risk event

Non-routine operating conditions will occur on occasion due to start-up and shutdown of the TAN Plant associated with planned maintenance and catalyst replacement events. Emergency shut-downs and associated start-up can occur but are expected to be rare events associated with upset conditions within the plant. Due to the closed loop design of the plant, during such events there is expected to be an increase in NOx, and NH_3 emissions from the nitric acid plant stack during start-up and shut-down, and particulates (ammonium nitrate) and NH_3 from the common stack (TAN prilling plant) during shut down as emissions are directed to these primary emission points.

The nitric acid plant design also allows for venting of NH_3 from the Unit 12 Vent during start-up to maintain optimal pressure of ammonia and oxygen in the converter. YPN has developed a new control protocol (as described in section 6.1.5) to achieve optimal pressure of ammonia and oxygen in the converter without venting. With the implementation of the new control protocol, NH_3 venting from Unit 12 will only be required during start-up in the event that pressure control cannot be achieved, to ensure the safety of the plant and personnel.

Emissions released from the point sources described above during abnormal operating conditions are transported through the atmosphere via dispersion and can impact on the air quality at sensitive receptors potentially causing adverse health impact to public at the receptor.

9.5.2 Identification and general characterisation of emission

Emissions resulting from non-routine operating conditions were considered in the PER and 2012 modelling assessments undertaken for the TAN Plant (see sections 6.1.1 and 6.1.2). These assessments considered predicted emissions from the Nitric acid plant and TAN prilling plant during such conditions and, with the exception of NO_2, used similar emission rates (the 2012 rates were slightly higher). The 2012 assessment also used approximately double the NO_2 emission rate as it assumed all NOx as NO_2. Predicted maximum emission rates during non-routine operating conditions for the two stacks are presented in Table 10 and Table 13.

The 2012 model predicted maximum GLCs resulting from non-routine operation of the TAN Plant are discussed in section 6.1.2 (Table 14). Although peak emissions during non-routine operations are expected to be significantly higher than the normal operating conditions, modelling suggests that ambient air quality assessment criteria for NO_2, PM_{10} and NH_3 will still be achieved at sensitive receptors.

While emissions are likely to increase during non-routine operating conditions, they are generally of short duration (typically expected to take up to six hours for start-up and shut-downs are expected to be less than an hour duration) and infrequent (the TAN Plant is expected to operate for nominally six months at a time with start-ups predicted to occur twice per year).

The Existing Licence includes discharge limits during start-up (Table 30) which were based on measured emission rates during the commissioning of the TAN Plant. Emission limits are only set for the nitric acid plant as emissions from the common stack at the commencement of start-up are negligible and increase to normal emission rates observed during normal operating conditions at the conclusion of start-up therefore start-up specific limits are not required.

Table 30: Discharge to air limits during start-up

Discharge point	Emission	Limit (mg/m^3)	Maximum period
Nitric acid plant stack	NO_x (as NO_2)	1540	2 hours
	NH_3	11.5	

The initial nitric acid plant design for venting from Unit 12 during start-up was for an emission rate of 2.5 kg/hr with total emissions during a start-up event estimated to be 40 kg. During commissioning no venting occurred from Unit 12. Through implementation of the revised start-up control protocol, venting is not expected to occur during start up unless pressure control cannot be maintained during the event.

9.5.3 Description of potential adverse impact from the emission

Potential health impacts associated with ammonia, particulates (ammonium nitrate) and NOx are described in section 9.4.3.

9.5.4 Criteria for assessment

The ambient air quality outlined in Table 28 in section 9.4.4 are considered by the Delegated

Officer to be relevant to the assessment of risk to public health and therefore apply to human receptors located outside the premises.

9.5.5 Applicant controls

Engineering controls which have been developed to minimise emissions from the nitric acid and TAN prilling plants are described in section 9.4.5.

To minimise the likelihood of venting of NH_3 from Unit 12 during start-up events a revised control protocol will be implemented so that venting is only required in the event that optimal pressure of ammonia and oxygen in the converter is unable to be achieved without venting.

9.5.6 Consequence

The 2012 model predicted maximum GLCs resulting from non-routine operation of the TAN Plant are discussed in section 6.1.2 (Table 14). The highest GLC at sensitive receptors are expected to occur at Hearson Cove for all emissions considered.

Modelling predicts that with the inclusion of background levels the 1-hour GLC of NO_2 at Hearson Cove may be up to 63% of the NEPM criteria during non-routine operating conditions if they occur during worst case meteorological conditions. If just TAN Plant emissions are considered the 1-hour GLC of NO_2 at Hearson Cove may be up to 44% of the NEPM criteria The Delegated Officer has therefore determined that air quality assessment criteria are at risk of not being met and low level health impact may occur. Therefore, the Delegated Officer considers the consequence of NOx emissions during abnormal operating conditions to be **Moderate**.

The maximum modelled 1-hour GLC of NH_3 at Hearson Cove during non-routine operating conditions was 4% of the assessment criteria therefore the Delegated Officer has determined that air quality assessment criteria are likely to be met and the consequence of NH_3 emissions during non-routine operating conditions are considered to be **Minor**.

The maximum modelled 24-hour GLC of PM_{10} at Hearson Cove during non-routine operating conditions was 66% of the assessment criteria with the TAN Plant emissions contributing 18% of the assessment criteria. The Delegated Officer has determined that air quality assessment criteria are at risk of not being met and given the chemical characteristics of the particulates (ammonium nitrate) emissions may have low level adverse health impacts. The Delegated Officer therefore considers the consequence of PM_{10} emissions to be **Moderate**.

9.5.7 Likelihood of Risk Event

Non-routine operations are expected to occur for up to six non-continuous hours per year, however have been modelled continuously for a year. The potential for coincidence of worst-case atmospheric conditions and abnormal operations is therefore considered to be limited and the modelling conservative.

The Delegated Officer considers that the likelihood of emissions during non-routine operating conditions exceeding the NEPM criteria and subsequently impacting the health of public receptors is**:**

- NOx and PM_{10}: **Possible**
- NH_3: **Unlikely**

9.5.8 Overall rating of point source emissions to air during non-routine operating conditions risk event

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 23) and determined that the risk rating of point source emissions to air causing public health impacts during non-routine operations for NOx, NH_3 and

particulates is **Medium risk.**

9.6 Risk Assessment – fugitive emissions to air (ammonium nitrate particulates)

9.6.1 Description of point source emissions to air during normal operation of the TAN Plant risk event

Fugitive emissions of ammonium nitrate particulates can occur as a result of the storage, handling, transfer and bagging of product, and handling of material in the off-spec area.

Fugitive particulates are transported through the atmosphere via dispersion and can impact on the air quality at sensitive receptors potentially causing adverse health impact to the sensitive receptors.

9.6.2 Identification and general characterisation of emission

Ammonium nitrate is a colourless, crystalline substance, that is highly soluble in water, and soluble in alcohol and liquid ammonia. Technical grade ammonium nitrate (referred to as TAN) is developed into prills within the TAN prilling plant via a process of crystallization of droplets of ammonium nitrate (a salt of ammonia and nitric acid) which are then dried, screened and cooled before being coated with anti-caking agent in a coating drum and directed to the TAN storage building, truck loading facility or bagging and bagged storage facility.

Handling and transfer of the prills can result in dust lift off from the product surface or of undersize prills. Storage, handling and transfer of TAN prills is undertaken within dedicated infrastructure to reduce the likelihood of fugitive emissions of ammonium nitrate particulates occurring.

9.6.3 Description of potential adverse impact from the emission

Ammonium nitrate is an oxidising agent and exposure to its dust may cause serious irritation to the eyes. Inhalation of the dust may also result in respiratory irritation. Absorption of ammonium nitrate by inhalation, ingestion or through burnt or broken skin may cause dilation of blood vessels, dizziness, drowsiness, nausea and headache.

9.6.4 Criteria for assessment

No specific criteria for acceptable environmental exposure to ammonium nitrate particles have been endorsed. The 1-hour NEPM criteria applicable to PM_{10} emissions are considered by the Delegated Officer to be relevant to the assessment of risk to public health and therefore apply to human receptors located outside the premises (refer to Table 28 in section 9.4.4 for details).

9.6.5 Applicant controls

Specific engineering and management controls for minimisation of ammonium nitrate particulate emissions adopted by the applicant and considered by the Delegated Officer are summarised below:

- The bulk storage shed operates at a positive pressure to maintain the humidity and temperature in the storage area (TAN prill degrades with moisture). The building is sealed and entrances have fan blowers which create an air curtain to keep air (and entrained dust) inside.
- Fines are screened out in the bulk storage shed prior to product being transferred via conveyor to the loading areas. Fines drop out into a storage bay. A front-end loader is used to collect fines and transfer them to the off-spec hopper (outside the shed) for reprocessing. Loader buckets are quarter filled to minimise dust during transfer.

- Retractable loading arms with shrouds on the ends are installed at the truck loading area. Fines are screened out prior to transfer to the loading area, as they are not part of product specification, which reduces potential dust. Excess air goes back through the transfer chute to the prilling tower.
- When bagging, the opening between the bag and the loading arm is sealed and no air escapes. Bags are clamped closed when filling is complete.
- Material is directed to the off-spec area if is there is a problem with loading equipment or if the product does not meet the required specification. Material is directed to two undercover storage bays on concrete hardstand. Once the issue with the plant is rectified, material in the off-spec area is removed from the storage bays using loaders and transferred to a hopper for reprocessing.
- Handling and storage of TAN prills is required to comply with the requirements of the premises Dangerous Good Licence DGS021976, the DGS Act and Regulations. Regulatory controls under these mechanisism are intended to protect public safety and minimise the risk of detonation

9.6.6 Consequence

If fugitive ammonium nitrate dust emissions occur from storage or transfer areas, then the Delegated Officer has determined that public at sensitive receptors could have low level adverse health impact. Therefore, the Delegated Officer considers the consequence of fugitive ammonium nitrate dust emissions to be **Moderate**.

9.6.7 Likelihood of Risk Event

With consideration afforded to the Applicant's controls and distance to nearby receptors, the Delegated Officer considers that the likelihood a fugitive ammonium nitrate dust emissions having an adverse impact on receptors is **Rare.**

9.6.8 Overall rating of fugitive emissions to air

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 23) and determined that the overall rating for the risk of fugitive emissions of ammonium nitrate particulate causing health impacts is **Medium**.

9.7 Risk Assessment – emissions to land (contaminated water and environmentally hazardous substances)

9.7.1 Description of emissions to land risk event

Emissions of contaminated water and environmentally hazardous materials to land can result in contamination of soil and groundwater or degradation of the marine environment (supratidal flats, mangroves, King Bay) via direct discharge, or infiltration and groundwater flow.

Emissions to land may occur on the premises as a result of runoff from plant and TAN handling areas and breaches of containment or transfer infrastructure which stores or transfers contaminated water and environmentally hazardous materials. Breaches could include overtopping, pipeline rupture, leaks or spills, seepage from ponds or runoff from plant areas. Potential sources include:

- runoff from TAN handling areas including the offspec area, TAN bagging facility and truck loading facility;
- potentially contaminated stormwater, flushing water, and process wastewaters from the contaminated water ponds (or clean water ponds when stored as a contingency);

- saline water from the pipeline carrying it in the seawater cooling circuit;
- ammonia in the delivery pipeline;
- waste oil in the containment sumps which collect oil from the oil interceptor outlets on the premises; and
- hydrocarbon storage facilities, including diesel and hydrocarbon wastes (such as waste oil).

Emissions to land can also occur from storage, handling and disposal of solid waste streams generated on the Premises. These include spent catalysts, sludges from infrastructure and water storage ponds and other domestic and commercial waste.

The TAN Plant is classed as a Major Hazard Facility and also operates in accordance with a Dangerous Goods Licence therefore is required to adhere to regulatory controls administered by DMIRS. The Delegated Officer considers DMIRS is the relevant regulatory authority to assess and manage risk associated with releases from large dangerous good storage infrastructure including the nitric acid and ammonium nitrate storage tanks. They are therefore not considered in this risk assessment.

9.7.2 Identification and general characterisation of emission

Key contaminants expected in the contaminated water streams and sludges include heavy metals, hydrocarbons, suspended and dissolved solids, and nitrates. Key contaminants in the solid waste are heavy metals, hydrocarbons and nitrates.

Table 31 characterises the various waste streams generated on the premises which could potentially cause discharges to land.

Table 31: Waste streams generated at the TAN Plant

Waste stream	Location of discharge
Contaminated stormwater and flushing water from plant areas	Contaminated water ponds
Mixed bed regeneration waste	
Rejected process condensates and air condensate	
Offspec prills which can't be recycled	Disposed offsite to licensed facilities
Catalysts from the nitric acid plant	
Sludges from the heat exchanger, nitric acid process equipment and ammonia stripper	
Oil residue from the ammonia stripper	
Sludge from contaminated stormwater and treated effluent ponds	

9.7.3 Description of potential adverse impact from the emission

Depth to groundwater at the Premises is variable and generally shallow ranging from 0.5 to 8 mbgl. There is potential for contaminated water or environmentally hazardous materials to

degrade local groundwater quality if discharged to land and infiltration to groundwater occurs. Improper storage/ disposal of spent catalysts, sludges and offspec TAN can also lead to soil contamination and infiltration to groundwater.

Groundwater flows in a south-easterly direction. The hydraulic gradient is steeper in the northern part of the Premises, and becomes shallower to the south and south-east as the topography flattens into the supratidal flats. While groundwater contours indicate flow to the south-east, the sediments in the supratidal flats south of the Premises have been identified to have a higher hydraulic conductivity than the surrounding geology. Therefore, there is the potential for some groundwater flow to occur to the south-west towards King Bay. Groundwater dependent ecosystems may be impacted by degradation in groundwater quality. Marine fauna within King Bay could be impacted if degradation of marine water quality occurs due to flow of impacted groundwater into the system.

If groundwater flow to the south-east occurs there could potentially be impact to the mangroves present 600 m east of the Premises. Mangroves are known to be sensitive to hydrocarbon contamination.

9.7.4 Criteria for assessment

The *Australian and New Zealand Environment and Conservation Council (ANZECC) Guidelines for Fresh and Marine Water Quality* (99% level of protection) do not directly apply to emissions to groundwater; however, they are considered relevant assessment criteria to assess ecological risks associated with the discharges to groundwater, given the proximity of the inshore marine environment, which is the closest environmental receptor for groundwater discharging from beneath the premises. The environmental values in relation to groundwater, as specified in the *National Environment Protection (Assessment of Site Contamination) Measure 1999* are considered to be appropriate criteria to assess ambient groundwater quality.

In accordance with the requirements of condition 8 of MS 870, YPN has developed trigger levels for the Premises based on 10% above baseline groundwater quality. Groundwater monitoring results are compared with the trigger criteria as an indicator of groundwater contamination resulting from the premises activities.

9.7.5 Applicant controls

Specific engineering and management controls adopted by the applicant and considered by the Delegated Officer are summarised below:

- environmentally hazardous materials are either stored in double walled tanks or in bunded areas.
- the drainage system has been designed to transfer flows during a 1 in 50 year event;
- the contaminated stormwater drainage system includes sealed areas (coated concrete, roof surfaces, bunds) and conduits (various channels and pipes) that prevent infiltration to ground;
- runoff from TAN handling areas including the truck loading facility, bagging facility and offspec area is directed to the contaminated water drainage system;
- contaminated water ponds have been designed and constructed with a storage capacity for up to a 1:10 year average recurrence interval (ARI), 24 hour rainfall event;
- contaminated water ponds are double lined with 1.5 mm thick HDPE to achieve a permeability of less than 1 x 10^{-9} m/s and have multiple tell-tale leak detectors between the two liners to allow for detection of leakage from the upper liner;
- clean/contingency contaminated water ponds are a contingency water storage for contaminated water and have therefore been upgraded to include double lining with 1.5

mm thick HDPE to achieve a permeability of less than 1 x 10^{-9} m/s and have multiple tell-tale leak detectors between the two liners to allow for detection of leakage from the upper liner;

- the contents of the clean/contingency contaminated water ponds will be discharged via the MUBRL in the event they are required for contingency contaminated water storage;
- treated effluent ponds are single lined with 1.5 mm thick HDPE to achieve a permeability of less than 1 x 10^{-9} m/s.
- the ponds and seawater cooling pipeline are inspected by operators on a daily basis during daily rounds of the premises.

9.7.6 Key findings

The Delegated Officer has reviewed the information regarding point source emissions to land and has found:

1. The TAN Plant was classified on 7 December 2018 as possibly contaminated - investigation required under section 13 of the CS Act. Actions and ongoing investigations relating to the contamination are being managed in accordance with the CS Act.
2. Trigger levels designed to detect groundwater contamination are established through the requirements of condition 8 of MS 870 therefore to avoid regulatory duplication are not included as controls in the licence.
3. Emissions associated with storage, handling, or transfer of solid wastes and environmentally hazardous materials can be managed under the general provisions of the EP Act and the *Environmental Protection (Unauthorised Discharges) Regulations 2004*. Disposal of spent catalysts, sludges and hydrocarbons offsite will be subject to requirements under the *Environmental Protection (Controlled Waste) Regulations* and any regulatory requirements which apply to the offsite waste disposal site.
4. To avoid regulatory duplication, the Delegated Officer determined that bulk storage of chemicals on the premises would not be considered in the risk assessment as the premises is subject to regulation by DMIRS for Dangerous Goods storage and as a Major Hazard Facility.

9.7.7 Consequence

If emissions to land occur as a result of breached containment infrastructure, then the Delegated Officer has determined that low level offsite impact could occur. Therefore, the Delegated Officer considers the consequence of emissions to land to be **Moderate**.

9.7.8 Likelihood of Risk Event

In consideration of previous discharges to land which have occurred on the premises the Delegated Officer has determined that low level offsite impact could occur at some time as a result of emissions to land therefore, the Delegated Officer considers the likelihood of discharges to land causing groundwater contamination to be **Possible**.

9.7.1 Overall rating of emissions to land (contaminated water and environmentally hazardous materials)

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 23) and determined that the overall rating for the risk of

emissions to land due to containment breaches is **Medium**.

9.8 Risk assessment - noise emissions

9.8.1 Description of risk of noise emissions

Noise emissions arise from normal operation of the TAN Plant due to:

- operation of major plant and ancillary equipment;
- onsite vehicle movement (loaders, trucks etc.); and
- onsite operation of generators, pumps, fans, compressors, etc.

Noise from the premises may impact the amenity of people using public access areas, such as Hearson Cove, in the proximity to the premises.

9.8.2 Identification and general characterisation of emission

The Existing Licence requires noise emission monitoring to be undertaken on a quarterly basis. The noise monitoring results reflect the cumulative noise at the boundary of the TAN Plant and the adjacent Ammonia Plant if it is undertaken when both plants are in operation. Due to the operational downtime of both plants however only one reported monitoring event occurred when both plants were in operation. The results of noise monitoring undertaken since 2018 are included in Table 32. The highest result was recorded at the Ammonia Plant western boundary when both plants were in operation, however is only marginally greater than the highest result recorded when only the Ammonia Plant was operating. Monitoring results are highest at N1 which is on the western boundary of the Ammonia Plant premises. All results are more than 5 dB(A) below the licence limit of 65 dB(A).

Table 32: Results of noise monitoring undertaken at the TAN and Ammonia Plant premises boundaries 2018-2019

Date	Operational status	Average LA10 (dB)			
		N1	N2	N3	N4
16/10/18	Ammonia plant only operating	58.7	52.8	45.8	37.5
20/12/2018	Ammonia plant only operating	58	55.7	57.9	50.4
8/3/2019	Ammonia plant only operating	57.9	53.8	54.7	46.2
7/6/2019	Ammonia Plant utilities operating and TAN Plant operating	55.1	51.9	47.5	44.8
1/7/2019	Ammonia and TAN Plants both operating	58.8	54.4	53.8	49.8

NOTE 1 – Monitoring locations N1 and N2 are in closest proximity (west and south) to the Ammonia Plant. Monitoring location N3 is located midway between and north of the Ammonia and TAN Plants, and N4 is east of the TAN Plant.

9.8.3 Description of potential adverse impact from the emission

Regular exposure to consistent elevated noise levels may cause health impacts such as hearing impairment, irritability, and hypertension. Noise emissions from the premises are expected to be consistent with other industries which are located in the area zoned ‘strategic industry’ by

City of Karratha Planning Scheme No. 8.

Deep Gorge is the nearest recreational area located approximately 1,200 m south of the premises. Hearson Cove is another recreational area accessed by members of the public, located 550 m south east of the premises boundary. Noise emissions may impact the amenity of people in these recreational areas.

9.8.4 Criteria for assessment

As per discussion in section 6.3, the EPA recommended an aspirational goal of an ambient noise level of 45 dB(A) at Hearson Cove in Bulletin 1077. The Department's noise experts concluded that the goal is no longer relevant and that ambient noise levels at Hearson Cove Beach could be minimised by ensuring that all industrial facilities located in proximity reduce noise levels at their respective plant boundaries to below the 65 dB(A)

The following assessment criteria has therefore been adopted at the premises boundary.

Table 33: Noise assessment criteria specified in the EP (Noise) Regulations

Type of premises receiving noise	Time of day	LA_{10} (dB)
Industrial and utility premises other than those in the Kwinana Industrial Area	All hours	65

A review of records in the DWER's ICMS did not identify any noise related complaints from the community relating to normal operation of the TAN Plant.

9.8.5 Applicant controls

During commissioning of the TAN Plant, the nitric acid plant compressor was identified as the primary source of noise. To mitigate the impact of noise from the compressor, external acoustic insulation was fitted to the compressor air inlet duct in August 2017.

Other noise mitigation measures implemented on the Premises include the following:

- equipment such as compressors and pumps are located within enclosures, cases, blankets or are situated in a building as required;
- silencers installed on vents;
- pipework with acoustic cladding;
- relief system for flow/ acoustically induced vibration and fatigue;
- repairing, modifying or replacing high noise generating items; and
- selecting machinery with minimum noise levels.

9.8.6 Key findings

Key findings: The Delegated Officer has considered the results of ambient noise emissions monitoring as presented in the application and the advice received and has found:

1. The TAN Plant and the Ammonia Plant are major contributors to noise levels at Hearson Cove. Cumulative noise from the operation of the two plants has therefore been considered in this risk assessment.
2. Only one exceedance of the noise criteria of 65 dB(A) was recorded the SE boundary of the TAN Plant during commissioning monitoring which was likely due to operation of the TAN Plant.
3. Subsequent to the exceedance external acoustic insulation was installed on the nitric

acid plant compressor air inlet duct in the TAN Plant as it was identified as a significant noise source of noise.

4. Only one boundary monitoring event has occurred, post commissioning of the TAN Plant, when both plants were in operation. There are therefore insufficient monitoring records to conclude that the existing licence limit of 65 dB(A) can be consistently complied with. Compliance with the limit will minimise the likelihood of noise emissions impacting on sensitive receptors.
5. During the 2018 amendment of the existing licence, YPF committed to develop and conduct a revised noise monitoring program which identifies the representative noise at Hearson Cove. Advice on the scope of the program was provided in the Decision Report for the 2018 amendment (DWER 2018). At the time of this assessment YPF had not provided details of the proposed program to the Department as there has been limited time when both the TAN and Ammonia Plants have been concurrently operating. With the TAN plant expected to recommence operation in 2020, it is the Department's expectation that the revised noise monitoring program will be developed and submitted for consideration.

9.8.7 Consequence

Considering the results of ambient noise monitoring conducted during commissioning of the TAN Plant, and ambient noise monitoring conducted in 2018 and 2019 when one or both plants were operation, the Delegated Officer has determined that cumulative noise emissions associated with operation of the TAN and Ammonia Plants may cause low level impact to amenity at the nearest receptors. Therefore, the Delegated Officer considers the consequence of noise emissions to be **Minor.**

9.8.8 Likelihood of risk event

The Delegated Officer considers that cumulative noise emissions from the TAN and Ammonia Plants could impact the amenity of sensitive receptors at some time. Therefore, the likelihood is **Possible.**

9.8.9 Overall rating of risk of noise emissions

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 23) and determined that the overall rating for the risk of noise emissions impacting amenity of receptors during normal operations is **Medium.**

9.9 Summary of acceptability and treatment of Risk Events

A summary of the risk assessment and the acceptability or unacceptability of the risk events set out above, with the appropriate treatment and control, are set out in Table 34 below. Controls are described further in section 10.

Table 34: Risk assessment summary

	Description of Risk Event			Applicant controls	Risk rating	Acceptability with controls (conditions on instrument)
	Emission	**Source**	**Pathway/ Receptor (Impact)**			
1.	Point source emissions to air during normal operating conditions NOx, N_2O, NH_3, PM	Nitric acid plant stack, common stack, nitric acid storage tank vents, Unit 31/32 Vent	Air/wind Environmental/ Public Health impacts	See section 9.4.5	**Medium Risk**	Acceptable subject to regulatory controls
2.	Point source emissions to air during abnormal operating conditions (start-up and shutdown) NOx, N_2O, NH_3, PM	Nitric acid plant stack, common stack, Unit 12 Vent	Air/wind Environmental/ Public Health impacts	See section 9.5.5	**Medium Risk**	Acceptable subject to regulatory controls
3.	Fugitive emissions to air (ammonium nitrate particulates)	TAN handling areas including storage facility, truck loading facility and bagging facility	Air/wind Public Health impacts	See section 9.6	**Medium Risk**	Acceptable subject to regulatory controls
4.	Emissions to land Contaminated water, hydrocarbons, chemicals (ammonia)	Water storage ponds Runoff from TAN handling areas Ammonia delivery pipeline	Direct Discharge/ seepage Degradation of local groundwater quality Potential impact on surface water/marine quality due to local groundwater flow direction	See section 9.7.5	**Medium Risk**	Acceptable subject to regulatory controls
8.	Noise Emissions	Operation of the TAN Plant (cumulative assessment with adjacent Ammonia Plant)	Air/ Wind dispersion Public amenity impacts	See section 9.8.5	**Medium Risk**	Acceptable subject to regulatory controls

10. Regulatory controls

A summary of regulatory controls determined to be appropriate for the Risk Event is set out in Table 34. The risks are set out in the assessment in section 9 and the controls are detailed in this section. DWER will determine controls having regard to the adequacy of controls proposed by the Applicant. The conditions of the Licence will be set to give effect to the determined regulatory controls.

Table 35: Summary of regulatory controls to be applied

		Controls (references are to sections below, setting out details of controls)		
		Infrastructure and equipment (10.1.1, 10.2.1and 10.3.1)	Monitoring and Reporting Requirements (10.1.3, 10.3.2, 10.4.2 and 10.5,)	Specified emissions and limit (10.1.2 and10.4.1)
Risk Items (see risk analysis in section 9)	Point source emissions to air – Normal Operations	●	●	●
	Point Source emissions to air- Non-routine operations	●	●	●
	Fugitive emissions to air - ammonium nitrate particulates	●		
	Emissions to land-contaminated water and environmentally hazardous substances	●	●	
	Noise emissions		●	●

10.1 Licence controls - point source emissions to air

Conditions relating to point source emissions to air have been retained from the Existing Licence as there has been no change to the activity. Additional conditions have been included relating to revised emission rates for Unit 31/32 as detailed in the following sections.

10.1.1 Infrastructure and equipment

Infrastructure operational requirements which are intended to reduce or minimise point source emissions to air are specified for relevant infrastructure in condition 1. Requirements for the TAN prilling plant and nitric acid plant are as per the Existing Licence.

Grounds: Predicted emissions and impact on air quality takes into consideration engineering design and management measures intended to minimise or reduce air emissions. Accordingly, emission control technology incorporated into emission sources are specified as operational

requirements for infrastructure.

10.1.2 Specified emissions and limits

Condition 2 is included in the licence to authorise the emissions which have been considered and assessed in this decision report to be discharged to air via the nitric acid plant stack, common stack, Unit 31/32 vent, Unit 12 vent, and nitric acid storage tank vents. The locations of the emission points are illustrated in the Map of authorised discharge point locations in Schedule 1 of the issued licence.

The nitric acid storage tank vents have been included in the licence to authorise emissions from this source which has been considered in the air quality modelling assessment for the Premises.

Condition 3 and 4 have been included specifying limits that apply to the point source emissions to air during normal operation and start-up of the nitric acid plant. The limits have been retained from the Existing Licence as there has been no change to the operation of the TAN Plant. The specified limits and justification for the limits is included in Table 36 and Table 37.

Table 36: Point source emission to air limits (normal operation)

Discharge point	Emission	Limit (mg/m^3)	Justification for the limit value proposed
Common stack (A1)	PM	15	As per recommendations of EPA Report 1379, limits have been set which are in line with best practice emission concentrations. As per discussion in section 5.2.2, DWER has conducted a review of the pollution control applied to operation of the nitric acid plant and TAN prilling plant and has concluded that contemporary best practice pollution control technology (wet scrubbers and a NOx reduction unit equipped with a catalyst) has been incorporated in the design of the TAN Plant and that emissions performance compares favourably with relevant best practice stack emission concentration criteria. Limits in the Existing Licence have therefore been retained.
	NH_3	10	
Nitric acid plant stack (A2)	NOx (as NO_2)	103	
	NH_3	0.75	
	N_2O	196	

Table 37: Point source emission to air limits (start-up)

Discharge point	Emission	Limit (mg/m^3)	Maximum period	Justification for the limit value proposed
Nitric acid plant stack (A2)	NOx (as NO_2)	1540	2 hours	The limits applicable to the Nitric acid plant stack only apply for a maximum of 2 hours. This prohibits the licence holder from operating in start-up for prolonged periods and minimises the potential for offsite impacts. The limit value has been determined based on CEMS monitoring conducted during start-up periods during the commissioning of the TAN Plant.
	NH_3	11.5		

Grounds: Emissions of NOx (includes NO_2 and N_2O), NH_3 and PM (ammonium nitrate), have been assessed as medium risk during both normal and non-routine (start-up/shutdown) operating conditions. Controlling point source emissions to air through limits is key to ensuring that GLCs at the receptors remain within specified criteria to protect public health.

Justification for the limits which has been applied is included in Table 36 and Table 37.

Height of an emission point is one of the tools to aid in dispersion of the contaminant plume and to minimise ground level impacts. Stack heights are therefore specified in the licence.

10.1.3 Monitoring and modelling requirements

The licence includes monitoring requirements for discharges to air in condition 6 and locations in the Map of monitoring locations in Schedule 1 of the issued licence. Flow monitoring is also specified to allow for calculation of emissions rates.

Other monitoring requirements specified in the licence to ensure collection of representative and accurate monitoring data include:

- Requirement for the licence holder to undertake ongoing operation, maintenance and compliance for the CEMS installed in accordance with the CEMS Code;
- Requirement to ensure that any stack sampling is undertaken at sampling locations in accordance with the Australian Standard *AS4323.1 Stationary Source Emission Method 1: Selection of sampling positions*;
- Requirement that any non-continuous sampling and analysis is undertaken by a holder of NATA accreditation relevant to the methods of sampling and analysis; and
- Requirement to separate monitoring events by a specified period.

Additional monitoring requirements have been included in condition 6 for short term monitoring (minimum of three events) of NH_3 for the Unit 31/32 vent (refer to applicant controls in section 9.4.5) to confirm that the proposed maximum emission rate of 4.5 g/s can be achieved through implementation of a revised control protocol for blowdown from the ammonia stripper. The USEPA method for stack sampling and analysis of NH_3 is not suitable for the Unit 31/32 vent due to the expected elevated concentration of ammonia in the vent gas and ad-hoc nature of the emissions (several times per day). An alternate monitoring method for NH_3 emissions from the Unit 31/32 vent is therefore required. The applicant has not yet finalised the proposed method for the monitoring therefore condition 15 has been included in the licence requiring the submission of the proposed monitoring methodology and a peer review of that methodology to ensure it is appropriate for representative monitoring of the emission. The Applicant also proposed to complete revised modelling for NH_3 GLC based on the results of the monitoring to confirm predicted levels. Modelling requirements and reporting have therefore been specified in conditions 16 to 17.

The requirement for the licence holder to continuously monitor ambient air for ammonia at three locations at the premises boundary is retained from the Existing Licence in condition 11 (locations are shown in the Map of monitoring locations in Schedule 1). Continuous monitoring of ambient air quality is required with alarms that are activated at 35ppm, initiating investigations into the cause.

Grounds: Emissions of NOx (includes NO_2 and N_2O), NH_3 and PM (ammonium nitrate), have been assessed as medium risk (during both normal and non-routine operation of the TAN Plant) therefore monitoring is required for these pollutants to demonstrate emissions remain within assessed levels and limits. In line with the Existing Licence quarterly monitoring is specified for emissions from the common stack, and continuous monitoring via a CEMS for the nitric acid plant stack. CEMS is specified for the nitric acid plant stack as emissions are more likely to be variable from this source during non-routine operating conditions. Quarterly monitoring is considered appropriate for the common stack as emissions are not expected to significantly

fluctuate or exceed the nominated and assessed emission limits during non-routine operation.

Ongoing compliance requirements to demonstrate continued acceptability and accuracy of the CEMS in accordance with the CEMS Code are specified in the licence to ensure accurate data collection.

The Applicant has identified that NH_3 emissions for the Unit 31/32 vent are higher than the original design for the plant and has implemented a revised control protocol for blowdown from the ammonia stripper to minimise emissions (refer to section 6.1.5 for details). YPN proposed in their application to undertake monitoring and modelling of emissions from the Unit 31/32 vent when the TAN Plant is restarted and reaches steady state production in order to verify predictions relating to emission rates and GLCs are achieved. Requirements to conduct short term monitoring (minimum of three events) of NH_3 and revised modelling to predict impact on air quality of discharges to air from the Unit 31/32 vent have therefore been specified in the licence. Proposed monitoring methodology and modelling scope of work (in accordance with the *Department of Environment Air Quality Modelling Guidance Notes [2006])* are required to be submitted to DWER to ensure use of a representative monitoring methodology (requirements include a peer review of the method), and appropriate model, meteorology and inputs for the revised modelling to ensure predictions are sufficiently conservative.

Timeframes have been specified for the monitoring and modelling based expectations for the time needed to complete these requirements following the restart of the TAN plant and achievement of steady state production. Specification of timeframes for completion of monitoring and modelling are required to ensure there is no lag to the completion of requirements. The revised modelling will be considered by the DWER to determine whether any further controls relating to emissions from the Unit 31/32 vent are required. Given that timeframes for completion of monitoring and modelling are based around the restart of the TAN plant and achievement of steady state production, a notification requirement has been included in condition 21 requiring the licence holder to notify the CEO when start-up of the TAN plant occurs and when steady state production is achieved. Notifications will be referred to, to confirm when monitoring and modelling requirements are required to be completed.

Ambient air quality monitoring requirements have been retained from the Existing Licence as this monitoring is considered suitable to detect when NH_3 emissions have increased on the premises so that appropriate investigation and remediation actions can be undertaken. The retention of ambient quality monitoring requirements from the Existing Licence affords an additional level of protection from potential health impacts associated with NH_3 emissions. Continuous monitoring is intended to identify the presence of ammonia in air at the premises boundary to trigger investigation and remedial action for the source of the ammonia as ambient concentrations should be low during normal operation of the plant. Potential impacts associated with a release of ammonia will depend on the nature of source, the time taken to identify and rectify the issue. The trigger level for alarm activation is based on the Short Term Exposure Level (15-minute average) specified by Safe Work Australia. Exceedance of the criteria does not mean there is an imminent threat of health impact rather continued exposure at the concentration level or higher levels could result in impact to health.

10.2 Licence controls – fugitive emissions to air (ammonium nitrate particulates)

10.2.1 Infrastructure and equipment

Infrastructure operational controls to prevent fugitive emissions of ammonium nitrate particulates from TAN storage and handling areas (including the bulk storage building, bagging facility, truck loading facility and off-spec storage area), have been included in the licence and are based on controls implemented by the licence holder. These include:

- limitations on infrastructure where bulk TAN storage and handling activities can occur;

- maintenance of positive pressure and operation of fans at entrances to the bulk storage building;
- ensuring the connection between the loading arm and bag is sealed during bag filling;
- use of dust suppression measures at the truck loading facility when truck loading is undertaken; and
- storage of off-spec TAN within roofed storage bays.

Grounds: This risk associated with fugitive emissions to air of ammonium nitrate particulates was assessed as medium as there is potential for fugitive emissions to impact on the health of receptors if not appropriately contained within the Premises infrastructure. The licence holder's infrastructure controls intended to prevent fugitive emissions of ammonium nitrate particulates are therefore included as operational controls in the licence to minimise the likelihood of emissions occurring.

10.3 Licence controls – emissions to land

10.3.1 Infrastructure and equipment

Infrastructure operational controls to prevent groundwater contamination have been included in the licence and are based on controls implemented by the licence holder. These include:

- liner, freeboard and leak detection requirements for ponds which can store contaminated stormwater and process water;
- specification of the water streams that can be received into each storage pond on the Premises based on the licence holder's water management strategy;
- limitation on the use of clean/contingency water storage ponds to when Ponds 4 and 5 are at capacity;
- requirements for management of runoff from TAN handling infrastructure; and
- visual inspections of the seawater cooling circuit pipeline.

Grounds: This risk associated with emissions to land was assessed as medium as there is potential for groundwater contamination to occur if contaminated stormwater and environmentally hazardous substances are not appropriately contained. The licence holder's infrastructure controls intended to prevent discharge to land or containment loss are therefore included as operational controls in the licence to minimise the likelihood of releases occurring.

10.3.2 Monitoring requirements

The groundwater monitoring requirements from the Existing Licence have been retained in the issued licence as there has been no change to the assessed level of risk since the 2018 risk assessment for the premises.

Groundwater monitoring requirements for the operation of the TAN Plant were set during the 2018 amendment of the existing licence. The requirements were guided by Schedule B2 of the NEPM 2013 and included the following sampling and analysis requirements which are retained in condition 12 of the licence:

- pH, electrical conductivity, total dissolved solids, dissolved oxygen, redox potential and temperature;
- total alkalinity;
- major cations/ions;
- total and dissolved metals (Al, Cd, Cr(III), Cr(VI), Cu, Ni, Pb, and Zn);

- Ammonia as ammoniacal nitrogen (NH3-N), nitrate and nitrite;
- hydrocarbons;
- option for in-situ groundwater physiochemical parameters (electrical conductivity, redox potential, pH, temperature and dissolved oxygen) to be measured in the field;
- collection of field parameters in a flow-through cell to avoid contact between groundwater and the atmosphere. A flow-through cell will enable continuous measurement and monitoring of key parameters during purging to identify when a representative sample may be obtained;
- sampling to be undertaken in accordance with relevant Australian Standard and analysis to be completed by a NATA accredited laboratory for the required methodology, except where an exemption specifies;
- specification that limits of reporting are below the site-specific trigger values YPN has developed for the monitoring wells in accordance with the requirements of MS 870; and
- specification that 'ultra-trace' analysis should be used where possible due to the possible matrix interference with saline groundwater samples and consequential increase of the limits of reporting.

MDEA and potential degradation products for selected primary compounds (nitramines and nitrosoamines) were not retained from the Existing Licence as MDEA is not stored on handled on the Premises and is therefore only relevant to the adjacent Ammonia Plant.

Grounds: Premises operations have been assessed as having a medium risk of causing impact local groundwater. Given the location of the Premises and proximity to a sensitive marine environment, ambient groundwater quality monitoring is considered a key operational control tool to assess for ongoing impact to groundwater associated with the premises operations. Quarterly monitoring events have been specified to ensure timely detection of potential impacts.

Groundwater quality trigger values have been developed by YPN for monitoring wells on the basis of maximum background water quality plus 10% in accordance with the requirements of MS 870 condition 8-4. YPN is required to report, investigate and implement actions to address trigger exceedance which occur. The Delegated Officer has therefore determined, in accordance with the *Guidance Statement: Setting Conditions* not to duplicate the triggers as licence limits. Annual reporting requirements specify monitoring data to be presented over a minimum three year time period and include comparison with historical trends.

10.4 Noise emissions

Conditions relating to noise emissions have been retained from the Existing Licence as there has been no change to activities on the premises and the assessed level of risk has not increased since the 2018 risk assessment for the premises.

10.4.1 Limit

A noise limit of 65dB(A) is specified in condition 5 of the licence at specified monitoring locations.

Grounds: Noise emissions from premises operations have the potential to impact amenity of users at Hearson Cove. Technical advice recommended that industry incorporate best practice noise attenuation measures on all identified significant noise sources to achieve a noise level of 65dB(A) at respective plant boundaries.

10.4.2 Monitoring

Quarterly boundary noise monitoring is specified in condition 13 of the issued licence using the methods described in the EP (Noise) Regulations. The location of noise monitors are as depicted in the Map of monitoring locations in Schedule 1 of the issued licence.

Grounds: Monitoring is required to demonstrate compliance with the specified emission limit.

10.5 Record Keeping and Reporting

Conditions relating to record keeping and reporting have been retained from the Existing Licence as there has been no change to activities on the premises or increase to the assessed level of risk since the 2018 risk assessment for the premises which necessitate a change to these conditions.

Record keeping requirements are specified in condition 18 and 19 to ensure the Applicant retains suitable records of its activities. Notification requirements are included in condition 21 of the licence to provide a framework and requirements for reporting of limit exceedances. Reporting of limit exceedances informs DWER of incidents which may impact on the risk assessment for the premises and whether performance is in line with expectations. Exceedance of a limit does not indicate that there is an imminent threat to the public or environment therefore the timeframe for notification is set at seven days to allow time for investigations and actions relating to the exceedance to be undertaken and reported.

The premises is in close proximity to Dampier and Karratha communities, and recreational areas popular with residents. Activities on the premises may impact on the health or amenity of public in these areas. Condition 20 is therefore included in the licence requiring the applicant to record the details of complaints and actions taken in response to complaints. Recording, reporting and investigating of complaints aids in determining if the community is being impacted by the operation of the premises.

The licence conditions require that monitoring of discharges to air, ambient air quality at the premises boundary (NH_3), noise and groundwater must be undertaken. The results of the monitoring are required to be submitted to DWER in the form of an AER. Submission of an AER allows DWER to review the contained information to inform future review and risk assessments, and assess if the activities on the premises are impacting on the environment. Condition 24 specifies the timeframe for submission of the AER, the information which must be included in the report and the format the information is to be provided in. Information to be reported includes monitoring data and interpretation of that data, characteristics and emissions of start-up and shutdown events, complaint details and ambient air quality exceedance responses. Reporting of gas venting volumes during start up and shutdown events is an inclusion in the licence as it aids in understanding of the frequency of events, and quantity of emissions during such events to inform ongoing review of the risk of the premises.

The applicant is also required by condition 23 to submit an AACR each year to demonstrate whether the licence conditions have been complied with in the preceding year.

11. Determination of Licence conditions

The conditions in the issued licence in Attachment 1 have been determined in accordance with the Guidance Statement: Setting Conditions.

The Guidance Statement: Licence Duration has been applied and the issued licence expires in 20 years from date of issue.

Table 38 provides a summary of the conditions to be applied to this licence and how they relate to conditions of the Existing Licence.

Table 38: Summary of conditions to be applied

New licence condition reference	Grounds	Existing licence condition
Infrastructure and equipment Condition 1	The condition is valid, risk-based and contain appropriate controls on infrastructure requirements.	Condition 2 Additional requirements have been added for TAN handling infrastructure and water management infrastructure.
Discharges to air Conditions 2-4, 6-11, 15-17	These conditions are valid, risk-based and consistent with the EP Act.	Conditions 3 – 11 Additional monitoring and modelling requirements for Unit 31/32 vent have been included.
Ambient groundwater Monitoring Condition 12 and 14	These conditions are valid, risk-based and consistent with the EP Act.	Condition 21 Monitoring for MDEA and derivatives is not included from the Existing Licence because this product is not stored or handled on the premsies.
Noise emissions Conditions 5 and 13-14	These conditions are valid, risk-based and consistent with the EP Act.	Conditions 22-24 No changes
Records and reporting Conditions 18 to 24	Reporting conditions are valid, risk-based and consistent with the EP Act.	Conditions 27-31 An additional requirement requiring the CEO to be notified of start-up and attainment of steady state production after start up has been included to ensure the Department is aware of the status of the TAN plant to confirm Unit 31/32 vent monitoring timeframes are achieved.

DWER notes that it may review the appropriateness and adequacy of controls at any time and that, following a review, DWER may initiate amendments to the licence under the EP Act.

12. Applicant's comments

The Applicant was provided with the draft Decision Report and draft licence on 27 March 2020. The Applicant provided comments on 8 April 2020 which are summarised, along with DWER's response, in Appendix 2.

13. Conclusion

This assessment of the risks of activities on the premises has been undertaken with due consideration of a number of factors, including the documents and policies specified in this Decision Report (summarised in Appendix 1).

This assessment has assessed the risks posed by emissions and discharges resulting from the continued operation of the TAN Plant. The assessment has resulted in a licence with risk based regulatory controls.

Based on this assessment, it has been determined that the issued licence will be granted subject to conditions commensurate with the determined controls and necessary for administration and reporting requirements.

The licence issued as a result of this application supersedes all previously authorised licences and amendment notices issued in relation to the premises.

James Milne
A/Senior Manager, Process Industries
Delegated Officer
under section 20 of the *Environmental Protection Act 1986*

Appendix 1: Key documents

	Document title	In text ref	Availability
1.	Licence L7997/2002/11 – Yara Pilbara Fertilisers and Yara Pilbara Nitrates	L7997/2002/11	accessed at www.dwer.wa.gov.au DWER records (A1701710)
2.	Decision Report L7997/2002/11 – Yara Pilbara Fertilisers and Yara Pilbara Nitrates	DWER 2018	
3.	Licence application form and supporting document: Application for new licence. Yara Pilbara Nitrates	NA	DWER records (DWERDT219728)
4.	DER, July 2015. *Guidance Statement: Regulatory principles.* Department of Environment Regulation, Perth.		accessed at www.dwer.wa.gov.au
5.	DER, October 2015. *Guidance Statement: Setting conditions.* Department of Environment Regulation, Perth.		
6.	DER, August 2016. *Guidance Statement: Licence duration.* Department of Environment Regulation, Perth.		
7.	DER, February 2017. *Guidance Statement: Risk Assessments*. Department of Environment Regulation, Perth.		
8.	DWER, June 2019. *Guideline: Decision Making*. Department of Water and Environmental Regulation, Perth.		
9.	DWER, June 2019. *Guideline: Industry Regulation Guide to Licensing*. Department of Water and Environmental Regulation, Perth.		
10.	DWER, February 2019, *Murujuga Rock Art Strategy*. Department of Water and Environmental Regulation, Perth.		
11.	Ministerial Statement 870	MS 870	accessed at www.epa.wa.gov.au
12.	Ministerial Statement 567	MS 567	
13.	Ministerial Statement 594	MS 594	
14.	Ministerial Statement 1121	MS 1121	
15.	EPA Bulletin 1077	Bulletin 1077	
16.	EPA Report 1379	EPA Report 1379	
17.	Technical Ammonium Nitrate Production Facility Public Environmental Review for Burrup Nitrates Pty Ltd, 2010. Burrup Nitrates Pty Ltd, Perth.	NA	

	Document title	In text ref	Availability
18.	Consolidated Approval Notice Proposed Technical Ammonium Nitrate Production Facility EPBC 2008/4546	EPBC 2008/4546	accessed at www.environment.gov.au
19.	Burrup Peninsula Technical Ammonium Nitrate Production Facility Air Quality Assessment Update	ERM 2012	DWER records (A1126301)
20.	European Commission Reference Document on Best Available Techniques for the Manufacture of Large Volume Inorganic Chemicals – Ammonia, Acids and Fertilisers (European Commission, 2007).	European Commission, 2007	Accessed at: https://eippcb.jrc.ec.europa.eu/sites/default/files/2019-11/lvic_aaf.pdf
21.	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) (EFMA Booklet No. 2)	NA	Accessed at: https://www.fertilizerseurope.com/wp-content/uploads/2019/08/Booklet_2_final.pdf
22.	*EFMA Best Available Techniques for Pollution Prevention and Control in the European Fertilizer Industry Booklet No. 6: Production of Ammonium Nitrate and Calcium Ammonium Nitrate* (EFMA Booklet No. 6)	NA	Accessed at: https://issuu.com/efma2/docs/booklet_nr_6_production_of_ammonium
23.	Monitoring of Ambient Air Quality and Meteorology during the Pilbara Air Quality Study 2002, Department of Environment, Perth WA	DoE 2002	accessed at www.dwer.wa.gov.au
24.	Air quality and air pollution modelling guidance notes, 2006. Department of Environment, Perth WA	DoE 2006	
25.	Burrup Technical Ammonium Nitrate Production Facility Air Quality Management Plan 2013, Yara, Perth WA	NA	accessed at https://www.yara.com.au/about-yara/about-yara-australia/pilbara/yara-pilbara-nitrates/
26.	Licence L7997/2002/11, Annual Environmental Report and Annual Audit Compliance Report 2018. Yara Pilbara Fertilisers and Yara Pilbara Nitrates	NA	DWER records (DWERDT148056)

Appendix 2: Summary of applicant's comments on risk assessment and draft conditions

Condition	Summary of Applicant's comment	DWER response
1 (Table 1)	The applicant provided clarification on the following items in the table and requested updates to the report based on the clarifications: • specification that the catalytic abatement system on the nitric acid plant is for NOx emissions. • sources of water inflow to the contaminated and clean/contingency contaminated water ponds and requested removal of duplicated operational requirements; • dust controls for bulk TAN handling and storage infrastructure; and • leak detection is not in place on the seawater cooling circuit pipeline due to the differing pipeline diameters in the circuit making it difficult to measure loss of flow as a result of a leak. Instead of leak detection the Applicant conducts daily visual inspections of the pipeline.	The Delegated Officer considered the clarifications provided by the applicant and has updated Table 1 to include specification the catalytic abatement system for the Nitric Acid plant is for NOx emissions, further defined dust controls for the bulk TAN handling and storage infrastructure, clarification of water sources and operational requirements for the premises ponds and replaced the requirement for leak detection on the seawater cooling circuit with daily visual inspections which are considered an appropriate control for detecting leaks from the pipeline. The Delegated Officer also considers that based on the location and flows through the pipeline, leaks are likely to be readily identified by operators at the plant at other times.
6 (Table 5)	The applicant requested the concentrations for the nitric acid plant stack be amended to be corrected to STP at 17% oxygen on a dry basis as this had previously been identified in correspondence to DWER as an error in the existing licence. The applicant requested that the specified monitoring method (USEPA CTM027) for the Unit 31/32 monitoring be amended to be replaced with an in-house method validated for the vent characteristics. USEPA CTM027 (an isokinetic sampling method) is not considered to be a suitable method for monitoring NH_3 emissions from the vent as it is designed for sampling and analysis of NH_3 in air emissions samples in the ppm range, and NH_3 is expected to comprise the majority of the gas vented from the U31/32 vent. Flow rates in the vent are also	The correspondence advising of the error in correction of concentrations for the nitric acid plant stack was referred to and footnotes to the table updated accordingly to reflect that concentrations for the nitric acid plant stack emissions should be corrected to 17% oxygen at STP. The Delegated Officer considered the monitoring method proposed by the applicant for the Unit 31/32 vent and noted that the method may undergo changes based on potential improvements which will be evaluated when the TAN Plant is restarted. As the applicant was unable to provide a definitive method for the monitoring, a condition requiring the applicant to

Condition	Summary of Applicant's comment	DWER response
	highly variable which can cause issues for isokinetic sampling. The applicant provided a draft method developed specifically for monitoring of NH3 from Unit 31/32 vent. The method notes that potential improvements to the procedures have been identified which will be evaluated and considered for inclusion in the method. As the TAN plant has recently undergone improvement works and is in the process of being re-started at the time of this assessment, the applicant also requested that the timeframe for monitoring of the Unit 31/32 vent be amended from a specified date, to a timeframe of within three months of the TAN Plant reaching steady state production as the plant needs to be under normal operation in order for representative samples to be collected.	submit a proposed methodology to the CEO for sampling and analysis of NH_3 emissions from the Unit 31/32 vent has been included in the licence and monitoring is to be undertaken in accordance with the submitted method. A requirement has also been included that the methodology is peer reviewed to ensure it is appropriate for representative monitoring of emissions from the source. As the methodology will be refined once the TAN plant has achieved steady state operation a timeframe of two months from achieving steady state has been allowed for the submission of the methodology to allow time for refinement to be made. The timeframe for completing monitoring has been set as three months from achieving steady state production to allow sufficient time for optimising the new blow down operational procedure to minimise NH_3 emissions from the vent, and for the three monitoring events to be completed. The TAN plant must be in steady state operation in order for monitoring to be representative of normal operating conditions. A definition for steady state production was included in the licence definitions and a requirement for reporting when start-up of the TAN plant occurs and when steady state production are achieved have been included to provide a suitable framework for DWER to confirm monitoring timeframes have been met.
16 and 17	The applicant queried the relevance of the *Department of Environment Air Quality Modelling Guidance Notes (2006)* in relation to conditions requiring a scope of works to be developed, and modelling conducted to assess the impact of emissions from the Unit 31/32 vent and requested the reference to the guidance notes be removed and the scope of works instead be reviewed and approved by DWER. The applicant also requested timeframes for completion of	The *Department of Environment Air Quality Modelling Guidance Notes (2006)* are used by DWER air quality experts to assess whether modelling of emissions to air is sufficiently conservative to assess the risk associated with air emissions from premises. The guidance notes are still in use and are relevant and provide requirements that should be met for development of sufficiently conservative air quality

Condition	Summary of Applicant's comment	DWER response
	modelling be based on the completion of Unit 31/32 monitoring rather than set dates as the TAN plant was not in normal operation at the time of the assessment (being restarted) and the time needed to achieve steady-state production is uncertain. The monitoring data is needed as an input to the modelling.	models. The Delegated Officer revised the improvement conditions relating to air quality modelling such that the scope must be based on the guidance notes and modelling must be undertaken in accordance with the scope submitted. DWER's air quality experts are able to provide further advice on air quality modelling to the applicant as required. The timeframe for completion of the modelling and submission of a report and data files was also revised from a specified date to within one month of completing the Unit 31/32 monitoring. A definition for steady state production was included in the licence definitions and a requirement for reporting when start-up of the TAN plant occurs and when steady state production are achieved have been included to provide a suitable framework for DWER to confirm modelling timeframes have been met.
12 (Table 7)	The applicant requested: • clarification be included that only in-situ field measurements are to be taken through a flow through cell and that field measurements are not required to be NATA accredited; and • removal or clarification of requirements for limits of reporting needing to be lower than site specific trigger values and for ultra trace analysis. It was noted that site specific trigger values have not been developed for the groundwater monitoring wells DS1-8 and US2.	The footnotes relating to the monitoring specified in Table 7 were updated to clarify that only analysis of in-field samples is required to be undertaken through a flow-through cell which is in alignment with Schedule B2 of the NEPM (Assessment of Site Contamination). Updates were also made to the footnotes to specify a reference for the trigger values for which the limits of reporting are required to be lower than, and to clarify that ultra-trace analysis should be used if matrix interference raises limits of reporting (where it is possible as high dissolved solids can impact on the ability for this method to be used). The Delegated Officer noted the applicant's comment that trigger values have not been developed yet for DS1-8 and US2 but considers that these should be applied once developed. MS 870 condition 8-4 requires the development of trigger values for groundwater monitoring wells.

Condition	Summary of Applicant's comment	DWER response
Schedule 1	The applicant provided updated premises, infrastructure, authorised discharge point and monitoring location maps for inclusion in the licence.	The maps in schedule 1 were updated accordingly.
Decision report, miscellaneous sections	The applicant provided clarification on the following items in the decision report and requested updates to the report based on the clarifications: • YPN ownership structure; • stormwater and wastewater management; • infrastructure names; • licence numbers; • visual inspections rather than leak detection on the seawater cooling circuit; and • fugitive ammonia alarm trigger levels. The applicant also provided details of additional controls for preventing and minimising emissions of environmentally hazardous substances and contaminated water which included bunding or double walled tanks, visual inspections and the DMIRS approved emergency management plan.	The information provided by the applicant has been considered by the Delegated Officer and has been added or amended in relevant sections of the decision report where required.
Decision report and licence, miscellaneous sections	The applicant identified typographical errors and/or omissions in the licence and decision report.	Typographical errors and omissions were updated in the licence and decision report.

Appendix 3: Summary of comments on the application for licence from stakeholders

Summary of comments	DWER response
Stakeholders have submitted that they are concerned that the plant does not comply with best practice/implement best available technology and that the applications do not incorporate the precautionary principle or the principle of intergenerational equity. DWER is required by legislation to have regard to these principles.	Operation of the TAN Plant was assessed by the EPA under Part IV of the EP Act. The EPA's assessment of the proposal considered that the stack emissions for the nitric acid plant were consistent with best practice but that emissions from the common stack were not and therefore MS 870 included requirements (condition 5) to adopt best practice pollution control technology to minimise stack emissions. The DWER undertook a technical review in 2018 which found best practice pollution control had been included in the plant design and construction, and performance of the pollution control equipment compares favourably with relevant best practice stack emission concentration criteria under normal operating conditions (refer to section 6.1.1 for further discussion). Condition 5 of MS 870 was replaced by conditions specified in MS 1121 subsequent to a section 46 enquiry relating to air quality. Included conditions require YPN to compare expected emissions and implemented pollution controls with best practice, and identify and consider advances in pollution control that can be incorporated into the TAN Plant. The Delegated Officer therefore considered the requirements of MS 1121 provide for YPN to identify and adopt changes which will minimise air emissions, and in accordance with the Regulatory Framework has not duplicated this requirement. The EPA's Statement of Environmental Principles, Factors and Objectives explains how environmental impact assessment by the EPA fulfils the requirements of the EP Act, making specific reference to the object and principles of the EP Act including the precautionary principle. The EPA had regard to the precautionary principle and the principle of intergenerational equity in its assessments of the TAN Plant (refer to Reports 1379 and 1648). DWER's regulatory framework which applies to the assessment of applications under Part V of the EP Act incorporates the precautionary principle. The framework is based around undertaking a risk based assessment of emissions and their potential impacts to the environment and public health. Suitable controls are determined based on the outcome of the risk assessment to ensure activities do not pose an unacceptable risk. The

Summary of comments	DWER response
	risk assessment undertaken has not identified that there is a threat of serious or irreversible damage. Intergenerational equity is equally supported by this approach as it ensures that environmental and public health values are protected into the future. The precautionary principle states that where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. As discussed in section 5.2.2, the findings of the recent EPA inquiry into changing implementation condition 5-1 in MS 870 (TAN Plant) to protect rock art are relevant to consideration of the application of the precautionary principle. As documented in EPA Report 1648 the inquiry found that "*there is currently no compelling scientific evidence which indicates that there is an immediate material threat of serious or irreversible damage to rock art from cumulative industrial air emissions within the Murujuga airshed"*. To ensure there is a framework in place for protection of the Murujuga rock art into the future DWER, in conjunction with the MAC, is implementing the Murujuga Rock Art Strategy. The EPA also recommended in EPA Report 1648 that ministerial conditions of existing industrial facilities located on Murujuga should be changed via section 46 of the EP Act, to include a requirement to reduce the risk of impacts to rock art from air emissions.
The best practice pollution controls are focussed on point source emissions and do not consider other emission sources such as loading and transport of product.	In accordance with DWER's *Regulatory Best Practice Principles* regulatory decisions will be made proportionate to the level of risk posed to public health, the environment and water resources. The risk assessment relating to fugitive emissions of ammonium nitrate particulates, and controls implemented as an outcome to that assessment, are included in sections 9.6 and 10.2 respectively. As per the risk assessment, the risk associated with fugitive emissions of ammonium nitrate particulates is considered to be medium, which is considered to be acceptable subject to regulatory controls in accordance with DWER's Regulatory Framework (*Guidance Statement: Risk Assessments*). Accordingly, infrastructure controls have been applied which specify storage and handling requirements for TAN intended to minimise fugitive ammonium nitrate particulate emissions.

Summary of comments	DWER response
Stakeholders have raised concern that rock art (petroglyphs) on Murujuga is already being damaged by acidic emissions and requested that the applicant be required to further reduce emissions from the plant to as close to zero as technically possible to meet the obligations of the precautionary principle. Increase in the acidity of rock surfaces will dissolve the rock surface patina which is essential for the preservation of petroglyphs. Industrial and shipping emissions which are causing an increase in the acidity of rock surfaces on Murujuga include: • emissions of SO_2 and NO_2 which form sulfuric and nitric acids, and when combined with salt water spray can also form hydrochloric acid; and • emissions of nitrogenous compounds (nitrogen dioxide, nitrous oxide, ammonia, ammonium nitrate particles) which stimulate the growth of bacteria, fungi and lichens that produce organic acids lowering the pH of the rock surface. Stakeholders have submitted that technology is available which can reduce emissions to zero. Specifically, that Yara International state SO_2 from ships can be reduced to 0 ppm and using Selective Catalytic Reduction (SCR) systems NOx can be reduced by 98% on any industrial plant. Placing several of the SCR systems or scrubber systems in series within a venting outlet would therefore result in emissions being reduced to near zero. The new licence must require the applicant to use the technology to reduce emissions to near zero.	In accordance with DWER's *Regulatory Best Practice Principles* regulatory decisions will be made proportionate to the level of risk posed to public health, the environment and water resources. As per earlier response in this table, the EPA has considered damage to rock art in its inquiry into condition 5-1 of MS 870 (TAN Plant), and as per the findings documented in EPA Report 1648 has found that "*there is currently no compelling scientific evidence which indicates that there is an immediate material threat of serious or irreversible damage to rock art from cumulative industrial air emissions within the Murujuga airshed"*. In line with the precautionary principle, to ensure there is a framework in place for protection of the Murujuga rock art into the future DWER, in conjunction with the MAC, is implementing the Murujuga Rock Art strategy which establishes the regulatory framework for assessing and managing potential impacts on Murujuga's rock art petroglyphs (further details are in section 5.3 of this Decision Report). As per the risk assessment in section 9.1 (Table 21 and Table 22), the Delegated Officer has determined that the regulatory framework described in section 5.3 is appropriate for assessing and managing potential impacts to rock art as there are multiple industries located on Murujuga and surrounds which could potentially impact rock art, therefore a coordinated approach is most appropriate. The Murujuga Rock Art Strategy establishes the long term basis for coordinated monitoring and analysis of changes to rock art on Murujuga and, if appropriate, implementation of management or mitigation measures. Information from the monitoring will be used to determine whether further regulation of emissions from industries operating on Murujuga and surrounds is required.. Operation of the TAN Plant was assessed by the EPA under Part IV of the EP Act. The EPA's assessment of the proposal considered that the stack emissions for the nitric acid plant were consistent with best practice but that emissions from the common stack were not and therefore MS 870 included requirements (condition 5) to adopt best practice pollution control technology to minimise stack emissions. The DWER undertook a technical review in 2018 which found best practice pollution control had been included in the plant design and construction, and performance of the pollution control equipment compares favourably with relevant best practice stack emission

Summary of comments	DWER response
	concentration criteria under normal operating conditions (refer to section 6.1.1 for further discussion). As per sections 9.4 and 9.5, the risk associated with emissions of NOx, PM and NH_3 to air from the plant during normal and non-routine operation is considered to be medium. In accordance with DWER's regulatory framework (*Guidance Statement: Risk Assessments*) a medium level of risk is acceptable and likely to be subject to some regulatory controls. Accordingly controls including monitoring, limits and infrastructure requirements to minimise emissions have been included in the licence as per justification in section 10.1. The level of risk does not justify further control to require the licence holder to reduce emissions as there is no immediate threat to public health associated with the emissions. Suitable emission control is dependent on a number of factors including the relevance to the infrastructure it is applied to, the fuel source and ambient conditions amongst other considerations. The technology that the stakeholder submissions refer to in relation to abatement of SO_2 emissions from ship fuel combustion is not contextually relevant nor applicable to the TAN Plant.
Stakeholder submissions raised that Doctors for the Environment state that NO_2 values as low as 9 ppb cause asthma in children and that reducing NO_2 emissions from the plant is therefore important for the health of local workers, residents and people visiting Deep Gorge and Hearson Cove, as well as for the preservation of the Burrup rock art. Model predictions in the application suggest this concentration will be exceeded on an annual mean level at all local sites including Karratha. Peak hourly rates are ten times annual rates and can pose an immediate health risk. The proximity of the TAN plant to Hearson Cove and Deep Gorge continues to be a concern to human health and safety, both for the public and workers, given the potential for toxic gas releases into the air (especially CO and NO_2), frequent westerly winds and 365 days/year operation.	Assessment of the risk associated with air emissions, including NOx is detailed in sections 9.4 and 9.5 of this Decision Report. The assessment has been undertaken in accordance with DWER's regulatory framework (*Guidance Statement: Risk Assessments*) with the level of risk associated with NOx emission found to be medium. Relevant criteria for air emissions were taken from the NEPM which is considered the appropriate criteria to apply. A medium level of risk is acceptable and likely to be subject to some regulatory controls. Accordingly controls including monitoring, limits and infrastructure requirements to minimise emissions (NOx) have been included in the licence as per justification in section 10.1. The Western Australian Government is considering the establishment of a long-term, coordinated ambient air quality monitoring network on Murujuga and in the surrounding area suitable for monitoring human health impacts. The introduction of a centralised and coordinated monitoring network will expand the knowledge base to manage the air quality in the region and result in more informed decision-making. A consultant has been engaged to provide advice on suitable monitoring locations, pollutant sources to be monitored and instrumentation and siting for ambient air monitoring. A coordinated

Summary of comments	DWER response
	approach to monitoring and management of air emissions from industries located on the Burrup is considered the most appropriate approach.
Satellite imagery taken by the Sentinel-5P (P for precursor) shows high concentrations of NO_2 over the Burrup Peninsula, Dampier and Karratha for the 7th of November 2019 showing the extent of emissions from industry on Murujuga and other areas of the region. The satellite measures the concentration of NO_2 in the column of air to the ground. The extremely high concentration of NO_2 over Murujuga and Karratha may suggest the high concentrations of NO_2 is the cause for the anecdotal 'Karratha respiratory syndrome'. This is a threat to human health and therefore the licence should authorise virtually zero emissions of NO_2.	The derived NO_2 concentrations from Sentinel-5P satellite data are based on tropospheric NO_2 vertical column density. Although most NO_2 sources are suggested to be related to ground level or point source anthropogenic activities, the satellite data have limitations in identifying that emissions are from a single industrial activity. The resolution of the data file is 7 km x 3.5 km and there are multiple large industries (Pluto LNG Plant, Karratha Gas Plant, port activities, and the adjacent Ammonia plant) contributing NOx emissions within the Burrup region therefore it is not possible to attribute concentrations to a source. While it appears feasible to calculate gridded emissions from satellite data alone, the limitation is the resolution of the data file which covers more than one operation. Data from the Sentinel-5P are best used to indicate the regional NO_2 concentrations and are not appropriate for assessing emissions for one premises when multiple emission sources are present in proximity to the premises.
The applications include modelling of air emissions and cumulative impacts but how do the emissions (especially NOx) translate to cumulative acidic deposition on the rock art and biodiversity of the Burrup Peninsula. This impact needs to be assessed before it's too late to stop the destruction of the rock art.	The regulatory framework for assessing and managing potential impacts on Murujuga's rock art petroglyphs is described in section 5.3. The Delegated Officer considered the potential for air emissions to impact on rock art (Table 21and Table 22) and concluded that the regulatory framework described in section 5.3 is appropriate for assessing and managing potential impacts to rock art as there are multiple industries located on Murujuga and surrounds which could potentially impact rock art, therefore a coordinated approach is most appropriate. The Murujuga Rock Art Strategy establishes the long term basis for coordinated monitoring and analysis of changes to rock art on Murujuga and, if appropriate, implementation of management or mitigation measures. Information from the monitoring will be used to determine whether further regulation of emissions from industries operating on Murujuga and surrounds is required. The Murujuga Rock Art Strategy provides for establishment of an atmospheric deposition network which will provide data on the composition

Summary of comments	DWER response
	and concentration of contaminants that are potentially transferred from the atmosphere to the rock surfaces.
Stakeholders have submitted that monitoring and reporting of emissions should be undertaken by an independent body of scientists and not by Yara.	It is usual practice for the Department to specify that a licence holder undertakes monitoring and reporting of data. To ensure the accuracy and validity of monitoring data, licence conditions specify that all non-continuous sample collection and/or analysis is undertaken by a holder of a current NATA accreditation for the methods of sampling and/or analysis. Non-NATA accredited analysis is allowed where, field collection and analysis of samples is required due to laboratory holding times being unable to be met. Sampling in accordance with relevant methods is also specified in the licence to ensure representative samples are collected. As the stakeholder comment also relates to rock art monitoring it is highlighted that as per the discussion in section 5.3 the rock art monitoring program being undertaken under the Murujuga Rock Art strategy is being undertaken by a consultant, in close consultation with the MAC, and the program and outcomes will be subject to independent peer review.
Emissions monitoring should be undertaken in real time with reporting of monitoring data and exceedances made available for public scrutiny. The licenses should include a requirement for alarm systems which immediately notify Yara, government and the public of breaches of maximum limits (such as through public website reporting).	Publicly available real-time monitoring data can be useful in facilitating public participation and increasing public understanding of emissions and their regulation. However, publication of real-time data is only useful if it can be meaningfully interpreted by the public. To achieve this, the published data should directly relate to impact criteria applied at sensitive receptor locations. However, the ambient monitoring specified in the licence conditions is not designed to achieve this goal. Rather, it is designed as an operational tool where a concentration is set to trigger early warning alerts and investigation action to identify and rectify the source of discharge to minimise the likelihood of offsite impacts. The limits within the licence are not indicators of an imminent threat to the public or environment, rather they are intended to limit emissions to levels below which impacts to health and/or the environment are not expected to occur. Therefore exceedance of a limit does not warrant immediate notification. Rather, an appropriate response to minimise the risk associated with a limit exceedance is for the licence holder to identify an exceedance has occurred, investigate and rectify the cause of the exceedance and report

Summary of comments	DWER response
	this information as per the conditions of the licence. Section 72 of the EP Act contains provisions to notify DWER of waste discharges that have caused or are likely to cause pollution, material environmental harm or serious environmental harm as soon as practical after the discharge therefore the licence does not duplicate such a requirement. Real-time data displays are only meaningful in the context of continuous monitoring with relatively short averaging periods, so that trends of elevated emissions and exceedances can be observed and detected when they occur. Data that are collected less frequently, such as at monthly or quarterly intervals are not suitable for real-time displays and are more usefully observed for trends over longer periods of 12 months or more.
Stakeholders have raised concern that the location of ambient air monitoring associated with the TAN plant cannot provide an adequate dataset for measuring emissions that would particularly affect the public using Hearson Cove and Deep Gorge. Additional air monitoring stations with alarms should be located along the east and southeast lease boundaries (near DS1, DS2 and DS3 groundwater bores).	The ambient air monitors and alarms are intended to identify the presence of NH_3 in air at the premises boundary to trigger investigation and remedial action for the source of the ammonia as ambient concentrations should be low during normal operation of the plant. The trigger level for alarm activation is based on the Short Term Exposure Level (15-minute average) specified by Safe Work Australia. Exceedance of the criteria does not mean there is an imminent threat of health impact rather continued exposure at the concentration level or higher levels could result in impact to health. The monitors are located at the Premises boundary and are therefore more than 500 m from the nearest sensitive receptor at Hearson Cove. Concentrations at the receptor would be lower than at the Premises boundary. For worker health and safety YPN has a network of monitors around the TAN Plant area which have the same trigger criteria and are closer to potential emission sources. These are likely to trigger an alarm before the boundary monitors. This lowers the likelihood of an alarm triggering at the Premises boundary as NH_3 presence can be detected earlier. Consequently, the location of the ambient NH_3 monitoring stations is considered adequate to detect NH_3 presence in the air at the defined trigger levels at the premises boundary and additional stations are not considered necessary.
Concern was raised that the TAN plant did not undergo a separate and rigorous assessment process because it was constructed and	As per section 5.7, application was made to the Department for a works approval for the construction and commissioning of the TAN Plant. The

Summary of comments	DWER response
began commissioning under an amendment to the Works Approval for the ammonia plant. Cumulative emissions across the region must be considered in addition to the emissions from individual plants.	application was assessed and granted (W4701/2010/1) on 25 July 2017. The works approval authorised construction and commissioning of the TAN Plant. An application was made to amend licence L7997/2002/11 to include the operation of the TAN Plant. The application was assessed in accordance with DWER's regulatory framework and, based on the outcome of the risk assessment, regulatory controls were included in an amended licence relating to the operation of the TAN Plant. The assessment considered cumulative emissions were appropriate (air quality, noise). This assessment has also considered cumulative emissions where relevant to the assessment (air quality, noise). Part IV assessment for the TAN Plant also considered emissions from the TAN Plant with reference to emissions from other industries on the Burrup.
The TAN plant application lacked quantification of some emissions such as the ammonia and ammonium nitrate released as fine particles into the air during the prilling process. The stakeholder raised that the amount of particles removed by the scrubbers and the emissions released after scrubbing was not quantified.	DWER does not rely solely on information provided in an application to undertake its assessment. The Delegated Officer referred to information in the application as well supplementary information publicly available or available in DWER records for the assessment of the application. Documents referred to in undertaking this assessment are listed in Appendix 1 – Key documents and are referenced where appropriate throughout the text. The capability of pollution control equipment was assessed for the works approval W4701/2010/1 application and emission targets (including for particulates and NH3 from the TAN prill plant) were included in the instrument. These targets are included in the issued Licence L9223/2019/1 as limits.
Concern was raised that the timeframe provided in the application for the start-up and achievement of steady state operation of the TAN followed by monitoring, modelling and reporting to validate emission rates will create a delay in informing DWER (and the public) whether revised emission rates provided for the plant are accurate.	The Delegated Officer has taken into consideration the proposed timing for restart of the TAN Plant as well as time needed for monitoring and modelling in determining appropriate timeframes for the completion of validation monitoring and modelling for Unit 31/32 Vent. The issued licence includes conditions specifying requirements and timeframes for monitoring and modelling for emissions from the Unit 31/32 Vent.
Concern was raised regarding the TAN plant site's classification as '*possibly contaminated – investigation required*' due to the contamination of groundwater by ammonia and nitrates, making the	A classification of '*possibly contaminated – investigation required*' indicates contamination may be present with further investigative work required to confirm whether contamination has occurred and assess the level of

Summary of comments	DWER response
groundwater unusable.	contamination. As per section 9.7.6 actions and ongoing investigations relating to the TAN Plant's site classification in regards to contamination are being managed in accordance with the CS Act and accordingly the licence does not include controls relating to this. Groundwater at the premises is brackish to saline and is therefore not suitable for public use.
The TAN plant has had limited production time in the last 12-18 months therefore there is concern over the use of monitoring and testing results provided as a basis for modelling and regulation.	The Delegated Officer does not rely solely on monitoring information in undertaking its assessment of the risk of emissions and discharges. In addition to monitoring information the Delegated Officer also refers to modelling results, site history, capability of pollution control equipment, other regulatory requirements amongst other information in determining the risk associated with activities on a premises and applying appropriate controls. Information which has been referred to The issued licence includes monitoring and reporting requirements which require the licence holder to provide monitoring results on an annual basis in the form of an AER. DWER is able to review information contained in AERs to inform future review and risk assessments, and assess if the activities on the premises are impacting on the environment. Should review of the information indicate risk to the environment or public health has increased the CEO has the power to amend the licence under section 59 of the EP Act to include additional controls as necessary to reduce the risk to an acceptable level.
Penalties should be included in the licence for breaches of maximum emission limits or licence conditions to ensure there is incentive for emissions reduction technology to remain effective over time.	Penalties for breaching conditions of the licence are not specified within the instrument as the EP Act includes provisions for offences and penalties for contravening licence conditions.
The risk assessment for the Existing Licence assigned a medium risk for air emissions at Hearson Cove and residential areas at Dampier and Karratha, and the workforce at surrounding industrial and port premises. A medium risk is not acceptable and indicates more stringent emissions standards and regulation are required in the licence to reduce human and environmental health risks.	Risk associated with point source air emissions from normal and non-routine operation of the TAN Plant, and fugitive ammonium nitrate particulates has been assessed in sections 9.4, 9.5, and 9.6 of the Decision Report. The level of risk is based on the potential consequences of air emissions and likelihood these consequences will occur. In accordance with DWER's regulatory framework (*Guidance Statement: Risk Assessments*) a medium level of risk

Summary of comments	DWER response
	is acceptable and likely to be subject to some regulatory controls. Accordingly controls including monitoring, limits and infrastructure requirements to minimise emissions have been included in the licence as per justification in sections 10.1 and 10.2.
The Existing Licence for operation of the TAN and ammonia plants is inadequate for protecting the Murujuga rock art for future generations. Strict controls must be applied to acidic and nitrogenous emissions from the plants if the petroglyphs are to be preserved. The reasons for the inadequacy of the Existing Licence were set out in the appeal against the licence and DWER did not provide an adequate response or explanations in relation to the specific and detailed matters raised. All grounds for appeal remain relevant to the current licence application and must be answered in relation to the scientific information presented.	The regulatory framework for assessing and managing potential impacts on Murujuga's rock art petroglyphs is described in section 5.3. The Delegated Officer considered the potential for air emissions to impact on rock art (Table 21and Table 22) and concluded that the regulatory framework described in section 5.3 is appropriate for assessing and managing potential impacts to rock art as there are multiple industries located on Murujuga and surrounds which could potentially impact rock art, therefore a coordinated approach is most appropriate. The Murujuga Rock Art Strategy establishes the long term basis for coordinated monitoring and analysis of changes to rock art on Murujuga and, if appropriate, implementation of management or mitigation measures. Information from the monitoring will be used to determine whether further regulation of emissions from industries operating on Murujuga and surrounds is required.
The frequency of monitoring in the Existing Licence is averaged over 60 minutes which does not comply with the CEMS code which requires monitoring of NOx at an average of 15 minutes or less.	The reference to the CEMS Code refers to cycle times, not averaging times for monitoring. Cycle time is defined in the CEMS Code as the time it takes to complete a measurement or cycle of measurements from all analysers in a time-shared system. The averaging period specified in the licence, in contrast, relates to the time period over which measurements or data points are averaged, implying that multiple data points are collected, which are used to calculate an average. In a time shared system, this would mean that at least four data points (every 15 minutes) would be collected over a 60-minute period. The specification of a 60-minute averaging time in the licence does not mean that only one data point is collected over 60 minutes. The requirement for averaging data over a 60-minute period therefore does not create inconsistencies with the CEMS Code.
Stakeholders have submitted that previous CSIRO studies should not be used as a basis for decision making as there is published research refuting the CSIRO data analysis (e.g. Rock Art Research, 2017, vol. 34, p.130-148).	The regulatory framework for assessing and managing potential impacts on Murujuga's rock art petroglyphs is described in section 5.3. The Delegated Officer considered the potential for air emissions to impact on rock art (Table 21and Table 22) and concluded that the regulatory framework

Summary of comments	DWER response
Yara continues to rely on the EPA finding that “there is sufficient time for the monitoring and evaluation activities associated with the Murujuga Rock Art Monitoring Program to be undertaken and for definitive information in regard to whether cumulative industrial air emissions within the Murujuga airshed are adversely affecting rock art to be obtained". Stakeholders disagree with the above position as current scientific evidence shows the increase in rock surface acidity close to industry is already dissolving the patina within which the rock art is engraved (irreversible damage) which is needed to preserve the rock art for future generations. The rock art is at risk of further impact if measures are not taken to prevent further emissions on the Burrup. Until a new monitoring program is established on the Burrup that provides quantifiable and repeatable results acidic emission must be reduced to near zero to protect the rock art.	described in section 5.3 is appropriate for assessing and managing potential impacts to rock art as there are multiple industries located on Murujuga and surrounds which could potentially impact rock art, therefore a coordinated approach is most appropriate. The Murujuga Rock Art Strategy establishes the long term basis for coordinated monitoring and analysis of changes to rock art on Murujuga and, if appropriate, implementation of management or mitigation measures. Information from the monitoring will be used to determine whether further regulation of emissions from industries operating on Murujuga and surrounds is required. The risk assessment in section **Error! Reference source not found.** and **Error! Reference source not found.** shows air emissions do not pose an unacceptable risk of public health impact therefore, in accordance with DWER’s regulatory framework, there is no basis for requiring emissions to be reduced. Limits have been included on the licence for NOx, NH_3 and PM (ammonium nitrate) emissions which are considered to be the most significant.
DBCA reviewed the application in relation to its roles and responsibilities under the *Conservation and Land Management Act 1984* (CALM Act) or the *Biodiversity Conservation Act 2016* (BC Act). DBCA did not propose any specific comment in regards to the licence application.	No response required.
The City of Karratha reviewed the application and advised they have no objection to, or comment to make, in regards to the application	No response required.

Appendix 4: Benchmark Toxicology Services Report

Attachment 1: Issued Licence L9223/2019/1