



Application for Licence

Part V Division 3 of the *Environmental Protection Act 1986*

Licence Number	L9224/2019/1
Applicant	Yara Pilbara Fertilisers Pty Ltd
ACN	095 441 151
File number	DWER2019/000563
Premises	Yara Pilbara Fertilisers Ammonia Plant Village Road BURRUP WA 6714 Legal description Part of Lot 564 on Deposited Plan 31023 Certificate of Title Volume 2222 Folio 200 As defined by the coordinates in Schedule 2: Premises Boundary
Date of report	20 October 2025
Decision	Revised licence granted

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1. Decision summary

This amendment report documents the assessment of the application submitted by Yara Pilbara Fertilisers Pty Ltd (YPF) for changes to the Yara Pilbara Fertilisers Ammonia Plant that will result in process gases containing ammonia (NH_3) that are currently emitted through the plant's Back End Vent (BEV) during start-up, to be re-directed through the production flare.

As a result of this assessment, an amendment to licence L9224/2019/1 has been granted.

The decision report for the licence will remain on the department's website for future reference and will act as a record of the department's decision making.

2. Scope of assessment

2.1 Regulatory framework

In completing the assessment documented in this amendment report, the Department of Water and Environmental Regulation (DWER, department) has considered and given due regard to its Regulatory Framework and relevant policy documents which are available at [DWER Regulatory documents | Western Australian Government \(www.wa.gov.au\)](https://www.wa.gov.au/government/publications/dwer-regulatory-framework).

2.2 Application summary

On 22 December 2023, YPF submitted an application to amend licence L9224/2019/1 to the department under section 54 of the EP Act.

The application is for the installation and operation of a valve that will redirect process synthesis gas (syngas) emissions that have previously been emitted through the BEV during plant start-up to the production flare for the purpose of combusting the NH_3 in the process gas and reducing ammonia emissions.

By redirecting the process gas to the production flare, ammonia will be combusted to nitrogen (N_2), nitrogen oxides (NO_x) and water with a small percentage of the ammonia remaining uncombusted.

The application (and this amendment report) only relates to changes to the ammonia plant, comprising the operation of a valve that will redirect start-up process gases containing ammonia to the production flare. A thorough risk assessment for operation of the ammonia plant was conducted in 2020 when a new licence for the premises was granted ([L9224/2019/1 Decision Report](#)) and is not within the scope of the application.

3. Background and context to the application

3.1 Overview of premises

YPF operates a liquid ammonia plant under licence L9224/2019/1 on part of Lot 564 on Deposited Plan 31023, Village Road, Burrup (the premises), approximately 11 km north-west of Karratha and 7 km north-east of the town of Dampier. The plant is located on the Burrup Peninsula which forms part of the Dampier Archipelago which is also known as Murujuga.

Ministerial approval to construct and operate the plant was granted through Ministerial Statement (MS) 586 by the Minister for Environment under Part IV of the *Environmental Protection Act 1986* (EP Act) in 2002. A licence to operate the plant under Part V of the EP Act was first granted in 2005, with operation of the plant commencing in 2006. In 2015 MS 586 was amended to remove regulation of air emissions on the basis they can be regulated under the Part V licence for the plant.

The current ammonia plant licence L9224/2019/1 was granted on 20 April 2020. A Technical

Ammonium Nitrate (TAN) Plant was constructed adjacent to the ammonia plant which commenced operation in 2018. A separate licence L9223/2019/1 applies to the TAN plant and is held by Yara Pilbara Nitrates Pty Ltd (YPN).

The ammonia plant processes natural gas from an offshore gas reserve to produce ammonia (NH₃). The ammonia plant operates 24 hours a day, seven days a week and can produce 950,000 tonnes of anhydrous liquid ammonia per year using the Kellogg Brown and Root (KBR) Purifier Process.

The produced ammonia is stored at -33°C in two 40,000 tonne tanks to keep it in liquid form. An above ground export pipeline and recirculation line is used to transport the refrigerated liquid ammonia between the premises and the Dampier Bulk Liquids Berth at the Port of Dampier, where it is loaded into ships for export.

3.2 Murujuga's rock art petroglyphs

The premises is located on Murujuga (the Dampier Archipelago, including the Burrup Peninsula and surrounds) 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. In July 2025, the Murujuga Cultural Landscape was inscribed on the United Nations Educational, Scientific and Cultural Organisation (UNESCO) World Heritage List. Aboriginal sites or objects within a declared area of the Murujuga Cultural Heritage Landscape are also protected from being moved, damaged, defaced, or otherwise disturbed (unless specifically exempt) under the *Aboriginal and Torres Strait Islander Heritage Protection (Murujuga) Declaration 2025* made by the Federal Minister for the Environment and Water under section 10 of the *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* (Commonwealth) on 12 September 2025. 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.

The department recognises the cultural importance and heritage value of rock art both internationally and locally and is committed to conducting further detailed scientific investigations and continuing the coordinated approach involving implementation of the Murujuga Rock Art Strategy (MRAS) and Murujuga Rock Art Monitoring Program (MRAMP), joint initiatives of DWER and MAC. 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 a long-term framework for the monitoring, analysis and management of environmental quality to protect the rock art on Murujuga from the impacts of anthropogenic emissions. The MRAMP is a scientific monitoring and analysis program examining whether the rock art engravings of Murujuga are subject to accelerated change as a result of industrial air emissions. The results from the monitoring program will identify relevant environmental quality indicators and define acceptable and unacceptable environmental quality conditions, therefore providing data for measuring and assessing environmental performance against environmental quality criteria.

The department has published key milestones for the MRAS which include annual reports on the monitoring studies being undertaken under the MRAMP and the development of interim Environmental Quality Criteria (EQC) and final EQC which are scheduled for completion in 2026 (DWER 2023). The data obtained from the first two years of monitoring studies and laboratory investigations undertaken under the MRAMP, have been used to develop a set of interim EQC for nitrogen dioxide (NO₂), sulphur dioxide (SO₂) and ammonia (NH₃) which were first published in *Murujuga Rock Art Monitoring Program: Interim Environmental Quality Criteria* (WSP & Curtin University 2025) in May 2025 in conjunction with the MRAMP second year monitoring studies report. The report states that the interim EQC's are not exceeded by current atmospheric levels of pollutants.

3.3 Appeals

Two appeals were received on the conditions of L9224/2019/1 in relation to the assessment and conditions not adequately protecting rock art in the surrounding area, or human health.

The appeals were determined in January 2025. In his Appeal Determination in relation to the granting of L9224/2019/1, the Minister for Environment determined that the implementation of the MRAS and the MRAMP are the most appropriate mechanisms for determining impacts on rock art and establishing an appropriate management response. MRAS and MRAMP are commitments of the State Government and they operate within the existing legislative framework including the EP Act and the *Burrup and Maitland Industrial Estate Agreement*.

4. Backend Vent

The BEV was identified as an emission point for hydrogen (H₂) and nitrogen (N₂) in the original and subsequent licence applications for the ammonia plant. Ammonia was not originally identified as an emission from the BEV and is not explicitly authorised as an emission from the BEV in the existing licence. Ammonia emissions from the BEV do not occur during normal operation of the plant only being discharged from this source during upset conditions as further described in section 4.1.

YPF identified that it was technically feasible to eliminate BEV emissions during start-up through an engineering modification to redirect the emissions (process gases containing ammonia) to the production flare where they would be combusted.

4.1 Back end vent ammonia emissions

Ammonia is produced in the back end of the plant when H₂ and N₂ are reacted.

The amendment application states that emission of process gases from the BEV occurs as a result of:

1. Pressure safety and relief valve discharge in an over pressure event;
2. Process depressurising during a shutdown;
3. Manual venting during upset conditions – non steady state operations
4. Removal of a portion of non-specification start-up process gases from the back end of the ammonia plant during start-up of the plant.

The application states that minimal ammonia is emitted during scenarios 1, 2 and 3 which are rare events and emissions in scenario 4 depend on the number and duration of start-up events the ammonia plant has. Scenario 4 is the focus of the application as it is during these events that syngas will be redirected to the production flare.

No venting of ammonia from the BEV occurs during normal operation of the plant. Ammonia may be vented during abnormal operations:

- when excess inert gas cannot be controlled by the ammonia recovery unit, an infrequent event usually occurring less than every two years (was previously occurring more than once every two years based on previous operation of the plant but due to the plant operation modifications, as outlined in section 4.2, it has now been reduced to less than every two years); or
- during start-ups that include converter catalyst reduction operations, which occur every 20 years.

Table 1 below shows the number of BEV NH₃ emission events that have happened between 2019 – 2025 and details of the resulting emissions.

Table 1: Back end vent NH₃ emission event summary

	2019	2020	2021	2022	2023	2024	2025 (June)
Total No. Start ups	2	2	7	3	3	2	0
Total number of upset conditions	3	1	15	22	3	2	0
Number of venting hours	290	15	141	221	45	0	0
Maximum NH₃ emission rate (g/s)	249.5	399.0	530.8	288.0	163.2	0	0
Median NH₃ emission rate (g/s)	157.9	134.5	101.3	134.4	85.5	0	0
Average NH₃ emission rate (g/s)	150.3	165.4	110.5	120.8	73.4	0	0
Total NH₃ emissions per year (t/year)	253	12	43	97	1.3	0	0

YPF has advised DWER that between November 2019 and June 2022 the seawater cooling tower for the ammonia plant was being rebuilt and contributed to an increase in upset conditions which led to increased venting. The cooling tower has now been rebuilt with expected reduction in upset conditions occurring.

YPF has also advised that it has implemented process controls that have resulted in venting of process gas typically not being required for regular start-ups. As a consequence, venting to the BEV does not occur in most instances and once the valve is installed for the redirection of the of process gas, flaring of process gas will not be a regular occurrence.

4.2 Plant modifications to reduce ammonia emissions

YPF conducted investigations into an engineering solution that directs synthesis gas (syngas) emissions containing ammonia from the BEV to the existing production flare. YPF has stated that the production flare is designed to provide efficient mixing of the feed gas and air, at appropriate gas velocities to facilitate ignition of the combustible gas/air mixture and near complete oxidation of NH₃ to N₂, along with oxidation of H₂ to H₂O and methane to CO₂ in waste process gases and operates at a temperature of 1273 K (~1000°C).

The installation of a control valve (HV-1019A) in the syngas line will direct the process syngas from start up and up-set conditions to the flare instead of the BEV, where NH₃ will be combusted to N₂, H₂O, and NO_x with a very small amount of NH₃ (~0.1%) remaining un-combusted. This will eliminate the venting of process syngas containing ammonia from start-up and upset conditions to the atmosphere from the BEV. The installation of valve HV-1019A does not eliminate emissions from other emission sources that do not contain ammonia from the BEV so the vent is required to remain on the licence as an authorised emission point for H₂ and N₂.

Following the identification of the BEV as an ammonia emission source YPF conducted process optimisation works to reduce emissions from the BEV. As a result of these works the maximum emission rate of ammonia that is expected to be combusted by the flare has reduced from 530.8 g/s (maximum emission rate recorded in recent years and used as a basis for initial air emission modelling) to below to 384.8g/s.

In an emergency overpressure event that results in the lifting of the pressure relief valve at the

discharge of the synthesis gas compressor, very small amounts of ammonia may be released from the BEV. YPF advised this is a rare emergency event and has only happened once in the previous five years. This amendment report does not assess or authorise this emission.

4.3 Air dispersion modelling of NO_x and NH₃ emissions

As part of the application YPF submitted air dispersion modelling for NO_x and NH₃. The model used the worst case emissions from the production flare which is based on a process flow limit that the plant is designed to accommodate where two pressure relief valves lift simultaneously, along with the redirection of process syngas to the production flare during a start-up (scenario 4 in section 4.1 above). The flow rates used for the air dispersion model are prior to the process optimisation so are higher than the flow rates that are expected, which makes the emission rates used in the model conservative and YPF have advised this flow rate of ammonia could not currently be achieved.

Emissions resulting from the lifting of the two pressure relief valves are already directed to the production flare with the redirection of process syngas from the BEV the only additional source of ammonia directed to the flare. As detailed above, the additional maximum ammonia rate was modelled at 530.8g/s. This has since been reduced due to process optimisation conducted by YPF at the plant.

The modelling also includes other sources of NO_x and NH₃, the ammonia plant's primary reformer furnace (PRF) and package boiler (PB) as well as the adjacent TAN plant's nitric acid plant.

The application states that it is assumed that 99.8% of the NH₃ will be converted to N₂ by combustion within the flare, with 0.1% being converted to NO and 0.1% unreacted (remaining as NH₃). This was estimated based on a literature review of the below references:

- John Zink Company (1995),
- Li, Lai, Chem, Wu, Kobayashi, Deng and Huang (2021),
- Kobayashi, Hayajawa, Kunkuma, Somarathne and Okafor (2019),
- Texas Commission on Environmental Quality (2021).

Modelling also assumed that all NO is converted to NO₂ by the time it reaches the receptors.

Modelling used the worst-case cumulative emissions for NO_x from the production flare, the PRF, the PB and the TAN plant's nitric acid plant and using worse case meteorological conditions.

The modelled emission rate of ammonia directed to the flare was 43,117 g/s. This emission rate was selected based on the theoretical flare capacity and the additional process syngas redirected from the BEV to the flare. The contribution from the BEV redirection (i.e additional emissions), as per maximum emission rates in Table 1, is 530.8g/s, which is a small portion (1.2%) of the total flow to the flare of 43,117 g/s. YPF has stated an occurrence of both valves lifting simultaneously is a 1 in 100 year event and has not happened in 18 years of operation of the Ammonia plant (JBS&G 2024).

The modelling results show that the change to the predicted 1-hour maximum NO_x ground level concentration (GLC) due to flaring the ammonia from the valve lifts and the redirected BEV emissions is small. The modelled GLC at Deep Gorge, Hearson's Cove South and Hearson's Cove North remain the same. The maximum GLC within the modelling domain increased from 151.7 µg/m³ to 154.1 µg/m³ (1.6% increase). All modelled GLC were below the air quality guideline values (AGV) at sensitive receptors.

Table 2: Maximum predicted 1-hour NO_x and NH₃ GLC during worst case flaring scenario (pressure relief valve lifts and BEV process syngas)

Scenario	AGV (µg/m ³)	Deep gorge (µg/m ³)	Hearsons Cove south (µg/m ³)	Hearsons Cove north (µg/m ³)	Maximum in the modelling domain (µg/m ³)
NO_x (as NO₂) (Cumulative: PRF, PB and NAP and flare)	150	40.2	50.5	43.5	154
NH₃ (flaring only)	330 1180*	3.63	1.89	1.65	19.3

*AGV under consideration for assessment of NH₃ emission impacts, not an official AGV

Table 3: Comparison of maximum predicted 1-hour NO_x 1 GLC from existing operation (no flaring) compared with worst case flaring scenario (pressure relief valve lifts and BEV process syngas)

Scenario	AGV (µg/m ³)	Deep gorge (µg/m ³)	Hearson's Cove south (µg/m ³)	Hearson's Cove north (µg/m ³)	Maximum in the modelling domain (µg/m ³)
NO_x (as NO₂) (existing operation - PRF, PB and NAP)	150	40.2	50.5	43.5	151.7
NO_x (as NO₂) (PRF, PB and NAP and worst case flaring)		40.2	50.5	43.5	154.1

Comparison of the modelling results indicates that the NO_x emissions from the flare including the BEV process syngas are not expected to change the GLC at sensitive receptors under worst case scenario.

Given the number of hours per year that BEV emissions would be directed to the flare (a maximum of 290 hrs in 2019 and average of 142 hrs per year between 2019 and 2025), NO_x emissions from the flaring of the BEV process syngas are not expected to significantly contribute to or alter the cumulative yearly NO_x emissions emitted from the ammonia plant (further clarification on this is provided in section 4.4).

Redirecting emissions from the syngas loop from the BEV to the production flare is expected to negate the need to emit infrequent large amounts of NH₃ emissions from the plant while only marginally increasing NO_x GLC for short, infrequent periods during a worst-case flaring scenario. The increase in GLC for a worst-case scenario is only slightly contributed to by the additional flaring of the process syngas, therefore in almost all occasions the GLC of NO_x is considered unlikely to change as a result of the redirection of the process gas.

DWER undertook a technical review of the modelling and found it was generally acceptable. It was identified that the modelling may have had some reduced conservatism due to:

- it not considering cumulative impacts from other non-YPF related sources;
- the flare efficiency potentially not being sufficiently conservative;
- it being unclear if the design of the flare is suitable for the volume of ammonia to be combusted.

As a result of the above the department requested YPF to provide further information on the flare efficiency and the volume of ammonia the flare can combust. YPF advised that the flare has a capacity to combust up to 37,500 g/s of ammonia.

YPF also provided a sensitivity analysis for the flare operating at varying efficiencies and under different flow rate scenarios as further discussed below.

4.3.1 Sensitivity analysis of NH₃ flaring efficiencies

YPF provided further information (JBS&G 2024) on the flare combustion efficiency to inform the assessment. The information provided included the flare vendor guarantee of a combustion efficiency for ammonia of 98% and an assessment from YPF's head process engineer which indicates the flare can readily achieve 99% combustion efficiency.

YPF also provided additional information on revised maximum flow rates of ammonia from valves 105PRV and 105PRV-MJ2, and the redirection of valve HV-1019A to the production flare as part of a sensitivity analysis to compare predicted 1-hour NO_x GLC for different emission scenarios and flare efficiencies. The scenarios used were:

- Scenario 1 for the sensitivity analysis used an ammonia emission rate of 37,500 g/s representing the maximum flare capacity. This emission rate is more than if the two valves (105PRV and 105PRV-MJ2) lifted to produce a flow rate of 35,933 g/s together with the additional flow rate of the BEV redirection of 384.8 g/s (maximum expected rate following process improvements) which totals 36,318 g/s. The modelled flow rate of ammonia to the flare is therefore higher than the actual maximum that could ever be expected to directed to the flare.
- The scenario 2 emission rate was a combination of a single valve PRV105MJ lifting and the redirection of the BEV emission to a total of 30,492 g/s

Table 4 below shows the contribution from each source and Table 5 shows the emission rates used for each scenario.

Table 4: Emission sources for revised maximum flow rates of ammonia

Source	Emission rate (g/s)
PRV105MJ	30,107
PRV105MJ-2	5,826
Redirection of BEV process syngas	384.8

Table 5: Scenario emission rates

Scenario	Emission rate (g/s)	Based on
1	37,500g/s	Maximum flare capacity
2	30,492g/s	PRV105MJ lift and redirection of BEV process syngas

The model scenarios comprising different flaring scenarios and efficiencies are detailed in Table 6 and the predicted maximum 1-hour GLC for each scenario are presented in Table 7.

Table 6: Flaring scenarios (taken from JBS&G 2024)

Scenario	Description	Flaring efficiency
1-1	Maximum flare capacity (37,500 g/s)	99.8% NH ₃ to N ₂ , 0.1% NH ₃ to NO _x , 0.1% NH ₃ slip
1-2		99.0% NH ₃ to N ₂ , 0.9% NH ₃ to NO _x , 0.1% NH ₃ slip
1-3		99.0% NH ₃ to N ₂ , 0.5% NH ₃ to NO _x , 0.5% NH ₃ slip
1-4		98.0% NH ₃ to N ₂ , 1.9% NH ₃ to NO _x , 0.1% NH ₃ slip
1-5		98.0% NH ₃ to N ₂ , 1.0% NH ₃ to NO _x , 1.0% NH ₃ slip
2-1	105PRV-MJ valve lift + HV-1019A redirection	99.8% NH ₃ to N ₂ , 0.1% NH ₃ to NO _x , 0.1% NH ₃ slip
2-2		99.0% NH ₃ to N ₂ , 0.9% NH ₃ to NO _x , 0.1% NH ₃ slip
2-3		99.0% NH ₃ to N ₂ , 0.5% NH ₃ to NO _x , 0.5% NH ₃ slip
2-4		98.0% NH ₃ to N ₂ , 1.9% NH ₃ to NO _x , 0.1% NH ₃ slip
2-5		98.0% NH ₃ to N ₂ , 1.0% NH ₃ to NO _x , 1.0% NH ₃ slip

Table 7: Maximum predicted 1-hour NO_x GLC for flaring scenarios

Scenario	Deep Gorge µg/m ³	Hearson Cove south µg/m ³	Hearson Cove north µg/m ³	Max. in modelling domain µg/m ³	AGV µg/m ³
1-1	40.2	50.3	43.5	153.7	150
1-2	40.2	56.9	44.0	166.8	
1-3	40.2	53.6	43.8	160.3	
1-4	40.2	65.0	44.7	183.2	
1-5	40.2	57.7	44.1	168.5	
2-1	40.2	50.2	43.5	153.4	
2-2	40.2	55.5	43.9	164	
2-3	40.2	52.8	43.7	158.7	
2-4	40.2	62.1	44.5	177.3	
2-5	40.2	56.1	44.0	165.4	

The most conservative scenario is highlighted (scenario 1-4) comprising an emission rate of 37,500 g/s with a flaring efficiency of 98% combustion of NH₃ to N₂ (1.9% of the remaining NH₃ being converted to NO_x and 0.1% remaining as NH₃).

The sensitivity analysis indicates that for the most conservative modelling scenario the 1-hour NO_x GLC at sensitive receptors are predicted to remain well below the AGV. The GLC in the analysis used a worst-case scenario and were based on:

- the flare combusting ammonia at the time of the worst meteorological conditions; and

- the flare combusting ammonia at its highest theoretical capacity of 37,500 g/s, which exceeds actual highest possible emission rate of 36,318 g/s.

4.4 Comparison of 2021 ammonia emission to BEV to emission from ammonia being flared

YPF provided data for the total ammonia emissions vented to atmosphere from the BEV for the years 2019-2025 as shown in Table 1. Based on the emission rates and venting hours in the table, DWER conducted a comparison of the ammonia emissions vented from the BEV in 2021 to what the emissions would likely have been if the same volume of ammonia was flared using a conservative flare efficiency of 98% (98% ammonia converted to N₂ and H₂O and 1.9% to NO₂ and 0.1% un-combusted ammonia).

The year 2021 was selected as it is most representative of an average year. The results of the comparison are shown in Table 8 below. The results demonstrate that the redirection of process syngas from the BEV to the production flare is expected to achieve a large reduction in the total volume of ammonia emitted from the plant with only a small corresponding increase in total volume of NO₂ emitted. By comparison, based on emission data reported for the premises in the [National Pollutant Inventory](#), this represents less than 0.4% of the premises annual NO_x emissions.

Table 8: Comparison of 2021 BEV ammonia emissions to emissions if BEV process syngas was directed to the production flare

Ammonia vented from the BEV in 2021	2021 calculated production flare emissions if redirected (98% efficiency)	
	Additional NO ₂ (1.9%)	Remaining NH ₃ (0.1% un-combusted)
43 tonnes	2.2 tonnes	43 kg

5. Risk assessment

The department assesses the risks of emissions from prescribed premises and identifies the potential source, pathway and impact to receptors in accordance with the *Guideline: Risk assessments* (DWER 2020).

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.

This assessment only relates to the installation and operation of a valve to allow for start-up process gases containing ammonia which are current emitted to atmosphere via the BEV to be redirected to the production flare for combustion.

5.1 Source-pathways and receptors

5.1.1 Emissions and controls

The key emissions and associated actual or likely pathway during premises operation which have been considered in this Amendment Report are detailed in Table 9 below. Table 9 also details the control measures the licence holder has proposed to assist in controlling these emissions, where necessary.

Table 9: Licence Holder controls

Emission	Sources	Potential pathways	Proposed controls
NO _x	Process syngas generated due to start up or upset conditions	Air/wind dispersion	Redirection of process syngas during plant start up to the flare (via a valve) to combust NH ₃ to N ₂ . The valve will remain in a closed position during normal operation and will only open during upset condition scenarios or plant start up.
NH ₃			Procedure to ensure the production flare is operating prior to plant start up when redirection of process syngas may need to occur. Plant to be shut down if flare ceases to operate. Operational procedures to reduce the syngas directed to the flare.

5.1.2 Receptors

In accordance with the *Guideline: Risk assessments* (DWER 2020), the Delegated Officer has excluded employees, visitors and contractors of the Licence Holder's from its assessment. Protection of these parties often involves different exposure risks and prevention strategies and is provided for under other state legislation.

Table 10 below provides a summary of potential human receptors that may be impacted as a result of activities upon or emission and discharges from the prescribed premises (*Guideline: Environmental siting* (DWER 2020)).

Table 10: Sensitive human receptors and distance from prescribed activity

Human receptors	Distance from prescribed activity
Hearson's Cove Beach (zoned conservation recreation and natural/landscapes City of Karratha Planning Scheme No.8)	1.5 km south of the premises
Ngajarli (Deep Gorge) (zoned conservation recreation and natural/landscapes City of Karratha Planning Scheme No.8)	1 km south of the premises
Dampier townsite	7.3 km southwest from the premises
Karratha townsite	11.5 km south southeast of the premises
Industrial receptors	
Pilbara Port (zoned strategic industry City of Karratha Planning Scheme No.8)	1.2 km west of the premises
Pluto LNG Project (zoned strategic industry City of Karratha Planning Scheme No.8)	1.6 km northeast of the premises
Karratha Gas Plant (zoned strategic industry City of Karratha Planning Scheme No.8)	3.3 km north of the premises
Parker Point iron ore project (zoned strategic industry City of Karratha Planning Scheme No.8)	4.5 km southwest of the premises

Specified ecosystems	
National Heritage Listed place – Dampier Archipelago (including the Burrup Peninsula) (ID 105727) UNESCO World Heritage Listed – Murujuga Cultural Landscape	The Dampier Archipelago including the Burrup Peninsula is listed on the National Heritage List and the UNESCO World Heritage List due to the presence of rock engravings and other Aboriginal heritage sites such as stone arrangements. The nearest rock art is 400 m from the premises.

5.2 Risk ratings

Risk ratings have been assessed in accordance with the *Guideline: Risk Assessments* (DWER 2020) for those emission sources which are proposed to change and takes into account potential source-pathway and receptor linkages as identified in Section 5.1. Where linkages are incomplete they have not been considered further in the risk assessment.

Where the licence holder has proposed mitigation measures/controls (as detailed in Section 5.1), these have been considered when determining the final risk rating. Where the Delegated Officer considers the licence holder's proposed controls to be critical to maintaining an acceptable level of risk, these will be incorporated into the licence as regulatory controls.

Additional regulatory controls may be imposed where the licence holder's controls are not deemed sufficient. Where this is the case the need for additional controls will be documented and justified in Table 11.

The amended licence L9224 that accompanies this Amendment Report authorises emissions associated with the operation of the Premises.

The conditions in the amended licence have been determined in accordance with *Guidance Statement: Setting Conditions* (DER 2015).

Table 11. Risk assessment of potential emissions and discharges from the direction of process syngas to production flare

Risk Event					Risk rating ¹ C = consequence L = likelihood	Licence Holder's controls sufficient?	Conditions ² of licence	Justification for additional regulatory controls/reasoning
Source/Activities	Potential emission	Potential pathways and impact	Receptors	Licence Holder's controls				
Redirection of process syngas including NH ₃ from the BEV to the production flare	NO _x (From incomplete combustion of NH ₃)	Air/windborne pathway causing impacts to human health and amenity	Members of the public at any of the human receptors listed in Table 10	Refer to Section 5.1	C = Moderate L = Possible Medium Risk (no change)	Y	Condition 1 requires the flare to be available prior to start-up and HV-1019A to remain closed during normal operating conditions.	The Delegated Officer has determined that the redirection of the process syngas during start-up events from the BEV to the production flare will result in an overall reduction in ammonia emissions (both emission rate and overall quantum of ammonia emissions from the plant are expected to be reduced by elimination of venting during start-up). The redirection will not increase the risk of impacts to air quality from the premises air emissions (ammonia and NO_x). This is based on modelling and sensitivity analysis demonstrating that the combustion of ammonia in the production flare as a result of the redirection only slightly contributes to the NO_x emissions from the ammonia plant, the GLC of NO_x under a worst case scenario at the nearest sensitive receptors is predicted to remain well below AGV and such flaring events will occur infrequently in association with start-up events which have appreciably decreased in frequency and duration due to process improvements. The Delegated Officer has determined that the licence holder's proposed control of ensuring the production flare is operating prior to plant start up when redirection of process syngas may need to occur is critical to ensure redirected process syngas is efficiently combusted therefore specified this as a requirement in addition to the requirement for the valve to remain closed during normal operation to ensure the redirection valve is used as proposed in the application. To maintain oversight of venting and flaring during abnormal operating conditions the Delegated Officer included a requirement to monitor and record details of venting and flaring during such events and modified existing annual reporting requirements to require provision of the recorded information in the annual report.
	NH ₃				C = Minor L = Unlikely Medium Risk (no change)	Y		
	NO _x NH ₃	Air/windborne pathway causing acceleration of natural weathering/ alteration/ degradation of the rock art	Petroglyphs within the UNESCO World Heritage Listed – Murujuga Cultural Landscape	Refer to Section 5.1	C = Minor (noting interim EQC currently met) L = Unlikely Medium Risk (Proposed change will not increase risk of impact to rock art)	Y	Condition 2 authorises installation of the redirection valve (HV-1019A) for the combustion of process syngas including ammonia <u>Conditions 22 and 28 requiring monitoring and reporting relating to venting and flaring during start-up, shutdown and upset condition events.</u>	As set out in section 3.2 and 3.3 the MRAS and MRAMP provide the framework for the coordinated monitoring and analysis of changes to rock art on Murujuga, for determining impacts, 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 Delegated Officer noted that based on current available monitoring data, the interim EQCs developed under the MRAS and the MRAMP for the protection of the petroglyphs are being met and considered whether the proposed change is expected to alter this. As the requirement to flare process syngas is an infrequent event which will occur for short durations (i.e. is not a continuous source), and the flare is designed to convert the majority of the ammonia (98%) to N₂ and H₂O, the emissions from flaring are not expected to have a tangible impact on annual plant NO_x emissions. Flaring of the process syngas is also expected to result in a significant reduction in annual ammonia emissions, specifically short-term, infrequent, high concentration discharges from the BEV. The Delegated Officer considered the composition of the syngas, the capability and capacity of the flare with regard to combustion of the syngas, and the frequency of expected flaring, together the outcomes of modelling and sensitivity analysis as presented in section 4, to determine whether the proposed change (redirection of process syngas from the BEV to the flare during start-up or upset condition events) is expected to alter the risk of exceeding the interim EQC and impacting the rock art. Based on this information the Delegated Officer determined the redirection of process syngas to the production flare will not increase or alter the risk as the change will eliminate high concentration, high volume ammonia emissions from the BEV associated with plant start-up and any corresponding increase in NO_x emissions is predicted to be small, short-term and will only marginally contribute to the overall plant NO_x emissions. It is also noted that given the historical performance of the plant, the worst case model scenarios presented are expected to be a rare occurrence therefore actual flow of ammonia to the flare is expected to be significantly less.

Note 1: Consequence ratings, likelihood ratings and risk descriptions are detailed in the *Guideline: Risk assessments* (DWER 2020).

Note 2: Proposed Licence Holder's controls are depicted by standard text. **Bold and underline text** depicts additional regulatory controls imposed by department.

6. Consultation

Table 12 provides a summary of the consultation undertaken by the department.

Table 12: Consultation

Consultation method	Comments received	Department response
Local Government Authority advised of proposal on 20/03/2024 via email	The City of Karratha responded on 6/05/2024 advising the works may require a development application to be submitted.	It is the responsibility of the licence holder to ensure any required planning approvals have been granted prior to works being conducted.
Department of Energy Mines, Industry Regulation and Safety (DEMIRS) advised of proposal 20/03/2024	No comments received	NA
Department of Biodiversity Conservation and attractions (DBCA) advised of proposal 20/03/2024	DBCA replied on 9/04/2024 advising DBCA has no further comments.	NA
Friends of Australian Rock Art (FARA)	FARA responded on 8/04/2024. The comments and DWERs response are in Schedule 1	See Schedule 1
Murujuga Aboriginal Corporation	No comments received	NA
Conservation Council of Western Australia	No comments received	NA
Third party consulting firm	No comments received	NA
Other registered stakeholders	No comments received	NA

7. Decision

The delegated officer assessed the information in the application and determined that the installation and operation of a valve HV-1019A which will direct process syngas containing ammonia, that was previously emitted to atmosphere via the BEV, to the production flare where it will be combusted and discharged to atmosphere will not increase the risk to public health or the environment, inclusive of Murujuga's petroglyphs.

In reaching this conclusion the delegated officer considered the following:

- Interim EQC developed for the protection of Murujuga's petroglyphs are currently being met.
- The combustion of the process syngas containing ammonia by the production flare, which was previously emitted from the BEV, is expected to result in a significant reduction in the ammonia emissions associated with plant start-up events with only a small corresponding increase in NO_x emissions from the flare, which worst case modelling predicts will not significantly increase NO_x GLC therefore is not expected to increase the risk of exceeding the interim EQC or impacting rock art.
- The frequency of start-up events requiring venting of process syngas via the BEV has significantly decreased due to plant and process control improvements therefore flaring of the process syngas is only likely to occur infrequently (start-ups) and is not expected to occur for extended durations.

- Based on the combustion efficiency and infrequent nature of flaring events the redirection is expected to only minimally increase annual NO_x emissions while significantly reducing annual NH₃ emissions.
- Modelled emission rates are representative of an absolute worst-case flaring scenario which has an extremely low likelihood of occurring therefore modelling is conservative. The rate of ammonia redirected to the flare is expected to be significantly less than the modelled scenario.
- Given flaring of syngas at the worst-case modelled concentrations has a very low likelihood of occurring, it is unlikely to coincide with worst-case meteorological conditions.
- For the worst-case flaring scenario which was modelled, the proportion of ammonia in process syngas redirected from the BEV to the flare represents less than 1.5% of the total ammonia flared with the remainder contributed from valve lifts that already report to the production flare (i.e. the addition of the process syngas represents only a small change).
- Minimal ammonia (0.1-1%) is expected to remain un-combusted from flaring and is significantly less than if the process syngas was otherwise emitted via the BEV as per the current plant design.

In addition to specifying installation of the redirection valve HV-1019A in the licence conditions, the delegated officer considered it necessary to impose conditions based on the licence holder's proposed controls requiring the flare to be available prior to start-up of the plant and for the valve not used during normal operating conditions to ensure redirected syngas is appropriately combusted and flaring only occurs when necessary during start-up events. The delegated officer also determined to impose additional conditions requiring the licence holder to monitor, record and report annually the details of flaring and venting emissions during start-up, shut-down and upset conditions to ensure future operation is aligned the information which informed this assessment. Similar information was previously required in the Annual Environmental Report however requirements to monitoring and report the information have been specified and clarified through the conditions.

The delegated officer has therefore amended licence L9224/2019/1 in accordance with section 59(1) of the EP Act by authorizing installation and operation of redirection valve HV-1019A to allow for process syngas previously vented by the BEV to be combusted and discharged via the production flare.

8. Conclusion

Based on the assessment in this decision report, the delegated officer has determined to amend licence L9224/2019/1 to authorise redirection of start-up ammonia emissions from the BEV to the production flare, subject to conditions commensurate with the determined controls and necessary for administration and reporting requirements.

8.1 Summary of amendments

Table 13 provides a summary of the proposed amendments and will act as record of implemented changes. All proposed changes have been incorporated into the Revised Licence as part of the amendment process.

Table 13: Summary of licence amendments

Condition number	Proposed amendments
1	Amended to include requirement to ensure production flare and storage flare pilot lights are lit immediately prior to commencing startup of the plant

Condition number	Proposed amendments
	Requirement included by new valve HV-1019A to remain closed during normal operating conditions
2	Amended to: - Include requirement to install the backend vent tie in valve; and - Removed the construction requirements related to the evaporation pond which has been completed.
3	Wording amended from “constructed” to “installed” as the BEV is an installation requirement.
22	Inclusion of new condition to require monitoring and recording of flaring and venting during start-up, shutdown and upset condition events.
28	Amended table 14 to: - Include in the Annual Environmental Report a summary of flaring events due to start-ups, shut-downs and upset conditions on an annual basis as required to be recorded by condition 22. - Remove requirement to include in the Annual Environmental Report a summary of start-up and shut down events as this is now covered by the requirement to report on condition 22 as per the above inclusion.

References

1. Department of Environment Regulation (DER) 2015, *Guidance Statement: Setting Conditions*, Perth, Western Australia.
2. Department of Water and Environmental Regulation (DWER), June 2019. *Guideline: Decision Making*. Department of Water and Environmental Regulation, Perth.
3. DWER 2020, *Decision Report – Yara Pilbara Fertilisers – 20 April 2020* (DWER reference A1861482)
4. DWER 2023, *Program: Murujuga Rock Art*. Available at: <https://www.wa.gov.au/service/aboriginal-affairs/aboriginal-heritage-conservation/program-murujuga-rock-art> (Accessed 10 March 2025).
5. WSP & Curtin University 2025, *Murujuga Rock Art Monitoring Program: Interim Environmental Quality Criteria* Available at: [Murujuga Rock Art Monitoring Program: Interim Environmental Quality Criteria](#)
6. JBS&G Yara Pilbara Ammonia Plant – Yara Pilbara Fertilisers Pty Ltd – Licence L9224/2019/1 Amendment Supporting Application – Back End Vent Emissions December 2023
7. JBS&G Production Flare Emissions – Back End Vent Bypass – Yara Pilbara Fertilisers Pty Ltd – Dispersion Modelling Report July 2023 (Attachment 8B of the application DWER Reference DWERDT885541)
8. JBS&G Responses to DWER RFI Aug 2024 (DWER Reference A2315617 received by DWER on 25/9/2024)
9. John Zink Company (1995), *Ammonia Flares* <https://dec.alaska.gov/media/21914/john-zink-flare-emissions.pdf>
10. Li, Lai, Chem, Wu, Kobayashi, Deng and Huang (2021), *A review on combustion characteristics of ammonia as a carbon free fuel*. Available at <https://www.frontiersin.org/articles/10.3389/fenrg.2021.760356/full>
11. Kobayashi, Hayajawa, Kunkuma, Somarathne and Okafor (2019), *Science and technology of ammonia combustion* available at <https://www.sciencedirect.com/science/article/pii/S1540748918306345?via%3Dihub>
12. Texas Commission on Environmental Quality (2021) *New Source Review (NSR) Emission Calculations* available at: https://www.tceq.texas.gov/assets/public/permitting/air/Guidance/NewSourceReview/emiss_calc_flares.pdf
13. Minister for Environment's Appeal Determination: Appeals Against L9224/2019/1, Yara Pilbara Fertilisers Ammonia Plant, Murujuga, 28 January 2025 available at: https://oac-prod-appealsconvenor.powerappsportals.com/_portal/modal-form-template-path/1f8c9f08-b07f-437c-a5a2-7c8cfc9acbe3?id=7700029b-27ae-ef11-b8e8-002248932902&entityformid=f8ed8efb-0e85-ee11-8179-000d3ae17509&languagecode=1033

Appendix 1: Summary of Friends of Australian Rock Art (FARA) comments on application

Summary of comment	Department's response
Need for the amendment - why is this being proposed by the applicant?	
Fara raised concerns that ammonia is not a permitted emission through the BEV (Back End Vent) in the licence and that the redirection is proposed to rectify a breach of the licence.	Compliance matters are outside the scope of the licence assessment and are a separate matter to be dealt with in accordance with the Department's <i>Compliance and Enforcement Policy</i> (2021). Redirection of process syngas during start-up from the BEV to the production flare is expected to eliminate ammonia venting from the BEV. Emission of ammonia from the BEV only occurs as a result of upset conditions and start-ups (i.e infrequent typically short duration events) and is not a continuous emission source during normal operation of the plant. The department has assessed the application and determined the short-term infrequent flaring of process syngas will not increase the risk of impacts to rock art or human health, therefore the proposed change to the premises is considered acceptable and has been authorised in the licence.
Fara raised concerns about ammonia emissions impacting people within the vicinity of the plant and specifically odour at Hearson's Cove and effects to the rock art	Based on the assessment documented in this report the proposed change (redirection of process syngas to the production flare during start-up events) is not expected to increase the risk of air quality impacts. Based on the information provided in the application the proposed change will remove the need to vent process syngas containing ammonia with a corresponding small change to NO _x GLC predicted to occur during such events, and no change to GLC predicted at sensitive receptors. This is likely due to the high efficiency combustion and dispersion of the flare.
Fara raised the issue of the flare increasing NO ₂ emissions and that state of the art scrubber technology should be used to reduce	As outlined in the original decision report for L9224 the ammonia plant was established using best available technology, and employs low NO _x burners in the

Summary of comment	Department's response
the emissions to near zero as Yara has used elsewhere on the plant.	primary reformer and the package boilers which are the key sources of NO_x emissions from the plant. SCR technology is not suitable for a flare as they have variable operating temperature, variable and intermittent emissions and are specifically designed to disperse pollutants at height to minimise ground level impacts. This issue was also examined through the appeal on the conditions of L9224/2019/1 at the time of grant.
Monitoring of emissions and impacts to rock art	
As ammonia emissions are not an authorised emission from the back-end vent in accordance with condition 5 of the licence how will the department deal with this non-compliance?	The scope of the assessment is limited to the acceptability of the proposed change. Compliance matters are outside the scope of the licence assessment and are a separate matter to be dealt with in accordance with the Department's <i>Compliance and Enforcement Policy</i> (2021).
FARA raised concerns regarding table 7 in the licence that relates to the change in air emission monitoring on the primary reformer stack and the package boiler stack from stack testing to CEMS.	The comment is not specific to the scope of the assessment as no changes relating to the PRF or PB are proposed in the application.
FARA raised concerns about ammonia emissions from upset conditions and start ups as they appeared to increase between 2019 and 2022	As outlined in section 4.1 and Table 1 the number of emissions events as a result of upset conditions or start-ups has significantly reduced since 2022 and prior to this time increased frequency was in part associated with limitations with the plant cooling capacity due to the cooling towers needing to be rebuilt. Process improvements/controls and re-establishment of the cooling capacity have subsequently resulted in the number of start-ups that have resulted in emissions to the BEV significantly reducing.

Summary of comment	Department's response
Fara wishes to know how much extra NO_x will be produced by the flaring of the process gases. Fara requested monitoring data and annual reports be provided so it can independently verify the NO_x levels, and how it is affecting the rock art.	Section 4.4 includes a comparison of ammonia emissions from the BEV for with the calculated corresponding NO_x emissions from flaring of the syngas. The amount of ammonia within process syngas discharged via the BEV in 2021 was 43 tonnes. If this ammonia had been combusted by the flare (at 98% efficiency) the resulting NO₂ emissions would have been 2.2 tonnes. This represents less than 0.4% of the premises annual NO_x emissions. This represents a significant net reduction in emissions. Reports and data submitted to the department are able to be requested through Freedom of Information Act 1992 processes. Further information on the process is available online.
NO₂ and NO_x emissions effects on the rock art	
FARA raised concerns relating to an increase in NO_x emissions impacting rock art	Based on the information presented in sections 4.1-4.4 the resultant NO_x emissions from flaring of process syngas redirected to the flare during start-ups and upset conditions is not expected to significantly increase NO_x GLC or annual NO_x emissions. The redirection of the process gas is not a continuous occurrence and is only required for certain start-up/upset scenarios, with the number and duration of such scenarios having already been significantly reduced. As outlined in section 3.2, interim EQCs developed for the MRAMP are currently being met and the proposed change is not expected to cause exceedance of the EQC given the marginal change in GLC predicted to occur for a worst case scenario.
How will Yara's future actions contribute to the safeguarding of cultural heritage that will be negatively impacted by the activities allowed by L9224/2024/1? FARA considers Yara and DWER are disingenuous in their stated commitments to protect the Murujuga Rock Art.	The amendment will result in a significant reduction in ammonia emissions during start-up of the ammonia plant with an associated minimal increase to NO_x emissions. The frequency of this occurring is expected to be low based on data (Table 1) over the past 3 years. As discussed in section 3.2 impacts to rock art are currently being investigated and managed through the MRAS and MRAMP program. If information becomes available, including information published by the MRAMP, that is indicative of new risk issues requiring assessment the CEO may determine to amend the licence at any time.

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

Licence Condition	Summary of applicant's comment	Department's response
Condition 4 (a) and 4 (b)	Yara suggest that the word "civil" be removed from the type of engineer. Yara, suggest that the word "constructed" be changed to "installed" in both 4(a) and 4(b).	Licence updated to reflect the suggested changes. Type of suitably qualified person is updated in the definitions.
Definitions	Remove the reference to "Civil" in the "suitably qualified" definition and replace with "Chemical" in (a) and "process" in (b)	Licence updated reflect the suggested changes as they better reflect the nature of the works.
Schedule 3 (Evaporation pond)	Remove schedule 3 as reference to Schedule 3 has now been removed from the licence.	Licence updated to remove schedule 3
Amendment Report Section	Summary of applicant's comment	Department's response
Section 4.1	Confirmed venting of syngas from BEV had been reduced significantly	Noted
Section 4.1 Table 1	Confirmed no start ups or shuts downs resulting in BEV emissions between January 2025 and June 2025	Noted
Section 4.4 Table 8	Confirmed the calculations in table 8 are correct	Noted