Orica Australia Pty Ltd
28-Apr-2015

Orica Kooragang Island, Ammonia Production Limit Increase

Modification of Project Approval 08_0129

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Certification

Submission of Environmental Assessment (EA) prepared under the *Environmental Planning and Assessment Act 1979* Section 75F

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in respect of	Ammonia Production Limit Increase Environmental Assessment	
Project application Applicant name	AECOM Australia Pty Ltd (AECOM)	
Applicant address	PO Box 73 HRMC NSW 2310	
Land to be developed	Lot 3 D.P. 234288	
Proposed project	Increase annual ammonia production limit within the capacity of the existing ammonia plant Map(s) attached	
Environmental Assessment	an Environmental Assessment (EA) is attached	
Certification	I certify that I have prepared the contents of this Environmental Assessment and to the best of my knowledge it is true in all material particulars and does not, by its presentation or omission of information, materially mislead.	
	Signature: Name: Simon Murphy Date: 28 April 2015	Signature: Name: Catherine Brady Date: 28 April 2015

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Executive Summary

Introduction

This Environmental Assessment (EA) has been prepared by AECOM Australia Pty Ltd (AECOM) on behalf of Orica Australia Pty Ltd (Orica) to support an application by Orica to modify Major Project Approval (MP08_0129) relating to Orica's Kooragang Island (the Site) expansion project. The proposed modification is seeking approval to increase the Site's allowable annual ammonia production limit from the current ammonia production limit of 360 kilotonnes per annum (ktpa), as specified in Condition 2 of Project Approval 08_0129, to 385ktpa (The Project). The Project is not seeking to alter or expand existing ammonia plant infrastructure or operating parameters from that specified in the 2009 Environmental Assessment (EA) and approved by the now NSW Department of Planning and Environment in 2009. The increase is to be achieved through increased Ammonia Plant availability.

Modification approval is being sought under section 75W of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The Minister for Planning and Infrastructure is the approval authority for this application under the transitional arrangements of Part 3A of the EP&A Act. AECOM has prepared an EA in accordance with the provisions of the former Part 3A of the EP&A Act and the *Environmental Planning and Assessment Regulation 2000*. The EA addresses the Director-General's Requirements previously prepared for the expansion project issued to Orica in 2009 as agreed with the NSW Department of Planning and Environment.

Project Description

Following the completion of commissioning activities associated with the uprate of the Site's Ammonia Plant in 2012, Orica has been progressively improving the Ammonia Plant reliability enabling the plant to potentially realising the production quantity previously assessed in the 2009 Environmental Assessment of 1050t/day with the plant operating continuously, 365 days a year .These improvements have resulted in the Ammonia Plant potentially exceeding the current allowable ammonia production limit by 25ktpa if the Ammonia Plant was permitted to operate at these rates continuously through the year. Approval is therefore being sought to increase the allowable ammonia production to 385ktpa, which is consistent with the Ammonia Plant operating conditions previously assessed in the 2009 EA. No construction or operation of additional plant or infrastructure is required as part of the Project.

Statutory Planning

The Site is located within the Newcastle Local Government Area on land governed by Newcastle Local Environmental Plan (LEP 2012). The Site is also within the boundary of the Three Ports Site as defined by *State Environment Planning Policy (Three Ports) 2013* and thus falls under the provisions of the *State Environmental Planning Policy (Major Development) 2005* (Major Development SEPP). In 2009, expansion of the Facility was approved as a Major Project in accordance with the Major Development SEPP (Project Approval (08_0129)).

The Project has been determined to be a Major Development allowing it to be assessed through section 75W of the *Environmental Planning and Assessment Act 1979.* This approach was confirmed in consultation with the NSW Department of Planning and Environment.

The Project is consistent with the provisions of local, regional and State planning instruments, which would otherwise apply to the Project, including:

- *Newcastle LEP 2012*;
- *State Environmental Planning Policy (Three Ports) 2013; and*
- *State Environmental Planning Policy 33 – Hazardous and Offensive Development*.

Environmental Assessment

A preliminary environmental risk assessment identified air quality, noise and hazard as environmental impact factors of relevance when developing the Projects environmental supporting documentation, rating them as a medium for assessment commensurate with the size and nature of the project relative to its natural and human environment.

Air Quality

Ammonia Plant air quality environmental performance assumptions previously modelled in 2009 to support the project's application for approval assumed an average daily production rate for the uprated Ammonia Plant of 1050t/day, with the plant running continuously 365 days a year. Since the uprate of the Ammonia Plant, the Site has undertaken compliance emission testing and ambient monitoring in accordance with the requirements of the Site's Environment Protection Licence (EPL 828).

An Air Quality Impact Assessment (AQIA) (refer Appendix A) was prepared to support Orica's MOD 3 application. The AQIA took the form of a consistency review, comparing air quality compliance testing data collected since the Ammonia Plant has been uprated against the predictions made in the dispersion modelling conducted for the original expansion (AECOM, 2009).

The review was limited to emissions from EPL monitoring locations that supported the uprated Ammonia Plant operations, i.e. the Ammonia Plant and the Nitrates Boiler (associated emission points being the Pre-Reformer Stack, the Reformer Stack and the Boiler Stack). Only Oxides of Nitrogen (NO_X) emissions were assessed as they were determined to be the dominate air quality emission associated with the production of ammonia.

The consistency review compared emission rates used in the dispersion modelling (AECOM, 2009, 2014) against the emission rates measured from the Plant since the Site began operating at a level considered to be consistent with the proposed production rate of 385 ktpa (or approximately 1,050 tpd). Emission test data measured after August 2012 (when the plant began consistently operating in production rates in excess of 900 tpd) were used for the comparison, as they were considered representative of emissions for the plant operating at the proposed production rate. Air quality data was collected during 2013 and 2014 in compliance with the requirements detailed in the Site's Environment Protection Licence 828.

The AQIA identified that the measured emissions of NO_X from the Pre Reformer Stack and Reformer Stack were below the emissions of the Approved Project (AECOM, 2009) and the EPL NO_2 equivalent emission limit. The maximum measured emission concentration from the Nitrates Boiler Stack was lower than the concentrations previously assessed and the EPL NO_2 equivalent limit, representing approximately one third of the maximum modelled emission concentration in AECOM 2009.

The AQIA determined currently complies with air quality performance criteria and that an increase in annual ammonia production at the Orica KI Site is not expected to result in local NO_2 concentrations greater than those previously predicted and approved in 2009 and following approved modifications.

Noise and Vibration

Noise modelling completed during the 2009 EA associated with the uprate of the Ammonia Plant, assumed an average daily production rate of 1050t/day and continuous operation consistent with the proposed annual ammonia production rate of 385ktpa. Noise limits associated with the expansion are detailed in Condition 30 of the Project Approval requiring all expansionary components of the project meet a noise design limit 10dB(A) below noise levels of existing operations, to ensure that there is negligible increase in noise at the nearest residential receiver.

Since the completion of commissioning activities associated with the uprate of the Ammonia Plant, Orica has undertaken quarterly compliance noise monitoring for the first 12 months and annual testing thereafter in compliance with the Site's Noise Management Plan (NMP). Noise monitoring has confirmed compliance with Condition 30 requirements.

The only additional noise generating activities not previously considered during the 2009 EA relates to an additional 11 ships per annum, which would dock at Kooragang Island Berth K2, increasing ship visits to the Orica Site to 27 ships per year prior to the completion of the remaining works associated with the expansion for which shipping will be reduced to approximately 5 shipments per year. The assessment undertaken for this EA concluded that noise emissions from the additional ships were at least 7 dB below the project specific criteria and this will have an inconsequential impact on residential receivers.

Hazard and Risk

The Site has an existing Preliminary Hazard Analysis (PHA) which was prepared as part of the approval for upgrades and expansions of the Orica Site as part of DA 08_0129. Further Hazard and Risk assessment has been undertaken of the potential hazards associated with the proposed annual ammonia production limit increase from 360ktpa to 385ktpa. The Hazard and Risk assessment focused on the change in risk profile associated with proposed modifications to shipping scenarios associated with the Project. No changes to Ammonia Plant operating parameters were required. The Hazard and Risk associated with a 385ktpa ammonia production rate had previously been modelled in the Site's PHA and were shown to be compliant with Hazardous Industry Planning Advisory Paper No 4 (HIPAP 4) risk criteria.

Three risk categories for both the Site and for shipping were assessed including Fatality Risk (IFR), Toxic Injury and Toxic Irritation. The assessment demonstrated that the proposed changes associated with temporarily increasing the shipping frequencies and utilisation of ship loading pipeline and loading infrastructure would not impact the projects compliance with HIPAP 4 risk criteria.

Other Environmental Aspects

In relation to the other environmental aspects assessed in the 2009 EA including transport, soil and water, greenhouse gas, waste, flora and fauna, heritage and visual; no significant environmental impacts were predicted and where relevant, reasonable and feasible management measures and safeguards have been recommended to mitigate potential impacts.

Statement of Commitments

A Statement of Commitments has been prepared in respect of the proposed increase in ammonia production. Orica commits to the continued implementation of its environmental management and monitoring plans and environmental mitigation measures detailed in the Statement of Commitments for the Project.

Justification and Conclusion

The assessments of environmental factors in relation to the proposed annual ammonia production limit increase have shown that the Project would not have a significant impact on the receiving environment or nearby community if the appropriate management and mitigation measures are implemented as identified in this EA.

The Project is considered to be justified and is consistent with the social, environmental and economic justifications and consistency with the objects of the EP&A Act as presented in Section 19 of the 2009 EA.

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1.0 Introduction

1.1 Overview

This Environmental Assessment (EA) has been prepared by AECOM Australia Pty Ltd (AECOM) on behalf of Orica Australia Pty Ltd (Orica) to support Orica's application to the NSW Department of Planning and Environment (DP&E) to modify Project Approval 08_0129.

Orica operates a manufacturing Site (the Site) on Kooragang Island (KI), Newcastle, which produces ammonia, nitric acid and ammonium nitrate, which is predominately utilised in the Hunter Valley. An Environmental Assessment (AECOM, 2009) was prepared in 2009 for the expansion of the Site and was approved under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) on 1 December 2009 (DA 08_0129).

A review of the detailed design against operational requirements resulted in an application to vary the plant and equipment layout, which was approved by the Department of Planning and Infrastructure on 11 July 2012 (MOD 1).

A second modification to the Project Approval (MOD2) was approved by DP&E on the 17 December 2014 relating to the construction and operation of three ammonia flares designed to further improve safety and reduce the site's risk associated with the use of ammonia, as well a change in location and storage quantity of the nitric acid tank.

An overview of the expansion project construction phasing (approved expansion (DA 08_0129) plus modifications is detailed in **Table 1**.

Table 1 Expansion Project Construction Phase

<table>
<tr><th colspan="2">Phase / Stage</th><th>Description of Work</th></tr>
<tr><td colspan="3">Ammonia Plant Uprate</td></tr>
<tr><td rowspan="2">1</td><td>1a</td><td>Ammonia Plant Expansion – Plant Air Compressor Building
Construction of Plant Air Compressor building shell (compressor installed in Stage 1(b)).</td></tr>
<tr><td>1b</td><td>Ammonia Plant Expansion - Installation/Modification of Plant
Installation of new equipment including new compressor, process vessels pipework and instruments in the Ammonia Plant.</td></tr>
<tr><td colspan="3">Nitric Acid and Ammonium Nitrate Manufacture Increase</td></tr>
<tr><td rowspan="2">2</td><td>2a</td><td>OBL 1(a) - Nitrates Infrastructure & Ammonium Nitrate Solution (ANS) Loadout
Installation of new site infrastructure including the new site entrances, internal access roads, security and weighbridge facilities, ANS product storage and despatch facilities.</td></tr>
<tr><td>2b</td><td>OBL 1(b) - Nitrates Despatch & Support Infrastructure
Construction of new Ammonium Nitrate (AN) Bag store, AN Despatch facilities and amenities, demolition of existing AN Bag store and despatch, construction of new AN Bulk Store, modification to existing AN bulk store, construction of WANS, construction of new control room and electrical infrastructure.</td></tr>
<tr><td rowspan="2">3</td><td>3a</td><td>Nitric Acid Plant 4 – Nitric Acid & AN Solution plants and Support Infrastructure
Construction of the NAP4/ ANS Plant and tie-ins. Construction of Nitrates support infrastructure including new Nitric Acid Storage, Ammonia Storage, Boiler, Cooling Tower, Demin Plant expansion Instrument Air upgrades, new Ammonia pumps, pipe bridges & transfer lines.</td></tr>
<tr><td>3b</td><td>Ammonium Nitrate Plant 3
Construction of Nitric Acid Plant 3 Dry Section plant and tie-ins.</td></tr>
<tr><td>4</td><td>4</td><td>Nitric Acid Tank
Construction and Operation of a nitric acid tank and associated scrubber, capable of exporting and importing nitric acid via the sites nitric acid wharf pipeline.</td></tr>
<tr><td colspan="3">Ammonia Management Improvement Project</td></tr>
<tr><td>5</td><td>5</td><td>Ammonia Flares
Construction and operation of three ammonia flares located in the nitrates, ammonia storage and ammonia plant areas.</td></tr>
</table>

To date, only Phase 1 of the expansion project schedule, associated with the uprate of the Ammonia Plant, has been completed. Preparations relating to preliminary construction activities associated with the ammonia flares (Phase 5) have also commenced.

In developing the project's Environmental Assessment in 2009 and including subsequent MOD1 and MOD2 amendments, the uprated Ammonia Plant production rate of 1050 t/day was assumed in air quality, hazard and risk and noise environmental impact models. Currently Condition 2 of the Project Approval limits the manufacture of ammonia to 360 ktpa, however the 2009 EA was based on the uprated Ammonia Plant operating continually through the year at an average daily production rate of 1050 t/day, equating to approximately 385 ktpa.

Since the completion of commissioning activities associated with the uprated Ammonia Plant on 28 February 2012, Orica has been focussed on improving the plant's reliability with the Ammonia Plant operating consistently between 1030 to 1055 tonnes/day (t/d) during the 2014 to 2015 compliance period. The increase in production has not occurred as a result of changes to Ammonia Plant infrastructure or plant operating parameters other than those specified in the 2009 EA.

As a result of ongoing improvements to the Ammonia Plant's reliability, Orica now operate consistently at daily production rates of between 1030 to 1055 t/d, equating to a maximum annual production quantity of approximately 385 ktpa. Maintenance associated with the Ammonia Plant will remain consistent with the site's current maintenance strategy; with major plant outages planned every 2 and half years. Approval is being sought to increase the annual production limit of ammonia from 360 ktpa to 385 ktpa to enable realisation of the operational production rates of the current Ammonia Plant previously assessed in the 2009 EA.

1.2 Approval Pathway

In accordance with Clause 3 of Schedule 6A of the EP&A Act, section 75W of the Act (as in force immediately before its repeal on 1 October 2011 and as modified by Schedule 6A) continues to apply to transitional Part 3A projects. The Project can therefore be assessed under s75W of the EP&A Act, which states that:

2) The proponent may request the Minister to modify the Minister's approval for a project. The Minister's approval for a modification is not required if the project as modified will be consistent with the existing approval under this Part.

3) The request for the Minister's approval is to be lodged with the Director-General. The Director-General may notify the proponent of environmental assessment requirements with respect to the proposed modification that the proponent must comply with before the matter will be considered by the Minister.

4) The Minister may modify the approval (with or without conditions) or disapprove of the modification.

This EA has been prepared to address the potential environmental issues associated with the proposed annual ammonia production limit increase modification. As agreed with the DP&E (refer to **Section 4.1**), AECOM has used the Director General's Requirements (DGRs) previously issued for the 2009 EA, to guide the assessment of the potential impacts resulting from the Project.

1.3 The Proponent

Orica Australia Pty Ltd (Orica) is an independent, Australian-owned company with a global reach in more than 100 countries worldwide.

Orica is the largest provider of commercial explosives and blasting systems to the mining and infrastructure markets, the global leader in the provision of ground support in mining and tunnelling, and the leading supplier of sodium cyanide for gold extraction.

Orica has a strong portfolio of manufacturing and distribution assets strategically located across Australia, Asia, Europe, Middle East, Africa, Latin America and North America which enables it to provide valuable supply chain capabilities for its customers.

The Site primarily supplies Orica's Mining Services division, providing ammonium nitrate which is used in the manufacture of commercial explosives for mining and quarry.

1.4 Overview of the Site

The Orica Site is located on KI which lies near the mouth of the Hunter River within the Port of Newcastle, approximately 3.5 km north of Newcastle CBD in New South Wales. **Figure 1** shows the regional location of the Site.

Neighbouring land uses to the Site consist of:

- **North** - Incitec Pivot Fertiliser Distribution Centre. The distribution centre adjoins the Ammonia Plant at the northern boundary;
- **North West** – Kooragang Berth No.2. The berth is used for the unloading of cement, vegetable oil, woodchip and bulk products (fertiliser, ammonia, and ammonium nitrate);
- **West** – Qube holds the lease over this land for use in port related activities;
- **South West** – Qube. The terminal is used for bulk material handling (Coal, Wood Chip, Fertiliser, Grain & Soda Ash);
- **South** – Patricks Warehousing and Despatch site. The Facility operates adjacent to the southern boundary of the Facility;
- **South** – Walsh Point. The point is located across Heron Road (i.e. the southern end of KI); and
- **East** – Vacant land. The thin strip of land between Greenleaf Road and the Facility is currently vacant, apart from the northern section which is being developed as a diesel and marine fuel terminal.

The nearest residential areas are located at Stockton, approximately 800 m to the east and south east and Fern Bay, approximately 1.5 km to the north east. There are also residential properties approximately 2 km to the south at Carrington and 2.2 km to the south west at Mayfield.

The Site is topographically flat and includes a range of existing buildings, plant and machinery and supporting infrastructure associated with the production of ammonia, nitric acid and ammonium nitrate at the Facility.

Orica's KI Site consists of:

- An Ammonia Plant;
- Three Nitric Acid Plants, NAP1, NAP2 and NAP3 (nitric acid is used in the production of ammonium nitrate);
- Two AN Plants, namely AN1 which manufactures Nitropril (a porous prilled ammonium nitrate product) and AN2 which manufactures Opal (a granulated ammonium nitrate product) and 88% ammonium nitrate solution;
- Bagging and bulk dispatch facilities for anhydrous ammonia, solid ammonium nitrate, AN solution, nitric acid and granulated material; and
- Offices and amenities located adjacent to Greenleaf Road on the eastern side of the Site.

The main elements of the Site are shown on **Figure 2**.

The land to which the Project relates is identified as Lot 3 DP DP234288. The land is owned by Orica.

G:\ENV\GIS\Projects\603\60306451 Orica Kooragang Island Flare Modification\Figures\AQIA\60306451 F1 Site Location 17 10 2013 TO

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SITE LOCATION

Proposed Modification, Greenleaf Road, Kooragang Island

FIGURE 1

2.0 The Project

2.1 Approved Project

Approval was gained in 2009 for the expansion to the ammonium nitrate Site located on KI. The expansion included:

- An additional Nitric Acid Plant (NAP4);
- An additional Ammonium Nitrate Plant (ANP3);
- Modification of the existing Ammonia Plant;
- Additional storages for nitric acid (including a 2,000 tonne nitric acid storage tank), solid ammonium nitrate and ammonium nitrate solution; and
- Upgrades to existing infrastructure such as cooling towers, air compressors, loading facilities, electrical systems, effluent treatment systems and the steam system.

The Project was approved with the following production limits:

- 360 kilotonnes per annum (ktpa) of ammonia product;
- 605 ktpa of nitric acid product; and
- 750 ktpa of ammonium nitrate product.

2.1.1 Modification No. 1 – Site Layout Changes

In July 2012 the plant and equipment layout for the Site was amended. No changes to the production limits were made as part of the modification. The layout of the Site as approved, and modified (DA 08_0129 MOD 1) is shown in **Figure 2**.

2.1.2 Modification No. 2 – Infrastructure Amendments

The modification related to the construction and operation of three ammonia flares and the change in location storage quantity of a nitric acid tank described in the Project Approval (08_0129).

2.2 Project Description

Orica is now seeking approval to increase the production of ammonia at the Site from the approved production rate of 360 ktpa to 385 ktpa (the Project).

Orica uses ammonia produced at the Site as a feed source for the production of ammonium nitrate, which is also produced at the Facility. The proposed ammonia production increase would not lead to an increase in the total amount of ammonium nitrate being produced at the Site. Surplus ammonia would be loaded onto ships at the adjoining Kooragang K2 Berth and transported to Orica's Yarwun facility in Gladstone, Queensland. The modification does not involve any change to the operating schedule of the Site and does not involve the construction and operation of any additional plant or infrastructure.

2.2.1 Amendment to Condition 2 – Terms of Approval

A review of the Project Approval was undertaken to examine which conditions would require amendment as a result of the Project.

Condition 2, Schedule 2, would need the following modification. Proposed additions to conditions are shown in **bold**:

2. The proponent shall carry out the project generally in accordance with the:

- *a) EA;*
- *b) EA (MOD 1)*
- *c) EA (MOD 2)*
- ***d) EA (MOD 3)***
- *e) Site Layout Plans (Appendices A and B)*

f) Statement of commitments for the Project (Appendix C); and

g) Conditions of this Approval;

2.2.2 Amendment to Condition 5 – Limits on Approval

Condition 5, Schedule 2 currently reads:

5 The proponent shall not produce more than the following at the Project Site:

a) 360,000 tpa of ammonia product;

b) 605,000 tpa of nitric acid product;

c) 750,000 tpa of ammonium nitrate product

Condition 5 would be modified to read:

5 The proponent shall not produce more than the following at the Project Site:

a) ***385,000*** *tpa of ammonia product;*

b) 605,000 tpa of nitric acid product;

c) 750,000 tpa of ammonium nitrate product

2.3 Project Benefits

The Project would allow efficiencies to be maximised at the Site. This would allow greater ammonia production to take place without the construction of new plant or equipment at the Site.

The primary benefit resulting from an increase of the allowable ammonia production quantity would be enabling the Ammonia Plant to operate at its optimal production rate, 365days/year, preventing the plant being required to be shut down once the current allowable ammonia production quantity had been reached.

The minimisation of Ammonia Plant start up and shutdowns is desirable for a number of reasons, namely they represent a period of potential heightened risk due to the transient non-routine plant activities that occur during these periods. Thermal cycling of plant equipment can also reduce the life of the equipment resulting in increased maintenance requirements. There are also elevated noise levels as a result of shutdown and start-up activities. Typically, an Ammonia Plant start-up can take up to three days for routine plant operations to be established.

In addition, the Ammonia Plant also requires additional natural gas to heat relevant process units of the plant, representing an inefficient use of the natural gas compared to circumstances where normal operations are maintained. This can result in an increase in natural gas consumption of up to 40,000GJ per start-up, the equivalent of a day's consumption under normal operating conditions.

Currently, the Site is required to shut down in the future to avoid exceeding the current 360ktpa ammonia production limit. Increasing the production limit to 385ktpa will allow the Site to operate without being required to shut down outside planned shutdowns for routine maintenance. In addition, operating the Ammonia Plant at reduced production rates significantly impacts of the plants natural gas efficiency, increasing the usage of natural gas per tonne of ammonia by up to 20%.

These benefits would see the improved productivity of the Ammonia Plant with environmental outcomes that are consistent with the information detailed in the 2009 EA.

2.4 Alternatives

As the proposed increase in the annual ammonia production limit only involves maximising the availability of the existing ammonia plant and requires no capital works or additions to the Site, the potential alternatives to the Project are limited to:

- The 'Do nothing' scenario.

2.4.1 Do Nothing

The do nothing option would see the Ammonia Plant operating at the current approved rate of production (i.e. 365 ktpa). There are three operating scenarios which could be used to meet the current ammonia production limit:

- Plant operates until the production limit is met and then shuts down for a period of up to 24 days;
- Periodic shut downs which total up to 24 days occur across the year; or
- The plant is operated at a lower production rate for the year to ensure the production limit is not exceeded.

None of these three options allow for the efficiency of the process to be maximised and therefore the do nothing option will result in inefficient plant operation and additional consumption of natural resources to produce the ammonia.

Increasing the number of shutdowns in a year to ensure the current production limit is not met may also have long term effects on plant reliability as shutdowns and start-ups subject the plant to thermal and pressure cycles which can result in increased maintenance requirements in the future.

2.5 Construction Activities

As the Project would use existing plant, no construction of additional plant or infrastructure is required. The existing plant and equipment will be used in accordance with the operations detailed in the 2009 EA. This Project has been facilitated through improvements to the Site's operational management and safety system, including the Ammonia Management Improvement (AMI) Program as described in **Section 2.7.**

2.6 Shipping

As previously discussed, the proposed increase in ammonia production is not being sought with a corresponding increase in ammonium nitrate production. Instead, Orica proposes to ship additional ammonia produced at the Site to Orica's Yarwun Site in Queensland as feedstock for the production of ammonium nitrate at that Site.

On average the Site currently sends approximately 16 ships of ammonia per year to Yarwun. With the additional ammonia production this is expected to increase by 11 shipments per year, to a total of 27 shipments per year. Following the completion of the expansion program, ammonia shipments are expected to reduce to 4 shipments per year.

2.7 Orica Kooragang Island Improvements

Orica is undertaking a progressive improvement of various components of its Site with the aim of improving community and environmental safety and increasing plant performance and efficiency. Key elements of the ongoing program of improvements which relate to Site improvements include the:

- Ammonia Management Improvement Program; and
- The Hunter Water Corporation Recycled Water Project.

2.7.1 Ammonia Management Improvement (AMI) Program

Central to the approval of the expansion (08_0129) of the Site were a series of improvements to existing ammonia management infrastructure. These improvements aimed at reducing the risk associated with the use of ammonia, to both the community and site personnel. These improvements included:

- Implementing additional ammonia detection and isolation systems to reduce the quantity of ammonia released to atmosphere as a result of potential leaks;
- Streamlining the pressurised liquid ammonia storage and piping systems to reduce inventories and simplify isolation; and
- Continuing to explore additional opportunities to further reduce the risks associate with the site's current operations.

In May 2012, Orica undertook a review of ammonia management practices across the industry, including manufacturers in Europe, South Africa, North America and Australia. Following this review Orica identified a number of opportunities to further improve Orica's ammonia management systems at the Site. The review identified four main points of improvement for KI:

1) Simplifying the ammonia distribution network;
2) Improving the ammonia collection and scrubbing capability;

3) Additional ammonia monitoring and detection systems; and

4) Designing ammonia management systems for large release scenarios (MOD 2).

Collectively these improvements to the Site are known as the Ammonia Management Improvement (AMI) Program. The primary aim of the AMI program is to improve the management of ammonia at the KI Site to ensure the community is not impacted by operations or events involving the potential release of ammonia to the environment. The AMI works would further reduce the Site's risk profile whilst maintaining consistency with the risk reduction improvements outlined in the Preliminary Hazard Analysis (PHA) prepared as part of the 2009 EA.

2.7.2 Hunter Water Corporation Recycled Water Project

Associated with the ongoing Site improvement and expansion projects, Orica has recently commissioned infrastructure to enable the e site to receive recycled water for use in the Site's cooling water systems and demineralisation plants.

Hunter Water Corporation (HWC) has partnered with Orica and the surrounding industry on KI to develop the Kooragang Industrial Water Scheme (KIWS). The KIWS will contribute to sustainable water cycle management for the Hunter region by conserving drinking water resources. As of November 2014, recycled water is in Ammonia Plant cooling towers and the sites demineralisation plant, conserving up to 2.3billion litres of drinking annually for the Hunter Region.

Existing Infrastructure Key

1 Ammonia Plant
2 Utilities Area
3 Acid Storage (Dilution infrastructure will be contained in the Tank 1 bund)
4 Nitric Acid Plant 3
5 Nitric Acid Plant 2
6 Nitric Acid Plant 1
7 Boiler Plant
8 ANS
9 AN Plant 2
10 AN Plant 1
11 AN Bulk Storage
12 Bagged Product Storage

Infrastructure Key (1 - 16)

1 New demin water system
2 New ammonia storage nitrate pumps
3 New instrument air compressor and dryer
4 Extension to No.2 11kV substation
5 New NA storage
6 New pipe rack
7 11kV trident switchroom
8 New boiler
9 Cooling water supply pumps
10 New cooling water treat,emt skids
11 New cooling towers
12 New NAP4/AN3 switchroom and transformer
13 New NAP4 plant
14 Ammonia compressor
15 Contaminated condensate tank
16 Clean process condensate tank

Infrastructure Key (17 - 32)

17 New No.6 ammonia bullet
18 New emergency generator and switchroom
19 New control room
20 New entry
21 New workshop
22 New entry security gate
23 New office
24 New weighbridge
25 New concentrator plant
26 New ANS/WANS loadout
27 New first flush pi
28 New dispatch office and amenities
29 New bag store
30 New AN road bulk loadout and weighbridges
31 2x 1.05/1.2t bag lines and 1x 25/40kg bag line
32 Switchroom

Infrastructure Key (33 - 38)

33 Transformers
34 Container bag loading area
35 New bulk store
36 New weighbridge
37 New office
38 New exit security gate
39 New FEL workshop and forklift parking
40 Transtank
41 Proposed AN# plant
42 New container storage
43 Nitrogen tie in
44 New ammonia plant nitrates pump
45 Proposed Recycled Water Tank (consistent with existing site approvals)

Key

Site boundary
Existing infrastructure location
OBL Stage 1A
OBL Stage 1B
OBL Stage 2
NAP4 & ANS
AN3

Note:
Information derived from Hatch EMA plan HEN2561-0000-00-014-0012 (**05/04/2011**)

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AECOM

APPROVED FACILITY PLAN
Proposed Modification, Greenleaf Road, Kooragang Island

FIGURE 2

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3.0 Statutory Assessment

3.1 Environmental Planning and Assessment Act 1979 (EP&A Act)

The approved project was declared to be a major project and approval was granted under Part 3A of the EP&A Act in 2009.

On 1 October 2011, Part 3A of the EP&A Act was repealed. At the same time, savings and transitional arrangements were put in place for projects that are classified as 'transitional Part 3A projects'. A transitional Part 3A project is defined in clause 2 of Schedule 6A of the EP&A Act, which includes projects which were approved prior to the repeal of Part 3A of the EP&A Act. For these types of projects, Part 3A of the EP&A Act (as in force immediately before the repeal of that Part and as modified under Schedule 6A after that repeal) continues to apply.

This project is defined as a transitional Part 3A project as it was approved prior to the repeal of Part 3A of the EP&A Act. As such, any modification to the approval is to be considered under section 75W of the EP&A Act.

Under section 75W of the EP&A Act, a proponent may request that the Minister modify the Project Approval if the project, as modified, would not be consistent with the project as approved. As the Project would not be consistent with the existing approval, specifically the limit on ammonia production, the Proponent requests that the Minister modify the 2009 Project Approval as outlined in this assessment.

Section 75W(3) of the EP&A Act also states that the Director-General may notify the proponent of environmental assessment requirements. As outlined in **Section 4.1**, DP&E agreed that the original project DGR's would be suitable to use for the Project as applicable.

3.2 Environmental Planning Instruments

3.2.1 Newcastle Local Environmental Plan 2012

The Site is located within the Newcastle City Local Government Area where the relevant Local Environmental Planning instrument is the Newcastle Local Environmental Plan 2012 (LEP 2012). However, the Site is within the boundary of the Three Ports Site as shown on the Newcastle Port Site – Land Zoning Map – LZN 001 and thus falls under the provisions of the *State Environmental Planning Policy (Major Development) 2005* (Major Development SEPP). By virtue of Part 20(4) of Schedule 3 Major Development SEPP, environmental planning instruments other than State Environmental Planning Policies do not apply to the Site as it is located within Three Ports land. Therefore the provisions of the LEP 2012 do not apply to the Site.

Newcastle Development Control Plan

The planning controls within the Newcastle Development Control Plan (DCP) have been reviewed as they relate to the proposed ammonia production limit increase. Due to the nature of the proposed modification, no specific controls from the DCP apply to the Project. Regardless, by virtue of Part 20(4) of Schedule 3 Major Development SEPP, the provisions of the DCP do not apply to the Project.

3.2.2 State Environmental Planning Policy (Major Development) 2005

The Major Development SEPP identified developments that were considered to be Major Developments under the EP&A Act before the EP&A Act was amended to remove this definition. In 2009, expansion of the Site was approved as a Major Project in accordance with the Major Development SEPP Project Approval (08_0129). As described in **Section 3.1** the Project represents a modification to the Project Approval.

3.2.3 State Environmental Planning Policy (Three Ports) 2013

State Environmental Planning Policy (Three Ports) 2013 (The Three Ports SEPP) amendments in relation to the Port of Newcastle, came into effect on 31 May 2014 following the sale of the Port of Newcastle. The Three Ports SEPP supersedes the Major Project SEPP in providing the land use zonings for the Port of Newcastle. Pursuant to the Three Ports SEPP, the Site is located within the SP1 Specials Activities zone.

3.2.4 State Environmental Planning Policy 33 – Hazardous and Offensive Development (SEPP 33)

SEPP 33 was designed to ensure that sufficient information is provided to consent authorities to determine whether a development is hazardous or offensive. Conditions can then be imposed on the development to reduce or minimise adverse impacts. Any development application for a potentially hazardous development must be supported by a Preliminary Hazard Analysis (PHA).

As the Project is not introducing any new materials or processes to the Site, and will be undertaken in a manner which includes appropriate safety systems, it does not constitute an additional hazardous or offensive development that would require further consideration under SEPP 33. The Project would see a minor increase to the intensity of existing processes and consequently consideration of hazard and risk is required. Further discussion in relation to the Project specific hazards and risk assessment is provided in **Section 6.3**.

3.3 Commonwealth Matters

3.3.1 Environment Protection and Biodiversity Conservation Act 1999

In addition to State-based approvals, actions that may significantly affect matters of National Environmental Significance (NES) require assessment and/or approval from the Commonwealth under the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999*. The EPBC Act lists eight matters of NES that must be addressed when assessing the environmental impacts of a project.

A review of the potential for the Project to impact on NES matters was undertaken. As the Project does not require construction or Site modification, it is considered highly unlikely that any NES matters would be impacted by the Project. No referral to the Commonwealth Department of the Environment is considered necessary.

3.4 Other Approvals Required

The Site currently operates under Orica's Environmental Protection Licence (EPL) No. 828.

The Project is seeking approval to increase the annual approved ammonia production limit. No additional production plant or physical changes to the Site are proposed. Therefore there will be no change in the number or type of discharge points from the Site as detailed in EPL 828.

Despite the proposed increase in annual ammonia production beyond that specified in the Project Approval, the original air quality assessment that guided the preparation of EPL 828 was undertaken assuming the ammonia plant was running at full capacity i.e. 385 ktpa. Therefore pollution loading is not expected to increase beyond the limits currently in the EPL. As such, variations to EPL 828 are not required as a result of the Project. This is supported by the Air Quality Impact Assessment undertaken for this modification (see **Section 6.1**), which concluded that there would be no increase in pollutant production beyond that identified previously.

4.0 Consultation

4.1 Department of Planning and Environment

Prior to the preparation of this EA, Orica met with DP&E to discuss the Project and the likely approval path as well as environmental assessment requirements. DP&E confirmed that the Project could be assessed as a modification to the existing Project Approval (08_0129) and that the DGR's issued for the existing approval should be used to guide the environmental assessment for the Project.

The DGR's for Project Approval 08_0129 are reproduced in **Table 2** along with guidance of where matters raised are addressed in this EA.

Table 2 Director General's Requirements (08_0129)

Assessment Requirements	Addressed in this EA
General Requirements	
An executive summary;	Executive Summary
A detailed description of the following: - historical operations on the Site; - existing and approved operations/facilities, including any statutory approvals that apply to these operations/facilities; and - the existing environmental management and monitoring regime.	Section 2.1 and original EA (2009).
A detailed description of the project, including the: - need for the project; - alternatives considered; - likely staging of the project; and - plans of any proposed building works.	 Section 2.3 Section 2.4 N/A N/A No building works proposed.
A risk assessment of the potential environmental impacts of the project, identifying the key issues for further assessment;	Section 5.0
A detailed assessment of the key issues specified below, and any other significant issues identified in the risk assessment (see above), which includes: - a description of the existing environment, using sufficient baseline data; - an assessment of the potential impacts of all stages of the project, including any cumulative impacts, taking into consideration any relevant guidelines, policies, plans and statutory provisions (see below); and - a description of the measures that would be implemented to avoid, minimise, mitigate, rehabilitate/remediate, monitor and/or offset the potential impacts of the project, including detailed contingency plans for managing any potentially significant risks to the environment.	Section 6.0
A statement of commitments, outlining all the proposed environmental management and monitoring measures;	Section 8.0.
A conclusion justifying the project on economic, social and environmental grounds, taking into consideration whether the project is consistent with the objects of the *Environmental Planning & Assessment Act 1979*.	The social, environmental and economic justifications and consistency with the objects of the EP&A Act for the modification are consistent with those presented in Section 19 of the 2009 Project EA, as applicable. Furthermore the project Benefits are described in

Assessment Requirements	Addressed in this EA
	Section 2.3.
A signed statement from the author of the Environmental Assessment, certifying that the information contained within the document is neither false nor misleading.	Certification page
Hazards	
- A Preliminary Hazard Analysis (PHA) of the project including the combined existing and proposed operations and a detailed assessment of the potential off-Site risks; - Details of the receipt, transfer and storage of chemicals on site such as ammonia and ammonium nitrate.	Section 6.3 and Appendix A NA. No changes to these activities are proposed.
Air Quality and Odour	
- An assessment of all air pollutants from all sources during construction and operation and from road, rail and sea transport, including any potential volatile organic compounds, particulates, odour, NO_X, N_2O and NH_3; - Details of all control measures including NO_X and N_2O abatement and start-up venting controls for NO_X and NH_3 for the Nitric Acid Plant; - Cumulative impacts of the Project in relation to existing and - Approved developments in the area.	Section 6.1 and Appendix A - addressed as applicable to the Project.
Noise	
Construction, operational and on-site and off-site road, rail and sea transportation noise;	Section 6.2 and Appendix B and Appendix C - addressed as applicable to the Project.
Soil and Water	
- An assessment of the potential soil, groundwater and surface water impacts including impacts on Newcastle Harbour; - Water supply including options for reuse of process water; - Proposed erosion and sediment controls (during construction) and the proposed stormwater management system (during operation); - An assessment of contaminated groundwater and soils, and acid sulfate soils, and proposed mitigation and management measures; and - Potential impacts of flooding, with consideration of climate change and projected sea level rises.	Section 6.4 - addressed as applicable to the Project.
Greenhouse Gas	
Quantitative analysis of the Scope 1 and 2 greenhouse gas emissions of the project and a qualitative analysis of the impacts of these emissions; details of measures to improve energy efficiency.	Section 6.4 - addressed as applicable to the Project.
Transport	
Details of all transport types and impacts on the safety and capacity of the local road network in particular Cormorant Road roundabout and Tourle Street Bridge; details of the access to the Site, internal roads and car parking.	Section 6.4 - addressed as applicable to the Project.
Waste	
Classification of all potential sources of liquid and non-liquid wastes, quantities, storage, treatment and disposal or re-use.	Section 6.4 - addressed as applicable to the Project.
Visual	

Assessment Requirements	Addressed in this EA
Impacts on nearest sensitive receivers.	Section 6.4 - addressed as applicable to the Project.
Flora and Fauna	
Impacts on critical habitats, threatened species or populations or ecological communities and their habitats in the region.	Section 6.4- addressed as applicable to the Project.
Heritage	
Aboriginal and non-Aboriginal.	Section 6.4 - addressed as applicable to the Project.

4.2 Community Consultation

Orica will utilise existing communication channels to promote information detailed in Orica's modification application and supporting consistency review. This will include a briefing to the site’s Community Reference Group (CRG), a forum consisting of both community and industry representatives that meet every three months. All information presented at CRG meetings is available on Orica's website and monthly Safety, Health, Environment and Community (SHEC) Report. The next CRG meeting is scheduled for the 25 May 2015.

In addition, Orica will provide an overview of the modification in the site's community bi-monthly newsletter, a publication that is distributed to over 6000 households in surrounding areas including Stockton, Fern Bay, Mayfield East, Carrington, Maryville and Tighes Hill.

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5.0 Prioritisation of Issues

A risk analysis was completed to rank potential environmental risks associated with the Project.

5.1 Risk Matrix

The prioritisation of issues for the Project was based on the need to recognise that a higher degree of assessment is required for the issues with the highest severity and greatest possible consequences. **Table 3** shows the issues prioritisation matrix used to identify priorities.

Each issue was given a ranking between one and three for the potential severity of risks and the perceived consequence of those effects if left unmanaged. These two numbers were added together to provide a numerical ranking for the issue that was used to categorise each issue into high, medium and low priorities.

Potential Consequences:

1) Broad scale environmental impact.
2) Regional environmental impact.
3) Local environmental impact.
4) Minor environmental impact.
5) Insignificant environmental impact.

Likelihood of adverse impact:

A) Almost certain.
B) Likely.
C) Possible.
D) Unlikely.
E) Rare.

Table 3 Issues Prioritisation Matrix

	Likelihood of adverse impact					
Potential Consequence		A	B	C	D	E
	1	High	High	Medium	Low	Very Low
	2	High	High	Medium	Low	Very Low
	3	Medium	Medium	Medium	Low	Very Low
	4	Low	Low	Low	Low	Very Low
	5	Very Low	Very Low	Very Low	Very Low	Very Low

5.2 Assessment

The prioritisation of environmental issues related to the Project is provided in **Table 4**.

This environmental risk analysis prioritises environmental issues in the absence of appropriate safeguard measures to manage environmental effects. This analysis was then used to inform the environmental assessment and the engineering and environmental design of the Project and in the identification of appropriate safeguards.

Table 4 Assessment of Environmental Issues

Issue	Potential Environmental Issue	Severity	Consequence	Priority
Air Quality	Stack emissions during operation.	3	B	Medium
Noise and Vibration	Noise and vibration impacts during operation, and shipping movements	3	C	Medium
Hazards and Risk	Material leaks/spills and interaction with materials and equipment of materials on Orica's or neighbouring sites. Change in shipping frequency.	3	C	Medium
Transport	Additional shipping – 11 ships per annum	4	C	Low
Greenhouse Gas	Increased emissions from increased energy use required for the Project	4	C	Low
Soils and water	Increased contamination potential due to increased material handling.	4	D	Low
Waste	Potential for increased waste generated during increased operation	4	D	Low
Flora and fauna	Negligible impacts to flora and fauna anticipated	5	E	Very Low
Heritage	Negligible impacts to Heritage anticipated	5	E	Very Low
Visual	Negligible visual impact anticipated	5	E	Very Low

5.3 Final Assessment

A summary of the final prioritisation of issues identified for the Project is shown in **Table 5**.

Table 5 Final Prioritisation of Environmental Issues

Prioritisation	Issue
Medium	Air Quality
	Noise and Vibration
	Hazards and Risk
Low	Transport
	Greenhouse Gas
	Soil and Water
	Waste
Very Low	Flora and Fauna
	Heritage
	Visual

Environmental issues identified as either 'low' or 'very low' have been addressed in **Table 15** in **Section 6.4**.

6.0 Environmental Assessment

6.1 Air Quality

6.1.1 Existing Environment

Air quality in Newcastle is dominated by motor vehicle emissions and major industry located around the port of Newcastle. Nearby industrial facilities likely to be contributing to the existing air quality include Tomago Aluminium, OneSteel, Koppers Coal Tar Site and Cargill grain terminals and seed processing.

The closest residential premises to Orica are located at Stockton, approximately 800 m east of Orica's property boundary. There are also residential properties 1.5 km to the southwest at Carrington and 2 km to the west at Mayfield.

The NSW EPA operates an ambient air quality and meteorological station at Fullerton Street Stockton. Orica previously operated the station until September 2014. The station continuously monitors general air quality as well as wind speed and direction. Air quality parameters measured are dust (PM_{10} and $PM_{2.5}$), NO_x and ammonia (NH_3). The data is publically available at the following web address http://www.environment.nsw.gov.au/aqms/newcastlelocalmap.htm and http://www.stocktonairqualitymonitoring.com/.

6.1.2 Methodology

An Air Quality Impact Assessment (AQIA)(refer Appendix A) was prepared to determine to support the modification.

The AQIA took the form of a consistency review of the change in emissions associated with the Project against the predictions made in the dispersion modelling conducted for the original expansion (AECOM, 2009) to determine whether the conclusions of the original AQIA would change as a result of the Project.

The review was limited to emissions from the plant and equipment affected by the proposed production change, i.e. the Ammonia Plant and the Nitrates Boiler (associated emission points being the Pre-Reformer Stack, the Reformer Stack and the Boiler Stack). Only Oxides of Nitrogen (NO_X) emissions were assessed.

The consistency review compared emission rates used in the dispersion modelling (AECOM, 2009, 2014) against the emission rates measured from the Plant since the Site began operating at a level considered to be consistent with the proposed production rate of 385 ktpa (or approximately 1,050 tpd). Emission test data measured after August 2012 (when the plant began consistently operating above 900 tpd) were used for the comparison, as they were considered representative of emissions for the plant operating at the proposed production rate. These test data were measured in 2013 and 2014.

6.1.3 Assessment of Impacts

The NO_X stack emissions from the Pre-Reformer, Reformer and the Boiler Stacks measured during 2013 and 2014 were compared to those modelled in 2009 and 2014 and to EPL 828. EPL 828 specifies an equivalent NO_2 equivalent limit of 350 mg/m^3 (0.35 g/m^3) for the Pre-Reformer and Reformer Stacks and 1000 mg/m^3 (1.0 g/m^3) for the Boiler Stack. The NO_2 equivalent limit of 350 mg/m^3 is consistent with the relevant emission standards for the Reformer Stack specified by the Protection of the Environment Operations (POEO) (Clean Air) Regulation 2010 under Schedule 4 – General standard of concentration. The POEO general standards limit for any boiler operating on gas is also 350 mg/m^3 of nitrogen dioxide (NO_2) or nitric oxide (NO) or both as NO_2 equivalent.

The EPA specifies impact assessment criteria for pollutants in the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (DEC, 2005). These criteria represent maximum allowable ground level pollutant concentrations.

The EPA does not specify criteria for NO_X, which are formed during the oxidation of nitrogen. For combustion sources, the NO_X at the point of emission is typically comprised of 95 % nitric oxide (NO), with the remaining 5 % being primarily nitrogen dioxide (NO_2). Ultimately, however, all NO emitted into the atmosphere is oxidised to NO_2 and then further to other higher oxides of nitrogen. As NO_2 is known to have effects on human health, the EPA has specified criteria for this pollutant; these are shown in **Table 6.**

Impact Assessment

In order to assess the potential impact of the project potential NO_2 generation, the increased ammonia production was compared to the project assessment criteria derived from the EPA as shown in **Table 6**.

Table 6 Air Quality Impact Assessment Criteria (DEC, 2005)

Pollutant	Averaging Period	Criteria (µg/m^3)
Nitrogen Dioxide (NO_2)	1 hour	246
	Annual	62

The emission rates from the Reformer and Boiler Stacks measured in 2013 and 2014 are shown in the following tables, together with the emission rates previously modelled for the subsequently approved modifications and the EPL limits.

Pre-Reformer Stack

Emissions from the Pre-Reformer Stack are shown in **Table 7.** The 2009 air quality impact assessment assessed three scenarios: existing Site, existing Site operating at the maximum emission rates; and the existing Site with the proposed modifications operating at the maximum emission rates. The highest relevant emission rates from this assessment were used for comparative purposes below. Emissions from the Pre-Reformer stack are measured on an annual basis only, and as such only two data sets are available for comparison to the modelled values.

Table 7 Pre-Reformer Stack Emissions

Description	Flow Rate (Nm^3/s)	Stack Height (m)	Stack Velocity (m/s)	Gas Temperature (°C)	NOx Emission	
					mg/m^3	g/s
Measured Emissions						
1 May 2014	**8.0**	27	**5.5**	**250**	**60**	**0.48**
29 August 2013	7.6		4.2	151	55	0.42
Modelled Emissions						
Approved Project, 2009	5.28	27	5.1	110	234	1.24
Approved Project, 2014	5.3	27	5.2	110	234	1.20

N.B. Maximum measured NO_X concentration and associated parameters shown in **bold type**
Nm^3/s: metres cubed per second (measured at standard temperature and pressure)
m: metres
m/s: metres per second degrees Celsius
mg/m3: milligrams per metre cubed
g/s: grams per second

As shown, the maximum measured emissions of NO_X from the Pre-Reformer Stack since the plant began operating at close to the uprated production rate of 1050T/day was 60 mg/m^3. This emission concentration is well below that assessed for the Approved Project (234 mg/m^3 for both 2009 and 2014). The measured flow rates, and velocities were similar to that assessed in 2009, with the measured velocities and flow rates slightly higher than the modelled values, however the measured temperatures were significantly higher than the modelled values.

Emissions from the Pre-Reformer Stack and the Reformer Stack consist of plumes of gas which rise from the stack and eventually disperse. The velocity and temperature of the emissions determines how high the pollutant plume reaches before it begins to disperse. The height at which the plume reaches before it begins to disperse is called the effective plume height. Pollutant plumes that reach higher altitudes before dispersing will more effectively disperse when reaching ground level. Gas with higher velocities and temperatures lead to higher effective plume heights and a greater degree of dispersal.

As the measured Pre-Reformer Stack temperature and highest measured velocity are higher than the modelled values, the actual plume emitted from the Pre-Reformer Stack is expected to be better dispersed when reaching ground level, than the modelled plume. Furthermore, as the measured emission rates are lower than those modelled, less NO_X is being emitted from the Pre-Reformer Stack under the higher production levels than was previously modelled. Together, the pollutant concentrations associated with Pre-Reformer Stack emissions are expected to be lower for the Site operating under the proposed production levels than were previously approved. It should be noted that no exceedances of the NO_2 criteria were predicted in AECOM (2009, 2014).

The maximum measured Pre-Reformer Stack NO_X emission was 60 mg/m^3, which equates to an NO_2 equivalent value of 90 mg/m^3. This value complies with the stacks NO_2 equivalent EPL limit of 350 mg/m^3.

Reformer Stack

Emissions from the Reformer Stack are shown in **Table 8**. The 2009 air quality impact assessment assessed three scenarios and the highest relevant emission rates from this assessment were used for comparative purposes below. It should be noted that the sampling location of the Reformer Stack changed in mid-2014 to make the port compliant with AS 4323.

Table 8 Reformer Stack Emissions

Description	Flow Rate (Nm^3/s)	Stack Height (m)	Stack Velocity (m/s)	Gas Temperature (°C)	NOx Emission	
					mg/m^3	g/s
Measured Emissions						
29 August 2013	44	47	17	123.6	170	7.5
5 December 2013	45		16	99.9	184	8.3
16 January 2014	53		18	100.3	192	10.2
6 February 2014	**38**		**14**	**123.5**	**230**	**8.7**
30 April 2014	57		14	131.5	148	8.4
5 August 2014	50		12	123.1	198	9.9
13 November 2014	44		10	127.0	144	6.3
Modelled Emissions						
Approved Project, 2009	45	47	11.6	118.5	313	14.2

N.B. Maximum measured NO_X concentration and associated parameters shown in **bold type**
Nm^3/s: metres cubed per second (measured at standard temperature and pressure)
m: metres
m/s: metres per second degrees Celsius
mg/m3: milligrams per metre cubed
g/s: grams per second

The maximum measured emissions of NO_X from the Reformer Stack since the plant began operating at close to the proposed operating limit were 230 mg/m^3. This emission concentration is well below that assessed for the Approved Project in 2009 (313 mg/m^3). The conditions that the emissions were measured in were similar to that assessed in 2009, with the measured velocities and temperatures typically slightly higher than the modelled values.

The measured Reformer Stack temperature and velocity are generally higher than the modelled values, resulting in better dispersion and lower ground level concentrations. The measured emission rates presented are also lower than those modelled. As such, the pollutant concentrations associated with Reformer Stack emissions are expected to be lower for the Site operating under the proposed production levels than were previously approved. It should be noted that no exceedances of the NO_2 criteria were predicted in AECOM (2009).

The maximum measured Reformer Stack NO_X emission was 230 mg/m^3, which equates to an NO_2 equivalent value of 348 mg/m^3. This value complies with the stacks NO_2 equivalent EPL limit of 350 mg/m^3.

Boiler Stack

The boiler at the Site is not directly linked to the production rate of the Ammonia Plant. However, it was included in the consistency review for completeness as the Ammonia Plant exports excess steam generated by the process to the Site's nitrates plants. This excess steam supplements steam generated from the boiler and has an impact on steam production at the Site. NO_X emissions associated with the production of Nitric Acid in the Site's three plants were not included as an increase in annual ammonia production quantity has no influence on the performance of the Nitric Acid plants.

Emissions from the Boiler Stack are shown in **Table 9**. AECOM (2014) assessed two potential boiler scenarios (typical operation and maximum operation), with each having the same NO_X emission concentration but different emission rates (g/s). Both were lower than those assessed in AECOM (2009).

Table 9 Boiler Stack Emissions

Description	Flow Rate (Nm^3/s)	Stack Height (m)	Stack Velocity (m/s)	Gas Temperature (°C)	NOx Emission	
					mg/m^3	g/s
Measured Emissions						
30 April 2014	3.3	40	2.9	121.7	61	0.2
27 March 2013	**3.4**	**40**	**3.2**	**175.9**	**81**	**0.3**
27 August 2013	4.3	40	4.1	187.8	55	0.2
Modelled Emissions						
Approved Project, 2009	19.3	40	16.6	200	234	4.5
Approved Project, 2014 – Scenario 1	15.7	40	12.9	137	184	2.89
Approved Project, 2014 – Scenario 2	19.8	40	16.8	148	184	3.65
N.B. Maximum measured NO_X concentration and associated parameters shown in **bold type**						

The maximum measured emission concentration from the Boiler Stack was 81 mg/m^3 (0.3 g/s), which is approximately one third (35%) of the maximum modelled emission concentration (234 mg/m^3). Importantly, the maximum emission rate measured in g/s was between 7% and 10% of the modelled values, which is a significant reduction in emissions.

The measured velocity and flow rates were substantially lower than the modelled parameters, while the temperatures were generally within the modelled ranges. As discussed above this means effective plume height would be lower than what had been previously modelled. These parameters indicate that while the dispersion of NO_X emitted from the Boiler Stack may not be as extensive as that previously assessed and approved, the amount of NO_X emitted is substantially lower. As such, operation of the plant at the proposed production limit is not expected to result in higher NO_2 concentrations at sensitive receptors than those previously approved.

A sensitivity analysis was undertaken to understand the influence of the higher flow rates that were observed for the 2009 and 2014 modelled emissions. The sensitivity analysis showed that even if the higher flow rates were applied to the current Boiler Stack conditions, NOx emissions would still be between 44% and 73% lower than compared to the 2009 assessment. As such, the conclusion remains relevant that the proposed annual ammonia production limit increase to 385ktpa is not expected to result in higher NO_2 concentrations at sensitive receptors than those previously approved. **Table 4** of **Appendix B** contains the sensitivity analysis.

The maximum measured Boiler Stack NO_X emission was 81 mg/m^3, which equates to an NO_2 equivalent value of 124 mg/m^3. This value complies with the stacks NO_2 equivalent EPL limit of 1,000 mg/m^3.

6.1.4 Environmental Safeguards

Orica currently conducts ongoing air quality monitoring in accordance with Conditions 22, 23 and 24 of Schedule 3 of the Project Approval. The Project would not result in any changes to the existing air quality management systems and modelling has shown that existing project air quality criteria would not be exceeded. The existing monitoring program would continue to be utilised to monitor potential air quality impacts of the proposed increase in ammonia production against the criteria.

6.1.5 Conclusion

The AQIA took the form of a Consistency Review which compared the emissions of the Approved Project as assessed through dispersion modelling (AECOM 2009; 2014), against the emission concentrations measured for the three sources since the Site began operating at a level considered by Orica to be representative of plant emissions, if the Site was operating at the proposed production rate (385ktpa). Emission testing data captured during 2013 and 2014 were used in the comparison.

The measured emissions of NOx from the Pre-Reformer Stack, Reformer Stack and Boiler Stack were well below the emissions of the Approved Project (AECOM, 2009) and EPL emission limits. No exceedances of the EPA NO_2 ground level criteria were predicted in AECOM (2009, 2014), and emissions from the Pre-Reformer and Reformer Stacks when the plant is operating at the proposed ammonia production rate were considered likely to result in lower NO_2 concentrations at sensitive receptor locations than those predicted in AECOM (2009).

6.2 Noise

A Noise Impact Assessment (NIA) was prepared to assess the potential noise impacts of the Project. The NIA is summarised below and attached at **Appendix C.**

6.2.1 Existing Environment

The existing noise environment surrounding the Site is dominated by industrial operations and land uses on KI. The closest residential premises to Orica are located at Stockton, approximately 800 m east of Orica's property boundary. There are also residential properties 1.5 km to the southwest at Carrington and 2 km to the west at Mayfield.

Atkins Acoustics conducted noise monitoring of the Site between 2009 and 2014 at the assessment locations shown in **Figure 3**. The assessment locations R4, R5 and R6 represent three of the six locations monitored for compliance against Project Approval 08_0129. These three locations were originally selected because they were less likely to be influenced by surrounding industrial noise sources, other external noise sources, variable weather effects, and because they would more accurately represent noise directly attributable to the Site's operations. It should be noted that R4, R5 and R6 are not the closest noise monitoring locations to residential receivers, but as discussed above, they were determined to be the best locations to assess the noise impact of the Site.

A noise monitoring location has been added for western receivers (R West, located at 6 Crebert Street, Mayfield East) to assess the noise impacts of the Project to the west of the Site. This assessment location was included in the noise assessment for this EA and does not have a project specific noise criterion.

Figure 3 Receiver Locations

Noise Management and Reduction Plan

Orica has in place a Noise Management Plan (NMP) to maintain its operational noise levels within the project specific criteria and where possible, reduce noise emissions from key sources. The NMP includes detailed commitments by Orica to manage noise. Specific activities and controls that will be implemented as part of the NMP include:

- Monitor noise in accordance with the NMP;
- Ensure that all equipment used onsite is effectively maintained; and

- Identify and manage modifications to plant and equipment that could potentially increase noise from the Site (short term and long term).

Site investigations conducted by Atkins Acoustics in 2009 and 2014 identified and ranked noise sources at the Site that contributed to the environmental noise emission. The outcome of this activity was a set of actions to be taken to control noise at the Site. Since 2010 Orica has implemented the following actions:

- Installed an acoustic enclosure for the No. 2 Nitric Acid Plant Process air compressor;
- Installed an acoustic treatment for the No. 1 Nitric Acid Plant Compressor Building;
- Installed an acoustic treated building for the new Ammonia Plant Process air compressor;
- Installed a new converter quench valve station to reduce high frequency valve/pipe noise on the Ammonia Plant;
- Decommissioned two Ammonia Process Air Compressors (101J and 102J);
- Managed venting of surplus low pressure steam on the Ammonia Plant;
- Verified the noise levels from MOD 1 and the existing plant (refer to Atkins (2013) and Section 6.2.2); and
- Assessed Ammonia Plant start-up noise emissions.

Orica's noise management commitments are ongoing, and future noise reduction strategies will be devised upon continued monitoring and investigation of noise sources at the Site.

6.2.2 Methodology and Ammonia Plant Compliance Noise Verification

The operational noise limits for the Project have been established in accordance with the Project Approval 08_0129. The specific noise conditions applicable to the Site have been replicated in the Noise Impact Assessment report in **Appendix C**.

Operational Noise Criteria

Orica's NMP (Atkins Acoustics 2011), presents the project specific noise criteria for the Site under approval 08_0129. The NMP nominates assessment locations and provides project specific noise criteria, which are based upon noise monitoring results conducted by Atkins Acoustics prior to the Ammonia Plant expansion in 2011. These criteria are 10 dB below noise levels from Orica's existing plant as required by project approval 08_0129 in order to manage amenity noise.

Table 10 presents these noise criteria, which are applicable at all times of the day (i.e. 24/7). The receivers assessed are shown in **Figure 3**.

A receiver point has been added for western receivers to assess the noise impacts of the Project to the west of the Site, but this receiver does not have a project specific noise criterion.

Table 10 Assessment Noise Criteria

Assessment Location	Project Specific Noise Criteria $_{LAeq\ 15min}$ dB
R4	52
R5	47
R6	46
R West (6 Crebert Street, Mayfield East)	N/A

As part of Orica's NMP, Atkins Acoustics was commissioned by Orica to conduct environmental noise audits during 2012-2013. Atkins then undertook an assessment of operational noise from the Site including plant associated MOD 2 (see **Section 2.1.2**).

Attended and unattended noise measurements reported for the period September 2012 to July 2013 were assessed. Modelling confirmed that noise contributions from MOD 2 satisfy the project noise criteria (Atkins, 2013). Site noise audits demonstrated that noise levels measured during the 2012-2013 period were within the normal range of operational noise levels and no specific overall noise trends have been identified.

The noise assessment criteria under Project Approval 08_0129 are set out in **Appendix A**.

6.2.3 Assessment of Impacts

Orica is proposing to increase the annual quantity of ammonia that it transports through the Port of Newcastle as a result of the increase in the annual ammonia production from 360ktpa to 385ktpa. This will not affect the production rate of nitric acid or ammonium nitrate and these will remain as per their existing approved limits. Orica is not proposing to introduce any new production plant infrastructure that will increase the noise emission from the Site, or add any reliability improvements to the plant that will increase the noise emission. The Ammonia Plant currently operates continuously for 24 hours a day and so the increase in the ammonia production limit modification will not change the hours of operation.

An increase in the quantity of ammonia produced will not result in increased road traffic volumes as the surplus ammonia produced will be transported by ship to Orica's Yarwun Site at Gladstone, Queensland.

Since no additional noise generating infrastructure is proposed and no additional road traffic noise will be generated, the NIA was solely concerned with potential ship noise.

Ships

Ships operating in association with the Project will be docked at Kooragang Island Berth K2 and loaded with ammonia via the existing pipeline from the Site and the existing ship loading equipment. The number of shipments currently operating from K2 and additional ships required to accommodate the proposed increase in the production limit is shown in **Table 11**.

Table 11 Ship Movements for Existing Scenario and Proposed Production Limit Modification

Scenario Description	Ships/year
Existing	16
With production limit increase modification	11
Total	**27**

Typically Deep Well Pump ships and Central Pump Room Ships operate at fuel terminals and the NIA has assumed that a similar type of ship will be used to transport ammonia.

To determine the potential impacts from ships when at berth, the NIA assessed the upper and lower sound power levels that the ships typically operate within. This gave an indication of the typical impacts that might be expected when a ship is in berth. This method of analysis is appropriate considering the wide range of sound power levels the ships have the potential to operate under and the results consider the upper and lower range of noise impacts. This provides a realistic assessment of impacts in comparison to just the assessment of the mean sound power level of ships when at berth.

The assessment considered noise propagation from the ship as a point source, only taking into consideration the losses due to the distances of the receivers to the ship berthed at K2 (refer **Figure 3**). This calculation method is conservative as it does not account for further reductions of air absorption, ground absorption and shielding due to structures.

The ship is assumed to operate for prolonged periods of time and therefore no time weighting discount has been applied to the noise levels.

Noise Contribution

The noise contribution from the berthed ship is shown in **Table 12**. The results demonstrate that the noise levels for the assessment receivers R4, R5 and R6 are well below the project specific noise criteria in **Appendix C** for both the higher and lower possible ship noise contributions. The noise levels at the western receiver, R West, were predicted to be lower than the noise levels at the assessment receivers. All predicted noise levels are at least 7 dB less than the project specific noise criteria and therefore at least more than 17 dB less than the existing noise levels from the Orica plant's existing operations (refer to section 6.2.2 for criteria).

The proposed increase in the ammonia production limit will increase the number of ships used to transport ammonia. However, a level of 17 dB below the existing noise environment demonstrates that the environmental noise levels at receivers will not increase as a result of the activity of these additional ships. Ship noise will therefore have inconsequential noise impacts on surrounding residential receivers. Furthermore only a single ship can be loaded with ammonia at the K2 Berth at any one time meaning there will be no cumulative impact from increased shipping.

Table 12 Noise Impacts for Increased Ship Movements

Receiver	Predicted ship noise level (Low Ship Noise Scenario), $L_{Aeq\ (15\ min)}$, dB(A)	Predicted ship noise level (High Ship Noise Scenario), $L_{Aeq\ (15\ min)}$, dB(A)	Project specific noise criterion, dB(A)[1]	Exceedance, dB(A)
R4	32	37	**52**	-
R5	34	39	**47**	-
R6	34	39	**46**	-
R West (6 Crebert Street, Mayfield East)	25	30	-	-

1) Note that receiver R West was not assessed in the 2009 approval and therefore has no project specific criteria. R West has been added to this assessment to determine potential impacts to receivers to the west of the Site as a result of additional shipping movements.

6.2.4 Environmental Safeguards

Orica will continue to operate the Site in accordance with the NMP prepared in accordance with Condition 32, Schedule 3 of the Project Approval. Orica would continue ongoing regular auditing of noise monitoring as required by the NMP following the approval of the project, to demonstrate ongoing compliance.

6.2.5 Conclusion

No noise generating plant infrastructure is proposed as part of this increase in the ammonia production limit modification. No additional road traffic will be generated as part of this Project. The only noise generating sources associated with the Project are the predicted additional ship movements. The assessment concluded that noise emissions from ships would be at least 7 dB below the project specific criteria and hence will have an inconsequential impact on residential receivers.

6.3 Hazard and Risk

The Site has an existing Preliminary Hazard Analysis (PHA) which was prepared by GHD in 2009 as part of the approval for upgrades and expansions of the Orica Site as part of DA 08_0129. GHD has undertaken further assessment of the potential hazards associated with the proposed annual ammonia production limit increase from 360ktpa to 385ktpa. The outcomes of this assessment are summarised below. The Hazard Assessment is attached at **Appendix A**.

6.3.1 Existing Environment

In 2011 (MOD 1 PHA) an application to modify the 2009 approval was lodged by Orica following the completion of technology selection and feasibility study design work. The modification related to proposed changes to the post expansion Site layout and improvements to the ammonia handling systems.

In 2012, Orica sought approval to modify the project approval (MOD2) relating to the construction and operation of three ammonia flares and the change in location and increase in storage capacity of a nitric acid tank detailed in approval (08_0129). The PHA was updated to reflect the change in location of the NA tank and three ammonia flares.

Assumptions underpinning the development of the Project PHA, and subsequent modifications to the Site were based on a continual production throughout the year at a daily ammonia production rate of 1050T/day. Therefore, an annual ammonia production quantity of 385ktpa (the ammonia production rate proposed as part of the Project) has previously been modelled. A review of the model inputs has however identified that shipping and pipe utilisation inputs associated with ship loading infrastructure was based on a 360ktpa ammonia production scenario. This Hazard and Risk assessment will therefore focus on the change in risk profile associated with proposed modifications to shipping scenarios associated with the Project.

6.3.2 Methodology

To support Orica's modification application, GHD assessed the impact on risk contours developed for the Project as a result of increasing the frequency in which ammonia is transported via ship from the Site. As part of the modification to shipping frequencies, the risk profile for the Site has been updated to assess the change in risk from these modifications in relation to relevant planning risk assessment criteria. This involved undertaking a Site Quantitative Risk Assessment (QRA) which formed part of a Preliminary Hazard Analysis (PHA).

The modelling work was completed using the existing QRA model developed for the Orica KI Update PHA MOD 2 for the AMI project. For consistency, the same model and software (DNV's Phast Risk version 6.7) were used as per the PHA.

The model was updated to assess the risks associated with upgrades associated with MOD 2 at the Site and the Project. The model updates are summarised in **Table 13.**

Table 13 Model Update Descriptions

Name	Description	Updates
Base Case	Update of the model for current approved Site operations including the AMI project.	- Decreased shipping frequency factor to address a model previous error. - Removed risk scenario from the model which is now covered by the AMI flare.
Existing Case	Update of the model for ammonia production of 385ktpa.	- Increased shipping frequency and pipeline utilisation to reflect increased ammonia being shipped to Orica's Yarwun Site. - Decreased pressure conditions for export pipes to reflect current maximum operating loading setup.
The Project	Update of the model for ammonia production of 385ktpa and upgrades to Ammonia export pipes.	- Increased export pipes diameter, pipes loading rate and pipe pressure (pressure increased from Current Case but reduced overall compared to Base Case). - Decreased ship loading duration and pipeline utilisation to reflect increased capacity of upgraded pipes. - Incorporated function of vapour return line upgrade.

Three risk categories for both the Site and for shipping were assessed including Individual Fatality Risk (IFR), Toxic Injury and Toxic Irritation. The QRA model provides risk contours which are expressed as the probability of an incident occurring per annum. All risk contours modelled for this assessment are included in **Appendix A**.

6.3.3 Assessment of Impacts

Individual Fatality Risk – Site

There would be no significant changes to the risk contours when comparing the Project with MOD 2. This is expected as the inputs related to modelling the Site IFR predominately relate to Ammonium Nitrate storage for which there is no change proposed as part of the Project. A minor change to the ammonia shipping frequency would not impact on the IFR contour. The IFR associated with the Site remains compliant with the criteria specified in HIPAP 4.

Individual Fatality Risk – Shipping

Modelled shipping IFR would decrease with the Project. This is expected as the pipe pressures associated with the shipping scenarios would reduce and the duration a ship is at berth would also reduce.

Toxic Injury – Site

The toxic injury contour would not change between the approved MOD 2 case and the Project. The toxic injury risk associated with the Site would remain compliant with the suggested criteria specified in HIPAP 4 for the Project.

Toxic Injury – Shipping

There were no toxic injury risk contours generated by the model for the MOD2, current, or Project cases because the minimum probability contour for this scenario (10 in a million per annum) was not reached. The shipping toxic injury risks associated with the Site would remain compliant with the suggested criteria specified in HIPAP 4 for the Project.

Toxic Irritation – Site

Comparing the toxic irritation contours, the risk contour would not change between the MOD2 case and the Project. The toxic injury risk associated with the Site would remain compliant with the suggested criteria specified in HIPAP 4 for the Project.

Toxic Irritation – Shipping

There were no toxic irritation risk contours generated by the model for the MOD2, current, or Project cases because the minimum probability contour for this scenario (50 in a million per annum) was not reached. The shipping toxic injury risks associated with the Site would remain compliant with the suggested criteria specified in HIPAP 4 for the Project.

Risk Ranking Point

A risk ranking point was chosen for the same location for each of the cases modelled and is shown in **Figure 4.** The comparison of the change in risk for each of the cases modelled is presented in **Table 14.** Modelling of the risk ranking point indicates that risk would decrease for each risk category at the Site and for shipping when comparing the MOD 2 and Project cases.

Figure 4 Risk Ranking Point

Table 14 Risk Ranking Comparison Results

Model	Base Case (probability per annum)	Current Case (probability per annum)	Project (probability per annum)
Site IFR	3.0008×10^{-6}	2.9978×10^{-6}	2.9973×10^{-6}
Site Injury	5.9817×10^{-5}	5.9774×10^{-5}	5.9596×10^{-5}
Site Irritation	1.0237×10^{-4}	1.0232×10^{-4}	1.0216×10^{-4}
Shipping IFR	8.8784×10^{-8}	8.5540×10^{-8}	8.5276×10^{-8}
Shipping Injury	8.6055×10^{-7}	7.8012×10^{-7}	6.8988×10^{-7}
Shipping Irritation	9.4128×10^{-7}	8.6274×10^{-7}	8.3548×10^{-7}

6.3.4 Environmental Safeguards

The Hazard and Risk assessment has shown that the current hazard and risk management measures implemented at the Site will be sufficient for the Project, as risk associated with the Site has either decreased or remained constant when compared to current operations. The existing safety management system, including the emergency response plan would be updated to reflect the new hazard and risk profile for the Site.

6.3.5 Conclusion

The assessment demonstrated that the proposed changes associated with shipping frequencies would result in a decrease in the risk profile for the shipping activities. Due to the low contribution of risk to the overall Site risk profile of the shipping scenarios, the Site IFR contours, Site toxic injury and Site toxic irritation contours have not changed from the previous MOD 2 case results. Hence, the risks associated with the Site would continue to comply with HIPAP 4 risk criteria for the Project.

6.4 Other Environmental Issues

A number of other environmental factors require assessment in relation to the Project.
Table 15 provides a summary of other environmental aspects that have been considered for the Project.

Table 15 Other Environmental Issues

Issue	Summary of Potential Impact
Transport	No construction traffic would be generated as there is no construction associated with the Project. Feedstock for the ammonia plant includes natural gas, water and electricity. No materials are required to be imported to the Site by truck. As no increase in production of ammonium nitrate is proposed there would not be an increase in product leaving the Site by truck. There would be an increase of approximately 11 ships per year from the Kooragang Island Berth 2, with a total of 27 ships per year accessing the Site. This increase would have a negligible impact on the operation of the Port of Newcastle. As discussed in **Section 6.3,** appropriate hazard and risk assessment and mitigation is employed at the Site and would continue to be implemented to manage risks associated with an increase in shipping levels. Overall additional shipments would have a negligible impact on the environment, community and the operation of the Port of Newcastle. Shipping would continue to be managed in accordance with the requirement of the Port of Newcastle and the Port Authority of NSW.
Greenhouse Gas	This proposed increase in the annual ammonia production limit would involve increased emissions from energy inputs required by the limit increase. Overall the Project would have minor impacts with regard to GHG generation.
Soil and Water	The Project would unlikely result in soil or water contamination. Existing management practices governing spills/ material handling at the Site would adequately accommodate the Project.
Waste	Any waste produced as a result of the Project would be managed within the Site's existing waste management systems.
Flora and Fauna	There is no requirement for extra plant and equipment to facilitate the Project and no impacts to flora or fauna are anticipated.
Heritage	The Site is on reclaimed land that is highly disturbed. The 2009 EA did not identify any indigenous or non-indigenous heritage constraints across the Site. No construction is proposed as part of the modification and as a result no impacts to heritage are anticipated.
Visual	As no physical changes to the Site are proposed there would be no visual impact attributable to the Project.

6.5 Cumulative Impacts

The Project seeks to take advantage of the capacity of the Site's existing Ammonia Plant by operating the Ammonia Plant at full capacity. The assessments in this EA replicated assessments undertaken for the original project approval and included real operating data of the plant to calibrate previous modelling. The outcomes of this assessment concluded that there would be little difference between the impacts of the Site as originally approved compared to the Project. Therefore there will be a negligible change in cumulative impact when comparing (Project Approval (MP08_0129) against the Project.

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7.0 Residual Risk Analysis

The Environmental Risk Analysis for the Project is based on a process adapted from *Australian Standard AS 4369:1999 Risk Management*. The process is qualitative and is based on the Residual Risk Matrix shown in **Table 18**.

Residual Environmental Risk is assessed on the basis of the significance of environmental effects of the Project and the ability to confidently manage those effects to minimise the risk of harm to the environment.

The significance of environmental effects is given a numerical value between one and five, based on:

- The receiving environment (its sensitivity and values);
- The level of understanding of the type and extent of impacts; and
- Likely community response to the environmental consequences of the Project.

The manageability of environmental effects is similarly given a numerical value between one and five based on the complexity of mitigation measures, the known level of performance on the safeguards proposed, and the opportunity for adaptive management. The numerical value allocated for each issue is based upon the following prescription.

Table 16 Significance of Effects

No	Significance	Receiving Environment
5	Extreme	Undisturbed receiving environment, type or extent of impacts unknown, substantial community concern.
4	High	Sensitive receiving environment, type or extent of impacts not well understood; high level of community concern.
3	Moderate	Resilient receiving environment, type and extent of impacts understood; community interest.
2	Minor	Disturbed receiving environment; type and extent of impacts well understood; some local community interest.
1	Low	Degraded receiving environment; type and extent of impacts fully understood; uncontroversial project.

Table 17 Manageability of Effects

No	Significance	Mitigation Measures
5	Complex	Complicated array of mitigation measures required; safeguards or technology are unproven; adaptive management inappropriate.
4	Substantial	Significant mix of mitigation measures required; past performance of safeguards is understood; adaptive management feasible.
3	Straightforward	Straightforward range of mitigation measures required; past performance of safeguards is understood; adaptive management easily applied.
2	Standard	Simple suite of mitigation measures required; substantial track record of effectiveness of safeguards; adaptive management unlikely to be required.
1	Minimal	Little or no mitigation measures required; safeguards are standard practice; adaptive management not required.

The chosen numbers are added together to provide a result which provides a ranking of potential residual effects of the Project when the safeguards identified in this EA are implemented.

Table 18 Residual Risk Matrix

Significance of Effects	Manageability of Effects				
	5 Complex	4 Substantial	3 Straightforward	2 Standard	1 Minimal
1 Low	6 Medium	5 Low/Medium	4 Low/Medium	3 Low	2 Low
2 Minor	7 High/Medium	6 Medium	5 Low/Medium	4 Low/Medium	3 Low
3 Moderate	8 High/Medium	7 High/Medium	6 Medium	5 Low/Medium	4 Low/Medium
4 High	9 High	8 High/Medium	7 High/Medium	6 Medium	5 Low/Medium
5 Extreme	10 High	9 High	8 High/Medium	7 High/Medium	6 Medium

7.1 Analysis

The analysis of residual environmental risk for issues related to the Project is shown in **Table 19**. This analysis indicates the environmental risk profile for the Project based on the assessment of environmental effects, the identification of appropriate safeguards, and the Statement of Commitments shown in this EA. It is noted that as there would be no impact to flora and fauna or heritage items and the Project would not give rise to a visual impact, no mitigation measures over and above those already employed at the Site are required.

Table 19 Risk Profile – The Project

Issue	Significance	Manageability	Residual Risk
Air Quality	2	2	4 Low/Medium
Noise and Vibration	2	2	4 Low/Medium
Hazards and Risk	2	2	4 Low/Medium
Transport	2	1	2 Low
Greenhouse Gas	2	1	2 Low
Soils and water	2	1	2 Low
Waste	2	1	2 Low
Flora and fauna	2	1	2 Low
Heritage	2	1	2 Low
Visual	2	1	2 Low

7.2 Conclusion

The residual risk analysis indicates that the Project, including appropriate safeguards as outlined in this EA (refer to **Section 6** and **Table 20**), would give rise to predominantly a low risk in relation to the identified environmental issues.

8.0 Statement of Commitments

Table 20 provides a summary of the safeguards which will be implemented during operation of the Project.

Table 20 Summary of Environmental Mitigation Measures

Aspect	Mitigation measure
Air Quality and Odour	- Ongoing operational air quality monitoring will be undertaken in accordance with Condition 22 of the Project Approval.
Noise and Vibration	- Orica will continue to operate the Site in accordance with the Noise Management Plan that was prepared in accordance with Condition 32, Schedule 3 of the Project Approval.
Hazards and Risk	- The existing safety management system, including the emergency response plan will be updated.
Transport	- Shipping will be managed in accordance with the requirements of the Port of Newcastle and Port Authority of NSW.
Waste	- Operational waste will be managed in accordance with the Site's existing Waste Management Plan.

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9.0 Conclusion

In 2009, Project Approval 08_0129 was granted for the expansion of Orica's KI Site under Part 3A of the EP&A Act. As a result of changes to the Site layout, the Project Approval was modified in 2012 under s75W of the EP&A Act (DA 08_0129 MOD 1). The Project Approval was again modified in 2014 approving the construction and operation of three ammonia flares and a change in location and storage capacity of the Site's nitric acid tank.

Orica is seeking increase the annual ammonia production limit of the Ammonia Plant from the approved 360ktpa to 385ktpa to realise existing capacity in the Ammonia Plant as previously detailed in the project's approval. No additions to the Site are required; rather the production increase would be achieved as a result of operational efficiencies, notably a reduction in plant shut downs as a result of improved maintenance practices.

This EA has been prepared in consultation with DP&E to address the potential environmental issues associated with the Project. Key environmental issues associated with the Project include air quality, noise and hazard and risk. Other environmental issues addressed include transport, soil and water, GHG emissions, waste, visual amenity, flora and fauna, and heritage impacts.

The assessments of each of these factors in relation to the proposed annual ammonia production limit increase have shown that the Project would not have a significant impact on the receiving environment or nearby community, provided that the appropriate management and mitigation measures are implemented as identified in this EA.

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Appendix A

Air Quality Impact Assessment

Appendix A Air Quality Impact Assessment

Orica Australia Pty Ltd
28-Apr-2015

Air Quality Impact Assessment

Orica Kooragang Island Annual Ammonia Quantity Increase

Air Quality Impact Assessment

Orica Kooragang Island Annual Ammonia Quantity Increase

Client: Orica Australia Pty Ltd

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Document Air Quality Impact Assessment

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Stack Emission Test Result Excerpts A

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1.0 Introduction

1.1 Project Overview

Orica Australia Pty Ltd (Orica) operates a manufacturing facility (the Facility) on Kooragang Island (KI) near Newcastle, which produces ammonia, nitric acid and ammonium nitrate. An Environmental Assessment (EA) (AECOM, 2009) was prepared in 2009 for the expansion of the Facilities' ammonium nitrate manufacturing capability from 500 kilotonnes per annum (ktpa) to 750 ktpa, which was approved by the Minister in December 2009 (DA 08_0129).

The Project Approval has been modified twice. MOD 1 consisted of changes to the plant and equipment layout (AECOM, 2011), which was approved in 2012. MOD 2, approved in 2014, amended the Ammonium Management Improvement project, which included measures designed to improve safety and reduce risk associated with the use of ammonia at the Facility. This included modification of the location and type of boiler used on site. The effects of this modification on air quality were assessed in AECOM (2014).

As a result of ongoing improvements to the Facilities' operational efficiency, Orica now seeks a third modification to the Project Approval. The purpose of MOD 3 (the Project) is to make use of the full production rate of the installed Ammonia Plant by increasing the annual production rate of ammonia from 360 ktpa to 385 ktpa.

1.2 Scope of Work

This Air Quality Assessment (AQA) was undertaken to determine whether the Project to the ammonia production rate would change the air emissions from the Facility, specifically whether the change would result in increased pollutant concentrations at sensitive receptors. This AQA, therefore, took the form of a consistency review of the change in emissions associated with the proposed production rate against the predictions made in the dispersion modelling conducted for the original expansion (AECOM, 2009) to determine whether the conclusions of the original AQA would change as a result of the Project.

The review was limited to emissions from the plant and equipment affected by the proposed production change, i.e. the Ammonia Plant and the nitrates boiler (associated emission points being the Pre-Reformer Stack, Reformer Stack and the Boiler Stack). Only Oxides of Nitrogen (NO_X) emissions were assessed.

The consistency review compared emission rates used in the dispersion modelling (AECOM, 2009, 2014) against the emission rates measured from the Plant since the facility began operating at a level considered to be consistent with the proposed production rate of 385 ktpa (or approximately 1,050 tonnes per day, or tpd). Emission test data measured after August 2012 (when the plant began consistently operating above 900 tpd) were used for the comparison, as they were considered representative of emissions for the plant operating at the proposed production rate. These test data were measured in 2013 and 2014.

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2.0 Proposed Modification

2.1 Approved Project

Approval was gained for the expansion to the ammonium nitrate facility in 2009. The expansion included:

- An additional Nitric Acid Plant (NAP4);
- An additional Ammonium Nitrate Plant (ANP3);
- Modification of the existing Ammonia Plant;
- Additional storage for nitric acid (including a 2,000 tonne nitric acid storage tank), solid ammonium nitrate and ammonium nitrate solution; and
- Upgrades to existing infrastructure such as cooling towers, air compressors, loading facilities, electrical systems, effluent treatment systems and the steam system.

The project was approved with the following production limits:

- 360 ktpa of ammonia product;
- 605 ktpa of nitric acid product; and
- 750 ktpa of ammonium nitrate product.

2.1.1 Modification No. 1 – Facility Layout Changes

In July 2012, the plant and equipment layout for the Facility was amended. No changes to the productions limits were made as part of the modification.

2.1.2 Modification No. 2 – Facility Layout Changes

The modification related to the construction and operation of three ammonia flares and the change in location and increase in storage capacity of a nitric acid tank detailed in approval (08_0129).

2.2 Proposed Modification Description

Orica is seeking approval to increase the production of ammonia at the Facility from the currently approved production rate of 360 ktpa to 385 ktpa. The increase would be achieved through efficiency gains; as such, no construction works would be required.

While Orica uses ammonia produced at the Facility as a feed source for the production of ammonium nitrate at the Facility, the proposed ammonia production increase would not lead to an increase in the total amount of ammonium nitrate being produced at the Facility. Rather, surplus ammonia would be transported to Orica's Yarwun (Gladstone) facility in Queensland.

2.3 Development Location

Kooragang Island is located within the Port of Newcastle, approximately 3 km north of the Newcastle central business district. The Orica Facility was commissioned in 1969, and the manufacture of ammonia, nitric acid and ammonium nitrate has occurred at the Facility since that time.

Existing industrial developments on Kooragang Island include Port Waratah Coal Service, wharf facilities, coal and woodchip loaders, Incitec Pivot Ltd, Sims Metal Ltd, Cargill, Cleanaway, Boral and Transfield Pty Ltd. The Hunter Estuary National Park is located approximately 1.5 km north of the Facility.

The nearest residential premises are located at Stockton, approximately 760 m east of the Orica property boundary. There are also residential properties 1.5 km to the southwest at Carrington and 2 km to the west at Mayfield.

The land adjacent to the Orica Facility is used for industrial and port related activities including the following:

- North: Incitec Pivot Limited operates a fertiliser storage and despatch facility;
- West: Port of Newcastle and its lessees operate bulk goods importing/exporting operations on the western side of Heron Rd;
- South: Patricks and Bulk Grain Terminals storage and despatch facilities; and
- East: land to the east of the Facility is currently vacant; there is, however, a proposed development for the storage of hydrocarbon products proposed on a portion of this land.

3.0 Assessment Methodology

3.1 Methodology

The NO_X stack emissions from the Pre-Reformer Stack, Reformer Stack and the Boiler Stack measured during 2013 and 2014 were compared to those modelled in 2009 and 2014 and to the EPL emission limits.

3.2 Assessment Criteria

3.2.1 Air Emission Standards

Emission standards for the Reformer Stack are specified by the Protection of the Environment Operations (Clean Air) Regulation 2010 (POEO) under Schedule 4 – General standards of concentration – any activity or plant (except boilers, gas turbines and stationary reciprocating internal combustion engines otherwise listed). The Group 6 limit, which applies to the Reformer Stack, is 350 mg/m^3 of nitrogen dioxide (NO_2) or nitric oxide (NO) or both as NO_2 equivalent. The POEO general standards limit for any boiler operating on gas is also 350 mg/m^3 of nitrogen dioxide (NO_2) or nitric oxide (NO) or both as NO_2 equivalent.

The Facilities' Environment Protection Licence (EPL 828) also specifies a NO_X limit of350 mg/m^3 (0.35 g/m^3) for the Reformer Stack. The EPL NO_X limit for the Boiler Stack is 1,000 mg/m^3 (1.0 g/m^3).

3.2.2 Ambient Air Quality Objectives

The EPA specifies impact assessment criteria for pollutants in the Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (DEC, 2005). These criteria represent maximum allowable ground level pollutant concentrations.

The EPA does not specify criteria for NO_X, which are formed during the oxidation of nitrogen. For combustion sources, the NO_X at the point of emission is typically comprised of 95 % nitric oxide (NO), with the remaining 5 % being primarily NO_2. Ultimately, however, all NO emitted into the atmosphere is oxidised to NO_2 and then further to other higher oxides of nitrogen. As NO_2 is known to have effects on human health, the EPA has specified criteria for this pollutant; these are shown in **Table 1**.

Table 1 Air Quality Impact Assessment Criteria

Pollutant	Averaging Period	Criteria (μg/m^3)
Nitrogen Dioxide (NO_2)	1 hour	246
	Annual	62

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4.0 Consistency Review

The emission rates from the Pre-Reformer, Reformer and Boiler Stacks measured in 2013 and 2014 are shown in the following tables, together with the emission rates previously modelled for the subsequently approved modifications and the EPL limits. Excerpts of the relevant stack emission test reports are provided in **Appendix A**.

4.1 Pre-Reformer Stack

Emissions from the Pre-Reformer Stack are shown in **Table 2**. The 2009 air quality impact assessment assessed three scenarios: existing facility, existing facility operating at the maximum emission rates; and the existing facility with the proposed modifications operating at the maximum emission rates. The highest relevant emission rates from this assessment were used for comparative purposes below. Emissions from the Pre-Reformer stack are measured on an annual basis only, and as such only two data sets are available for comparison to the modelled values.

Table 2 Pre-Reformer Stack Emissions

Description	Flow Rate (Nm^3/s)	Stack Height (m)	Stack Velocity (m/s)	Gas Temperature (°C)	NOx Emission	
					mg/m^3	g/s
Measured Emissions						
1 May 2014	**8.0**	27	**5.5**	**250**	**60**	**0.48**
29 August 2013	7.6		4.2	151	55	0.42
Modelled Emissions						
Approved Project, 2009	5.28	27	5.1	110	234	1.24
Approved Project, 2014	5.3	27	5.2	110	234	1.20
N.B. Maximum measured NO_X concentration and associated parameters shown in **bold type**						

As shown, the maximum measured emissions of NO_X from the Pre-Reformer Stack since the plant began operating at close to the proposed operating limit were 60 mg/m^3. This emission concentration is well below that assessed for the Approved Project (234 mg/m^3 for both 2009 and 2014). The measured flow rates, and velocities were similar to that assessed in 2009, with the measured velocities and flow rates slightly higher than the modelled values, however the measured temperatures were significantly higher than the modelled values.

The gas velocity and temperature determine the effective plume height, which is the height the pollutant plume reaches before it begins to disperse. The higher the effective plume height, the better the dispersion typically is, as the plume tends to travel further before reaching the ground. As the measured Pre-Reformer Stack temperature and highest measured velocity are higher than the modelled values, the actual plume emitted from the Pre-Reformer Stack is expected to reach a higher altitude and, subsequently, be better dispersed when reaching ground level, than the modelled plume. Furthermore, as the measured emission rates are lower than those modelled, less NO_X is being emitted from the Pre-Reformer Stack under the higher production levels than was previously modelled. Together, this suggests that the pollutant concentrations associated with Pre-Reformer Stack emissions are expected to be lower for the facility operating under the proposed production levels than were previously approved. It should be noted that no exceedences of the NO_2 criteria were predicted in AECOM (2009, 2014).

The maximum measured Pre-Reformer Stack NO_X emission was 60 mg/m^3, which equates to an NO_2 equivalent value of 90 mg/m^3. This value complies with the stacks NO_2 equivalent EPL limit of 350 mg/m^3.

4.2 Reformer Stack

Emissions from the Reformer Stack are shown in **Table 3**. The 2009 air quality impact assessment assessed three scenarios: existing facility, existing facility operating at the maximum emission rates; and the existing facility with the proposed modifications operating at the maximum emission rates. The highest relevant emission rates from this assessment were used for comparative purposes below. It should be noted that the sampling location of the Reformer Stack changed in mid-2014 to make the port compliant with AS 4323.

Table 3 Reformer Stack Emissions

Description	Flow Rate (Nm^3/s)	Stack Height (m)	Stack Velocity (m/s)	Gas Temperature (°C)	NOx Emission	
					mg/m^3	g/s
Measured Emissions						
30 April 2014	57	47	14	131.5	148	8.4
13 November 2014	44		10	127.0	144	6.3
5 August 2014	50		12	123.1	198	9.9
6 February 2014	**38**		**14**	**123.5**	**230**	**8.7**
16 January 2014	53		18	100.3	192	10.2
5 December 2013	45		16	99.9	184	8.3
29 August 2013	44		17	123.6	170	7.5
Modelled Emissions						
Approved Project, 2009	45	47	11.6	118.5	313	14.2
Approved Project, 2014	46.4	47	11.1	93.0	234	10.9
N.B. Maximum measured NO_X concentration and associated parameters shown in **bold type**						

As shown, the maximum measured emissions of NO_X from the Reformer Stack since the plant began operating at close to the proposed operating limit were 230 mg/m^3. This emission concentration is well below that assessed for the Approved Project (313 mg/m^3 for 2009 and 234 mg/m^3 for 2014). The measured flow rates, temperatures and velocities were similar to that assessed in 2009, with the measured velocities and temperatures typically slightly higher than the modelled values.

As the Reformer Stack temperature and velocity are slightly higher than the modelled values, the actual plume emitted from the Reformer Stack is expected to be better dispersed when reaching ground level than the modelled plume. Furthermore, as the measured emission rates are lower than those modelled, less NO_X is being emitted from the Reformer Stack under the higher production levels than was previously modelled. Together, this suggests that the pollutant concentrations associated with Reformer Stack emissions are expected to be lower for the facility operating under the proposed production levels than were previously approved. It should be noted that no exceedences of the NO_2 criteria were predicted in AECOM (2009, 2014).

The maximum measured Reformer Stack NO_X emission was 230 mg/m^3, which equates to an NO_2 equivalent value of 348 mg/m^3. This value complies with the stacks NO_2 equivalent EPL limit of 350 mg/m^3.

4.3 Boiler Stack

Emissions from the Boiler Stack are shown in **Table 4**. AECOM (2014) assessed two potential boiler scenarios (typical operation and maximum operation), with each having the same NO_X emission concentration but different emission rates (g/s); both, however, were lower than those assessed in AECOM (2009).

Table 4 Boiler Stack Emissions

Description	Flow Rate (Nm^3/s)	Stack Height (m)	Stack Velocity (m/s)	Gas Temperature (°C)	NOx Emission	
					mg/m^3	g/s
Measured Emissions						
30 April 2014	3.3	40	2.9	121.7	61	0.2
27 March 2013	**3.4**	**40**	**3.2**	**175.9**	**81**	**0.3**
27 August 2013	4.3	40	4.1	187.8	55	0.2
Modelled Emissions						
Approved Project, 2009	19.3	40	16.6	200	234	4.5
Approved Project, 2014 – Scenario 1	15.7	40	12.9	137	184	2.89
Approved Project, 2014 – Scenario 2	19.8	40	16.8	148	184	3.65
N.B. Maximum measured NO_X concentration and associated parameters shown in **bold type**						

The maximum measured emission concentration from the boiler stack was 81 mg/m^3 (0.3 g/s), which is approximately one third (35 %) of the maximum modelled emission concentration (234 mg/m^3). Importantly, the maximum emission rate measured in g/s was between 7% and 10% of the modelled values, a significant reduction in emissions. The measured velocity and flow rates were, however, substantially lower than the modelled parameters, while the temperatures were generally within the modelled ranges. Together, these parameters indicate that while the dispersion of NO_X emitted from the Boiler Stack may not be as extensive as that previously assessed and approved, the amount of NO_X emitted is much lower. As such, operation of the plant at the proposed production limit is not expected to result in higher NO_2 concentrations at sensitive receptors than those previously approved.

The maximum measured Boiler Stack NO_X emission was 81 mg/m^3, which equates to an NO_2 equivalent value of 124 mg/m^3. This value complies with the stacks NO_2 equivalent EPL limit of 1,000 mg/m^3.

As a means to further review the changes, a sensitivity analysis of the variation between flow rate and concentration was undertaken. **Table 5** presents the emissions of the above measured and modelled scenarios should the maximum concentrations be interchanged i.e. the max measured concentration be applied to the modelled flowrates and the max modelled concentration be applied to the measured flowrates. The emission rate percentage reduction from the typical boiler operations modelled (scenario 2) has been presented for each. The sensitivity analysis shows that emission rates for all scenarios are expected to decrease by between 44% and 73%. As such, the conclusion remains relevant that the proposed production limit is not expected to result in higher NO_2 concentrations at sensitive receptors than those previously approved.

Table 5 Boiler Sensitive Analysis

Description	Flow Rate (Nm^3/s)	NOx Emission		Emission Rate (g/s) Reduction*
		mg/m^3	g/s	
30-Apr-14	3.3	234	0.77	73%
27-Mar-13	3.4	234	0.80	72%
27-Aug-13	4.3	234	1.01	65%
Approved Project, 2009	19.3	81	1.56	46%
Approved Project, 2014 – Scenario 1	15.7	81	1.27	56%
Approved Project, 2014 – Scenario 2	19.8	81	1.60	44%
*reduction from the typical boiler operations (Scenario 2) emission rate of 2.89 g/s				

5.0 Conclusion

This AQA was prepared to assess the potential changes to NO_X emissions - and resultant NO_2 concentrations - from the Pre-Reformer, Reformer and Boiler Stacks as a result of increasing the current ammonia production rate from 360 ktpa of ammonia product to 385 ktpa. The AQA took the form of a Consistency Review which compared the emissions of the Approved Project as assessed through dispersion modelling (AECOM 2009; 2014), against the emission concentrations measured for the three sources since the facility began operating at a level considered by Orica to be representative of plant emissions if the facility was operating at the proposed production rate. Emission testing data captured during 2013 and 2014 were used in the comparison.

The measured emissions of NO_X from the Pre-Reformer and Reformer Stack were all below the emissions of the Approved Project (AECOM, 2009, 2014) and the EPL NO_2 equivalent emission limit. The measured flow rates, temperatures and velocities were similar to that assessed in AECOM (2009), with the measured velocities and temperatures typically slightly higher than the modelled values. No exceedences of the EPA's NO_2 ground level criteria were predicted in AECOM (2009, 2014), and emissions from the Pre-Reformer and Reformer Stacks when the plant is operating at the proposed ammonia production rate were considered likely to result in lower NO_2 concentrations at sensitive receptor locations than those predicted in AECOM (2009).

The maximum measured emission concentration from the Boiler Stack was much lower than the concentrations previously assessed and the EPL limit, representing approximately one third of the maximum modelled emission concentration (AECOM, 2009; 2014). Importantly, the maximum emission rate measured in g/s was between 7% and 10% of the modelled values, a significant reduction in emissions. As such, although the dispersion of emissions from the Boiler Stack may not be as extensive as that modelled and approved previously due to the relatively lower velocity of the emissions, operation of the plant at the proposed ammonia production limit is not expected to result in higher NO_X concentrations at sensitive receptors than those previously approved.

In conclusion, the proposed increase in ammonia production rate at the Orica facility is not expected to result in local NO_2 concentrations greater than those predicted for the previously assessed and approved modifications (AECOM, 2009; 2014).

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6.0 References

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Appendix A

Stack Emission Test Result Excerpts

Appendix A Stack Emission Test Result Excerpts

60319940_RPT_Aug14_Reformer Stack.docx

Oxides of Nitrogen Results Summary, 5 August 2014

	Reformer Stack	Regulatory Limit
Period of Sampling	10:53 – 11:53	NA
Stack gas flowrate (0°C, dry gas, 1 atm pressure) m^3/s	50	NA
Nitrogen Oxide (NO) mg/m^3	188	NA
Total Oxides of Nitrogen (NOx) mg/m^3	198	NA
Nitrogen Dioxide (NO_2) mg/m^3	9	NA
Equivalent Nitrogen Dioxide (NO_2) mg/m^3	299	350
Equivalent Nitrogen Dioxide (NO_2) Mass Emission Rate (mg/s)	14,950	NA

Reformer Stack Moisture & Velocity Results, 5 August 2014

Sampling Conditions:			
Stack internal diameter at test location	3025	mm	
Stack gas temperature (average)	123.1	°C	396.3 K
Stack pressure (average)	1030	hPa	
Stack gas velocity (average, stack conditions)	12	m/s	
Stack gas flowrate (stack conditions)	83	m^3/s	
Stack gas flowrate (0°C, dry gas, 1 atm pressure)	50	m^3/s	
Moisture Content (%)	**13**		
Gas Density (dry at 1 atmosphere)	**1.32**	**kg/m^3**	
Dry Molecular Weight	**29.5**	**g/g-mole**	

Notes *1 Emission concentration at Standard conditions of 0°C, 1 atm, dry gas

*2 Mass emission rate determined from sampling flow measurements and the respective test moisture content. See Q_{std} in field sheets and final calculations "Stack Analysis - Final Calculations" for each test.

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Oxides of Nitrogen Results Summary, 13 November 2014

	Reformer Stack	Regulatory Limit
Period of Sampling	10:02-11:02	NA
Stack gas flowrate (0°C, dry gas, 1 atm pressure) m^3/s	44	NA
Nitrogen Oxide (NO) mg/m^3	128	NA
Total Oxides of Nitrogen (NOx) mg/m^3	144	NA
Nitrogen Dioxide (NO_2) mg/m^3	16	NA
Equivalent Nitrogen Dioxide (NO_2) mg/m^3	212	350
Equivalent Nitrogen Dioxide (NO_2) Mass Emission Rate (mg/s)	9328	NA

Reformer Stack Moisture & Velocity Results, 13 November 2014

Sampling Conditions:			
Stack internal diameter at test location	3025	mm	
Stack gas temperature (average)	127	°C	400.2 K
Stack pressure (average)	1013	hPa	
Stack gas velocity (average, stack conditions)	10	m/s	
Stack gas flowrate (stack conditions)	73	m^3/s	
Stack gas flowrate (0°C, dry gas, 1 atm pressure)	44	m^3/s	
Moisture Content (%)	**11.9**		
Gas Density (dry at 1 atmosphere)	**1.32**	**kg/m^3**	
Dry Molecular Weight	**29.6**	**g/g-mole**	

Notes *1 Emission concentration at Standard conditions of 0°C, 1 atm, dry gas

*2 Mass emission rate determined from sampling flow measurements and the respective test moisture content. See Q_{std} in field sheets and final calculations "Stack Analysis - Final Calculations" for each test.

Orica Annual Emissions Testing Report14_14May14.docx

Oxides of Nitrogen Results Summary, April & May 2014

	Pre Reformer	Reformer	Boiler Stack*
Date of Sampling	1-May-14	30-Apr-14	30-Apr-14
Period of Sampling	9:10 – 10:10	9:29 – 10:29	11:57 – 12:57
Stack Gas Flow Rate (0°C, dry gas, 1 atm pressure) (m^3/sec)	8	57	3.3
Nitrogen Oxide (NO) (mg/m^3)	56	139	57
Nitrogen Oxide (NO) (mg/s)	448	7,923	188
Total Oxides of Nitrogen (NOx) (mg/m^3)	60	148	61
Total Oxides of Nitrogen (NOx) (mg/s)	480	8,436	201
Nitrogen Dioxide (NO_2) (mg/m^3)	3	8	3
Nitrogen Dioxide (NO_2) (mg/s)	24	456	10
Equivalent Nitrogen Dioxide (NO_2) (mg/m^3)	90	222	91
Equivalent Nitrogen Dioxide (NO_2) (mg/s)	720	12,654	300
Equivalent Nitrogen Dioxide (NO_2) Regulatory Limit (mg/m^3)	**350**	**350**	**1000**

*3% O_2 Correction applied to results as per the condition in the EPL.

Reformer Stack Moisture & Velocity Results, 30 April 2014

Sampling Conditions:		
Stack internal diameter at test location	3025	mm
Stack gas temperature (average)	131.5	°C
Stack pressure (average)	1008	hPa
Stack gas velocity (average, stack conditions)	14	m/s
Stack gas flowrate (stack conditions)	99	m^3/s
Stack gas flowrate (0°C, dry gas, 1 atm pressure)	57	m^3/s
Moisture Content (%)	**13**	**kg/m^3**
Gas Density (dry at 1 atmosphere)	**1.32**	**g/g-mole**
Dry Molecular Weight	**29.5**	

Notes *1 Emission concentration at Standard conditions of 0°C, 1 atm, dry gas

*2 Mass emission rate determined from pre and post-test sampling flow measurements and the respective test moisture content. See Q_{std} in field sheets and final calculations "Stack Analysis - Final Calculations" for each test.

Orica Emissions Testing Report 2013-14_29Aug13.docx

Oxides of Nitrogen Results Summary, August 2013

	Pre Reformer	Reformer	Boiler Stack*
Date of Sampling	29-Aug-13	29-Aug-13	27-Aug-13
Period of Sampling	10:36– 11:36	9:42– 10:42	12:05 – 13:05
Stack Gas Flow Rate (0°C, dry gas, 1 atm pressure) (m^3/sec)	7.6	46	4.3
Nitrogen Oxide (NO) (mg/m^3)	53	163	52
Nitrogen Oxide (NO) (mg/s)	403	7498	224
Total Oxides of Nitrogen (NOx) (mg/m^3)	55	170	55
Total Oxides of Nitrogen (NOx) (mg/s)	418	7820	236.5
Nitrogen Dioxide (NO_2) (mg/m^3)	1.5	7.8	2.4
Nitrogen Dioxide (NO_2) (mg/s)	11.4	359	10.3
Equivalent Nitrogen Dioxide (NO_2) (mg/m^3)	83	257	83
Equivalent Nitrogen Dioxide (NO_2) (mg/s)	631	11822	356.9
Equivalent Nitrogen Dioxide (NO_2) Regulatory Limit (mg/m^3)	**350**	**350**	**1000**

*3% O_2 Correction applied to results.

Reformer Stack Moisture & Velocity Results, 29 August 2013

Sampling Conditions:		
Stack internal diameter at test location	1800 mm X	2555 mm
Stack gas temperature (average)	123.6 °C	
Stack pressure (average)	1016 hPa	
Stack gas velocity (average, stack conditions)	17 m/s	
Stack gas flowrate (stack conditions)	76 m^3/s	
Stack gas flowrate (0°C, dry gas, 1 atm pressure)	44 m^3/s	
Moisture Content (%)	**16**	
Gas Density (dry at 1 atmosphere)	**1.32 kg/m^3**	
Dry Molecular Weight	**29.5 g/g-mole**	

Notes *1 Emission concentration at Standard conditions of 0°C, 1 atm, dry gas
*2 Mass emission rate determined from pre and post-test sampling flow measurements and the respective test moisture content. See Q_{std} in field sheets and final calculations "Stack Analysis - Final Calculations" for each test.

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Oxides of Nitrogen Results Summary, 5 December 2013.

	Reformer Stack	**Regulatory Limit**
Period of Sampling	9:10-10:10	NA
Stack gas flowrate (0°C, dry gas, 1 atm pressure) m^3/s	45	NA
Nitrogen Oxide (NO) mg/m^3	172	NA
Total Oxides of Nitrogen (NOx) mg/m^3	184	NA
Nitrogen Dioxide (NO_2) mg/m^3	11	NA
Equivalent Nitrogen Dioxide (NO_2) mg/m^3	276	350
Equivalent Nitrogen Dioxide (NO_2) Mass Emission Rate (mg/s)	12520	NA

Reformer Stack Moisture & Velocity Results, 5 December 2013

Sampling Conditions:		
Stack internal diameter at test location	1800 mm X	2555 mm
Stack gas temperature (average)	99.9 °C	373.1 K
Stack pressure (average)	994 hPa	
Stack gas velocity (average, stack conditions)	16 m/s	
Stack gas flowrate (stack conditions)	74 m^3/s	
Stack gas flowrate (0°C, dry gas, 1 atm pressure)	45 m^3/s	
Moisture Content (%)	**15.9**	
Gas Density (dry at 1 atmosphere)	**1.27 kg/m^3**	
Dry Molecular Weight	**28.4 g/g-mole**	

Notes *1 Emission concentration at Standard conditions of 0°C, 1 atm, dry gas
*2 Mass emission rate determined from sampling flow measurements and the respective test moisture content. See Q_{std} in field sheets and final calculations "Stack Analysis - Final Calculations" for each test.

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Oxides of Nitrogen Results Summary,16 January 2014

	Reformer Stack	**Regulatory Limit**
Period of Sampling	9:30-10:30	NA
Stack gas flowrate (0°C, dry gas, 1 atm pressure) m^3/s	53	NA
Nitrogen Oxide (NO) mg/m^3	187	NA
Total Oxides of Nitrogen (NOx) mg/m^3	192	NA
Nitrogen Dioxide (NO_2) mg/m^3	4	NA
Equivalent Nitrogen Dioxide (NO_2) mg/m^3	292	350
Equivalent Nitrogen Dioxide (NO_2) Mass Emission Rate (mg/s)	15476	NA

Reformer Stack Moisture & Velocity Results, 16 January 2014

Sampling Conditions:					
Stack internal diameter at test location	1800	mm	X	2555	mm
Stack gas temperature (average)	100.3	°C		373.5	K
Stack pressure (average)	1017	hPa			
Stack gas velocity (average, stack conditions)	18	m/s			
Stack gas flowrate (stack conditions)	82	m^3/s			
Stack gas flowrate (0°C, dry gas, 1 atm pressure)	53	m^3/s			
Moisture Content (%)			**12.3**		
Gas Density (dry at 1 atmosphere)			**1.27**	**kg/m^3**	
Dry Molecular Weight			**28.4**	**g/g-mole**	

Notes *1 Emission concentration at Standard conditions of 0°C, 1 atm, dry gas

*2 Mass emission rate determined from sampling flow measurements and the respective test moisture content. See Q_{std} in field sheets and final calculations "Stack Analysis - Final Calculations" for each test.

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Oxides of Nitrogen Results Summary, 6 February 2014

	Reformer Stack	**Regulatory Limit**
Period of Sampling	8:50-9:50	NA
Stack gas flowrate (0°C, dry gas, 1 atm pressure) m^3/s	38	NA
Nitrogen Oxide (NO) mg/m^3	222	NA
Total Oxides of Nitrogen (NOx) mg/m^3	230	NA
Nitrogen Dioxide (NO_2) mg/m^3	8	NA
Equivalent Nitrogen Dioxide (NO_2) mg/m^3	348	350
Equivalent Nitrogen Dioxide (NO_2) Mass Emission Rate (mg/s)	13224	NA

Reformer Stack Moisture & Velocity Results, 6 February 2014

Sampling Conditions:					
Stack internal diameter at test location	1800	mm	X	2555	mm
Stack gas temperature (average)	123.5	°C		396.7	K
Stack pressure (average)	994	hPa			
Stack gas velocity (average, stack conditions)	14	m/s			
Stack gas flowrate (stack conditions)	66	m^3/s			
Stack gas flowrate (0°C, dry gas, 1 atm pressure)	38	m^3/s			
Moisture Content (%)	**15**				
Gas Density (dry at 1 atmosphere)	**1.27**	**kg/m^3**			
Dry Molecular Weight	**28.4**	**g/g-mole**			

Notes *1 Emission concentration at Standard conditions of 0°C, 1 atm, dry gas

*2 Mass emission rate determined from sampling flow measurements and the respective test moisture content. See Q_{std} in field sheets and final calculations "Stack Analysis - Final Calculations" for each test.

Orica Annual Emissions Testing Report14_14May14.docx

Boiler Stack Moisture & Velocity Results, 30 April 2014

Sampling Conditions:		
Stack internal diameter at test location	1590	mm
Stack gas temperature (average)	121.7	°C
Stack pressure (average)	1009	hPa
Stack gas velocity (average, stack conditions)	2.9	m/s
Stack gas flowrate (stack conditions)	5.8	m^3/s
Stack gas flowrate (0°C, dry gas, 1 atm pressure)	3.3	m^3/s
Moisture Content (%)	**16**	
Gas Density (dry at 1 atmosphere)	**1.31**	**kg/m^3**
Dry Molecular Weight	**29.4**	**g/g-mole**

Notes *1 Emission concentration at Standard conditions of 0°C, 1 atm, dry gas

*2 Mass emission rate determined from pre and post-test sampling flow measurements and the respective test moisture content. See Q_{std} in field sheets and final calculations "Stack Analysis - Final Calculations" for each test.

Oxides of Nitrogen Results Summary, April & May 2014

	Boiler Stack*
Date of Sampling	30-Apr-14
Period of Sampling	11:57 – 12:57
Stack Gas Flow Rate (0°C, dry gas, 1 atm pressure) (m^3/sec)	3.3
Nitrogen Oxide (NO) (mg/m^3)	57
Nitrogen Oxide (NO) (mg/s)	188
Total Oxides of Nitrogen (NOx) (mg/m^3)	61
Total Oxides of Nitrogen (NOx) (mg/s)	201
Nitrogen Dioxide (NO_2) (mg/m^3)	3
Nitrogen Dioxide (NO_2) (mg/s)	10
Equivalent Nitrogen Dioxide (NO_2) (mg/m^3)	91
Equivalent Nitrogen Dioxide (NO_2) (mg/s)	300
Equivalent Nitrogen Dioxide (NO_2) Regulatory Limit (mg/m^3)	**1000**

*3% O_2 Correction applied to results as per the condition in the EPL.

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Oxides of Nitrogen Results Summary, March 2013.

	Boiler Stack
Date of Sampling	27/03/2013
Period of Sampling	8:23:30 – 9:23:30
Stack Gas Flow Rate (0°C, dry gas, 1 atm pressure)	3.4
Nitrogen Oxide (NO) (mg/m^3)	79*
Nitrogen Oxide (NO) (mg/s)	269
Total Oxides of Nitrogen (NOx) (mg/m^3)	81*
Total Oxides of Nitrogen (NOx) (mg/s)	277
Nitrogen Dioxide (NO_2) (mg/m^3)	2*
Nitrogen Dioxide (NO_2) (mg/s)	7
Equivalent Nitrogen Dioxide (NO_2) (mg/m^3)	124*
Equivalent Nitrogen Dioxide (NO_2) (mg/s)	420
Equivalent Nitrogen Dioxide (NO_2) Regulatory Limit (mg/m^3)	**1000**

*3% O_2 Correction applied to results.

Boiler Stack Moisture & Velocity Results, 27 March 2013

Sampling Conditions:		
Stack internal diameter at test location	1590	mm
Stack gas temperature (average)	175.9	°C
Stack pressure (average)	1016	hPa
Stack gas velocity (average, stack conditions)	3.2	m/s
Stack gas flowrate (stack conditions)	6.5	m^3/s
Stack gas flowrate (0°C, dry gas, 1 atm pressure)	3.4	m^3/s
Moisture Content (%)	**13**	
Gas Density (dry at 1 atmosphere)	**1.31**	**kg/m^3**
Dry Molecular Weight	**29.4**	**g/g-mole**

Notes *1 Emission concentration at Standard conditions of 0°C, 1 atm, dry gas

*2 Mass emission rate determined from pre and post-test sampling flow measurements and the respective test moisture content. See Q_{std} in field sheets and final calculations "Stack Analysis - Final Calculations" for each test.

Orica Emissions Testing Report 2013-14_29Aug13.docx

Oxides of Nitrogen Results Summary, August 2013

	Boiler Stack*
Date of Sampling	27-Aug-13
Period of Sampling	12:05 – 13:05
Stack Gas Flow Rate (0°C, dry gas, 1 atm pressure) (m^3/sec)	4.3
Nitrogen Oxide (NO) (mg/m^3)	52
Nitrogen Oxide (NO) (mg/s)	224
Total Oxides of Nitrogen (NOx) (mg/m^3)	55
Total Oxides of Nitrogen (NOx) (mg/s)	236.5
Nitrogen Dioxide (NO_2) (mg/m^3)	2.4
Nitrogen Dioxide (NO_2) (mg/s)	10.3
Equivalent Nitrogen Dioxide (NO_2) (mg/m^3)	83
Equivalent Nitrogen Dioxide (NO_2) (mg/s)	356.9
Equivalent Nitrogen Dioxide (NO_2) Regulatory Limit (mg/m^3)	**1000**

*3% O_2 Correction applied to results.

Boiler Stack Moisture & Velocity Results, 27 August 2013

Sampling Conditions:		
Stack internal diameter at test location	1590	mm
Stack gas temperature (average)	187.8	^oC
Stack pressure (average)	1019	hPa
Stack gas velocity (average, stack conditions)	4.1	m/s
Stack gas flowrate (stack conditions)	8.2	m^3/s
Stack gas flowrate (0^oC, dry gas, 1 atm pressure)	4.3	m^3/s
Moisture Content (%)	**11**	
Gas Density (dry at 1 atmosphere)	**1.31**	**kg/m^3**
Dry Molecular Weight	**29.3**	**g/g-mole**

Notes *1 Emission concentration at Standard conditions of 0^oC, 1 atm, dry gas
*2 Mass emission rate determined from pre and post-test sampling flow measurements and the respective test moisture content. See Q_{std} in field sheets and final calculations "Stack Analysis - Final Calculations" for each test.

Appendix B

Noise Impact Assessment

Appendix B Noise Impact Assessment

Orica Ammonia Uprate
Orica Limited
28-Apr-2015
Doc No. 60331640-RPNV-01

Noise Impact Assessment

Orica Ammonia Production Uprate - EA Modification

Noise Impact Assessment

Orica Ammonia Production Uprate - EA Modification

Client: Orica Limited

ABN: 24 004 145 868

Prepared by

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AECOM in Australia and New Zealand is certified to the latest version of ISO9001, ISO14001, AS/NZS4801 and OHSAS18001.

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			Name/Position	Signature
A	17-Feb-2015	Draft For internal review	Patrick Martinez Associate Director - Acoustics	
B	24-Feb-2015	Draft for client's review	Patrick Martinez Associate Director - Acoustics	
C	28-Apr-2015	Final	Patrick Martinez Associate Director - Acoustics	

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Appendix A
Glossary of Acoustic Terminology A

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1.0 Introduction

1.1 Background Information

AECOM Australia Pty Ltd (AECOM) has been engaged by Orica Limited (Orica) to assess the noise impacts associated with increasing the annual ammonia production limit at the Kooragang Island site (the Project). Recent improvements to the reliability of the ammonia plant implemented during 2013 and 2014 have resulted in the ammonia plant operating consistently at a plant reference rate of 1050 t/day (360 ktpa). The Ammonia plant currently operates 365 days per year. Nitric acid and ammonium nitrate production will remain as per approved limits.

The assessment is based off the following inputs:

- Surplus of ammonia produced to be transported by Ship to Orica's Yarwun facility;
- As part of the increase in production Orica is not proposing to introduce new plant infrastructure;
- Increase in ammonia production (as a result of improvements to the reliability of the Ammonia plant) will not result in increase in operational noise levels from Orica plant; and
- Increase in ammonia production (as a result of improvements to the reliability of the Ammonia plant) will not result in increase in road traffic volumes.

The site operates under the approval by the NSW Minister for Planning under no. 08_0129, dated 1 December 2009. Previous noise monitoring reports and the noise management plan associated with the site have been reviewed and relevant information has been used to inform this assessment.

A glossary of the acoustic terminology used within this report is provided in **Appendix A**.

1.2 Scope

The scope of this assessment is:

- Establish relevant criteria documents and extract relevant acoustic criteria for the Project;
- Assess noise from any additional noise generating plant or activities associated with the Project; and
- Compare the predicted noise levels of the Project and determine compliance against the established criteria.

No construction works are proposed for this modification. Therefore, a construction noise assessment is not required.

1.3 Relevant Standards and Guidelines

- NSW Environmental Protection Authority (EPA) NSW Industrial Noise Policy (INP); and
- Department of Planning Approval 08_0129 (dated 1 December 2009).

1.4 Relevant Documentation

Documentation reviewed and referred to as part of the noise impact assessment are:

- Noise Management Plan (ref. 41.6696.NMP:GA/DESKTOP/2011) written by Atkins Acoustics dated 21 August 2011.

2.0 Criteria

The operational noise limits for this project has been established in accordance with the Project Approval issued by the Department of Planning, referenced as 08_0129, dated 1 December 2009.

The specific noise conditions applicable to the Orica plant have been replicated below.

NOISE

Noise Limits

1) The Proponent shall ensure that the nose levels from the operation of the Project are at least 10 dB(A) below noise levels from Orica's Existing Operations as specified by conditions 31 & 32 below.

Existing Operations – Noise Verification Program

1) Prior to the commencement of construction the Proponent shall prepare and implement an Existing Operations Noise Verification Program to the satisfaction of the Director-General. The Program shall:

a) Be undertaken by a suitably experienced person;

b) Identify future reference points that will be used to demonstrate compliance;

c) Collect new or review existing data, and report on the seasonal background levels for the noise catchment; and

d) Confirm the noise levels from Orica's Existing Operations.

Noise Management Plan

32) Prior to the commencement of operations of the Project, the Proponent shall prepare and implement a Noise Management Plan in consultation with the EPA and to the satisfaction of the Director-General. The Plan shall:

a) Be undertaken by a suitability qualified and experienced expert;

b) Demonstrate how noise levels from the Project would be managed to ensure noise levels would be 10 dB(A) below noise levels from Orica's Existing Operations (see conditions 30 and 31);

c) Include a detailed monitoring program for reporting on ongoing compliance. The monitoring program shall:

- Outline the proposed receiver sites at Stockton and Kooragang Island that would be monitored;

- Include both attended and unattended noise monitoring;

- Verify that actual noise levels from the Project are consistent with the predictions made in the EA; and

- Verify that noise levels form Project are 10 dB(A) below the noise levels identified in condition 31 for Orica's Existing Operations;

d) Provide details of any complaints received in the preceding year relating to noise generated by the Project, and action taken to respond to those complaints;

e) Detail procedures for implementing additional reasonable and feasible noise mitigation measures for the Project in response to exceedance of limited and/or noise complaints; and

f) Be updated annual, unless otherwise agreed to by the Director-General.

2.1 Project Specific Noise Criteria and Assessment Locations

Orica's Noise Management Plan (NMP) prepared by Atkins Acoustics, dated August 2011, presents the project specific noise criteria for the project under approval 08_0129. The NMP nominates assessment locations and provides project specific noise criteria which are based upon noise monitoring results conducted by Atkins Acoustics prior to the uprate upgrade – these criteria are 10 dB below noise levels from Orica's existing plant.

The criteria which are applicable for all times of the day are presented in **Table 1**. The locations of these locations are shown in **Figure 1**. A receiver point has been added for western receivers (R West) which will be used for discussion in further sections of this report – this receiver does not have a project specific noise criterion.

Table 1 Assessment Noise Criteria

Assessment Location	Project specific noise criteria $L_{Aeq, 15min}$
R4	52
R5	47
R6	46
R West (6 Crebert Street, Mayfield East)	N/A

Figure 1 Locations of Receivers

3.0 Noise Management and Reduction Plan

Orica has in place a NMP in order to maintain their operational noise levels within the project specific criteria and where possible, reduce noise emission from key sources. The NMP has detailed commitments by Orica to manage noise. Specific activities and control that will be implemented as part of the NMP include:

- Monitor noise in accordance with the NMP;
- Ensure that all equipment used onsite is effectively maintained; and
- Identify and manage modifications to plant and equipment that could potentially increase noise from the site (short term and long term).

Site investigations conducted by Atkins Acoustics identified and ranked noise sources on the Orica premises that contributed to the environmental noise emission. The outcomes of this activity were a set of actions to be taken to control noise at the site. Since 2010 Orica has implemented the following actions:

- Designed and manufactured an acoustic enclosure for the No. 2 Nitric Acid Plant Process air compressor;
- Designed an acoustic treatment for the No. 1 Nitric Acid Plant Compressor Building;
- Designed and installed an acoustic treated building for the new Ammonia Plant Process air compressor;
- Designed and installed a new converter quench valve station to reduce high frequency valve/pipe noise on the Ammonia Plant;
- Decommissioned two Ammonia Process Air Compressors (101J and 102J);
- Installed an acoustic enclosure on the No. 2 Nitric Acid Plant Process air compressor;
- Installed acoustic treatment for the No. 1 Nitric Acid Plant Compressor Building;
- Managed venting of surplus low pressure steam on the Ammonia Plant;
- Verified the noise levels from Phase 1 of the Project and the existing plant; and
- Re-assessed contributors to plant noise emissions and developed action plans to address key contributors.

This commitment by Orica is ongoing, and future noise reduction strategies will be devised upon continued monitoring and investigation of noise sources on the Orica site.

4.0 Noise Assessment

Orica is proposing to increase the annual ammonia production limit from 360 ktpa to 385 kpta, this will not affect the production rate of the Ammonia Plant, nitric acid and ammonium nitrate and they will remain as per their existing approved limits. Orica is not proposing to introduce any new production plant infrastructure that will increase the noise emission from the site, or add any reliability improvements to the plant that will increase the noise emission. The ammonia production plant currently operates continuously for 24 hours a day, increasing the annual ammonia production limit will not change the hours of operation.

Increase in ammonia production will not result in increase in road traffic volumes and surplus of ammonia produced will be transported by ship to Orica's Yarwun facility.

4.1 Noise Sources

Since no additional noise generating infrastructure is proposed and no additional road traffic noise will be generated, this noise assessment will be solely concerned about ship noise.

The amounts of shipments within the existing and proposed scenarios are shown in **Table 2**. These figures have been provided by Orica.

Table 2 Ship Movements

Scenario Description	Ships/year [1]
Existing	16
With uprate modification	27[2]

Note:

1) Values provided by Orica have been rounded to the nearest whole number

2) This is the worst case volume, which the assessment is based on. The expected volume of ships is 9/year.

4.1.1 Ship/Tankers

Ship/tankers operating in association with the Project will be docked at Kooragang Island Berth K2 and loaded with ammonia via the pipeline from the Orica storage and production facility. Assessment of ship operations when at berth should be undertaken against the Project Approval issued by the Department of Planning, referenced as 08_0129, dated 1 December 2009.

AECOM has experience in the assessment of fuel transportation ships. Typically Deep Well Pump (DWP) ships and Central Pump Room (CPR) ships operate at fuel terminals. It is anticipated that a similar type of ship is used as part of the ammonia transportation process.

Sound power levels have been based upon AECOM's experience in which it has found that these ships typically operate with a range of sound power levels.

The mean and standard deviation of calculated sound power levels was determined in order to characterise the worst and best ships visiting the terminal.

In AECOM's experience there is high variability in noise characteristics of ships visiting ship terminals. AECOM has undertaken a statistical analysis of ship noise using the calculated mean and standard deviation of measured fuel ships sound power levels. This analysis has assumed ship noise characteristics are distributed normally.

The distribution of data with respect to the mean and standard deviation is shown in **Figure 2**. It shows that 68.2% of the dataset lies within one standard deviation of the mean, and 95.4% of the dataset lies within two standard deviations of the mean.

Figure 2 Mean and standard deviation of a normally distributed dataset

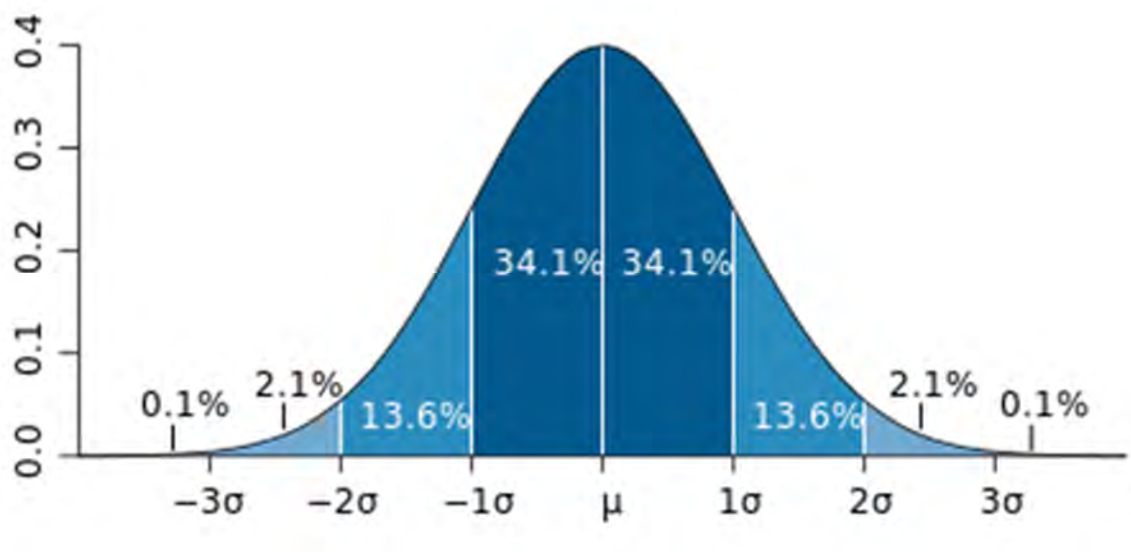

Image source: en.wikipedia.org

A summary of measured data is shown in **Table 3**.

Table 3 Ship Noise Characteristics Statistical Analysis

Statistic	-2σ	-1σ	μ	1σ	2σ
Percentile	2.1st	15.7th	50th	84.3rd	97.9th
Nomenclature	best	quieter	typical	louder	worst
DWP Ships					
Sound Power Level, dB(A)	98	101	103	106	108
L_{Ceq} - L_{Aeq}, dB	7.4	11.6	15.9	20.1	24.4
CPR Ships					
Sound Power Level, dB(A)	98	100	103	105	108
L_{Ceq} - L_{Aeq}, dB	9.1	13.4	17.6	21.9	26.1

As such, to determine the potential impacts from ships when at berth, an assessment has been undertaken looking at ships that are 1 standard deviation either side of the mean, to give an indication of the typical impacts that might be expected when a ship is in berth.

4.2 Methodology

The assessment takes into consideration noise propagation from the ship as a point source, only taking into consideration the losses due to hemispherical spreading and the distances of the receivers to the ship berthed at K2. This calculation method is conservative as it does no account for further reductions of air absorption, ground absorption and shielding due to structures.

The boat is assumed to operate for prolonged periods of time and therefore no time weighting discount has been applied to the noise levels.

4.3 Results

The noise contribution due to the berthed ship is shown in **Table 4**. In this table the assessment receivers are shown, and additionally, the worst affected western receiver is included for discussion. The results demonstrate that the noise levels for the standard assessment receivers R4, R5 and R6 are below the noise criteria. The same can be seen for the worst affected western receiver R West (6 Crebert Street, Mayfield East). All predicted noise levels are at least 7 dB less than the project specific noise criteria and therefore at least more than 17 dB less than the existing noise levels due to the Orica plant's existing operations.

The uprate will almost double the amount of ships used to transport ammonia. However, a level of 17 dB below the existing noise environment demonstrates that the environmental noise levels will not increase further as a result of the presence of these additional ships and will have inconsequential noise impacts on surrounding residential receivers.

Table 4 Noise Contribution Due to Ship

Receiver	Predicted ship noise level (Quieter, -1σ) , $L_{Aeq\ (15\ min)}$, dB(A)	Predicted ship noise level (Louder, 1σ) , $L_{Aeq\ (15\ min)}$, dB(A)	Project specific noise criterion, dB(A)	Exceedance, dB(A)
R4	32	37	52	-
R5	34	39	47	-
R6	34	39	46	-
R West (6 Crebert Street, Mayfield East)	25	30	-	-

5.0 Conclusion

AECOM has investigated the predicted noise increase associated with the ammonia production uprate at Orica's Kooragang Island site.

Orica has put in place a NMP which details commitments by Orica to manage noise emission from the Project. Specific activities and control that have been implemented as part of the NMP are stated in this report.

No noise generating plant infrastructure is proposed as part of this uprate modification. No additional road traffic will be generated as part of this Project. The only noise generating sources associated with the Project uprate are the ships. Therefore the noise assessment within this report is namely concerned with these additional shipments. The assessment concludes that noise emission due to the ships is at least 17 dB below the project specific criteria and will have an inconsequential impact on residential receivers.

Appendix A

Glossary of Acoustic Terminology

Appendix A Glossary of Acoustic Terminology

The following is a brief description of the acoustic terminology used in this report

Sound power level	The total sound emitted by a source
Sound pressure level	The amount of sound at a specified point
Decibel [dB]	The measurement unit of sound
A Weighted decibels [dB(A])	The A weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting filter emphasises frequencies in the speech range (between 1kHz and 4 kHz) which the human ear is most sensitive to, and places less emphasis on low frequencies at which the human ear is not so sensitive. When an overall sound level is A-weighted it is expressed in units of dB(A).
Decibel scale	The decibel scale is logarithmic in order to produce a better representation of the response of the human ear. A 3 dB increase in the sound pressure level corresponds to a doubling in the sound energy. A 10 dB increase in the sound pressure level corresponds to a perceived doubling in volume. Examples of decibel levels of common sounds are as follows:

0dB(A)	Threshold of human hearing
30dB(A)	A quiet country park
40dB(A)	Whisper in a library
50dB(A)	Open office space
70dB(A)	Inside a car on a freeway
80dB(A)	Outboard motor
90dB(A)	Heavy truck pass-by
100dB(A)	Jackhammer/Subway train
110 dB(A)	Rock Concert
115dB(A)	Limit of sound permitted in industry
120dB(A)	747 take off at 250 metres

Frequency [f]	The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high pitched sound and a low frequency to a low pitched sound.
Ambient sound	The all-encompassing sound at a point composed of sound from all sources near and far.
Equivalent continuous sound level [L_{eq}]	The constant sound level which, when occurring over the same period of time, would result in the receiver experiencing the same amount of sound energy.
Reverberation	The persistence of sound in a space after the source of that sound has been stopped (the reverberation time is the time taken for a reverberant sound field to decrease by 60 dB).
Air-borne sound	The sound emitted directly from a source into the surrounding air, such as speech, television or music.
Impact sound	The sound emitted from force of one object hitting another such as footfalls and slamming cupboards.
Air-borne sound isolation	The reduction of airborne sound between two rooms.

Sound Reduction Index [R] *(Sound Transmission Loss)*	The ratio the sound incident on a partition to the sound transmitted by the partition.
Weighted sound reduction index [R_w]	A single figure representation of the air-borne sound insulation of a partition based upon the R values for each frequency measured in a laboratory environment.
Level difference [D]	The difference in sound pressure level between two rooms.
Normalised level difference [D_n]	The difference in sound pressure level between two rooms normalised for the absorption area of the receiving room.
Standardised level difference [D_{nT}]	The difference in sound pressure level between two rooms normalised for the reverberation time of the receiving room.
Weighted standardised level difference [$D_{nT,w}$]	A single figure representation of the air-borne sound insulation of a partition based upon the level difference. Generally used to present the performance of a partition when measured in situ on site.
C_{tr}	A value added to an R_w or $D_{nT,w}$ value to account for variations in the spectrum.
Impact sound isolation	The resistance of a floor or wall to transmit impact sound.
Impact sound pressure level [L_i]	The sound pressure level in the receiving room produced by impacts subjected to the adjacent floor or wall by a tapping machine.
Normalised impact sound pressure level [L_n]	The impact sound pressure level normalised for the absorption area of the receiving room.
Weighted normalised impact sound pressure level [$L_{n,w}$]	A single figure representation of the impact sound isolation of a floor or wall based upon the impact sound pressure level measured in a laboratory.
Weighted standardised impact sound pressure level [$L'_{nT,w}$]	A single figure representation of the impact sound isolation of a floor or wall based upon the impact sound pressure level measured in situ on site.
C_I	A value added to an L_{nW} or $L'_{nT,w}$ value to account for variations in the spectrum.
Energy Equivalent Sound Pressure Level [$L_{A,eq,T}$]	‘A’ weighted, energy averaged sound pressure level over the measurement period T.
Percentile Sound Pressure Level [$L_{Ax,T}$]	‘A’ weighted, sound pressure that is exceeded for percentile x of the measurement period T.

*Definitions of a number of terms have been adapted from Australian Standard AS1633:1985 *“Acoustics – Glossary of terms and related symbols”*

Appendix C

Noise Assessment Criteria

Appendix C Noise Assessment Criteria

Noise Assessment Criteria

NOISE

Noise Limits

30. The Proponent shall ensure that noise levels from the operation of the Project are at least 10dB(A) below noise levels from Orica's Existing Operations as specified by conditions 31 & 32 below.

Existing Operations - Noise Verification Program

31. Prior to the commencement of construction the Proponent shall prepare and implement an Existing Operations Noise Verification Program to the satisfaction of the Director-General. The Program shall:

(a) be undertaken by a suitably qualified and experienced person;

(b) identify future reference points that will be used to demonstrate compliance;

(c) collect new or review existing data, and report on the seasonal background levels for the noise catchment; and

(d) confirm the noise levels from Orica's Existing Operations.

Note: Some construction activities may occur under the Project Approval provided that such activity are not undertaken during the monitoring period or that Orica can demonstrate that the activity would not contribute to the background noise level, to the satisfaction of the Director-General.

Noise Management Plan

32. Prior to the commencement of operations of the Project, the Proponent shall prepare and implement a Noise Management Plan in consultation with the EPA and to the satisfaction of the Director-General. The Plan shall:

(a) be undertaken by a suitability qualified and experienced expert;

(b) demonstrate how noise levels from the Project would be managed to ensure noise levels would be 10dB(A) below noise levels from Orica's Existing Operations (see conditions 30 & 31);

(c) include a detailed monitoring program for reporting on ongoing compliance. The monitoring program shall:

- outline the proposed receiver sites at Stockton and sites on Kooragang Island that would be monitored;
- include both attended and unattended noise monitoring;
- verify that actual noise levels from the Project are consistent with the predictions made in the EA; and
- verify that noise levels from the Project are 10dB(A) below the noise levels identified in condition 31 for Orica's Existing Operations;

(d) provide details of any complaints received in the preceding year relating to noise generated by the Project, and action taken to respond to those complaints;

(e) detail procedures for implementing additional reasonable and feasible noise mitigation measures for the Project in response to exceedance of limits and/or noise complaints; and

(f) be updated annually, unless otherwise agreed to by the Director-General.

Construction and Operating Hours

33. The Proponent shall comply with the restrictions in Table 2, unless otherwise agreed by the Director-General.

Table 2: Construction hours for the Project and Operation hours for the Project.

Activity	Day Time	
Construction	Monday - Friday	7:00am to 6:00pm
	Saturday	8:00am to 1:00pm
	Sunday and Public Holidays	Nil
Operation	All days	24 hours

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Appendix D

Hazard Assessment

Appendix D Hazard Assessment

Technical Note

1. Introduction

Orica Australia Pty Ltd (Orica) operates a manufacturing facility on Kooragang Island (KI) near Newcastle, which produces ammonia, nitric acid and ammonium nitrate.

On the 1st of December 2009, approval (DA 08_0129) was granted for the expansion of the site's ammonium nitrate manufacturing capability from 430ktpa to 750ktpa by the NSW Minister for Planning and Infrastructure under Part 3A of the Environmental Planning and Assessment Act 1979 (EP&A Act).

The site expansion project approval broadly consists of:

— An additional Nitric Acid Plant (NAP4);

— An additional Ammonium Nitrate Plant (ANP3);

— Modification of the existing Ammonia Plant; and

— Upgrades to existing infrastructure such as cooling towers, air compressors, loading facilities, electrical systems, effluent treatment systems and the steam system.

To support the site's expansion approval application, GHD was commissioned in 2008 to update the Preliminary Risk Assessment (PHA). This involved the inclusion of additional infrastructure and changes to existing operational parameters in the Quantitative Risk Assessment (QRA).

In 2011 (MOD 1 PHA) an application to modify the 2009 approval was lodged by Orica, following the completion of technology selection and feasibility study design work. The modification mainly related to proposed changes to the post expansion site layout and improvements to the ammonia handling systems including:

— Consolidation of pressurised liquid ammonia storage and piping systems to reduce inventories and simplify isolation;

— Implementing additional ammonia detection and isolation systems to reduce the quantity of ammonia released to atmosphere as a result of potential leaks from major pipelines between the Ammonia Plant, Ammonia Storage and ammonia storage tank (Bullet) 6; and

— Continuing to explore additional opportunities to further reduce the risks associate with the use of ammonia in site's current operations.

The MOD 1 modification was approved on 11 July 2012 (DA 08_0129 MOD 1).

In 2012, Orica applied again to the NSW Department of Planning to modify the project approval (MOD2). The modification related to the construction and operation of three ammonia flares and the change in location and increase in storage capacity of a nitric acid tank detailed in approval (08_0129). The PHA was updated to reflect the change in location of the NA tank and three ammonia flares and submitted to the NSW Department of Planning and Infrastructure in support of the modification. Approval was grant on 17 December 2014.

Detailed in the Project Approval, Condition 2, are production limits associated with the quantity of ammonia, nitric acid and ammonium nitrate permitted to be manufactured at the site, specifically:

- 360 kilotonnes per annum (ktpa) of ammonia product;
- 605 ktpa of nitric acid product; and

- 750 ktpa of ammonium nitrate product.

Assumptions underpinning the development of the Project PHA, and subsequent modifications, relating to the modification to the Ammonia Plant were based on a continual production throughout the year at a daily production rate of 1050T/day. Therefore an annual production quantity of approximately 385ktpa has previously been modelled. Orica is currently applying to the Department of Planning and Environment to modify the Project Approval to increase the allowable annual ammonia production limit from 360ktpa to 385ktpa. A review of the model inputs has however identified that shipping and pipe utilisation inputs associated with ship loading infrastructure was based on a 360ktpa ammonia production scenario.

To support Orica's modification application, GHD has assessed the impact on risk contours developed for the Project as a result of increasing the frequency in which ammonia is transported via ship from the site. As part of the modification to shipping frequencies, the risk profile for the facility has been updated to assess the change in risk from these modifications in relation to relevant planning risk assessment criteria. This involved undertaking a facility Quantitative Risk Assessment (QRA) using DNV PHAST Risk (version 6.7) which formed part of a Preliminary Hazard Analysis (PHA) and Development Application for submission to the NSW Department of Planning (DoP).

The modelling work was completed using the existing QRA model developed for the Orica KI Update PHA MOD 2 for the AMI project. All modelling was conducted using DNV's Phast Risk software version 6.7.

1.1 Objectives & Scope

The aim of this PHA update is to assess the change in risk profile associated with proposed modifications to the shipping scenarios, based on information provided by Orica (refer to Section 2.2 for details).

The scope of the update includes:

- Revise base case scenarios (leak frequencies and parameters) changed as a result of increasing the frequency of which ammonia is transported from the site via ship;
- Update the QRA models with the shipping scenario modifications; and
- Obtain risk contour results for comparison between the approved project contours (MOD2), the risk contours reflecting the current site plant production rates following the completion of ammonia uprate activities (Current) and risk contours relating to the expansion program with a 385ktpa ammonia production limit (MOD3).

2. Methodology

2.1 Software

For consistency, the same model and software (DNV's Phast Risk version 6.7) were used as per the PHA [1].

2.2 Input Data

The input data used for the Base Case, Current Case and MOD 3 Case models were provided by Orica as summarised in Table 1 [**Error! Reference source not found.**].

Table 1 Updates to Input Data (Provided by Orica)

		Base Case	Current Case	MOD 3 Case
All wharf pipes	Utilisation	0.064	0.094	0.016
Chill line (NH3-E23)	Pressure	19 bar	5 bar	2 bar
	Temperature	-33 deg C	-33 deg C	-33 deg C
SHIP-PIPE	Pressure	19 bar	5 bar	8 bar
	Temperature	-33 deg C	-33 deg C	-33 deg C
Vapour return line (NH3-E23)*	Pressure	N/A	N/A	2 bar
	Temperature	N/A	N/A	-5 deg C

*The vapour return line for NH3-E23 is an additional scenario added to the MOD 3 Case only.

2.3 Model Updates

2.3.1 Base Case

The updated Base Case model is the currently approved position including the AMI (Ammonia Management Improvement) Project with minor corrections as follows:

- Ship loading systems utilisation changed from 0.064 to 0.017 as it was found that the shipping frequency factor was associated with pre 2009 operations; and
- Scenario RV-127 removed as this risk is now covered by the AMI Flare.

2.3.2 Current Case

The Current Case model includes a change in ammonia production to 385,000 tpa from 360,000 tpa, with minor corrections as follows:

- Extra ammonia generated at the site following the completion of the uprate of the site's Ammonia Plant is current being shipped to Orica's Yarwun facility in Queensland. This has resulted in an increase in the frequency in both the shipping and pipe utilisation factors applied to ship loading infrastructure considered in the PHA. The shipping export pipeline utilisation factor has been increased from 0.064 to 0.094; and
- SHIP-PIPE and NH3-E23 scenarios operate at a lower pressure of 5 bar to reflect the current ammonia operating loading setup.

2.3.3 MOD 3 Case

The MOD 3 Case model includes change in ammonia production to 385,000 tpa from 360,000 tpa, with minor corrections as follows:

- Ammonia export pipeline (SHIP-PIPE) loading rate has increased from 250T/hr to 420T/hr with an increase in pressure from 5 to 8 bar to reflect proposed pump upgrades and pipe replacement activities currently planned by the site;
- Ammonia export pipeline (SHIP-PIPE) factor has been reduced from 0.094 (Current Case) to 0.016 to reflect a reduced ship loading duration;
- NH3-E23 was split into separate chilldown and vapour return lines:
    - NH3-E23 becomes a dedicated vapour line at a lower pressure of 2 bar and lower temperature of -5 degrees C; and
    - Added a new 50 NB liquid line to NH3-E23 (13 mm leak and rupture scenarios) at a lower pressure of 2 bar and temperature of -33 degrees.

3. Results

3.1 Individual Fatality Risk (IFR) – Site

Figure 3-1 Base Case – IFR

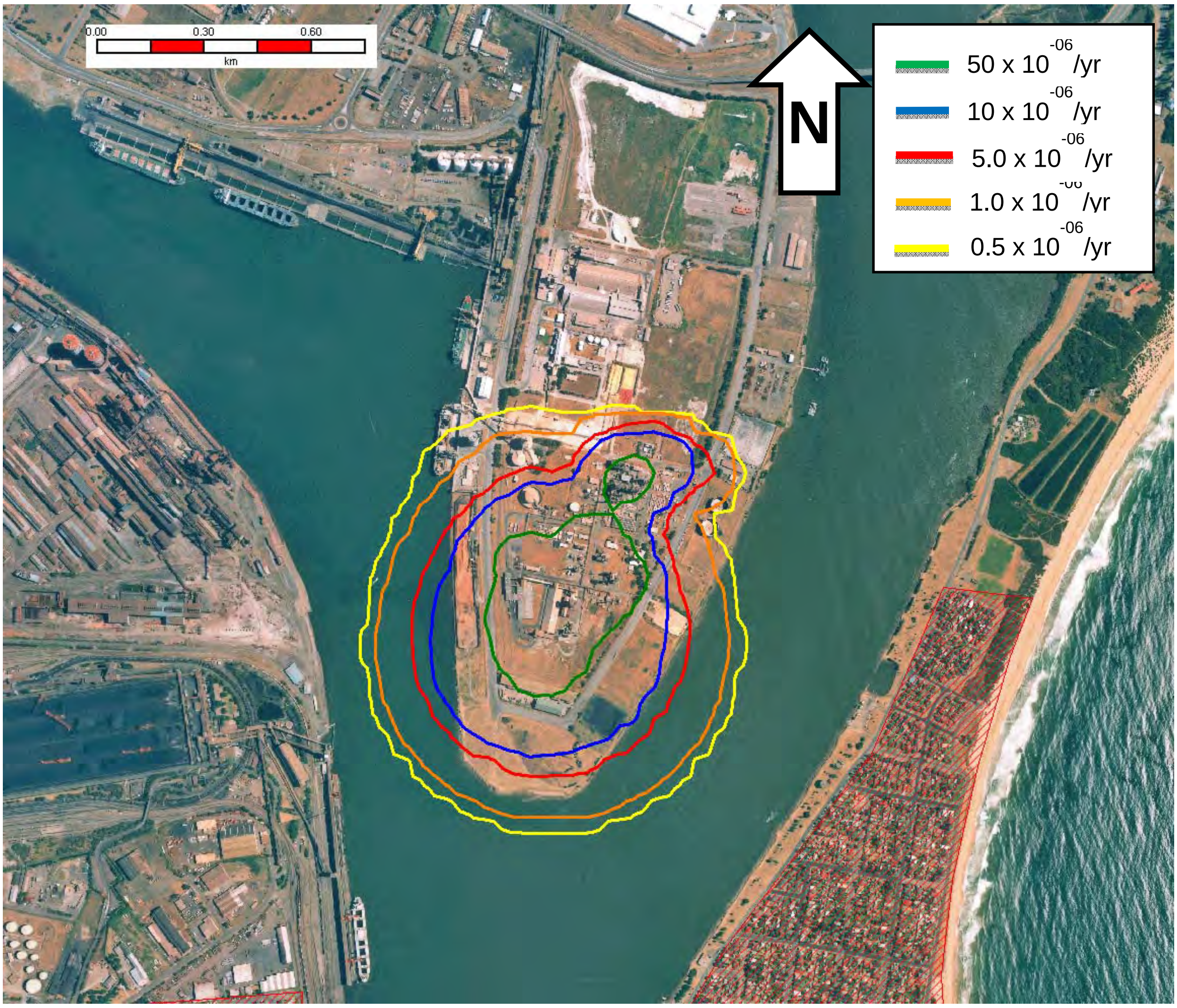
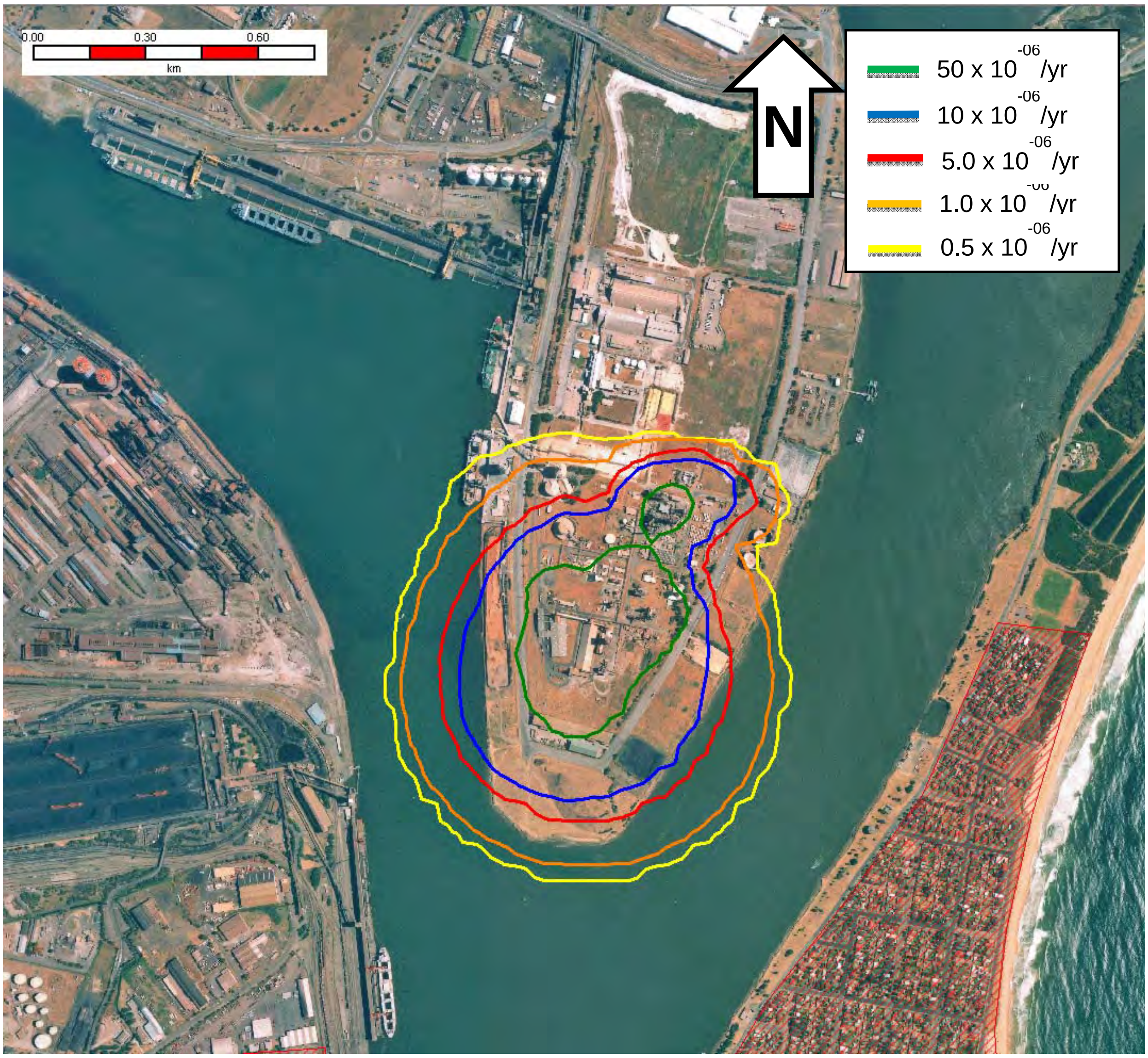


Figure 3-2 MOD 3 Case – IFR



Comparing the IFR contours from the previous Base Case, there is no significant change to the risk contours. This is expected as the IFR dominant inputs predominately relate to AN storage for which there is no change. A minor change to the ammonia shipping frequency has not impacted on the IFR contour. The IFR associated with the site remains compliant with the criteria specified in HIPAP 4.

3.2 Individual Fatality Risk (IFR) – Shipping

Figure 3-3 Base Case – Shipping IFR

Figure 3-4 Current Case – Shipping IFR

Figure 3-5 MOD 3 Case – Shipping IFR

The IFR contours for the shipping scenarios did not show risk results at required levels considered as being significant enough for consideration as determined by the HIPAP criteria (i.e. IFR at 50, 10, 5.0, 1.0 & 0.5 in a million).

Figure 3-3, Figure 3-4 and Figure 3-5 depicts additional results obtained for the shipping IFR at 0.1 and 0.05 in a million per annum. This shows that the Current shipping IFR has reduced from the Base Case IFR and further reduced for the MOD 3 Case shipping IFR. This is due to the overall effect from reduced pressures and reduced shipping frequencies. Although the pressure in the export pipeline has increased reflecting the higher loading rate from the Current Case to the MOD 3 case, the effect of lower shipping frequency has resulted in an overall reduction in risk.

3.3 Toxic Injury – Site

Figure 3-6 Base Case – Injury

Figure 3-7 MOD 3 Case – Injury

Comparing the toxic injury contours, the 10 in a million per annum contour has not changed between the Base Case and the proposed MOD 3 Case. The toxic injury risk associated with the site remains compliant with the suggested criteria specified in HIPAP 4.

3.4 Toxic Injury – Shipping

There were no toxic injury risk contours at 10 in a million per annum generated for the Base, Current, or MOD 3 Cases. The shipping toxic injury risks associated with the site remains compliant with the suggested criteria specified in HIPAP 4 as the 10 in a million per annum contour was not reached.

3.5 Toxic Irritation – Site

Figure 3-8 Base Case – Irritation

Figure 3-9 MOD 3 Case – Irritation

Comparing the toxic irritation contours, the 50 in a million per annum contour has not changed between the Base Case and the MOD 3 Case. The toxic injury risk associated with the site remains compliant with the suggested criteria specified in HIPAP 4.

3.6 Toxic Irritation – Shipping

There were no toxic irritation risk contours at 50 in a million per annum generated for the Base, Current, or MOD 3 Cases. The shipping toxic irritation risks associated with the site remains compliant with the suggested criteria specified in HIPAP 4 as the 50 in a million per annum contour was not reached.

3.7 Risk Ranking Results

The risk ranking point, referred to as RRP, was obtained at the same location for each case as presented in Figure 3-10. The comparison of the change in risk at this point for each case is presented in Table 2.

This indicates that the overall risk with the combined shipping and E23 changes has decreased from the Base Case to the current case and even further to the MOD 3 Case.

Figure 3-10 Risk Ranking Point (RRP)

Table 2 Risk Ranking Comparison Results

Model	Base Case	Current Case	MOD 3 Case
Site IFR	3.0008E-06	2.9978E-06	2.9973E-06
Site Injury	5.9817E-05	5.9774E-05	5.9596E-05
Site Irritation	1.0237E-04	1.0232E-04	1.0216E-04
Shipping IFR	8.8784E-08	8.5540E-08	8.5276E-08
Shipping Injury	8.6055E-07	7.8012E-07	6.8988E-07
Shipping Irritation	9.4128E-07	8.6274E-07	8.3548E-07

3.8 Conclusion

The QRA model was updated to incorporate the changes to the shipping frequency. The purpose of this was to check the impact of the changes on the site's risk profiles and shipping profiles and document the changes.

The study has demonstrated that the proposed changes associated with shipping frequencies have resulted in a slight decrease in the risk profile for the shipping activities. However, due to the low contribution of risk to the overall site risk profile of the shipping scenarios, the site IFR contours, site toxic injury and site toxic irritation contours have not changed from the previous Base Case results. Hence, the risks associated with the site continue to comply with HIPAP 4 risk criteria.

4. References

1. GHD, Report for Kooragang Island Update PHA MOD1 March 2012, Rev 5, Document Number 31/2473300/192842.
2. QRA Model - Hazard ID Frequency Scenarios - Ammonia Plant Quantity update spreadsheet, Rev C, received 4th February 2015 from S. Sandhoff.