Sodium Cyanide Manufacturing Facility Expansion – Stage 2

Australian Gold Reagents Pty Ltd

[redacted]

Works Approval Application

Supporting Information

Date 22 August 2025

TABLE OF CONTENTS

ABBREVIATIONS 4
1. APPLICATION SUMMARY & OVERVIEW OF PREMISES 5
1.1 Overview 5
1.2 Purpose and scope 6
2. APPLICANT & PREMISES DETAILS 8
3. OTHER APPROVALS & CONSULTATION 12
3.1 DWER 12
3.2 Local government 14
3.3 Other 14
3.4 Consultation 15
4. SITING and LOCATION 15
5. PROPOSED ACTIVITIES 21
5.1 NaCN manufacturing infrastructure 21
5.2 Description of proposed works 34
5.2.1 GAS MIXING 36
5.2.1.1 Natural gas and ammonia filter 36
5.2.1.2 Air blowers 36
5.2.2 REACTION SYSTEM 36
5.2.2.1 Steam Drum Elevation 36
5.2.2.2 Reactor Modification 38
5.2.3 ABSORPTION 38
5.2.3.1 SCP2 Absorber tower 38
5.2.4 INCINERATION 38
5.2.4.1 TO3 Incinerator 38
5.2.4.2 Upgrades to existing John Zink Incinerator 42
5.2.5 PRODUCT STORAGE AND HANDLING 42
5.2.5.1 Tank 4 (TK-04) 42
5.2.6 SUPPORTING INFRASTRUCTURE 42
5.2.6.1 Pipe work 42
5.2.6.2 Control room, Master Control Centre and Plant Instrumentation 43
5.3 Commissioning 43
5.3.1 SCP2 Plant commissioning 43
5.3.2 Waste gas incinerator commissioning 43
5.4 Proposed Time Limited Operations 44
6. EMISSIONS & DISCHARGES 45
6.1 Air Emissions 46
6.1.1 Ambient Air Quality Criteria 46
6.1.2 Emissions Limits 47
6.1.3 Ambient Air quality 47
6.1.4 AGR Air Emissions 49
6.1.5 Air quality assessment 55

6.1.6 Human Health Risk Assessment ... 78
6.2 Greenhouse Gas Emissions ... 79
6.3 Discharges to Land / Water ... 79
6.3.1 Cyanide destruction ... 80
6.3.2 Rainwater and washings collected inside bunded areas ... 80
6.3.3 Cooling tower blowdown water. ... 81
6.3.4 Maxitherm and John Zink incinerator blowdown. ... 82
6.3.5 Runoff collected outside of bunded areas. ... 82
6.4 Noise ... 85
6.5 Particulates (dust) ... 92
6.6 Solid Waste Management ... 92
6.7 Fire and Safety Risk ... 93
6.8 Process Control ... 94
6.9 Summary Risk Assessment ... 95
7. PROPOSED FEE CALCULATION (Att. 10 of AF) ... 96
8. REFERENCES ... 97
9. APPENDICES ... 98
Appendix 1 – MRP 2025 AGR Model Update and Emissions Verification Report. ... 99
Appendix 2 – Matison 2024 Human Health Risk Assessment ... 100
Appendix 3 – SLR 2024 AGR Expansion Project Noise assessment ... 101
Appendix 4 - Existing NaCN manufacturing process ... 102

ABBREVIATIONS

Term	Definition
AGR	Australian Gold Reagents
AGV	Air [Quality] Guideline Value
CSBP	CSBP Ammonia / Ammonium Nitrate & Industrial Chemicals
CSBP Kwinana	CSBP Kwinana Industrial Complex
CEMS	Continuous emission monitoring systems
CH_4	Methane (purified natural gas)
CO	Carbon monoxide
CO_2	Carbon dioxide
DWER	Department of Water and Environmental Regulation
Intensity	The calculated ratio of consumption or emissions per unit of production.
EPA	Environmental Protection Authority
EP Act	Environmental Protection Act 1986
GHG	Greenhouse gas
GLC	Ground level concentration
ha	Hectares
HCN	Hydrogen Cyanide
HQ	Hazard quotients
JZ	John Zink incinerator
KIA	Kwinana Industrial Area
KIC	CSBP Kwinana Industrial Complex
KWRP	Kwinana Wastewater Recycling Plant
MS	Ministerial Statement
NaCN	Sodium Cyanide
N_2	Nitrogen
NH_3	Ammonia
N_2O	Nitrous Oxide
NO	Nitric Oxide
NO_2	Nitrogen Dioxide
NOx	Oxides of nitrogen (combined)
SCMF	Sodium Cyanide Manufacturing Facility
SCR	Selective catalytic reduction
SNCR	Selective non-catalytic reduction
SDOOL	Sepia Depression Ocean Outlet Landline
SCS	Sodium Cyanide Solids plant
SCP	Sodium Cyanide (liquid) Plant
tCO_2-e	tonnes CO_2 equivalent
TK-04	Proposed Cyanide Storage Tank
TO3	John Zink Thermal Oxidiser incinerator #3, replacing existing Maxitherm incinerator
tpa	Tonnes per annual period
WHRU	Waste heat recovery unit
WesCEF	Wesfarmers Chemicals, Energy & Fertilisers

1. APPLICATION SUMMARY & OVERVIEW OF PREMISES

1.1 Overview

Australian Gold Reagents Pty Ltd (AGR) manufactures sodium cyanide (NaCN) at the Sodium Cyanide Manufacturing Facility (SCMF), located at Lot 20 Kwinana Beach Road, Kwinana Beach. The premises is classified as Category 31 under Schedule 1 of the *Environmental Protection Regulations 1987* and operates under Licence L6110/1990/13. The premises is located within the CSBP Kwinana Industrial Complex (KIC) in the Kwinana Industrial Area (KIA). The entire CSBP KIC encompasses an area of 138 hectares (ha) and is situated at the intersection of Kwinana Beach Road and Port Road. AGR occupies approximately 11.2 ha of Lot 20 on Diagram 78086.

The premises consists of two liquid NaCN plants (SCP1 and SCP2) that produce a ~40 per cent weight/weight (w/w) liquid NaCN via the Andrussow process which is then diluted prior to dispatch, or fed to the NaCN solids (SCS) plant for the manufacturing of NaCN briquettes.

Under the existing Ministerial Statement (MS) 1196 (Attachment 1 to MS1196, dated 27 August 2024), SCP1 and SCP2 are currently authorised to produce a combined output of 150,000 tonnes per annum (tpa) of pure (100 per cent) NaCN and the SCS plant is authorised to produce 105,000 tpa of solid NaCN briquettes (255,000 tpa, combined).

The total assessed production capacity authorised under the licence (L6110) is 136,000 tpa. AGR plans to implement staged plant upgrades to expand the NaCN production capacity.

- Stage 1 (W6952/2024/1 approved 1 April 2025) involves upgrades to SCP1, the wastewater recovery system and improved air scrubbing at SCS to increase the NaCN production capacity to 170,000 tpa (110,000 tpa liquids and 60,000 tpa solids) combined.
- Stage 2 of the SCMF expansion (**this application**) seeks to implement elements of the upgrades approved in MS1196 and increase the licensed capacity to 210,000 tpa – comprised of 150,000 tpa of liquid production and the previously approved 60,000 tpa solids. The NaCN production capacity at the licensed facility (L6110) will comply with levels authorised under MS1196.
- Future solids plant upgrades (not this application) may achieve the 105,000 tpa solid sodium cyanide production authorised in MS1196.

The proposed Stage 2 upgrade is required to meet increasing domestic and international demand for NaCN, primarily used in the gold mining industry as a leaching agent. The expansion in production capacity will be realised by modification, replacement, and duplication of existing process equipment. Furthermore, proposed

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plant amendments will enable optimisation of operations and achieve some improvements in air and greenhouse gas emissions.

1.2 Purpose and scope

This application is to enable an increase in liquid and solid NaCN production up to a combined total of 210,000 tpa (expressed as 100 per cent NaCN) (see Table 1 below) under L6110/1990/13 through plant equipment upgrades described in this document as part of a Stage 2 expansion upgrade, and as approved under MS1196.

Table 1: Prescribed premises amendment

Category	Description	Assessed Production	Proposed Production
31	Chemical manufacturing	170,000 tonne per annual period	210,000 tonnes per annual period

This will be achieved by:

- re-engineering (debottlenecking) of existing liquid NaCN plant (SCP2) infrastructure components (replicating works previously approved for SCP1 upgrades in the Stage 1 expansion WA W6952);
- replacing the Maxitherm selective catalytic reduction (SCR) SCP2 incinerator with a new three-stage incinerator (TO3) to improve air emission controls, specifically reductions in greenhouse gas emissions (Nitrous Oxides - N_2O);
- improved management of start-up gasses with SCP2 treated through the proposed TO3 incinerator;
- updating emission points for changes to the waste gas incinerators, and;
- installing a new NaCN storage Tank (TK-04).

Modelled but not included in this proposal:

- upgrading components of the existing John Zink (JZ) incinerator as an amendment to the previously approved Stage 1 works approval W6952;
- potential future addition of a waste heat recovery unit on the TO3 incinerator; not part of this works approval application, but included in emissions modelling scenarios.

Changes to air emissions including incineration of start-up gases have been modelled through an air quality assessment. Further information on air emissions is included in Section 6.1.

This document has been structured to ensure that the information provided in support of the application is presented in accordance with the format and requirements outlined in the Department of Water and Environmental Regulation (DWER) application form. Specifically, Table 3 has been developed to align with the relevant sections of the application form, facilitating clear and consistent presentation of key details.

See Table 2 below that lists the infrastructure changes shown in Figure 2: SCMF proposed expansion layout

Table 2: SCP plant equipment

No.	Feature	Status
1	Existing Turbo Alternator	Existing/Approved
2	Permit Office	Existing/Approved
3	John Zink Incinerator	Existing - Amendment to Stage 1 approval
4	New Turbo Alternator	Future Application
5	Thermal Oxidiser (TO3)	This Application – New infrastructure
6	Vehicle access gate	Existing/Approved
7	Workshops	Existing/Approved
8	Office	Existing/Approved
9	Reception	Existing/Approved
10	North wing office building	Existing/Approved
11	Solids warehouse	Existing/Approved
12	Maintenance storage area	Existing/Approved
13	Natural gas purification plant	Existing/Approved
14	Control room	Existing/Approved
15	Maxitherm incinerator	Existing - Decommissioning in this Application
16	Liquid sodium cyanide plant no.1	Existing/Approved
17	Liquid sodium cyanide plant no.2	Existing - Debottlenecking in this Application
18	Tank farm	Existing/Approved
19	Cyanide storage tank (TK-03)	Existing/Approved
20	Liquid sodium cyanide despatch	Existing/Approved
21	Cyanide storage tank (TK-04)	This Application – New infrastructure
22	Hard stand	This Application
23	Solids plant	Existing/Approved

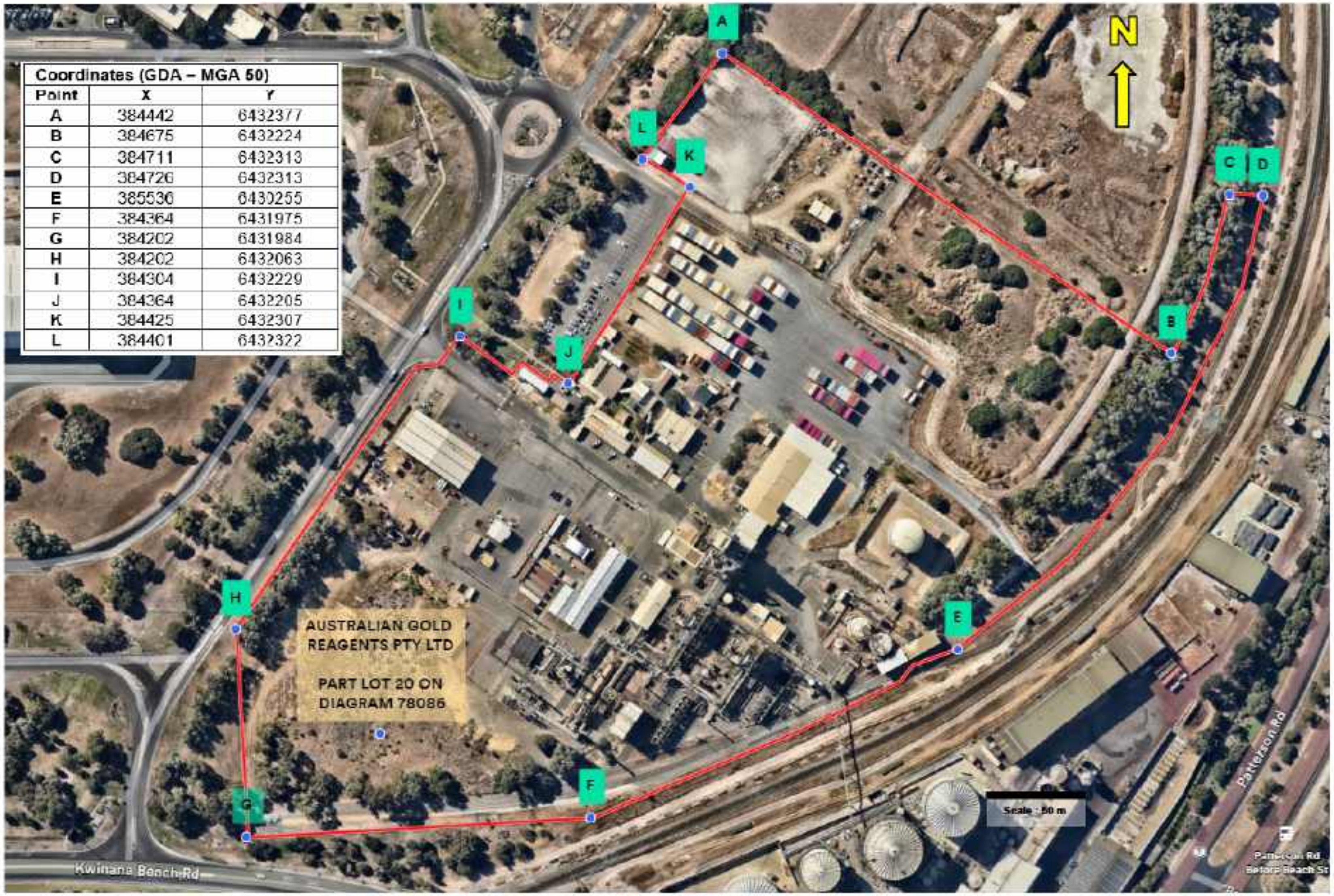
Table 3: DWER Application attachments

Application Form attachments	Document reference
Attachment 1A: Proof of occupier status	N/A - unchanged
Attachment 1B: ASIC company extract	N/A - unchanged
Attachment 1C: Authorisation to act as a representative of the occupier	N/A - unchanged
Attachment 2: Premises map/s	Unchanged, Figure 1
Attachment 3A: Environmental	N/A
Attachment 3B: Proposed activities	Section 5
Attachment 3C: Map of area proposed to be cleared (if clearing is proposed)	Figure 3
Attachment 3D: Additional information for clearing assessment	N/A
Attachment 4: Marine surveys (only applicable if marine surveys included in application)	N/A
Attachment 5: Other approvals and consultation documentation	Section 3
Attachment 6A: Emissions and discharges	Section 6
Attachment 6B: Waste acceptance	N/A
Attachment 7: Siting and location	Section 4
Attachment 8: Other attachments	Appendices
Attachment 9: Category-specific checklist(s)	N/A
Attachment 10: Proposed fee calculation	Section 7
Attachment 11: Request for exemption from publication	N/A

2. APPLICANT & PREMISES DETAILS

The applicant details remain unchanged since the previous licence amendment, which was approved on 27 March 2025. AGR continues to lease the land on which the SCMF is located from CSBP. Under the current 20-year lease agreement, which expires on 31 July 2027, a further term is available, extending the lease until 30 June 2031.

No changes to the prescribed premises boundary are proposed as part of this application (refer to Figure 1). The existing licence for the facility remains valid until 27 March 2034.



Coordinates (GDA – MGA 50)		
Point	X	Y
A	384442	6432377
B	384675	6432224
C	384711	6432313
D	384726	6432313
E	385536	6430255
F	384364	6431975
G	384202	6431984
H	384202	6432063
I	384304	6432229
J	384364	6432205
K	384425	6432307
L	384401	6432322

Figure 1: Sodium Cyanide Manufacturing Facility prescribed premises.

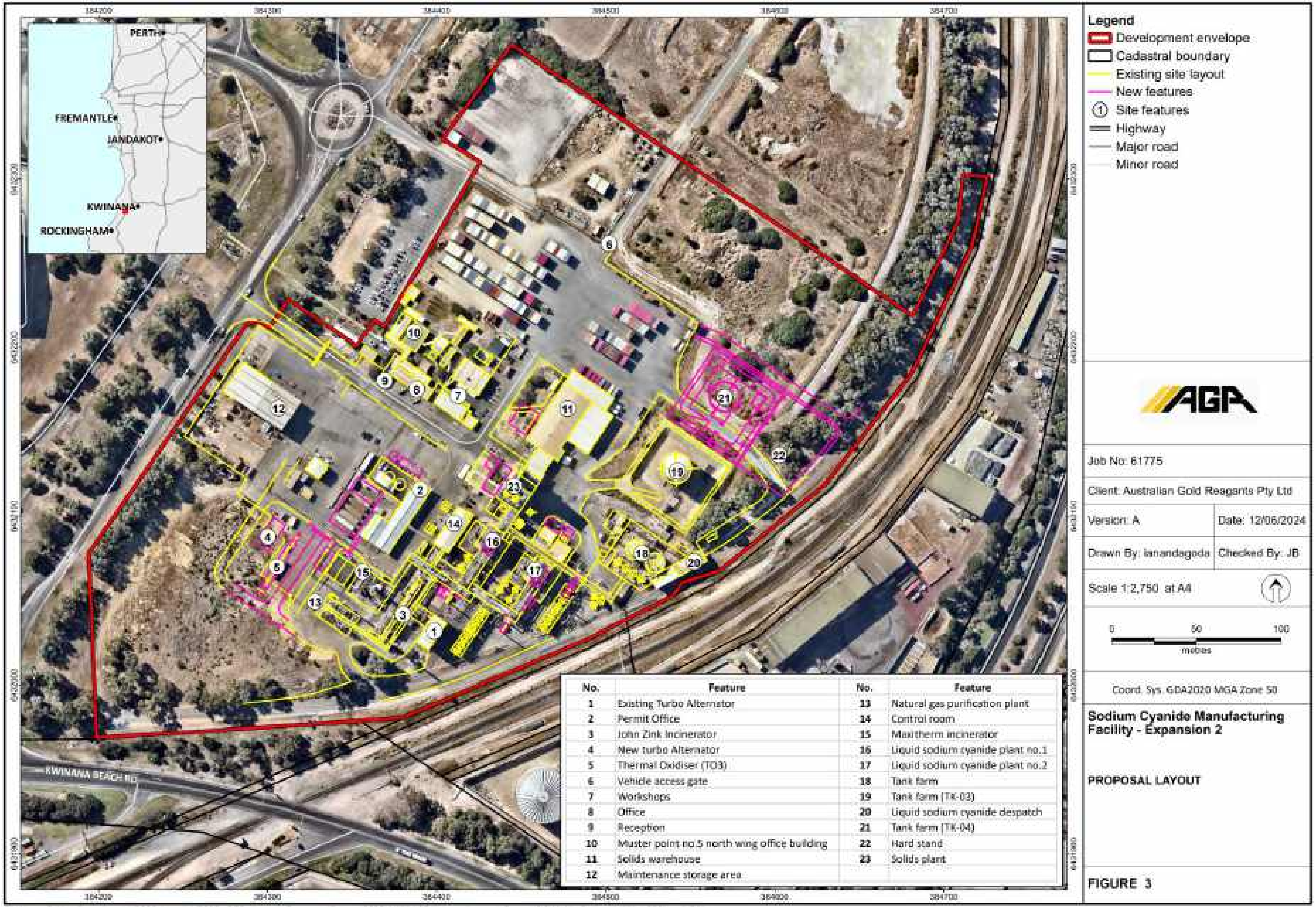


Figure 2: SCMF proposed expansion layout (Stage 1 + Stage 2)

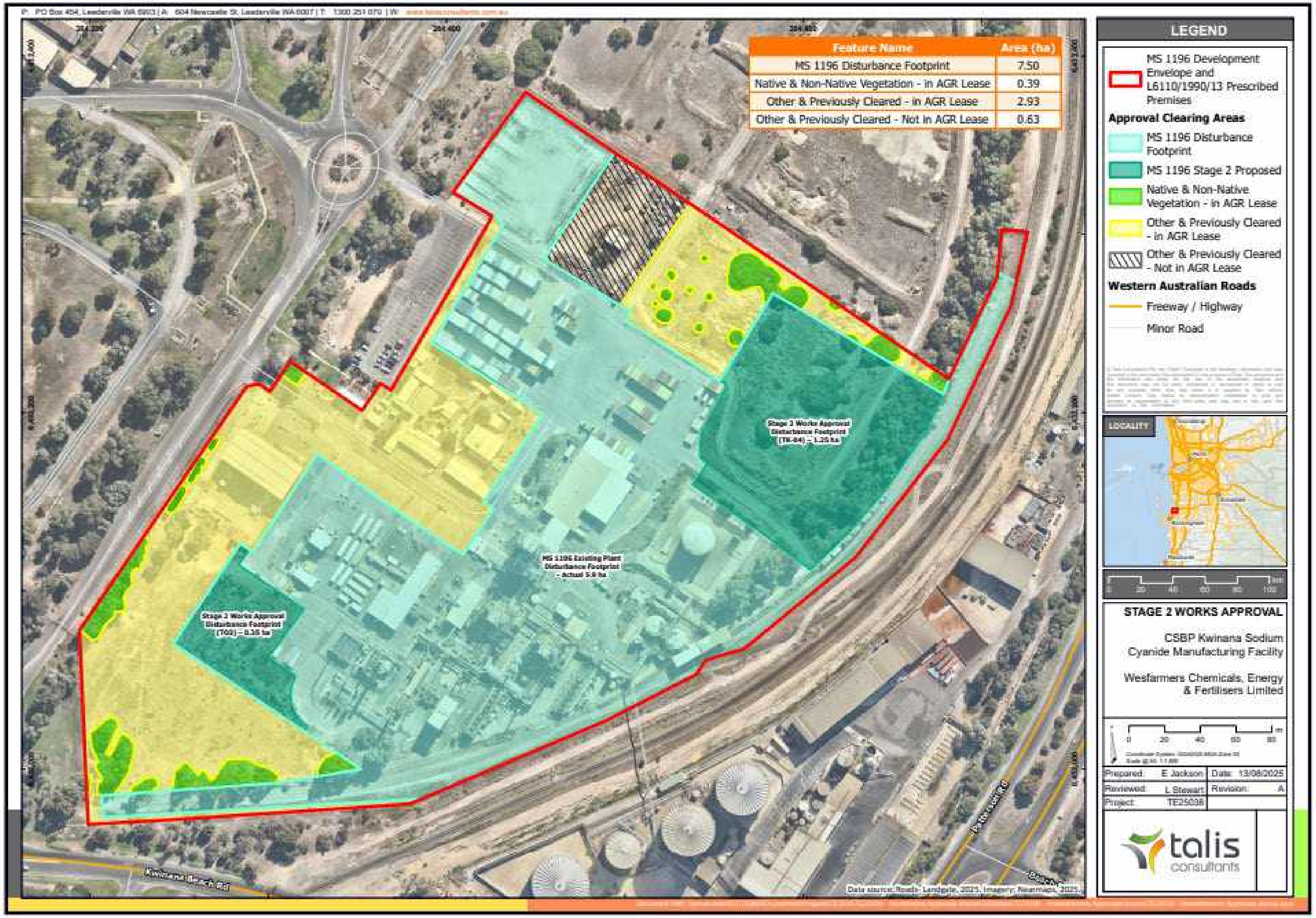


Figure 3: SCMF footprint and proposed clearing (Stage 1 + Stage 2)

3. OTHER APPROVALS & CONSULTATION

3.1 DWER

Part IV, EP Act

The Sodium Cyanide Plants (Liquid and Solid) at Kwinana and Transport of Sodium Cyanide by Road and Rail from Kwinana is a proposal approved under MS1196 for the operation of a liquid and solid NaCN production plant at Kwinana and the transport of NaCN by road and rail from Kwinana. Previous Ministerial Statements granted for the facility include: 006, 073, 099, 129, 347, 384, 579, 602, 668 and 700; these have been superseded by MS1196.

In December 2023, AGR lodged an application to the Environmental Protection Authority (EPA) to amend MS1196. The works were considered a minor amendment to the existing proposal and the EPA determined to assess the works on referral information, with further information requested in May 2024, which was provided in late June 2024.

Pursuant to s. 45C (1)(c) of the Environmental Protection Act 1986 (EP Act), the Chair acting as delegate for the Minister for Environment approved the following amendments of the approved proposal and implementation conditions on 27 August 2024:

- Expand the production capacity of the liquid NaCN plants from 110,000 tpa to 150,000 tpa and the solid plant from 60,000 tpa to 105,000 tpa through plant upgrades and debottlenecking.
- Decommissioning of the Maxitherm Incinerator at SCP2 and replace with a new higher capacity JZ incinerator (TO3) to reduce greenhouse gas emissions intensity.
- Amend the disturbance footprint and clarify the development envelope extent due to upgrading existing, and the construction of new, ancillary infrastructure.
- Replace condition 1-1 to reflect the increase in production and changes to disturbance areas and the development envelope.

A summary of the reasons for the approval decision are presented below:

- Air quality modelling was undertaken to model the impact of increasing the capacity of the plants. Results from the highly conservative air quality modelling indicate that it is highly unlikely that atmospheric emissions will result in exceedances of established air quality criteria at any sensitive receptors during both normal and upset conditions.
- There will be no increase in the total greenhouse gas emissions from the site as the new JZ incinerator (TO3) will reduce emissions intensity by reducing AGR site nitrous oxide (N_2O) emissions by c.90 per cent.

- The entire KIC (comprising CSBP and AGR licensed premises) is licensed under Part V of the EP Act. Emissions and discharges from the facility into the atmosphere and marine environment can continue to be managed under Part V of the EP Act. Groundwater abstraction will remain within the current licence limits and can continue to be managed under the *Rights in Water and Irrigation Act 1914*. Noise emissions will remain within the limits set in the *Environmental Protection (Noise) Regulations 1997*.
- Clearing of 0.23 ha of regrowth vegetation is required (within the proposed TK-04 footprint). The vegetation is in a degraded condition as it is dominated by weeds with few native species; it is unlikely that the clearing will significantly impact any conservation, significant flora, vegetation or fauna.

Proposed Footprint

MS1196 Plant Disturbance Footprint (Figure 3)(which is approved for 7.5ha) comprises

- 5.9 ha for the Existing Plant (made up of Stage 1 and the Stage 2 SCP debottlenecking)
- 1.25 ha for the Proposed Stage 2 Tank 4 (TK-04) footprint (which includes 0.23 ha of regrowth vegetation), and
- 0.35 ha for the Proposed Stage 2 TO3 footprint

Part V, EP Act

The Licence L6110/1990/13 expires on 27 March 2034.

The Licence was last amended by DWER on 27 March 2025 and was limited to updating the premises boundary and maps (updated to most recent development envelope from Ministerial Statement 1196), and correction of a typographical error.

An expansion works approval application (W6952/2024/1) was approved by DWER on 1 April 2025 to allow increased production to total of 170,000 tpa, with upgrades to SCP1 and SCS, improved wastewater management, and emission control. Stage 1 construction commenced in June 2025, with Stage 2 construction scheduled to commence in February 2026 to align with shutdown activities.

***Rights in Water and Irrigation Act 1914* (RIWI Act)**

AGR sources water from CSBP, which includes a combination of licensed groundwater and treated water from the Kwinana Water Reclamation Plant (KWRP). Water for the expansion will not require additional RIWI Act Approvals.

***Contaminated Sites Act 2003* (CS Act)**

The CS Act provides for the identification, recording and management of contaminated sites. Lot 20 is registered in the DWER Contaminated Sites database as possibly contaminated – investigation required. The SCMF is outside the plumes delineated in the detailed site investigations. A chlorophenol plume originating from off-site sources has been identified to be encroaching in the north-east of the Site (Lot 20), originating from the Nufarm Chemicals premises (formerly Chemicals Industry Kwinana). The plume is located in the north-eastern part of Lot 20, more than 400 m from the expanded facility boundary. The contamination plume does not impact the works associated with this application.

The proposed location of the new liquid NaCN Tank 4 (TK-04) will increase the footprint of the operation, extending over an historical gypsum pond used to cool and dry phosphogypsum byproduct between 1978 and 1986. These ponds were decommissioned in 1986 with the residual gypsum removed. Elevated levels of sulphur and phosphorus have been identified in the surface materials and clay liner of the various ponds, with presence still detected below. Sulphur and phosphorus concentrations in natural soils beneath the liners were significantly lower than surface materials.

3.2 Local government

The facility is in the City of Kwinana and zoned as Industrial (under the Town of Kwinana Local Planning Scheme No. 2 and the Metropolitan Regional Scheme), within the KIA.

The Development Application for Stage 1 was approved 24 April 2025.

The Stage 2 Development Application to the City of Kwinana will be lodged in September 2025.

3.3 Other

Dangerous Goods and Safety Act 2004 **(DGS Act)**

The facility is identified as a Major Hazard Facility under the *Dangerous Good Safety (Major Hazard Facilities) Regulations 2007*. The latest Safety Report is dated 6 December 2022, approved 13 January 2023.

The facility is also licensed under dangerous goods legislation (DGS012715). The facility is designed and operated to relevant approved Australian Standards. Access to the site is strictly controlled.

The associated legislation and licensing requires management of risk and implementation of safety management systems. Risks include exposure to toxic chemicals and gases from chemicals and fire incidents. All Dangerous Goods approvals, including product storage will be updated with the newly formed Department of Local Government, Industry Regulation and Safety (LGIRS), formerly known as the Department of Energy, Mines, Industry Regulation and Safety (DEMIRS).

3.4 Consultation

Stakeholder engagement has included the EPA Services, Regulatory Services (Industry Regulation) and Air Quality within DWER to discuss the management of emissions during upset conditions in the liquid NaCN plants, and environmental approval processes.

CSBP has acquired additional recycled water from the Water Corporation KWRP expansion which will be available for use in FY26. The management and treatment of site wastewater will be via the CSBP wastewater system that discharges into the Sepia Depression Ocean Outfall Landline (SDOOL). The discharge to SDOOL via CSBP prescribed premises (L6107) is consistent with licence conditions and Water Corporation trade waste agreements.

4. SITING AND LOCATION

The CSBP KIC is directly adjacent to Cockburn Sound to the west, with industry surrounding the site in all other directions. AGR is located on the south-eastern corner of the CSBP site, occupying approximately 11.23 ha, with a railway line separating AGR from Coogee Chemicals. Further to the east is a one-kilometre-wide parks and recreation reserve, which preserves a landscape buffer between the KIA and 'Urban' zoned land at Medina.

The proximity to sensitive receptors is not altered by this application. Table 4 below provides a summary of potential receptors within the general area. The regional setting is visually represented in Figure 4. Due to their residential and recreational use, these are sensitive receptor locations from a human health and amenity perspective. The proximity of the premises to these sensitive receptor locations may impact ambient air quality and amenity at these locations.

Table 4: Sensitive receptors and distance from premises

Type / classification	Description	Distance + direction to premises boundary	Proposed controls to prevent or mitigate adverse impacts (if applicable)
Nearest human sensitive receptor (s)	Wells Park (recreation)	1.2 km SW	The proposed upgrades are supported by impact assessments that establish acceptability of risk. Existing licence conditions contain regulatory controls to manage risk to receptors.
	Kwinana Golf Course	2.0 km E	
	Nearest residence	2.1 km E	
	Oval by Motorplex	3 km NE	
	Wombat Wallow Childcare Centre	2.9 km E	
	North Rockingham	3.2 km SW	
	Calista Primary School	3.3 km E	
	Hope Valley	4.2 km NE	
Environmentally Sensitive Areas	Unidentified TEC intersecting southern part of premises.	0 km S	No ESA will be disturbed as part of this application.

Type / classification	Description	Distance + direction to premises boundary	Proposed controls to prevent or mitigate adverse impacts (if applicable)
Threatened Ecological Communities (TEC)	Tuart trees / woodlands within boundary of premises.	~550 m north of proposed activity	No TECs will be disturbed.
Threatened and/or priority fauna	*Isoodon fusciventer* (Southern Brown Bandicoot / Quenda) previously identified in vegetated areas in the vicinity of the project area. *Zanda latirostris* (Carnaby's Cockatoo habitat trees located in eastern boundary of site)	Within premises boundary of Lot 20	No threatened or priority fauna exist in zone of impact.
Threatened and/or priority flora	No threatened or priority flora in zone of impact	n/a	Activities conducted in existing industrial footprint.
Aboriginal and other heritage sites	No sites identified in Aboriginal Heritage Inquiry System for the premises.	n/a	Activities conducted in existing industrial footprint.
Public drinking water source areas	No PDWSA within 5 km of facility.	n/a	No impact, no controls proposed.
Groundwater	The water table below the premises is located ~1.5m Australian Height Datum (AHD) about 2.5-3 m below ground level. Groundwater is abstracted for use on site under Rights in Water and Irrigation Act (RIWI Act) licence.	n/a	The proposed works will be within existing industrial footprint. TK-04 is to be constructed within a bunded hardstand north of NaCN TK-03. A separation distance of 2m to groundwater will be maintained. New infrastructure will include secondary containment for hazardous materials in accordance with appropriate standards and Codes of Practice.
Rivers, lakes, oceans, and other bodies of surface water, etc.	No natural lakes, wetlands, or river within the proximity of premises. Resource enhancement wetland in Bush forever site (ID 6375) Cockburn Sound (Indian Ocean)	>1 km E >1 km W	No impact, no controls proposed. Marine discharge is authorised in L6107 and MS665 with regulatory controls. No changes to risk expected and existing controls are considered appropriate.
Acid sulphate soils	No acid sulphate soils risk on site.	n/a	The proposed works will be within existing infrastructure. There will be no disturbance of ASS soils.
Other	Bush forever site – ID 18621	>1 km E	No impact.

Figure 4: AGR proximity to sensitive receptors

Figure 5: General layout of Sodium Cyanide Manufacturing Facility (yellow items form this application, blue items Stage 1 amendment)

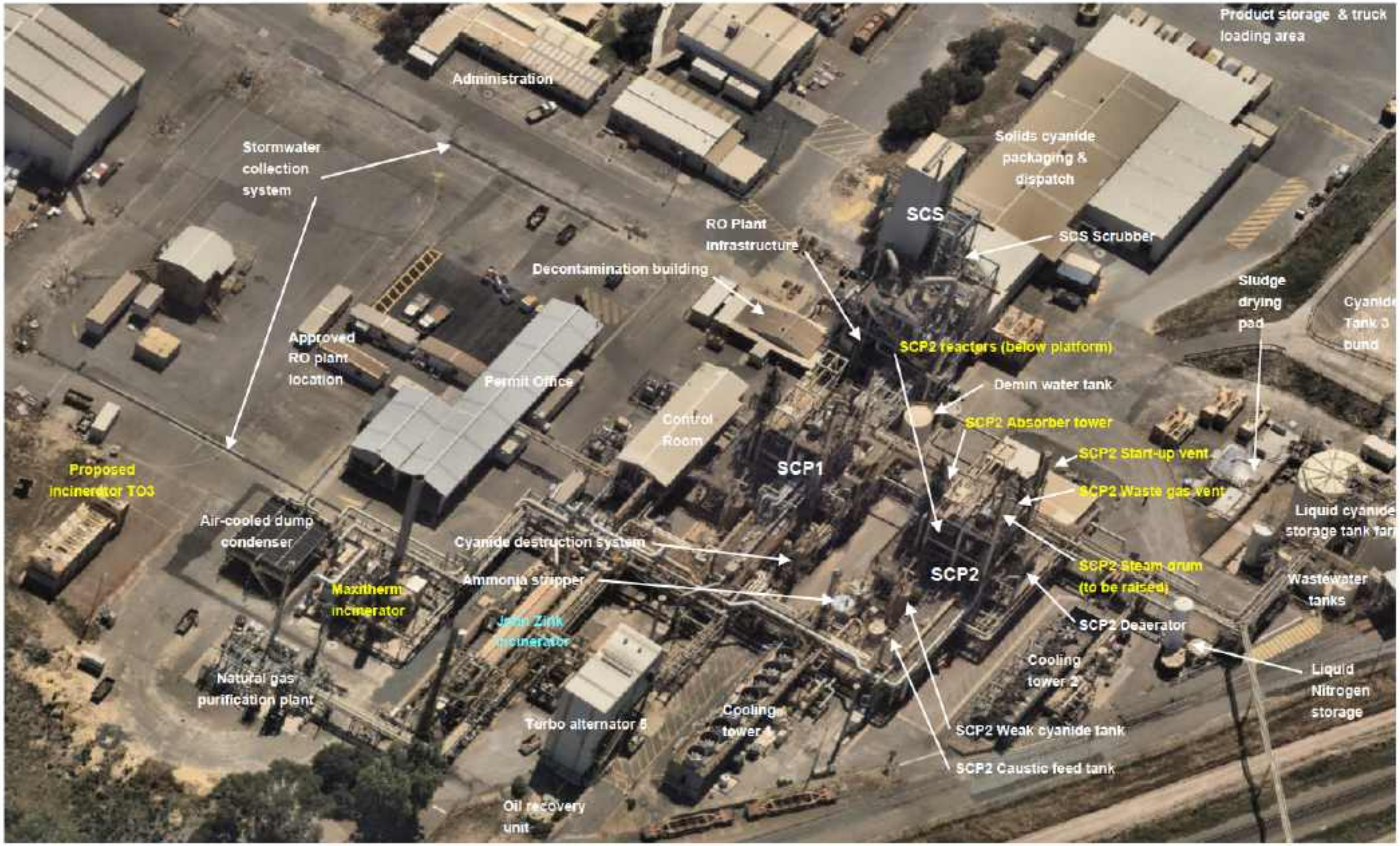


Figure 6: Sodium Cyanide Plant key components identification (white items existing, yellow items form this application, blue items Stage 1 amendment)

Figure 7: 1Air emission discharge locations (current and proposed).

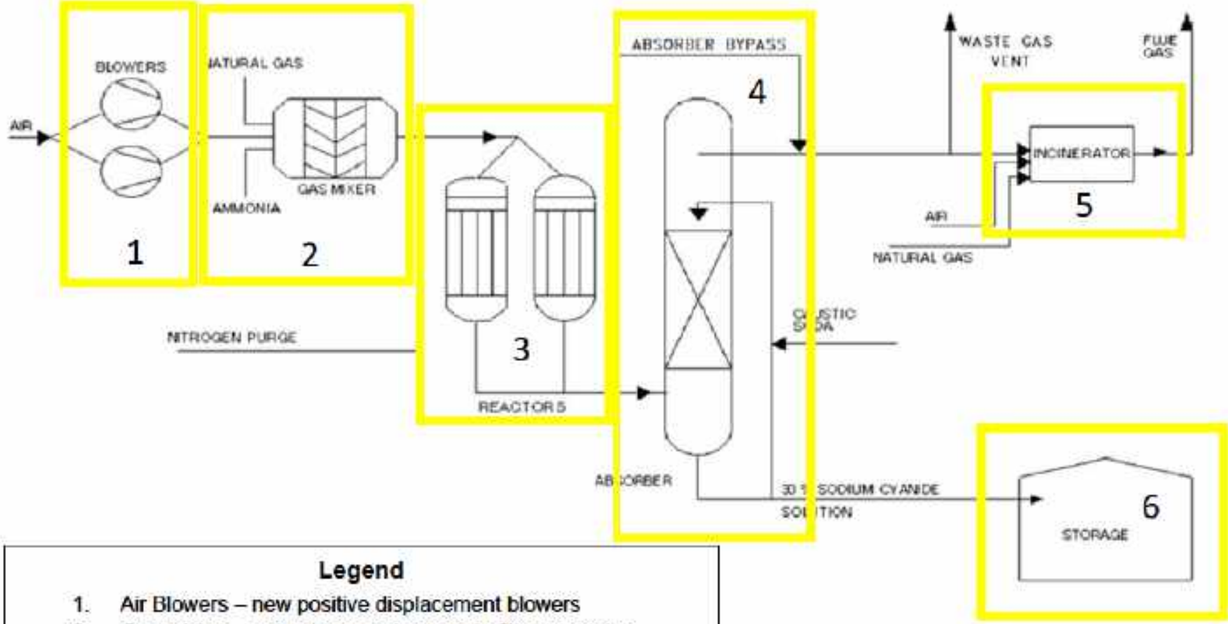
5. PROPOSED ACTIVITIES

This application will require modification to existing infrastructure, and new infrastructure to debottleneck the SCP2 manufacturing process, similar to upgrades to SCP1 (approved for Stage 1 under W6952/2024/1). Stage 2 includes a new JZ TO3 incinerator to replace the existing Maxitherm incinerator. A Stage 1 amendment will be submitted to modify the existing JZ incinerator. Total NaCN production will increase from 170,000 tpa to 210,000 tpa – consisting of 150,000 tpa liquid production (up from 110,000 tpa) and 60,000 tpa solid production (unchanged).

A detailed description of the current manufacturing process is provided in Appendix 4.

5.1 NaCN manufacturing infrastructure

The following key components are being upgraded as part of this proposal. The proposed infrastructure modifications are described in Table 5 in italics, and in Section 5.2.



Legend

1. Air Blowers – new positive displacement blowers
2. Gas mixing – natural gas and ammonia filter upgrades, mixed gas filter removal
3. Reaction system – modification for positive pressure operation, steam drum elevation
4. Absorption – optimisation of absorber tower packing
5. Incineration – new incinerator, incineration of process start-up gases
6. Product Storage – new 5,400m3 product tank

Figure 8: Process Flow Diagram of upgraded Sodium Cyanide Manufacturing process (SCP2)

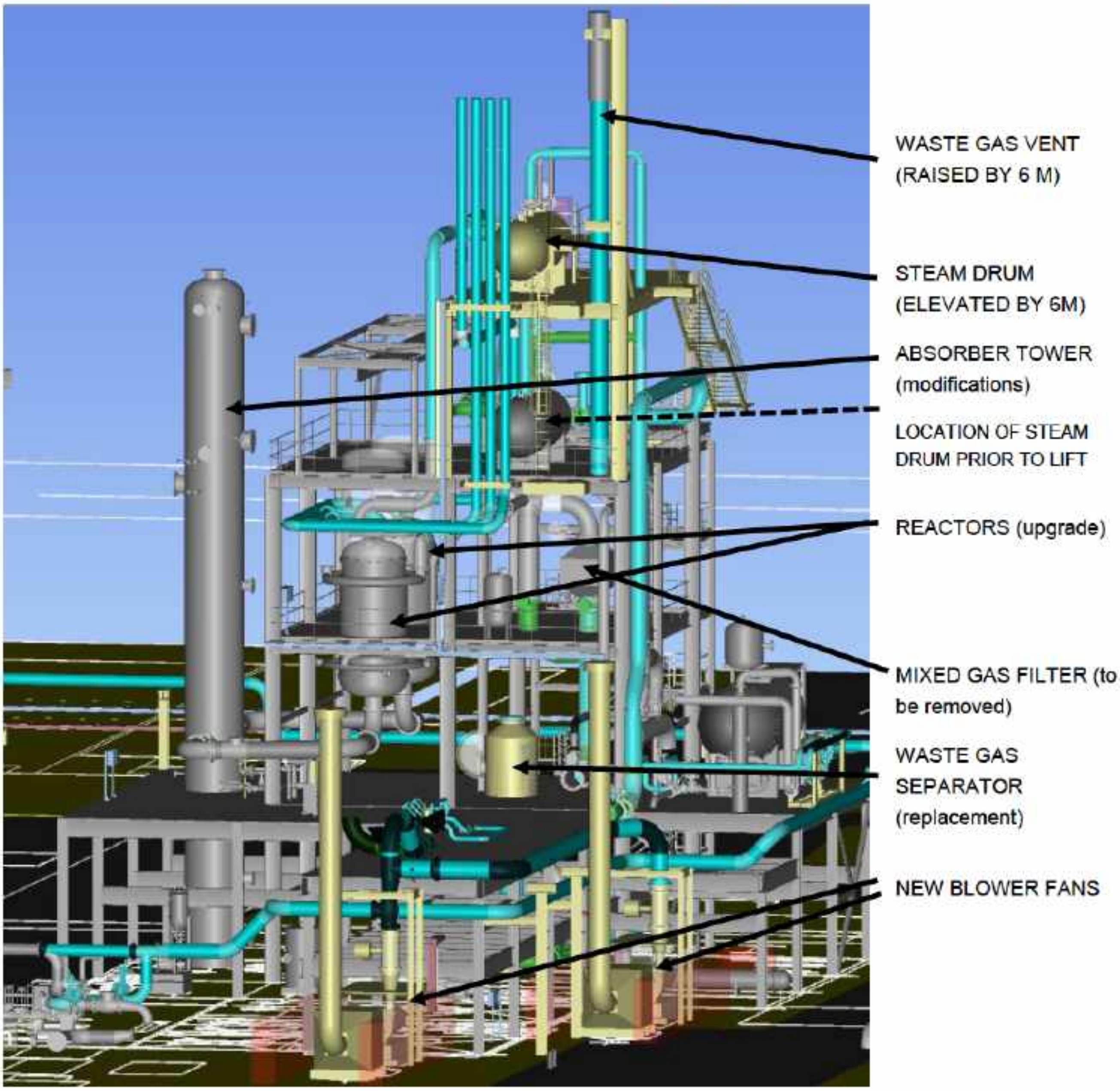


Figure 9: 23-D visualisation of SCP2 major component upgrades (from south, looking north)

Table 5: Key NaCN manufacturing infrastructure (and modifications in italics)

Component	Detail	Function	Site plan
Components of each of the Sodium Cyanide (liquid) Plants (SCP1 and SCP2)			
Gas mixing	Gas mixing includes the following subsystems and processes: • air sub-system, • NH_3 sub-system, • natural gas sub-system, and • mixed gas mixing and filtering.	NH_3, CH_4, and air is combined and blended for HCN production. Feedstock gases require filtering and preparation to achieve the required temperatures and pressures in the correct ratios. For SCP2: • In the current air subsystem, air is drawn into the process by the suction blower situated after the absorber tower. Airflow is measured and recorded. It passes through the air filter and air heater before flowing to the gas mixer. Air pressure can be boosted using fans on the intake to the plant, to reduce plant differential pressure and increase gas density at the suction of the blowers. • Ammonia, supplied as a high pressure liquid, is vaporised and pressure reduced before a controlled quantity enters the gas mixer. • Natural gas is used for two purposes - as a process raw material, and as fuel for the incinerator. Natural gas may be supplied from the Dampier to Bunbury Natural Gas Pipeline (DBNGP), from Wesfarmers LPG via PL57 gas pipeline, or the ATCO connection. It is pressure controlled before use. • The precisely ratioed flow of air, ammonia and natural gas are mixed and filtered before passing to the reactors. All particulate matter is removed from the mixed gas stream to avoid fouling the catalyst gauze or blocking the protective quartz wool layers in the reactor. The filter is a single pass, multi element type with removable filter elements (similar to filters used in large building air conditioning units). *Modifications will include* *a. natural gas and ammonia filter installation upgrades for SCP2 (similar to that installed in SCP1) to provide greater capacity for the expansion flow. See section 5.2.1 for modification details.* *b. The Auxiliary / Mixed Gas Filter – remove and replace with fully welded pipe spool as existing filter is not rated for pressurised operation.* *c. Air Heater – existing casing to be removed and replaced as the air heater is not rated for pressurised operation.*	Fig 5 Item 1 (SCP1) Item 2 (SCP2) Fig. 11 *Within SCP2* *Fig. 11*
Reaction system:	SCP2 has two reactors which operate in parallel. Four components in the reaction system: • gas distribution, • reaction, • quenching (rapid cooling), and • low pressure steam generation.	Production of HCN gas by reacting natural gas, NH_3 and air on a platinum-rhodium gauze catalyst. The catalyst consists between 6 to 11 layers of 90% platinum and 10% rhodium fine wire gauze supported on a strong, coarse, stainless steel wire mesh. Nitric acid reactors combust ammonia into NO_2 at c.900ºC by using a Pt/Rh catalyst. This is done below the LEL of ammonia (14%) using catalyst, typically at 10% NH_3. Cyanide reactors use the same reaction outside the flammability limits to partially oxidize NH_3 to NO, which then reacts with methane (CH_4) in subsequent catalyst layers.	Fig. 5 Item 1 (SCP1) Item 2 (SCP2) Fig. 11

Component	Detail	Function	Site plan
		Product gases are then quenched by heat transfer in a boiler, producing LP steam. It is necessary to quench the gases from the catalyst gauze as quickly as possible to about 250 ^{O}C as HCN decomposes at higher temperatures. At lower temperatures in the gas phase (below 150 ^{O}C), HCN tends to polymerise forming an unreactive, plastic-like dark brown solid (polymerisation is promoted by the presence of free NH_3). *SCP2 modifications will replicate modifications approved for SCP1 in W6952/2024/1. This will include* *a. elevation of the steam drum and modification of the reactor for positive pressure. See section 5.2.2 for modification details.* *b. The reactors will be modified to accommodate automated ignitors.* *c. The bursting disc discharge lines will be rerouted to a safe location. The discharge lines shall be sized to enable sufficient relief volume.*	*Within SCP2* *Fig. 17*
Absorption:	Absorption of HCN occurs in two stages in the absorption tower. • main absorption, and • fine absorption.	HCN gas is converted into NaCN solution with the addition of caustic soda (NaOH) solution and water through a recirculation process. For complete absorption of HCN, NaOH must be present in excess – pH of 11 to 12 (approximately 0.4% free NaOH) is maintained in the solution from the absorber. The purpose of the main absorption stage is to absorb the bulk of the hydrogen cyanide from the reaction gases. The main absorption stage consists of the following processes: • Absorption of HCN. • Control of NaOH addition. • Control of temperature and concentration of circulating cyanide solution. • Control of quantity of circulating and product cyanide solution. In the subsequent fine absorption stage (weak stage), the last traces of HCN are removed. *Modifications will include* *a. the optimisation of internal packing for the SCP2 absorber tower to improve production capacity and mass transfer (as approved for SCP1 in W6952/2024/1). See section 5.2.3 for modification details.* *b. The size of the waste gas separator will be increased for the increased flow* *c. Caustic Preheater – existing heat exchanger to be replaced with a new larger heat exchanger for the increased flow.*	Fig. 5 Item 1 (SCP1) Item 2 (SCP2) Fig. 11 *Within SCP2*
Main blower system:	The main blower system consists of the following components and processes:	SCP2 still currently operates under vacuum conditions. The vacuum is supplied by the suction effect of the main air blowers (located within enclosed building), which are positive displacement rotary blowers.	Fig. 5 Item 1 (SCP1) Item 2 (SCP2)

Component	Detail	Function	Site plan
	• droplet removal, • main blowers, • control of plant throughput, and • waste gas disposal (see next row).	The purpose of the main blower system is to: • draw gases through the plant, • control the quantity of gas drawn through the plant, and • raise the pressure of the waste gas so that it can be sent to the incinerator. Gas from the absorber contains droplets carried from the fine absorption stage which must be removed before being drawn into the blowers where the droplets may damage blower rotors. The droplets are removed by passing the gas through the waste gas separator. This centrifugal separator spins the gas as it enters, throwing the droplets against the walls where they come together and fall to a drain. The pressure drop across the separator is monitored, alarming when excessive. The drain runs into the waste gas separator drain pot. This vessel also collects the drainage from the waste gas bypass cooler and sample points within the plant. The main blowers are positive displacement, variable speed rotary blowers. a. *Two new air-blowers will be installed for SCP2 (same as approved for SCP1 under W6952/2024/1). New blowers will operate in tandem to achieve the required air flow of 34,000 Nm^3/hr (combined) and positive pressure in the plant.* b. *The existing suction blowers will be removed (redundant). See section 5.2.1.2 for modification details.*	Fig. 11 *Within SCP2*
Incineration (Waste gas discharge)	For SCP1 – John Zink incinerator – dual stage incinerator: reduction and oxidation stages	Under normal conditions waste gas flows to the incinerator where it is burned with natural gas and air. Waste gases can be directed to either incinerator through a common header; this is done as far as reasonably practicable. The low NO_x (Licence limit <5 g/s) flue gases are directed to atmosphere via the ~30.5 m high incinerator stack. During the incineration process any HCN is destroyed and ammonia vaporiser sludge incinerated. a. *The Maxitherm incinerator will be decommissioned after commissioning of the new TO3 incinerator is complete, and completion of the John Zink incinerator upgrades and maintenance.* The existing John Zink incinerator will be optimised (debottlenecked) as part of the expansion upgrade, and will be included as an amendment to the existing Stage 1 approval W6952. This will involve • additional air capacity with a new larger 24,341 Nm^3/hr capacity fan • modification of the waste heat recovery unit (WHRU) to enable the additional energy to be transferred into the steam produced to sustain the existing power generation.	Fig. 5, Item 4a.
	For SCP2 – Maxitherm incinerator – selective catalytic reduction (SCR) utilising vanadium catalyst		Fig. 5, Item 5a. *Within SCP2*

Component	Detail	Function	Site plan
	John Zink Thermal Oxidiser (TO3) Incinerator, with a 31.7 m high flue stack	*As part of this application, the Maxitherm incinerator will be replaced with a new larger John Zink Thermal Oxidiser (referred to as TO3) for the incineration of waste gases (primarily from SCP2). TO3 will reduce carbon emission intensity and process start-up gases. Refer to section 5.2.4.1* *The new TO3 incinerator will include:* *a. Natural gas (fuel) burner and pilot to provide heat for waste gas combustion* *b. Burner chamber where the first stage of waste gas combustion occurs* *c. Horizontal NOxIDIZER chamber, including selective non-catalytic reduction utilising ammonia for NOx control during start-up* *a. a reduction chamber,* *b. a quench stage and* *c. reoxidation chamber* *d. Self-supported 31.7 m tall refractory lined vent stack directing emissions to atmosphere* *e. Feed gas knock-out (KO) drum with internals and liquid discharge pump to remove entrained droplets in the waste gas feed stream* *f. Reoxidation fan, maintaining the required chemistry to minimise NOx formation* *g. Combustion air fan, providing air to the combustion process* *h. Instrumentation, including vent stack continuous emissions monitoring system (CEMS)* *i. Burner management system, providing safety and control functions* *j. Burner and pilot fuel natural gas skid, and instrument air skid* *k. Refractory-lined duct connecting the incinerator to the vent stack (holder for future waste heat recovery unit)* *Environmental Commissioning - A commissioning plan will be developed and provided to DWER 3 months prior to the anticipated commissioning date of the new incinerator.* *Time Limited Operations – Time limited operations under the Works Approval will be required for TO3.* A waste heat recovery unit may be installed (future application) for TO3 later to enable harvesting of waste heat for steam production and power generation through a new turbine alternator (TA10). This is expected to produce in the order of 8-11MW of electrical power.	*Fig. 5, Item 24* *Fig. 12, 13, 14, 16 & 18*
	SCP1 and SCP2 start-up stack	Venting of start-up gases. *a. An absorber by-pass line will be installed enable incineration of SCP2 start-up gases rather than direct venting to atmosphere.*	Fig. 5, Item 6 a & b *Within SCP2*
	SCP1 and SCP2 waste gas vent stack	Venting of shut-down gases. When it is not possible to burn the waste gas (e.g. incinerator trips /, incinerator off line for short periods), it is vented to atmosphere via the >30m tall waste gas stack.	Fig. 5, Item 7 a & b.

Component	Detail	Function	Site plan
		a. *The height of the SCP2 waste gas stack will be increased by 6 m, primarily to improve work safety on the elevated platform due to the height of the boiler steam drum. This increase will also enhance dispersion of gaseous emissions to be compliant with API 521 Standard (relieving of pressure vessels).*	*Within SCP2*
Product storage and handling			
Liquid cyanide storage tanks	*New 5,400 m^3 NaCN storage tank (TK-04) located in an appropriately sized bund with integrated sump and pump.*	*Additional liquid NaCN storage capacity (TK-04), to be located directly north of the existing storage TK-03, and of increased dimensions for greater storage capacity.* a. *initial design allows for 19 m diameter with 20 m side wall height, of 316 stainless steel construction.* b. *Secondary containment dimensions: initial design allows for 48 m x 48 m x 2.5 m, of reinforced concrete construction*	*Fig. 5, Item 25* *Fig. 15*
Supporting infrastructure			
Utilities	Pipe work	Integrates cyanide operations, provides ammonia from CSBP, natural gas from Wesfarmers LPG (Kleenheat) via a dedicated pipeline, and caustic soda from Coogee Chemicals. Connects plant areas, transports sodium cyanide in liquid form, and chemicals utilised in the manufacture of sodium cyanide. a. *New pipe racks will be installed to connect new equipment to existing infrastructure.*	*Within SCP2*
	Control room, master control centres and plant instrumentation	Operational control systems and instrumentation to monitor and control plant functions, and for motor control. a. *New and modified equipment will be integrated into the existing process control system.*	Fig. 5, Item 15 *Within SCP2*

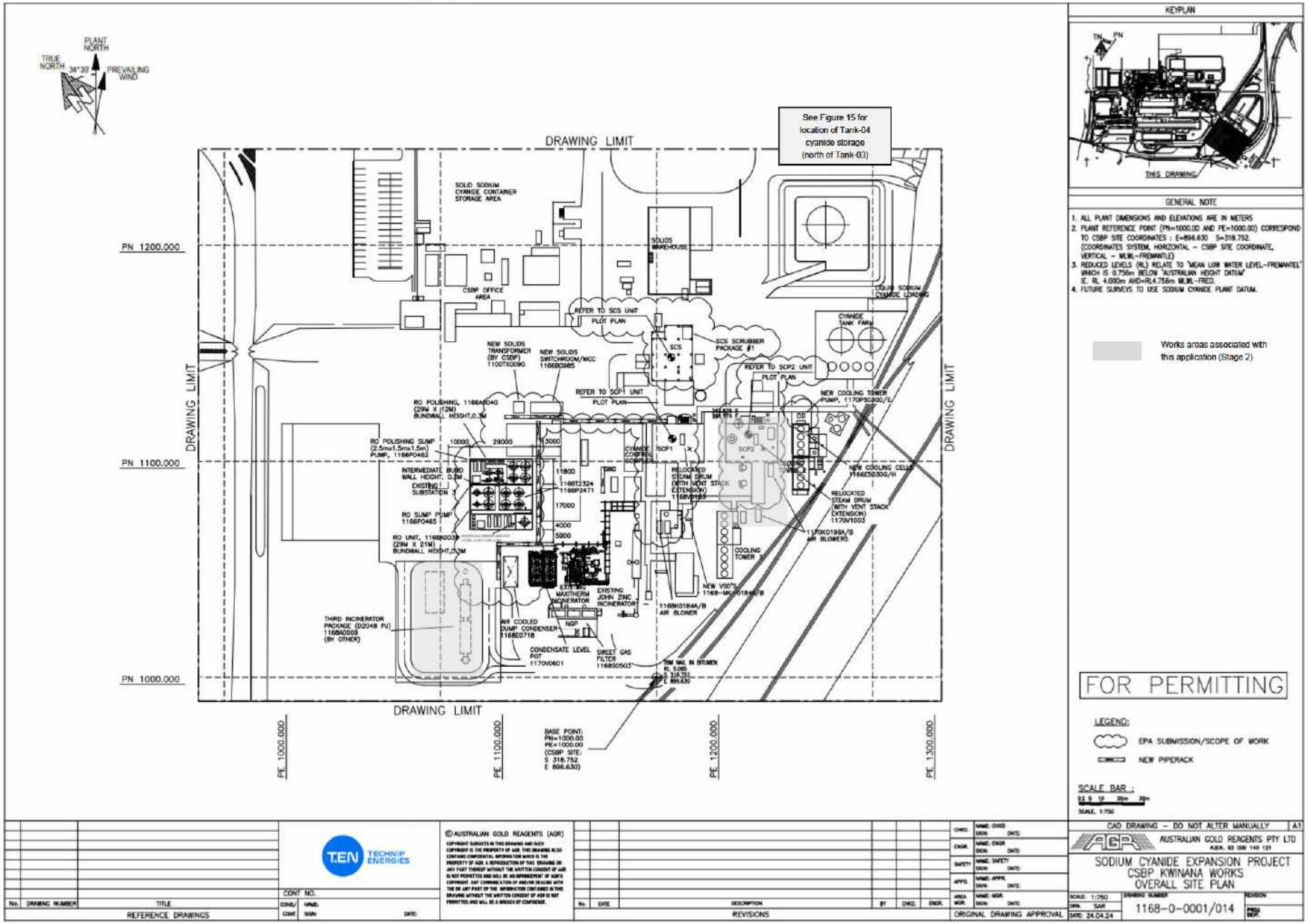


Figure 10: Sodium Cyanide Manufacturing facility plot plan of proposed plant upgrades.

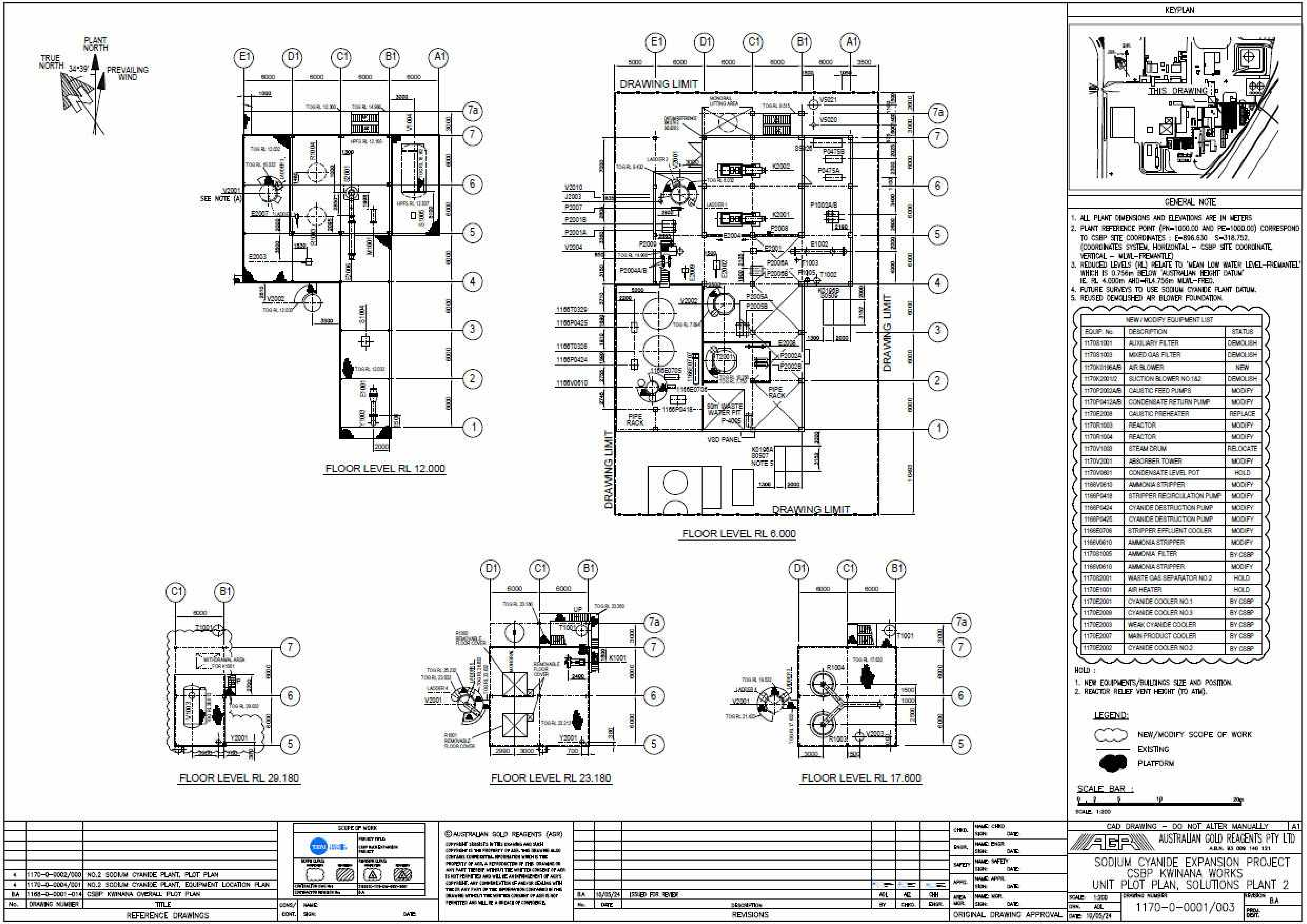


Figure 11: lot plan for SCP2 works

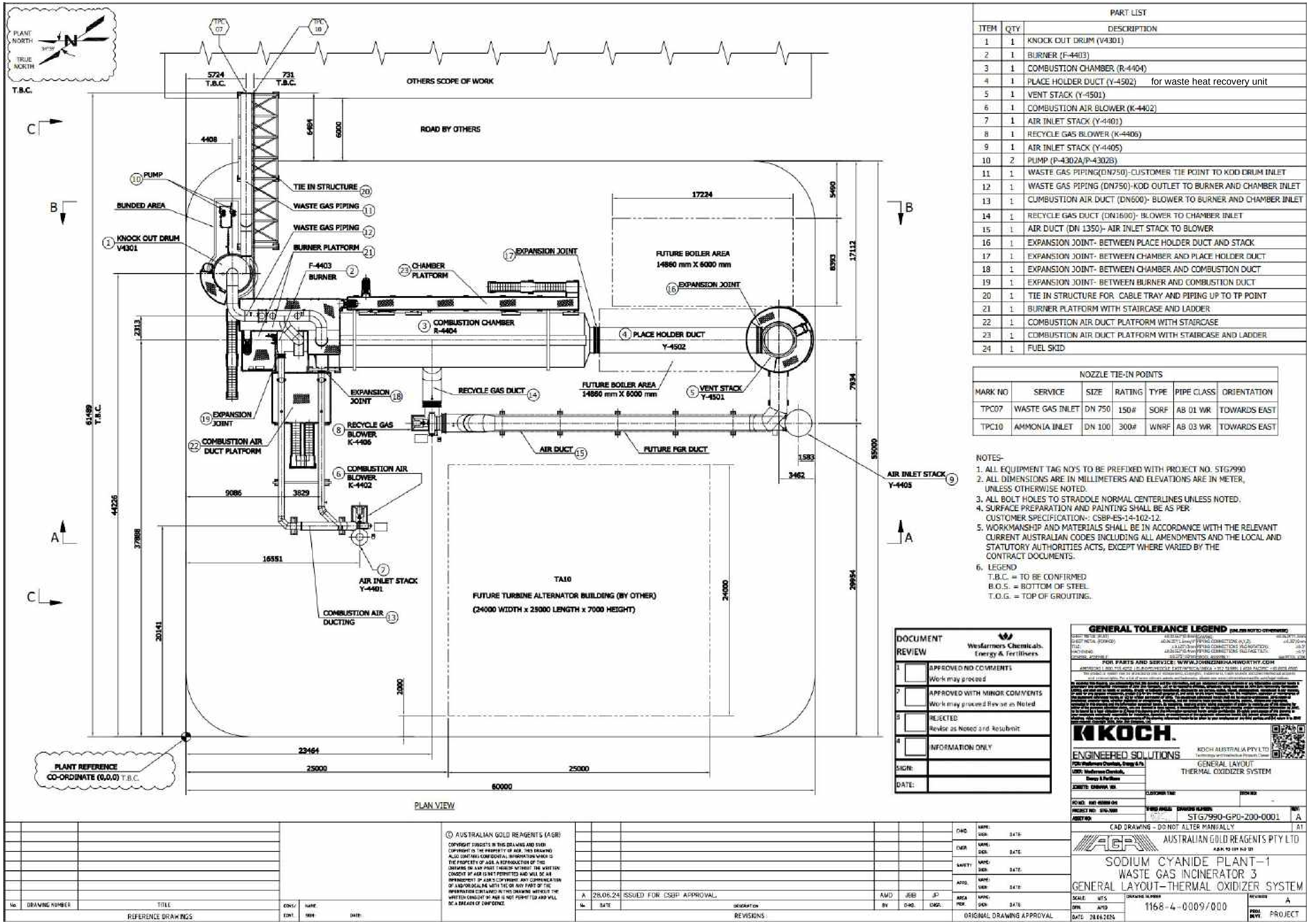


Figure 12: Thermal Oxidizer (TO3) general layout (top view)

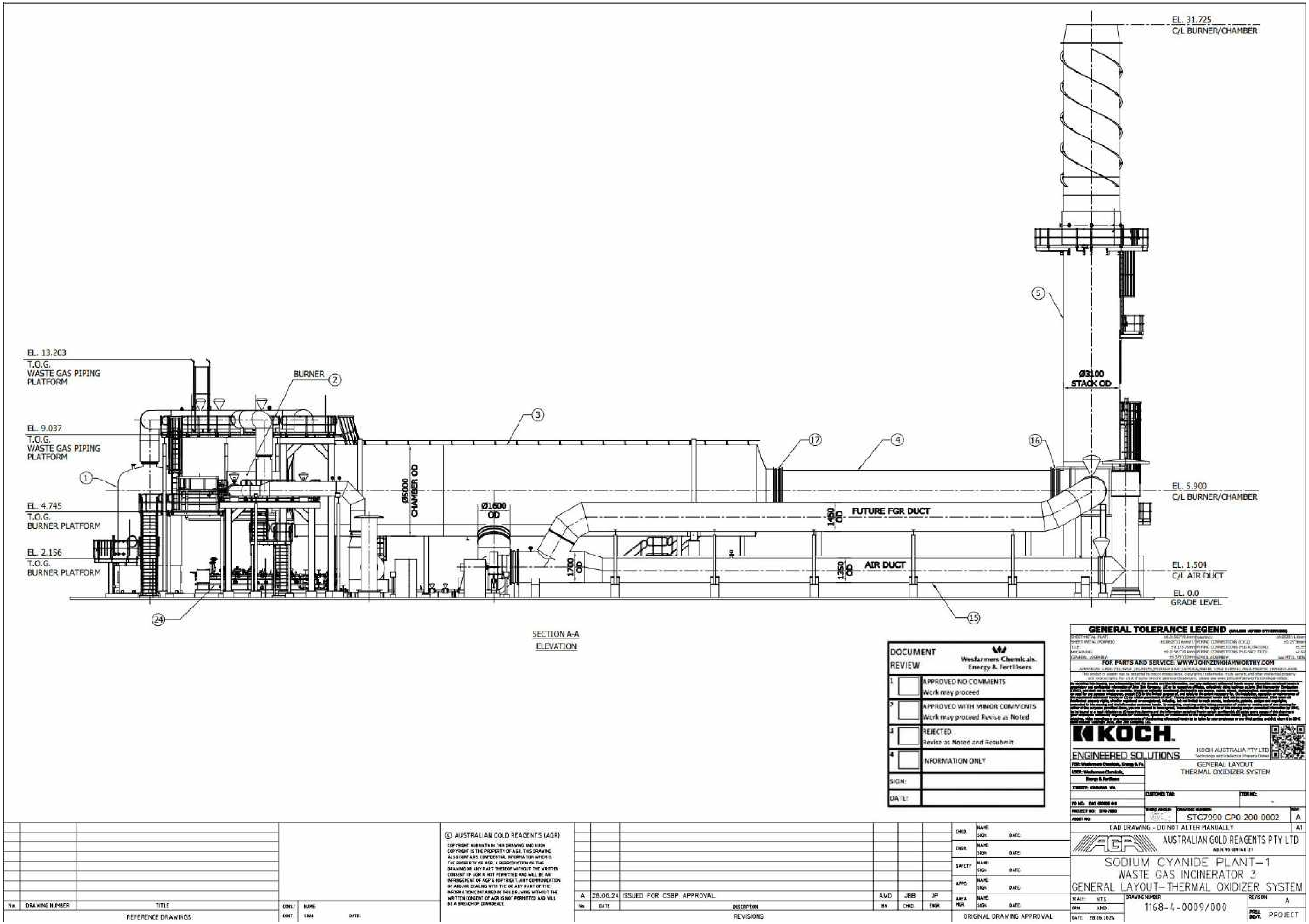


Figure 13: Thermal Oxidizer system general layout (side view)

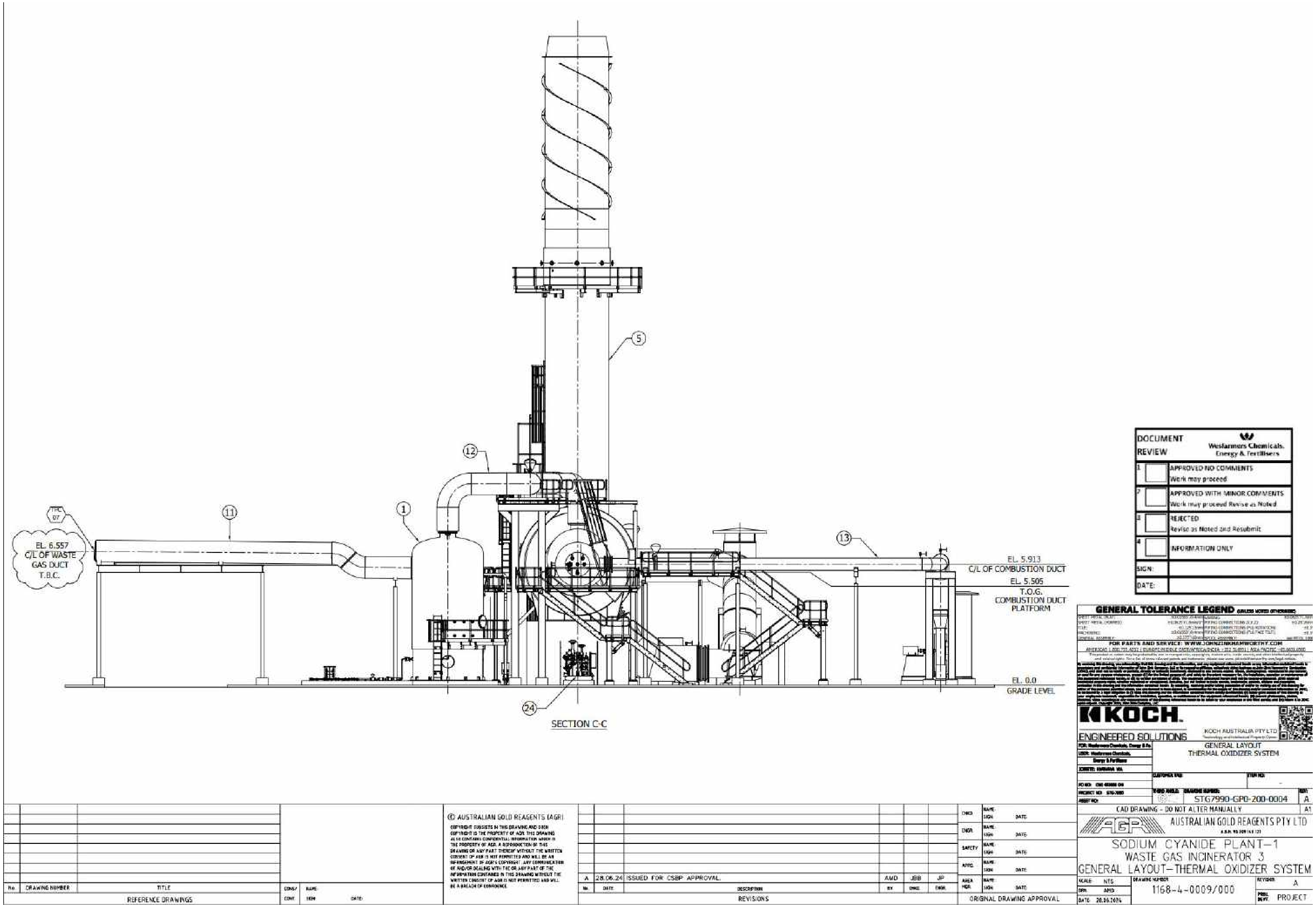


Figure 14: 3Thermal Oxidizer system general layout (side view)

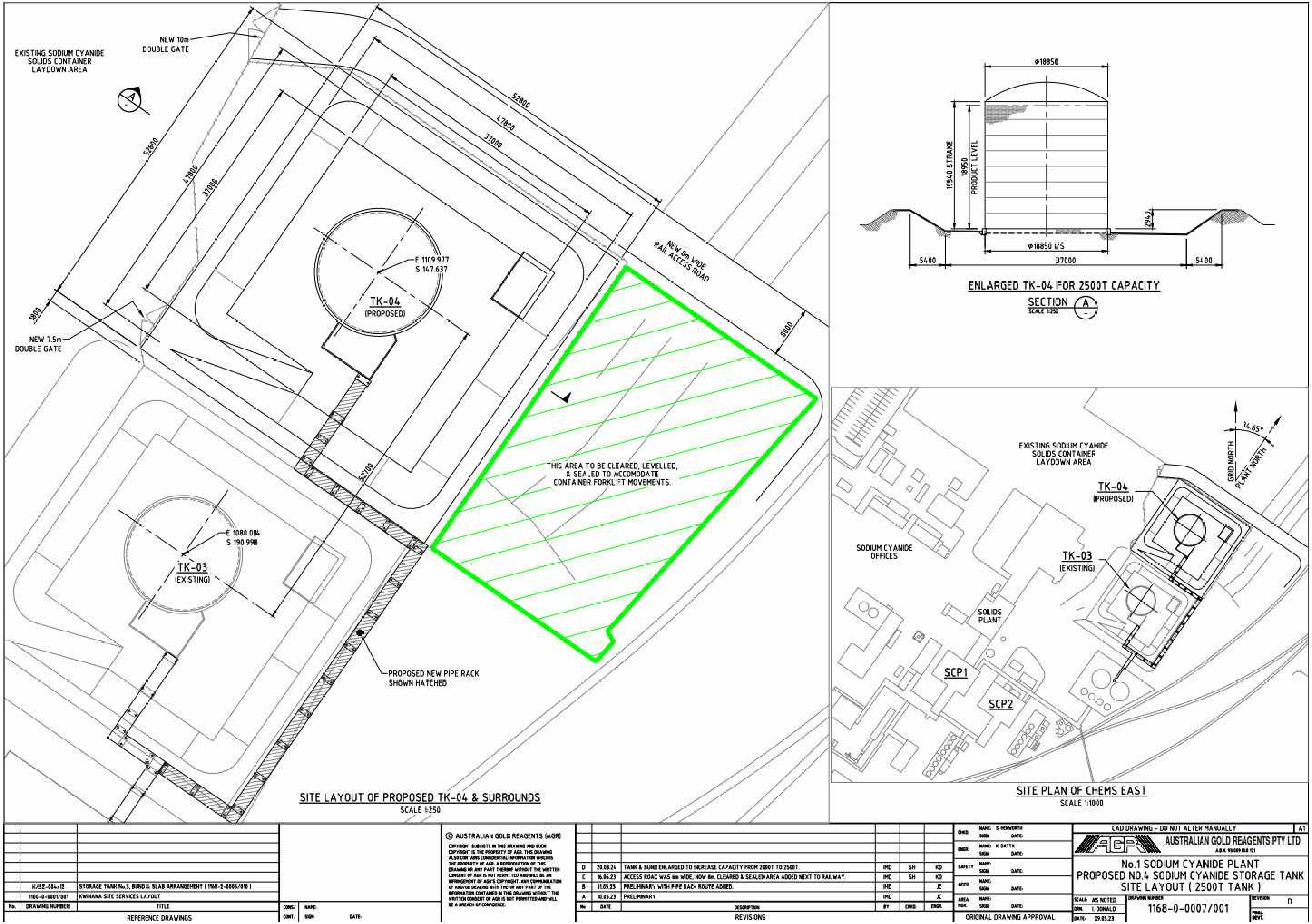


Figure 15: K-04 liquid sodium cyanide storage general layout

5.2 Description of proposed works

This application proposes to install new and modify existing equipment to debottleneck/ optimise SCP2, to enable an increase in total liquid NaCN production capacity from 110 ktpa to 150 ktpa. The modification will bring total combined production capacity to 210ktpa in accordance with MS1196 authorised production of a combined 255 ktpa. The modifications to plant and equipment are identified in Table 5 and detailed in sections below.

The SCP2 upgrades replicate those approved for SCP1 (W6952/2024/1 granted 1 April 2025), and also include replacement of the SCP2 waste gas incinerator. Upgrades to the existing SCP1 John Zink incinerator will be included as part of an amendment to the W6952 Stage 1 works approval. These works have also been assessed by the EPA and approved in MS1196 (27 August 2024). An updated plot plan showing the location of all emission points is presented in Figure 16.

A new emission point will be created by the installation of the TO3 incinerator. During commissioning, there will be a period during which both the existing Maxitherm and new TO3 are operating concurrently (transition phase). After commissioning of the TO3 is complete, and maintenance and upgrades to the existing JZ incinerator are also completed, the Maxitherm will be decommissioned.

Earthworks will involve building up and shaping the NaCN storage TK-04 bund area. No deep excavation is proposed. Shallow excavations (mostly less than one metre) will be limited to preparation of foundations for the air filters and air blowers. The TO3 incinerator will be built upon a new elevated pad.

No groundwater, acid sulphate soils or contaminated soils are expected to be intersected. Ground water below the site is >3 mbgl. Soils excavated will be stockpiled on a hardstand area, sampled and disposed of or relocated in accordance with internal procedures to meet regulatory requirements.
The increased storage capacity of TK-04 will assist to manage the additional product manufactured.

Construction and modifications to the plant will be completed during both day and night shifts. Tie-ins of new equipment will take place primarily during scheduled shutdowns. The NaCN manufacturing process remains unchanged. Management of waste will continue unchanged. Additional water usage and wastewater generation will be offset by recently approved water treatment capacity and return wastewater volumes generated to similar to levels prior to commencement of Stage 1 upgrades, which has been adequately managed by the CSBP combined water treatment system.

Figure 164: Plot plan of site identifying discharge point at the SCMF after upgrades have been completed

Air emissions will change as a result of this proposal. Air quality investigations have demonstrated that the proposal will not cause unacceptable concentrations or impact to receptors.

Sequencing and commissioning of incinerator works are provided in Section 5.3.

5.2.1 GAS MIXING

5.2.1.1 NATURAL GAS AND AMMONIA FILTER

As part of the pressurisation modification, gas filters will operate on each individual feed line for air, natural gas and ammonia, and no longer as a mixed feed. The air-stream will first be filtered by a three-stage HEPA air filter at the inlet to the air blowers. It is proposed that Ammonia and natural gas will now be filtered by new in-stream filters, the same as SCP1.The existing mixed gas stream filter will be removed as it is not suitable for pressurised operation.

The natural gas filter will have a maximum flow rate of 6,500 Nm^3/hr. The ammonia filter will have a maximum flow rate of 6,500 Nm^3/hr. The feed gases are precisely flow ratioed and fed into the gas mixer before passing to the reactors.

5.2.1.2 AIR BLOWERS

The existing air boost fan on SCP2 will be replaced with two new pressurised blowers operating in tandem to achieve the required air flow and operating pressure in the plant. The air intake will be ~12 m above ground level.

Each blower will have a capacity when operating in tandem of 17,000 Nm^3/h each (combined flow of 34,000 Nm^3/h). They will sit in a similar location to the existing boost fan (to be removed) at the southern end of SCP2. Oxygen (as air) is required so that combustion may achieve the required reaction temperature. A higher air supply pressure is required to convert the reactors to pressurised operation. This will result in the plant running at 30-50 kPag positive pressure measured at the reactor.

5.2.2 REACTION SYSTEM

5.2.2.1 STEAM DRUM ELEVATION

In the reaction system, HCN is formed at high temperatures. To prevent decomposition of HCN and the associated yield losses, the reaction products must be quickly cooled by rapid heat removal. This is achieved in an integral shell-and-tube heat recovery boiler mounted directly to the reaction section. Absorbed heat generates low pressure steam in the shell of the reactor with the steam collecting in the steam drum.

The existing SCP2 steam drum will be elevated by 6 m on a new pre-assembled platform to be established on top of the existing steam drum platform (as approved for SCP1 in W6952/2024/1). The raised steam drum will provide additional circulating driving force within the boiler system to remove the additional heat generated by the increased HCN production. This will also require the raising of the SCP2 waste gas stack by a similar distance to ensure personnel safety in the immediate area and compliance with the relevant API 521 standard (relieving of pressure vessels). This also has the benefit of improving gas dispersion from the waste gas stack.

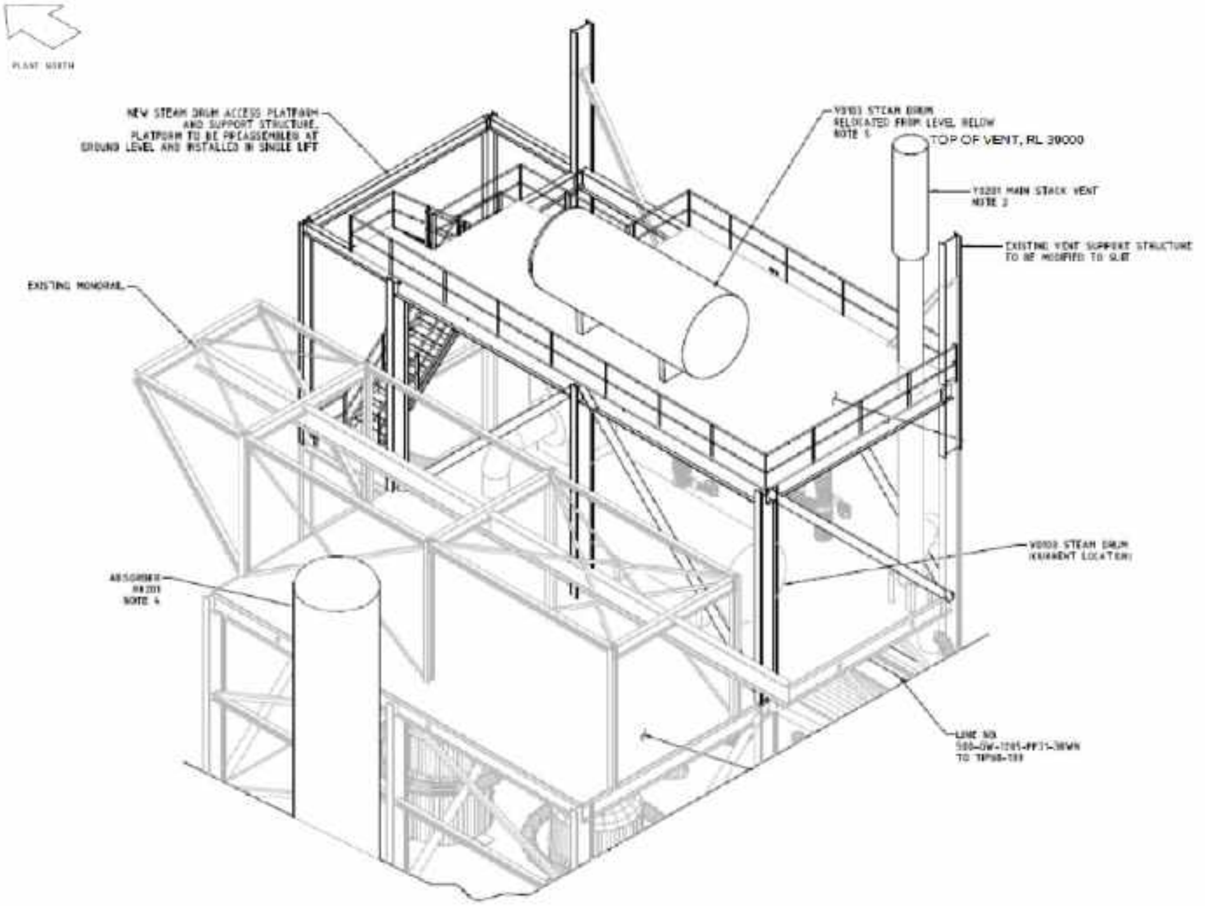


Figure 175: Isometric view of elevated steam drum

5.2.2.2 REACTOR MODIFICATION

The existing SCP2 reactors will be modified for positive pressure and to minimise the risk of process leaks downstream of the HCN reaction gauzes (as approved for SCP1 in W6952/2024/1).

Flanged connections will be minimised so far as practicable by replacing flanges with welded sections and high integrity gaskets. Pipework downstream of the reactor-boiler and prior to the absorber will also be redesigned to reduce the number of possible leak points. A new reactor ignition system will be designed to ignite the reaction under pressurised conditions. HCN gas detection will be stationed in the vicinity of the reactors in order to detect and warn of any possible leaks.

5.2.3 ABSORPTION

5.2.3.1 SCP2 ABSORBER TOWER

Consistent with the previous SCP1 approval, the existing SCP2 structured internal packing will be upgraded to increase production and mass transfer capacity. For the SCP2 absorber to operate efficiently, new higher capacity packing is required to optimise the conversion of HCN into NaCN product .

The waste gas separator will be resized to match increased production capacity. The caustic feed pump capacity will be increased to meet expansion case flow; and the existing caustic preheater will be replaced with a new larger heat exchanger to accommodate increased flow.

5.2.4 INCINERATION

5.2.4.1 TO3 INCINERATOR

The Maxitherm Incinerator will be replaced with a horizontal configuration John Zink patented Noxidizer technology incinerator (TO3) as part of the proposal. The horizontal design will allow for the future installation of a waste heat recovery unit (WHRU) upstream of the vent stack. A refractory-lined duct will be installed between the combustion chamber and the stack to allow for the future tie-in of the WHRU. The general layout for TO3 is presented in Figure 12 , Figure 13 and Figure 14.

The Noxidizer is effective at incineration of nitrogen-bound waste gases, whilst limiting NOx and N_2O formation. This is achieved in a three-stage combustion process. TO3 has a design waste gas flow rate of 60,000 Nm^3/hr, which will also accommodate increased start-up gas flows.

The Incinerator will include the following components:

- Fuel gas burner and pilot
- Burner chamber
- Horizontal NOxIDIZER chamber, consisting of a reduction chamber, a quench stage and reoxidation chamber

- Self-supported 31.7 m tall vent stack
- Feed gas knock-out (KO) drum with internals and liquid discharge pump
- Flue gas recirculation fan
- Combustion air fan
- Instrumentation, including stack continuous emissions monitoring system (CEMS)
- Burner management system
- Burner and pilot fuel gas and instrument air skid

A simplified flow path of the TO3 operation is illustrated Figure 18.

The three-stage combustion technology includes:

(1) Reduction Zone (oxygen deficient environment) - provide a high temperature, sub-stoichiometric environment for the reduction of the chemical compounds. This forces the formation of diatomic nitrogen (N_2) instead of NOx due to the absence of excess oxygen. This stage forms standard combustion products but without any free oxygen, also forms hydrogen (H_2) and carbon monoxide (CO) – which are subsequently combusted in the Re-oxidation stage. A forced draft high intensity gas burner will be used to provide heat for warm-up and fuel to maintain the combustion chamber operating temperature.

(2) Quench Zone (cooling) - prevents N_2 converting back to NO_X at high temps in presence of oxygen (ie. thermal NO_X). This is accomplished through the addition of air (or cooled flue gas recirculation with WHRU installed).

(3) Re-Oxidation Zone (oxygen rich environment) - provides the final removal of the H_2 and CO that was generated in the Reduction Stage. The Re-Oxidization Stage receives quenched gases from the Quench Stage at a temperature well above the ignition temperature of the H_2 and CO in the stream. Oxygen, in the form of ambient air, is injected into the quenched gas stream. This mixture is then allowed the required residence time to provide final burnout of the H_2 and CO in the gas stream. The final flue gas exiting the Re-Oxidization Stage is typically designed for two to three per cent oxygen content.

(4)

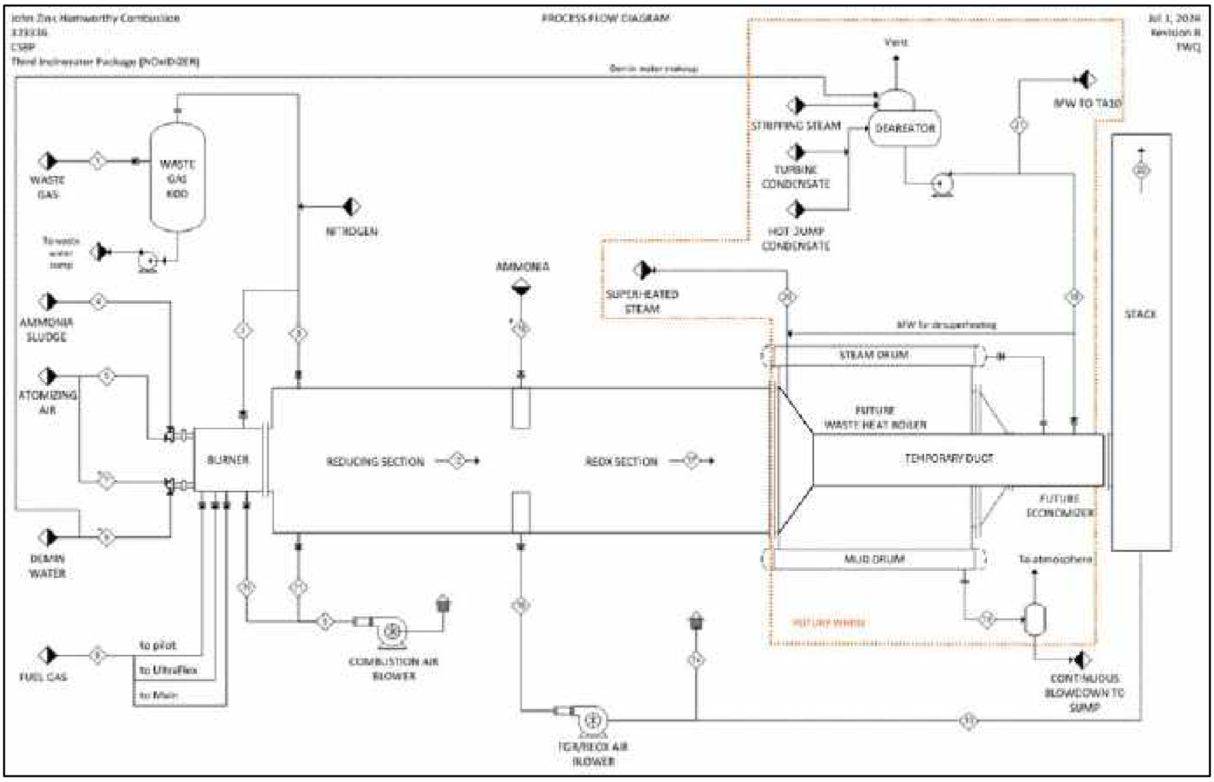


Figure 18: Simplified flow diagram of TO3 operation

A knock-out drum (KOD) installed upstream of the burner will remove entrained liquid droplets in the waste gas feed stream.

The TO3 design includes selective non-catalytic reduction (SNCR) with ammonia for NOx control during the start-up of SCP2 when high NOx is generated in the NaCN plant. Ammonia gas will be injected into the Reoxidation section of the thermal oxidiser chamber, after the combustion gases have cooled to react with NOx to form molecular nitrogen (N2) and water. Excess air is provided by the Reox Fan in the Reox section to ensure any excess ammonia is combusted.

The TO3 will provide increased combustion capacity and avoid N2O formation, which is currently produced as a byproduct by the Maxitherm Incinerator's SCR vanadium pentoxide catalyst NOX control. This will result in a significant improvement in CO_2-e emissions intensity from the Facility.

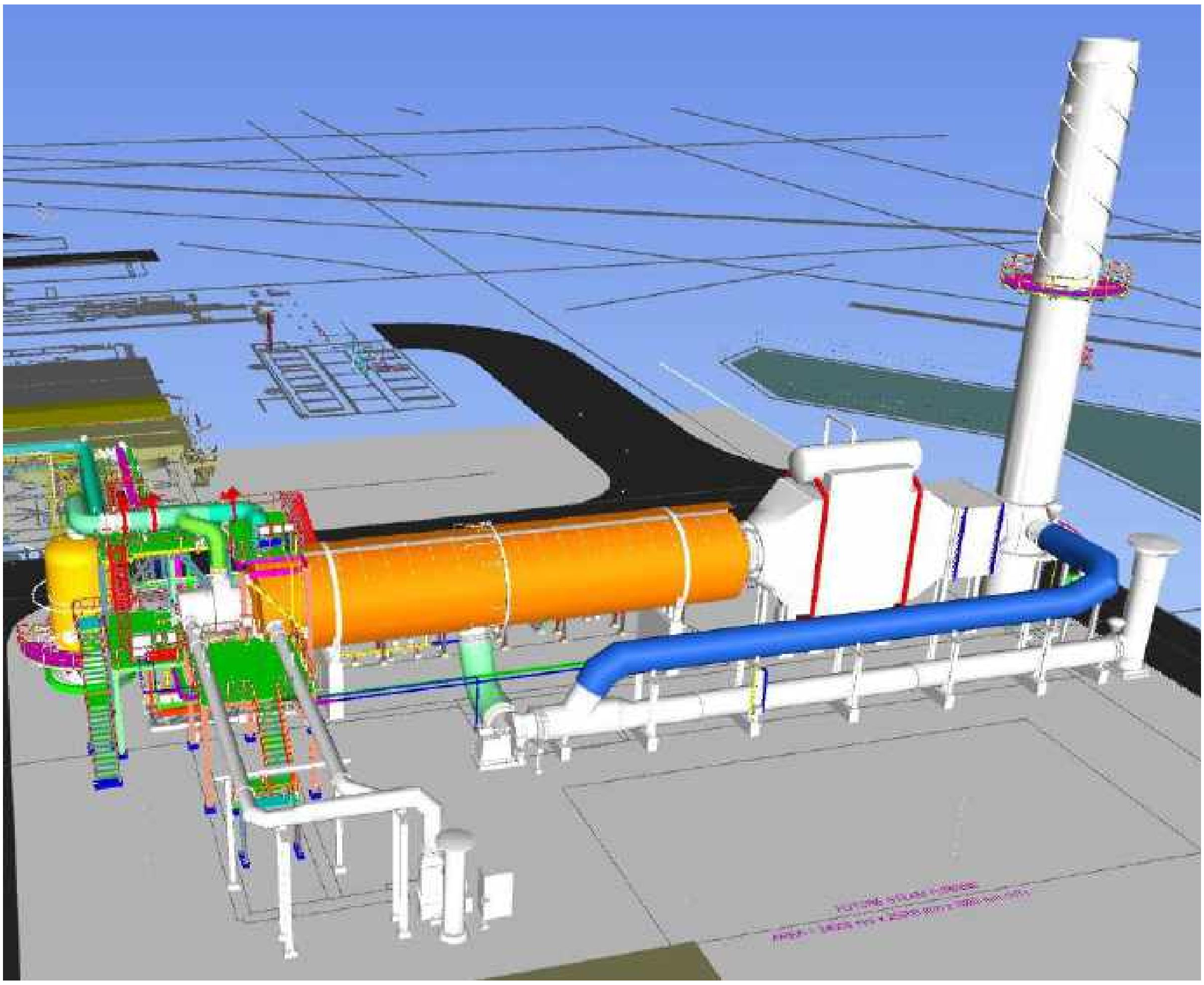


Figure 19: 3-D illustration of TO3 and future WHRU

The TO3 design is capable of incinerating 70kg/hr of ammonia sludge (composition is 70 per cent ammonia, 30 per cent water with traces of oil). The ammonia sludge is a waste product generated in the NaCN plant from the vaporisation of liquid ammonia. The ammonia sludge is atomised at the TO3 burner head and combusted together with the waste gas.

An interconnecting crossover line between SCP1 and SCP2 exists to allow waste gas to be fed to any incinerator. This interconnection will be continue to feed TO3 and JZ when the Maxitherm is decommissioned.

All package control, monitoring and safeguarding shall be integrated into the existing process control and safety instrumented systems.

The new TO3 incinerator is designed to achieve the following limits:

Table 6: TO3 Pollutant maximum concentration limit

Pollutant	Max concentration limit
Ammonia (NH_3)	<0.6 g/s
Nitrous Oxide (N_2O)	<10 ppm
Nitrogen Oxides (NO_X)	<10 g/s
Hydrogen Cyanide (HCN)	<0.35 g/s

Note the NOx emissions are based on an operating time of 95 per cent of the previous 12 months. For the remaining 5 per cent of time, short term peaks of 24 g/s is allowable for the TO3.

A commissioning plan will be provided to DWER at least three months prior to commissioning, outlining the steps for transition of emissions from the Maxitherm Incinerator to TO3, through to Maxitherm decommissioning.

5.2.4.2 UPGRADES TO EXISTING JOHN ZINK INCINERATOR

Upgrades to the existing John Zink incinerator will be completed under an amendment to the existing Works Approval W6952.

5.2.5 PRODUCT STORAGE AND HANDLING

5.2.5.1 TANK 4 (TK-04)

As part of this approval, AGR propose to construct an additional NaCN storage tank (TK-04), and continue to meet the site NaCN storage requirements.

TK-04 will be located directly north of the existing storage TK-03, and of increased dimensions for greater storage capacity. It is expected to be 19 m in diameter, with a 20 m side wall height, and constructed of 316 Stainless steel.

TK-04 will have secondary containment bunding constructed of reinforced concrete, of approximately 48 m x 48 m x 2.5 m. It will be designed to AS/NZS 4452 -1997 (The Storage and Handling of Toxic Substances). Figure 15 presents the proposed layout.

5.2.6 SUPPORTING INFRASTRUCTURE

5.2.6.1 PIPE WORK

New pipe racks will be installed to connect new equipment to existing infrastructure. The pipework will integrate cyanide operations - ammonia from CSBP, and natural gas from Wesfarmers LPG (Kleenheat) for cyanide production via a dedicated pipeline, and caustic soda from Coogee Chemicals. The pipe racks will connect plant areas, transport sodium cyanide in liquid form, and the various chemicals used for the manufacture of sodium cyanide.

5.2.6.2 CONTROL ROOM, MASTER CONTROL CENTRE AND PLANT INSTRUMENTATION

New and modified equipment will be integrated into the existing process control system.

Operational control systems and instrumentation will be installed to monitor and control plant functions, and for motor control.

5.3 Commissioning

5.3.1 SCP2 PLANT COMMISSIONING

Construction and modifications to the plant will be completed during both day and night shifts. Tie-ins of new equipment will take place primarily during scheduled shutdowns and no specific environmental commissioning of SCP infrastructure will be required, other than the waste gas incinerator TO3 installation (section 5.2.2).

The upgraded SCP2 plant will able to send start-up gases to the new TO3 incinerator prior to atmospheric discharge.

5.3.2 WASTE GAS INCINERATOR COMMISSIONING

The commissioning of equipment associated with the waste gas treatment system will be executed in a staged manner to ensure operational continuity and system integrity. The following sequence outlines the planned activities:

(1) Commissioning and Testing of TO3

The TO3 unit will be installed and subjected to a comprehensive testing phase to verify its functionality and performance.

(2) Refurbishment of Existing JZ Unit

The existing JZ unit will be taken offline for maintenance overhaul and refurbishment. During this period, waste gases will be directed to the Maxitherm and TO3 units to maintain waste gas treatment capacity.

(3) Reinstatement of JZ Unit

Upon completion of maintenance and refurbishment, the existing JZ unit will be reinstated and operated in conjunction with the TO3 unit, and combined system performance assessed.

(4) Decommissioning of Maxitherm

The Maxitherm unit will be decommissioned once stable and reliable operation of both the TO3 and JZ units has been demonstrated.

The estimated timeframe for the stages of commissioning of the waste gas treatment systems are detailed below.

Table **7:** Commissioning Timeframes

STAGES	TIMEFRAME	NOTES
1. Commissioning and Testing of TO3	Nov 2026 – Feb 2027	Completion of installation by Oct 2026

2. Maintenance of existing JZ Unit	Mar 2027 – Sep 2027	Assumed 6 months for maintenance and refurbishment works
3. Reinstatement of existing JZ unit	Sep 2027 – Nov 2027	Demonstration of waste gas incineration capacity
4. Decommissioning of Maxitherm	Dec 2027	Dependant on achieving stable operation from TO3 & JZ

An environmental commissioning plan will be developed for the TO3 Incinerator, focusing on verifying stack emissions during both normal operations and reactor start-up phases. Emission testing will follow regulatory authority methods to ensure compliance.

The testing will follow the incinerator vendor guidelines and aim to verify the vendor performance guarantee, including that the incinerator will:

- Operate under all foreseeable start-up, normal, and design conditions.
- Accept feed streams as specified in the Basis of Design.
- Treat waste to meet disposal quality standards.
- Operate within specified utility, chemical, and consumable usage limits, subject to agreed deviations.
- Maintain ground-level toxic concentrations within recognized health and environmental limits.

The testing will verify that the incinerator operates over an established operating timeframe, e.g. three months of normal operation, within the atmospheric emission limits, as described in Section 5.3.

Normal operation includes start-up using waste gas treated by upstream absorbers, excluding reactor start-up gases.

5.4 Proposed Time Limited Operations

Time Limited Operations will be for a period of 18 months to allow for commissioning of the new TO3 incinerator, and maintenance of the existing John Zink incinerator (see Table 7). This will then enable the decommissioning of the Maxitherm incinerator to occur.

Table 81: Proposed Emission Limits – Normal Operations – Total Cyanide, HCN & NH3

23Parameter	Licensed Emissions (g/s)					
	John Zink		TO3 Incinerator		Solid Plant Stacks	
	Limit	Target	Limit	Target	Limit	Target
Total Cyanide	N/A	N/A	N/A	N/A	0.3	0.2
Hydrogen Cyanide (HCN)	0.3	0.21	0.5	0.42	N/A	N/A
Ammonia (NH_3)	N/A	0.60	N/A	1.2	N/A	1.5

Note:

N/A = emission rates not specified.

Table 94: Proposed Emission Limits – Normal Operations – NOx

Parameter	Licensed Emissions (g/s)
	John Zink & TO3 Incinerator
	Limit[1]
Nox equal to or more than 95% operating time over the previous 12 months	15
Nox equal to or less than 5% operating time over the previous 12 months	36

Note

1. Combined total Nox emissions rate from both incinerators during normal operations (note: these license limits do not apply during start-up operations).

6. EMISSIONS & DISCHARGES

AGR submitted a request to amend MS1196 under section 45C of the EP Act on 3 November 2023. The EPA assessed impacts to air quality as a key environmental factor in their assessment of the proposed AGR expansion. In their *Notice of Decision to consent to Amend an Approved Proposal and Implementation Conditions without inquiry for MS1196*, dated 27 August 2024, they recognised that the air quality modelling was conservative and indicated that it is a unlikely that atmospheric emissions would result in exceedances of established air quality criteria at any sensitive receptors during both normal and upset conditions.

The notice of decision also identified that the AGR site is licensed, and emissions and discharges from the facility into the atmosphere (and marine environment) can continue to be managed under the Licence issued under Part V of the EP Act.

No significant emissions have been identified with the construction/installation of the required infrastructure within the existing plant premises. Installation and tie-ins will occur during routine and planned maintenance and shutdown periods.

Earthworks will be required for the formation of the new NaCN product tank (TK-04) and for the development of foundations for new equipment. Each of the activities will be of a short-term duration and will be managed to minimise fugitive dust emissions.

6.1 Air Emissions

AGR requested that MRP Technical Consulting Pty Ltd ("MRP") undertake an assessment (Appendix 1) of the air quality impacts associated with the proposed upgrade of the Facility's liquid and solid sodium cyanide plants reflecting the execution strategy of the expansion. The air quality assessment considers cumulative impacts which include the existing regional sources in conjunction the proposed new plant operations at all potential nearby receptors. To facilitate the cumulative impacts of other existing/approved regional sources in the region, all other significant sources of the pollutants of concern in the Kwinana Industrial area, both current and approved to be developed were included in the modelling

The key gaseous compounds emitted from the SCMF that may impact air quality are:

- NOX (NO and NO2) from the incineration of process gas;
- NH3 and HCN from process gas; and
- Particulate emissions from the solids plant.

The existing operations and the expansion has the potential to impact human health via emissions to air causing a reduction in ambient air quality. Ammonia is an acute toxicant and produces irritant effects on mucous membranes. Nitrogen dioxide acts systematically on the respiratory system affecting lung function, exacerbating respiratory disease, and triggers asthma. Hydrogen cyanide is a systemic toxicant that affects the central nervous, cardio-vascular and respiratory systems.

6.1.1 AMBIENT AIR QUALITY CRITERIA

Section 4.1 of the Air Quality Assessment Report (MRP, 2025, Appendix 1) describes the criteria used in the assessment. The criteria is derived from the DWER draft Guideline: Air Emissions (DWER, 2019), which includes ambient air quality guideline values (AGVs) applicable to the SCMF operations.

The Air Quality NEPM 2021 as described by MRP 2025 also defines current air quality standards for criteria pollutants, including carbon monoxide, nitrogen dioxide (NO_2), photochemical oxidants (as ozone), sulphur dioxide, lead, and particulates (as PM_{10} and $PM_{2.5}$). The NEPM criteria were used where the NEPM supersedes the DWER guidance. The ambient air quality criteria used is presented below.

Table 105: Ambient air quality guideline value (AGV) criteria (Appendix 1 - MRP 2025)

Compound	Averaging period	Concentration ($\mu g/m^3$)[1]
NO_2	1-hour	151
	Annual	28
NH_3	1-hour	330
	Annual	70
HCN	1-hour	200
	24-hour	9.2
	Annual	0.73

Notes

1. Referenced to 25ºC, and 101.3 kPa.

6.1.2 EMISSIONS LIMITS

The proposed limits for normal operations used in the assessment are based on design and established criteria; these are presented in Table 11 (Section 4.2 of MRP, 2025, Appendix 1). It is proposed that these limits be applied in the subsequent licence amendment.

Table 116: Normal operations proposed emission limits (g/s)

Compound	Units	John Zink (JZ)		TO3		Combined JZ & TO3 limit	Solid Plant	
		Limit	Target	Limit	Target		Limit	Target
Total cyanide	g/s	n/a	n/a	n/a	n/a	n/a	0.3	0.2
Hydrogen Cyanide (HCN)	g/s	0.3	0.21	0.5	0.42	n/a	n/a	n/a
Ammonia (NH_3)	g/s	n/a	0.6	n/a	1.2	n/a	n/a	1.5
NO_X ≥ 95 % (combined)	g/s	n/a	n/a	n/a	n/a	15	n/a	n/a
NO_X ≤ 5 % (combined)	g/s	n/a	n/a	n/a	n/a	36	n/a	n/a

The proposed emission limits and targets for HCN are expected to be reduced in the Licence to align with revised ambient air quality standards.

The proposed NH_3 and NO_x emission limits for TO3 are based on vendor guarantees and will require an amendment to the current Licence limits.

The proposed NO_X values are reflective of the combined current licence limit for JZ (5 g/s) and the TO3 vendor guarantee (10 g/s), and considers the ability of NO_X to be routed through either incinerator if necessary. This represents normal operations ≥ 95 per cent of the operating time over previous 12 months. NO_X emissions limits for ≤ 5 per cent of the operating time over the previous 12 months is restricted to 36 g/s, derived from the existing 12 g/s for the John Zink incinerator and the 24 g/s TO3 (vendor guarantee). It is anticipated that emission levels will be below these limits.

6.1.3 AMBIENT AIR QUALITY

Oxides of Nitrogen

The local airshed receives pollutants from multiple industry sources in the KIA. The local air quality, including NO_2 concentrations, is monitored at the DWER Rockingham and South Lake air quality monitoring stations, located approximately 3.5 km to the southwest and approximately 14 km to the northeast of the Facility respectively. A DWER monitoring station is also located at Wattleup; however, the station only monitors sulphur dioxide. DWER Air Quality Branch preferentially relies on the South Lake data for the KIA air quality assessment as it aligns with the prevailing winds, despite its increased distance and proximity to the Kwinana Freeway where traffic emissions could be detected.

DWER air quality data is made publicly available in an annual air quality report. The most recently available data (2022 calendar year at the time of the assessment for EPA approval, which has been used in this application for consistency) for NO_2 measured at South Lake is presented in Table 12. The 75th percentile measured NO_2 concentration data (35.8 μg/m³) has been used as the background for the assessment of cumulative impacts (MRP, 2025).

Table 127: 2021 DWER background concentrations - South Lake Monitoring Station (referenced to 25°C, and 101.3 kPa)

Compound	Averaging Period	Concentration (ppm)	Concentration (μg/m³)
NO_2	75th percentile 1-hour	0.019	35.8
	Annual	0.006	11.3

NO_2 sources associated with EP Act approved projects that are yet to be commissioned have been considered, to determine future indicative background concentrations and cumulative impacts.

Ammonia

MRP 2025 established ammonia concentrations measured in the locality during three monitoring campaigns conducted by DWER for the Background Air Quality Study (BAQS).

The highest 1-hour average NH_3 concentration (118 μg/m³) recorded at the Wells Park receptor during DWER's 2013-2014 monitoring campaign, was applied as the background at all receptors. This approach enables a conservative assessment of short-term cumulative impacts of the proposed upgrades on ambient NH_3 concentrations at receptor locations.

Similarly, the highest annual average NH_3 concentration (17 μg/m³ recorded in 2005-2006 BAQS) has been used to assess the predicted long-term cumulative impacts.

Hydrogen Cyanide

Ambient HCN monitoring undertaken by AGR in accordance with the requirements of MS 700 (preceding Ministerial Statement 1196 for AGR) did not detect background concentrations useful for an air quality assessment. AGR is the principal source of HCN.

6.1.4 AGR AIR EMISSIONS

Normal Operation

During normal operation, air emissions are directed to the atmosphere in accordance with the EP Act Licence.

Air pollution controls in the Licence specify continuous monitoring for SCP1 and SCP2 incinerator stacks for oxides of nitrogen (NO_X). The Licence also requires quarterly manual stack testing be undertaken for:

- NH_3 and HCN for the SCP incinerators; and
- NH_3 and total cyanide testing be completed for the solids plant stack.

AGR complies with the current production and licence emission limits. Discharge to air monitoring results undertaken in accordance with the Licence are presented in Figures 20, 21 and 22 as an indicator of compliance.

Under normal operating conditions, minor fugitive emissions may also occur from the venting of vessels and process equipment prior to maintenance activities. These are controlled in accordance with industry standard procedures to minimise the volume of gases emitted and any potential occupational health and safety or environmental impacts. Fixed gas monitors will be installed within SCP1 and SCP2 to continuously monitor for HCN, CH4 and NH3. The SCS has existing monitors for HCN only. Additionally, site personnel are equipped with personal gas monitors to detect process gases, when required.

Start-ups

Currently, start-up emissions of HCN and NH3 from SCP1 and SCP2 are released via the dedicated start-up stacks (also referred to as vent stacks). Only one liquid plant is in start-up at any time and this will not be changed.

SCP1 and SCP2 start-up venting is currently restricted, according to the prevailing wind speed and direction, as specified in Condition 11 of the Licence. The start-up regulatory controls were implemented to ensure favourable meteorological conditions enabled adequate dispersion of emissions to mitigate impacts at nearby receptors. The frequency of start-ups is not expected to be impacted by the expansion project.

As part of this submission, management of emissions from start-up will be improved by the upgrades via addition of an absorber bypass to convey start-up emissions (NOx, HCN and NH3) to the incinerators for destruction (as approved by MS1196) as opposed to existing venting. Start-up gases will be incinerated which will reduce risk of unacceptable exposure of NH3 and HCN at receptors that had previously led to start-up weather restrictions being imposed.

In the event that the downstream incinerator trips during the start-up process, gases will be discharged from the existing “shut-down stack” (also referred to as vent stack), in line with condition 1(b) of the Licence.

Waste gas venting and shut down

Waste gas venting occurs when SCP1 and SCP2 are running and the incinerators are not operational (i.e. are down for emergency maintenance or an incinerator trip). In these events, scrubbed gases downstream of the absorber are vented to atmosphere via the waste gas vent. When this occurs, production throughput is automatically reduced by 30 to 50 per cent to the capacity of the online incinerator, and nearby industrial receptors are notified to reduce the potential impacts associated with venting of NH3 and HCN. The installation of the combined header to the incinerators has allowed emissions from either plant to be diverted to the running incinerator. Venting occurs while transition of waste gas to the operating incinerator occurs. This combined with management of production rates to remain within the combustion capacity of the operating incinerator, will result in a reduction in venting hours compared to prior years.

Plant shutdowns (planned and plant trips) are not expected to increase due to the Stage 2 expansion. During any shutdown, the plant downstream of the gas mixer through to the reactors, absorber column and the shutdown stack are purged with excess N_2. The process takes approximately eight minutes, during which the absorber remains operational. The emissions profile reflects shut-down emissions across approximately two to three minutes.

The proposed NO_X values are reflective of the combined current licence limit for JZ (5 g/s) and the TO3 vendor guarantee (10 g/s) and, considers the ability of NO_X to be routed through either incinerator if necessary. This represents normal operations ≥ 95 per cent of the operating time over the prior 12 months. NO_X emission limits (<5 per cent of the operating time over the previous 12 months) is restricted to 36 g/s, derived from the existing 12 g/s for the John Zink incinerator and the 24 g/s TO3 (vendor guarantee). It is anticipated that emission levels will be below these limits.

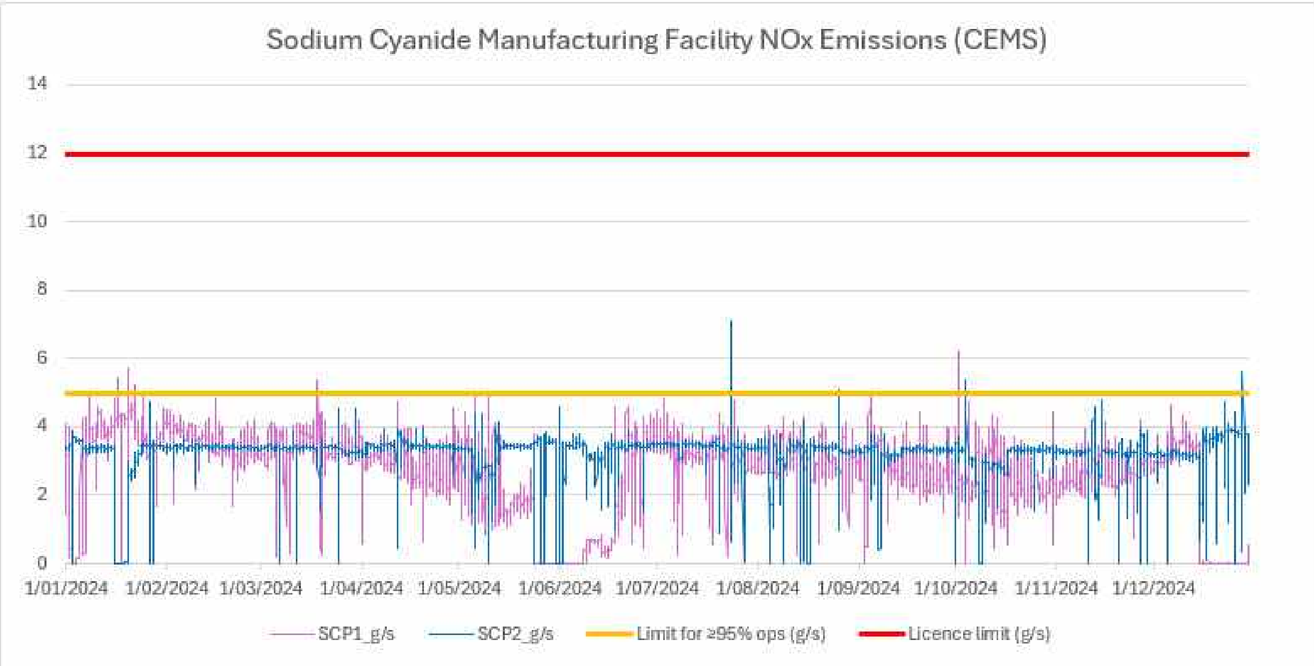


Figure 206: Current Nitrogen oxide emissions (CEMS) at 136 ktpa NaCN production capacity (combined)

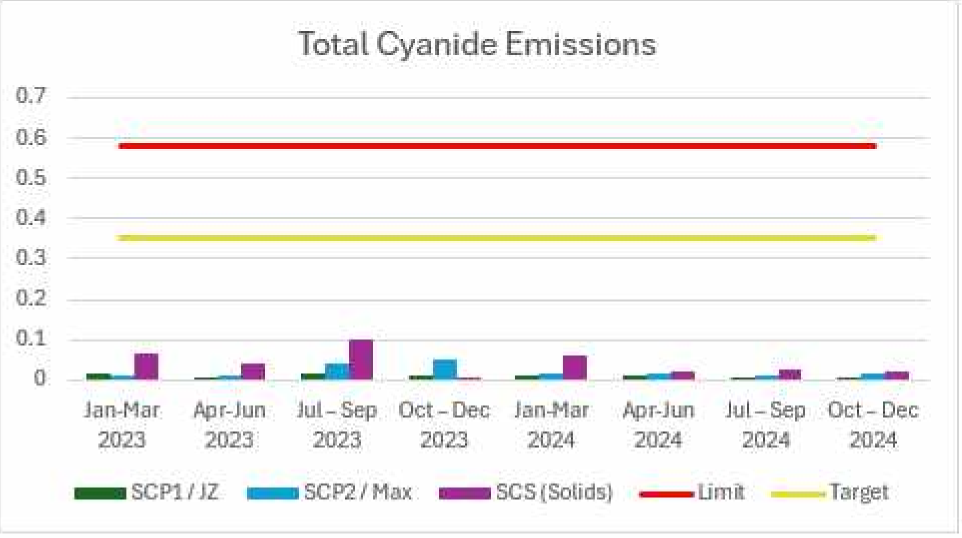


Figure 217: Recent Sodium Cyanide Manufacturing Facility (SCMF) cyanide emissions at 136 ktpa NaCN production capacity (combined)

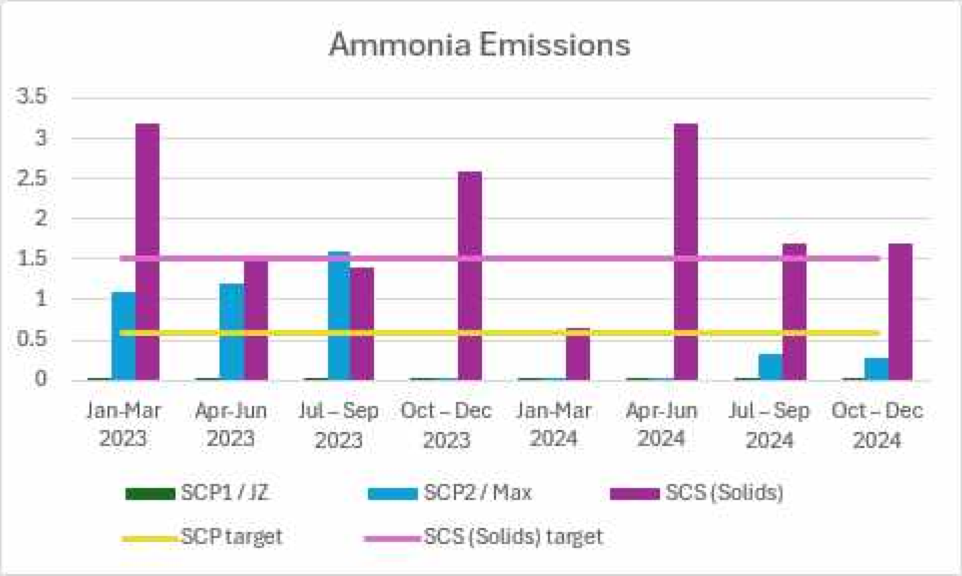


Figure 228: Current Sodium Cyanide Manufacturing Facility ammonia emissions at 136 ktpa NaCN production capacity (combined)

The changes that have the potential to influence air emissions have been modelled as part of the Stage 2 expansion:

- Installation of a new incinerator (T03) at SCP2.
- Decommissioning of the existing Maxitherm incinerator (SCP2).
- Incineration of start-up emissions from SCP1 and SCP2, which were previously vented, to address HCN and NH3.

- Elevating the waste gas discharge points for SCP1 and SCP2 by 6 m.
- Debottlenecking of the existing JZ incinerator (as an amendment to the Stage 1 approval document submitted 21 August 2025).

Nearby sensitive receptors, in the suburbs of North Rockingham, Leda, Calista and Medina, include residential developments, recreational facilities, a childcare facility and a school (Figure 5-1, Section 5.2 of MRP, 2025, Appendix 1). The updated point source emission points to air are identified in Figure 16.

Oxides of Nitrogen - NOx

Under current normal operation (production of 136 ktpa) the average NO_X concentration limit for SCP1 and SCP2 is 5 g/s (as required for 95 per cent of the operating time over the previous 12 months). Continuous emission monitoring for SCP1 and SCP2 during operation are typically less than 3 g/s, which is well below the licence limit (40 per cent below licence limit) when operating at 136 ktpa . For up to five percent of the time, the licence limits for NO_X are 12 g/s for SCP1 and SCP2; this is associated with transient / abnormal / upset conditions such as trips or temporary reduction in throughput for process safety. These limits were not exceeded during the 2021 to 2024 reporting periods. SCP1 and SCP2 NO_X emissions data (July 2021 to 2024) provided to the EPA show the plants operate >99 per cent of the time below the 95 per cent operating period NO_X gas loading limit / target. The approved Stage 1 throughput increase is yet to be implemented at the time of developing this application, and is also expected to operate within the existing restrictions.

Table 138: Expanded NaCN production NOx incinerator calculated capacity (expected).

Expanded (liquid @150 ktpa)	Waste capacity (Nm^3/s)	Waste gas (kg/s)	Flue gas (Nm^3/s)	NO_X in flue gas - max limit (ppmv)	NO_X in flue gas -actual (ppmv)	NO_X Limit (g/s)	NO_X Actual (g/s)
John Zink – upgraded normal [1]	10.7	10.6	15.9	154	110	5.0	3.6
TO3 – no WHRU – normal [1]	15.4	15.3	39.5	123	110	10.0	8.9
Combined normal [1]	26.1	25.9	55.5	132	110	15.0	12.5
John Zink – upgraded – Max [1]	11.3	11.2	16.8	145	110	5.0	3.8
TO3 no WHRU-max [1]	16.7	16.5	42.8	114	110	10.0	9.7
Combined – Max [1]	27.9	27.7	71.7	102	91	15.0	13.5

Note 1: to be confirmed in commissioning

The actual forecasted combined NO_X emissions are expected to be below 13 g/s while the maximum forecasted emissions are expected to be less than 15 g/s, which is the proposed licence limit for 95 per cent of normal operations.

The SCMF expansion will result in increased NOx emissions due to an increase in production; however, there is not expected to be an increase in net NOx emissions to the Kwinana airshed for reasons described below:

- Emissions will increase by approximately 160 tonnes per annum (assuming steady state operations limit). However, the CSBP NAAN tertiary abatement recently approved by the EPA (MS875, dated 7 March 2024), which will be implemented during the related period will realise a reduction of ~329 tpa NO_2.
- Furthermore, Alcoa, the largest source of NO_2 in the Kwinana area (>50 per cent of total emissions, or 1,700 tpa in 2021/22) according to NPI data commenced care and maintenance activities for its operation at its Kwinana refinery in 2024, significantly reducing NO_2 emissions in the airshed.

Ammonia – NH3

CSBP provides liquid ammonia to AGR for NaCN manufacturing, and together with AGR, present a potential source of NH_3.

Ammonia contained in the SCS plant discharge emissions have led to exceedances of the licence target in the 2024/25 reporting period (Table 12). The scrubbing system operating at the time was designed to remove HCN and is unsuitable for NH_3 removal. An ammonia scrubber was approved in the Stage 1 approval – W6952/2024/1), and is proposed to be installed in 2026.

Table 149: Licence target exceedances for Ammonia (2024/25)

Date	Plant	L6110 Ammonia target (g/s)	Ammonia actual (g/s)
25/9/2024	Solids	1.5	1.7
04/12/2024	Solids	1.5	1.7
19/02/2025	Solids	1.5	2.6
30/04/2025	SCP2	0.6	9.0
12/05/2025	Solids	1.5	1.6

Cyanide

The SCMF is the principal potential source of cyanide in the KIA.

Minor HCN emissions to atmosphere are possible from direct venting of process gases from SCP1 and SCP2 (post absorption phase), as well as incomplete combustion from the incinerator stacks.

Particulate emissions from the incinerator stacks have previously been conservatively characterised as 100 per cent NaCN for regulatory monitoring and reporting purposes. However, no particulate phase NaCN is expected from the incinerator stacks as the waste gas that feeds the incinerator contain no caustic or NaCN. To produce solid NaCN it requires two stages, first (1) a conversion of HCN gas to solution with caustic, and second (2) extensive drying operations (technology as applied in the SCS):

(1) $HCN (g) + NaOH (aq) \rightarrow NaCN (aq) + H_2O (l)$

(2) $NaCN (aq) + heat \rightarrow NaCN (s) + H_2O (g)$

AGR has completed a targeted stack testing program over an extended three to four hour sampling duration to enable characterisation of total cyanide in the particulate fraction from the incinerator stacks. The filter papers and corresponding probe rinses were analysed for cyanide, and particle-bound and total cyanide was determined. All cyanide analyses were reported as below the detection limit, corresponding to emission rates of <0.00484 g/s. Therefore, particulate emissions from the incinerator stacks are no longer considered to be contributing cyanide emissions from the incinerator sources. This investigation is explained in a licence amendment application submitted to DWER on 27 August 2024, and amended by DWER on 27 March 2025.

There is a potential for HCN and NaCN particulates to be discharged through the SCS plant. This SCS operates under vacuum conditions to reduce risk of release, and waste gases are treated (scrubbed) prior to release through a series of gas scrubbing vessels.

Proposed Emission Controls:

- The proposal includes the implementation of emissions controls such as:
- Waste gases are treated prior to atmospheric release through specified emission points (licence condition 1). Under normal conditions for SCP1 and SCP2 this is through the JZ or TO3 incinerator. Emissions from the SCS are treated through scrubbing prior to atmospheric release.
- Point source emissions are monitored (periodic and continuous) consistent with licence conditions 2, 3 and 4.
- Operating within the proposed licence limits ensures compliance while demonstrating a commitment to maintaining acceptable environmental risk.
- Incineration of liquid plant start-up gases through incinerators (via a proposed absorber by-pass line); these gases were previously vented.
- Directing waste gas preferentially through an operating incinerator (enabled by a waste gas interconnection). Venting of waste gas through the shut-down stack occurs when an incinerator trip occurs, and only continues to be undertaken whilst waste gas production exceeds the capacity of the online incinerators.
- Start-ups of the liquid plants will be undertaken at night time (18.00 to 06.00).
- Only one liquid plant will be started at a time (no dual plant start-ups), as per existing start-up requirements.
- Installation of a new incinerator (TO3) with increased combustion capacity and enhanced reliability when compared to the Maxitherm incinerator it is replacing; this will likely reduce the number of shutdowns and trips.

- Implement inherently safe design features that are critical to managing worker and environmental risk from releases such as ammonia, natural gas and hydrogen cyanide include:
    - Storage tank vents designed to prevent pressure build up, eliminating possibility of storage tank rupture due to overpressure, with vented gas incorporated into the manufacturing processes;
- Vessels and piping materials chemically resistant to acids and alkali chemicals;
- Pressure relief – bursting discs and PSVs provided for failsafe pressure integrity control.
- No on-site storage for liquid ammonia or natural gas (inventory is only that within process vessels and pipelines); and
- Process equipment is purged with nitrogen gas during a shutdown event.
- Adequate separation distance of occupied buildings from highest risk areas of plant.

6.1.5 AIR QUALITY ASSESSMENT

Air quality modelling was undertaken by MRP Technical Consulting to assess air quality impacts associated with the proposed production increase (Appendix 1). Seven scenarios were modelled to align with the expansion execution strategy , as summarised in Table 13.

Table 1510: Modelled scenarios:

Scenario	SCP1	SCP2	John Zink	TO3	Maxi-Therm	SP1	SP2	Background + other CSBP sources	Approved KIA projects not commenced
#1. Normal operations – AGR in isolation				WHRU	N/A				
#2. Normal operations – Existing (baseline)				N/A			N/A		
#3. Normal operations – Future Approved (baseline)				N/A			N/A		
#4. Normal operations – Upgrade Scenario # 1b				WHRU	N/A				
#5. Startup Scenario # 1b	Startup		Startup	WHRU	N/A				
#6. Waste Gas Venting Scenario #1 (single incinerator trip, dual plant venting)	40%	40%			N/A				
#7. Plant Shut-Down* Scenario #1b		Venting pre-shut-down		WHRU	N/A				

*Shut-down may be either SCP1 or SCP2 with the other liquids plant under normal operation

Note: Shaded Green = Running, Shaded Red = Offline, Shaded Yellow = Conditional

The modelling methodology for the assessment is described in MRP's 2025 Air Quality Assessment report (Appendix 1). CALPUFF and WRF models were used to determine predicted ground level concentrations (GLCs) in isolation and cumulatively across the modelled domain to assess air quality impacts associated with the proposed production increase. The predicted GLCs were assessed against established air quality guideline values (AGVs) (see Table 16).

The existing scenario (assumed to be 170 ktpa NaCN production capacity based on W6952/2024/1 approval) included emissions from the JZ (SCP1), Maxitherm (SCP2) and the SCS1, while future upgrade scenarios replace the Maxitherm with TO3 and include an additional emissions point from the second Solids Plant drying train (SCS2) (which will form part of a future application and enable an increase to 105 ktpa solid NaCN production). Furthermore, emissions from the SCP1 and SCP2 waste gas vents were included for upset condition scenarios.

The following operational modes have been considered in the air quality assessment:

- Normal operations – existing and upgraded to include TO3 (both with and without a waste heat recovery unit) in place of the Maxitherm and addition of the second Solids Plant train (SCS2) at proposed upper operation emission limits;
  - Additional modelling was subsequently undertaken at the 95 per cent operating period threshold to complement modelling completed at the upper limit;
- Start-up – upgraded by the implementation of gas bypass to convey start-up emission for incineration;
  - Revised start-up modelling was subsequently completed with updated design information, which allowed for an adjustment of the volumetric flow rate;
- Waste gas venting; and
- Planned shutdown/plant trip.

Emissions rates for normal plant operations were derived from:

- NH_3 targets and limits in the existing Licence, noting that actual emission levels are generally well within limits.
- Emissions rates for TO3 have been informed by the vendor performance guarantee and the requirement to meet acceptable ground level concentrations, which provide a conservative estimate of what emissions are anticipated to be.
- The upper NO_X limit for the incinerators was used for conservatism.
- Proposed HCN emissions limits and targets used for modelling of the upgrade.

Start-ups, restricted to one liquid plant at a time, has been modelled with the other liquid plant and Solids Plants (existing and proposed in MS1196) operating under normal conditions (proposed emission licence limits). Start-up emissions will be conveyed to the corresponding incinerator (SCP1 to the JZ incinerator and SCP2 to TO3) where HCN and NH3 will be destroyed; HCN and NH3 were thus modelled at maximum emission rates for both operating incinerators.

Emission rates of NO_X when utilising the John Zink for liquid plant start-up were modelled using the maximum emission rates guaranteed by the manufacturer. This is a conservative stance, and it is anticipated that actual start-up emission rates will be lower.

Emission rates from waste gas venting were based on the average composition of the vented gas. For single plant venting, where venting only occurs for 10 minutes while production is scaled down and emissions can be directed to the operating incinerator, a 10-minute gas release was averaged across one hour to provide an hourly average emission rate. For the dual plant venting scenario, where no incinerators are operational, the peak venting rate was used across the entire hour; this scenario is considered to be of low probability given only ~18 hours of dual plant venting between 2018 and 2025.

Cumulative impacts have been assessed, which included:

- All CSBP sources.

- Approved proposal emission sources (NO_2) within the KIA yet to be implemented, including the Kwinana Waste to Energy plant (not operational at the time of assessment), East Rockingham Waste to Energy, Covalent Lithium, Tianqi Lithium, BP Renewable Energy Plant.
- Background level monitored concentrations (GLCs).

In modelling the potential impacts to receptors, the following background levels (which also include future approved projects yet to be commissioned) were determined as follows (see Appendix 1 for details):

Table 1611: Summary of background levels of emission gases and guideline values (AGVs).

Compound	Averaging period	Background Concentration (ppm)	Background Concentration (µm/m³)	Ambient Guideline Value (AGV) (µm/m³)
NO_2	1-hour	0.019 [1]	35.8 [1]	151
	Annual	0.006 [1]	11.3 [1]	28
HCN	1-hour		-	200
	24-hr		-	9.2
	Annual		-	0.73
NH_3	1-hour		118	330
	Annual		17	70

Note 1: determined from 75th percentile 1-hour South Lake Monitoring Station (2022 data)

Meteorological data was used to identify the worst weather conditions and applied this to emission limits in the modelling scenarios to identify the highest predicted concentration, assuming this to be the norm. Further impact assessment work including air quality modelling relating to NO_X emissions was undertaken following a request from the EPA during its Part IV EP Act assessment.

The air quality impact assessment predicted GLC modelling (Appendix 1), is considered conservative for the following reasons:

i. For the operating scenarios air quality modelling considered the <5 per cent operating period limits (i.e., 36 g/s) in its NO_X predictions, despite this being an abnormal (upset) condition that seldom eventuates. Under normal operations, as represented by the ≥ 95 per cent of the time over the preceding 12 months, the emissions will be significantly less (<15 g/s). The latter was modelled and presented to the EPA (Appendix 1B). Historically, AGR operates >99 per cent of the operating period below the lower (95 per cent operating period) limit.

ii. All scenarios, including start-ups assumed the operating liquid plant was operating under upset conditions (i.e., using the <5 per cent operating limit of 36 g/s as opposed to 15 g/s stable operations). By using the steady state 15 g/s for the operating liquid plant while the other is in start-up, exceedances of AGVs at sensitive receptors reduced slightly (Appendix 1).

iii. Predictions of ground level concentrations are based on the combined CALPUFF and WRF modelling, using the maximum (highest) value encountered to determine predictions presented.

iv. The modelling identifies the maximum (highest) concentration levels identified over the period aligned to the worst case meteorological conditions for dispersion for that period without recognising that the probability of these events being realised is very unlikely; the model assumed the worst case climatic conditions as being the norm).

v. The proposed new licence limits, as used in the modelling, are deemed as being conservative and readily achievable (AGR expect to confidently operate below these levels).

vi. The ambient background values used in cumulative predictions are based on data collected over the period when the BP Kwinana Refinery was still operating (for part of the period). It also includes the operation of the Alcoa Kwinana Refinery which will no longer be operating at the time when the AGR expansion is implemented. Alcoa announced it would cease operations in Kwinana in 2024; their NO_2 emissions represent over 50 per cent of emissions in the Kwinana area (significant contributor to the airshed as presented in the 2021/22 NPI reporting period, being 1,700 tonnes).

vii. The modelling of CSBP emissions did not consider the lower emissions expected with the implementation of air abatement technologies on the three Nitric Acid and Ammonium Nitrate Plants (MS875 amendment approved on 7 March 2024 and W6915/2024/1 approved on 30 September 2024) where emission of NOx will reduce from a 569 tpa to 240 tpa limit; a reduction of 329 tpa. The amendment to MS875 was finalised after the AGR initial submission and associated air quality impact assessment modelling, and so was not considered

An independent human health risk assessment was also completed to complement the air quality assessment report (Section 6.1.6).

Normal Operations

Normal operations were assessed for short-term, mid-term and annual averages, for each of the pollutants of concern (NO_2, HCN and NH_3) as relevant. Predictive modelling for NO_X GLC was initially completed using proposed upper licence limits (36 g/s) (Appendix 1) and subsequently at the 95 per cent target of operating period over preceding 12 months (15 g/s) in an updated report (MRP, 2025; Appendix 1).

In the Air Quality Assessment, the existing normal baseline operations are represented by the operation of Solids Plant 1 (SCS1), SCP1 with John Zink incinerator, SCP2 with Maxitherm with other sources in the region considered cumulatively.

Upgraded operational scenarios include emissions from a potential future second solids plant train (SCS2) operating in parallel with SCS1, the two liquid plants (SCP1 and SCP2) whereby the new TO3 incinerator replaces the Maxitherm incinerator (assessed with and without operating a waste heat recovery unit (WHRU) in isolation, and with other sources in the region considered cumulatively.

Maximum GLCs from the upgrade scenario were predicted to occur when TO3 is operated with the WHRU, resulting in reduced stack temperature and reduced emission dispersion. Heat increases plume buoyancy and aids dispersion of compounds and reduce GLCs. A summary of the predicted maximum off-site GLCs is presented in Table

17. Predicted GLCs are lower under 95 per cent operating limits. Exceedance of NO_2 AGVs is largely restricted to the industrial area.

Table 1712: Summary of maximum predicted GLCs under normal operation outside the Kwinana Buffer Zone and at sensitive receptors (upper emission limits)

Scenario	Compound	Averaging Period	AGV (µg/m^3)	Maximum predicted GLCs + existing cumulative at upper limit	
				µg/m^3	% Guideline
Scenario #2 Existing	NO_2	1-hr max	151	123.6	82%
		Annual average	28	17	61%
	HCN limit	1-hr max	200	18	9%
		24-hr max	9.2	3	28%
		Annual average	0.73	0.25	34%
	NH_3	1-hr max	330	148	45%
		Annual average	70	17.4	25%
Scenario #4 Normal Operations	NO_2	1-hr max	151	126	83%
		Annual average	28	18	65%
	HCN limit	1-hr max	200	13	7%
		24-hr max	9.2	2	21%
		Annual	0.73	0.19	26%
	NH_3	1-hr max	330	169	51%
		Annual	70	17.7	25%

Under all upgraded normal operating scenarios (at the upper limits), GLCs at sensitive receptors modelled across the domain, all were below the AGVs.

As a result of predicted exceedances of NO_2 within the KIA and potential worker exposure, guidance was sourced from work health and safety criteria. Safe Work Australia published a document in January 2024: Workplace Exposure Standards for Airborne Contaminants to manage the risks and expectations under the *Work Health and Safety Act 2020* (s.19) and regulations (e.g., r.48, r.49). The exposure standard represents the airborne concentration of a particular substance or mixture that should not be exceeded.

In their characterisation, Safe Work Australia identify the following exposures:

- TWA (Eight hour time weighted average) means the maximum average airborne concentration of a substance when calculated over an eight-hour working day, for a five day working week.
- STEL (Short term exposure limit) means the time weighted average maximum airborne concentration of a substance calculated over a 15-minute period (Safe Work Australia 2024).

For NO_2, the TWA is 3 ppm (5.6 mg/m³) and the STEL is 5 ppm (9.4 mg/m³).

The maximum predicted offsite NO_2, 1-hour concentration level is 2.2 per cent of the TWA and 1.31 per cent of the STEL set out by Safe Work Australia. It is unlikely the maximum one-hour predicted offsite emissions will impact workers health and safety in the KIA, particularly when considering the probability of exceedance are associated with a limit imposed for ≤5 per cent operating period over the previous 12 months.

The predicted maximum cumulative GLCs (which includes approved KIA NO_2 sources yet to be commissioned) at nominated receptors are presented in Table 18.

Table 1813: Summary of cumulative GLC values outside the Kwinana Buffer Zone and at nominated receptors – Scenario #4 – Normal operations

1-hour Maximum NO_2 Ground Level Concentrations						
Receptor		Criteria	Background		Scenario #4 Normal	
			(µg/m³)	% Guideline	(µg/m³)	% Guideline
Max. Outside Buffer Zone		151	35.8	24%	126	83%
Rec_001	Wells Park				98	65%
Rec_002	Golf Course				111	73%
Rec_003	Thomas Oval				99	66%
Rec_004	Oval				106	70%
Rec_005	Nearest Residence				107	71%
Rec_006	North Rockingham				92	61%
Rec_007	Residence 3 (SE)				109	72%
Rec_008	Hope Valley				102	68%
Rec_009	Callista Primary School				105	69%
Rec_010	Wombat Wallow Childcare Centre				95	63%
Rec_011	Wellard Road Residence				103	68%
Annual Average NO_2 Ground Level Concentrations						
Receptor		Criteria	Background		Scenario #4 Normal	
			(µg/m³)	% Guideline	(µg/m3)	% Guideline
Max. Outside Buffer Zone		28	11.3	40%	18	65%
Rec_001	Wells Park				17	62%
Rec_002	Golf Course				14	50%
Rec_003	Thomas Oval				15	53%
Rec_004	Oval				16	58%
Rec_005	Nearest Residence				14	51%
Rec_006	North Rockingham				14	49%
Rec_007	Residence 3 (SE)				13	47%
Rec_008	Hope Valley				16	56%
Rec_009	Callista Primary School				13	47%

Rec_010	Wombat Wallow Childcare Centre				14	50%
Rec_011	Wellard Road Residence				14	51%
1-hour Maximum NH_3 Ground Level Concentrations						
Receptor		**Criteria**	**Background**		**Scenario #4 Normal**	
			(µg/m³)	**% Guideline**	**(µg/m³)**	**% Guideline**
Max. Outside Buffer Zone		330	118	36%	169	51%
Rec_001	Wells Park				177	54%
Rec_002	Golf Course				135	41%
Rec_003	Thomas Oval				140	42%
Rec_004	Oval				139	42%
Rec_005	Nearest Residence				145	44%
Rec_006	North Rockingham				137	42%
Rec_007	Residence 3 (SE)				129	39%
Rec_008	Hope Valley				129	39%
Rec_009	Callista Primary School				133	40%
Rec_010	Wombat Wallow Childcare Centre				135	41%
Rec_011	Wellard Road Residence				162	49%
Annual Average NH_3 Ground Level Concentrations						
Receptor		**Criteria**	**Background**		**Scenario #4 Normal**	
			(µg/m³)	**% Guideline**	**(µg/m³)**	**% Guideline**
Max. Outside Buffer Zone		70	17	24%	17.7	25%
Rec_001	Wells Park				17.8	25%
Rec_002	Golf Course				17.2	25%
Rec_003	Thomas Oval				17.3	25%
Rec_004	Oval				172	25%
Rec_005	Nearest Residence				17.2	25%
Rec_006	North Rockingham				17.2	25%
Rec_007	Residence 3 (SE)				17.1	24%
Rec_008	Hope Valley				17.1	24%
Rec_009	Callista Primary School				17.1	24%
Rec_010	Wombat Wallow Childcare Centre				17.2	25%
Rec_011	Wellard Road Residence				17.3	25%

Key findings include:

- Under normal operation (existing and proposed) in isolation, NO_2 levels are predicted to remain below AGVs. Cumulatively, (and specifically with all current and future approved KIA sources) receptor sites GLCs are predicted to remain below AGVs. However, exceedances are predicted within the KIA in close proximity to the site boundary, but not outside of the Kwinana Buffer Zone.

- HCN and NH_3 concentrations are predicted to remain below AGVs under all normal operating scenarios in isolation and cumulatively.

Plot contour maps for the emissions (cumulatively) for NO_2 maximum 1-hour and annual average comparing operations under upset and steady state conditions for the proposed upgrades are presented in the figures below, together with contour maps for HCN and NH3 (as presented in MRP Air Quality Assessment reports – Appendix 1).

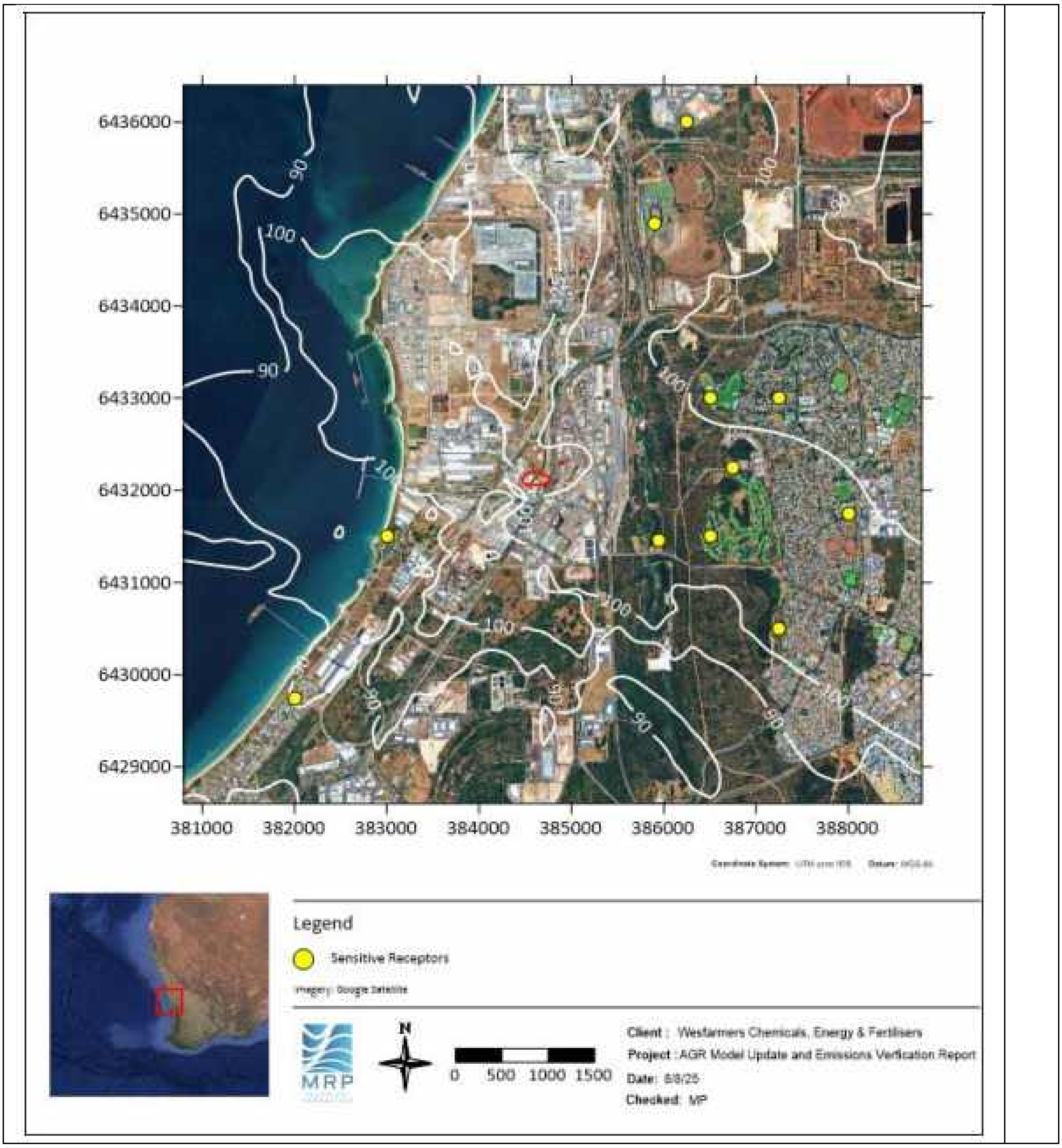


Figure 239: **Maximum 1-hr average predicted GLCs of NO_2 for normal operations** (MRP 2025; Appendix 1). AGV = 151µg/m³.

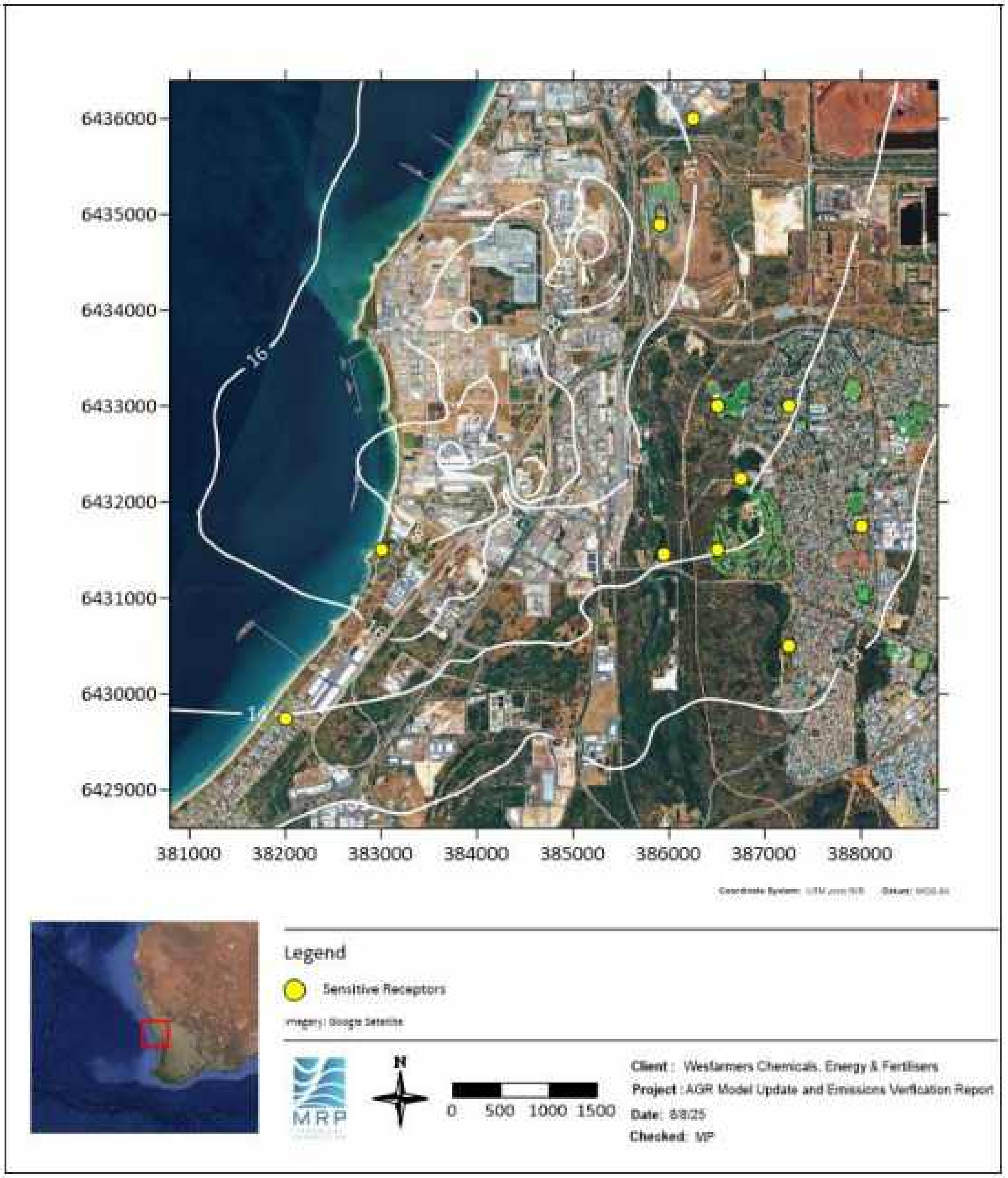


Figure 2410: Comparative assessment of **annual average predicted GLCs of NO_2 for normal operations (Scenario #4)** (MRP 2025; Appendix 1). AGV = 28 µg/m^3.

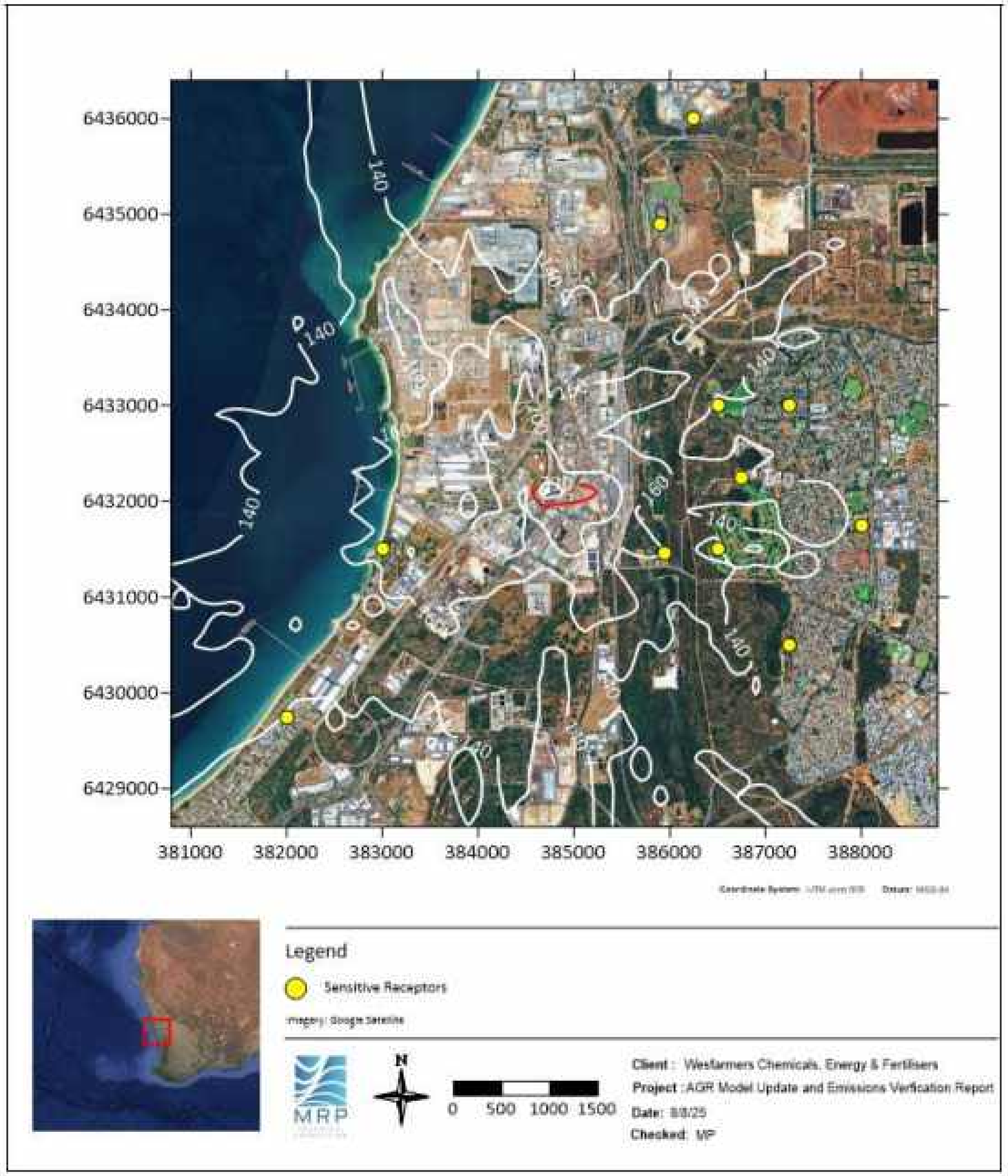


Figure 2511: Comparative assessment of **maximum 1-hour predicted GLCs of NH_3 for normal operations – upgrade scenario (Scenarios #1 & #4)** (MRP 2025; Appendix 1). AGV = 330 µg/m^3.

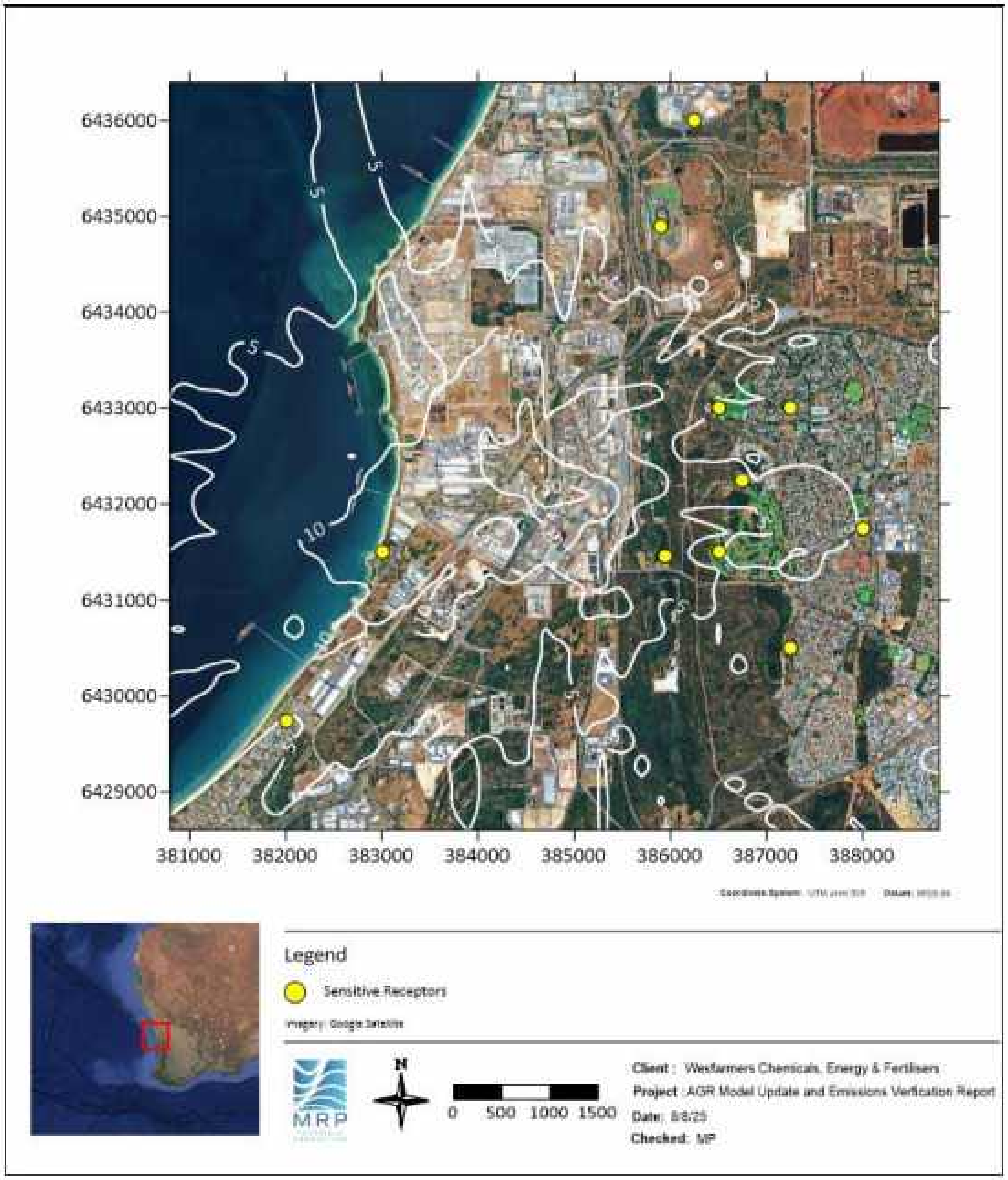


Figure 26 12: Maximum 1-hour average predicted GLCs of HCN (Scenario #4) (MRP 2025; Appendix 1).

Figure 2713: Maximum annual average predicted GLCs of HCN (Scenario #4) (MRP 2025; Appendix 1).

Start-up

Start-up scenarios were modelled with a single liquid plant undergoing start-up operations, with emissions being treated through the associated incinerator while the other incinerator (liquid plant) and expanded Solids Plant (SCS1 and SCS2) were in normal operation. Start-up emissions were previously vented through the start-up stacks at each plant, which led to predicted exceedances of HCN and NH_3 offsite and at sensitive receptors, particularly Wells Park. The exceedances led to start-ups being restricted to specific times and weather patterns. With the expansion upgrades, the predicted HCN and NH_3 are reduced to below AGVs. NO_2 levels are expected to be higher at the expense of burning more natural gas with the incineration of start-up emissions.

Selective Non Catalytic Reduction (SNCR) technology is being included in the TO3 design to minimise cumulative NO_x emissions during start-up cases. To minimise the NO_X from the firing of more gas and increasing temperatures, a burner quench is to be installed at the front end of the TO3 incinerator unit to control the flame temperature to minimise thermal NO_X formation as part of the proposal. The SNCR downstream also provides further mitigation. The SNCR is effectively an ammonia spray injection further downstream (towards the back end) of the unit to treat the NO_X flue gas.

Hourly averaged emission rates were used to determine the predicted 1-hour average GLCs. The current EP Act licence (L6110) stipulates restrictions on when start-ups can be performed. The modelling was run without these restrictions imposed (i.e., emissions were modelled across entire year irrespective of weather for periods between 6 pm to 6 am).

Air quality modelling for start-up operations was undertaken using revised emissions estimates associated with the start-up of a single NaCN plant in November 2020. The assessment included average and peak emission scenarios and assumed start-up only occurs subject to meteorological conditions specified in the existing operating licence between the hours of 6 pm and 6 am.

During the EPA assessment of the expansion, John Zink provided AGR with updated design information, which has allowed the start-up emission volumetric flow rates to be adjusted. This information was submitted to the EPA in June 2024 to inform their assessment.

With the updated design information, the volumetric flow rates during SCP1 start-up will increase from 9.6 to 11.4 Nm^3/s of the JZ incinerator.

The GLCs for the scenarios with the highest predicated emissions from the start-up of SCP1 and SCP2, respectively, are summarised in Table 19 (Appendix 1). It should be noted that the MRP 2025 assessment assumes that the second solid plant drying train (SCS2) is operating. SCS2 is not included in this application and the future construction and operation will be subject to a future application.

Table 1914: Receptor GLCs (µg/m³) during start-up operations (Scenario #5).

1-hour Maximum NO_2 Ground Level Concentrations						
Receptor		Criteria	Background		Scenario #5 Start-up	
			(µg/m³)	% Guideline	(µg/m³)	% Guideline
Max. Outside Buffer Zone		151	35.8	24%	507	336%
Rec_001	Wells Park				448	296%
Rec_002	Golf Course				252	167%
Rec_003	Thomas Oval				164	109%
Rec_004	Oval				175	116%
Rec_005	Nearest Residence				188	125%
Rec_006	North Rockingham				174	115%
Rec_007	Residence 3 (SE)				146	97%
Rec_008	Hope Valley				131	87%
Rec_009	Callista Primary School				167	111%
Rec_010	Wombat Wallow Childcare Centre				169	112%
Rec_011	Wellard Road Residence				222	147%
1-hour Maximum HCN Ground Level Concentrations						
Receptor		Criteria	Background		Scenario #5 Start-up	
			(µg/m³)	% Guideline	(µg/m³)	% Guideline
Max. Outside Buffer Zone		200	N/A	N/A	14	7%
Rec_001	Wells Park				14	7%
Rec_002	Golf Course				5	2%
Rec_003	Thomas Oval				5	2%
Rec_004	Oval				5	3%
Rec_005	Nearest Residence				6	3%
Rec_006	North Rockingham				5	2%
Rec_007	Residence 3 (SE)				3	2%
Rec_008	Hope Valley				3	1%
Rec_009	Callista Primary School				4	2%
Rec_010	Wombat Wallow Childcare Centre				4	2%
Rec_011	Wellard Road Residence				9	4%
1-hour Maximum NH_3 Ground Level Concentrations						
Receptor		Criteria	Background		Scenario #5 Start-up	
			(µg/m³)	% Guideline	(µg/m³)	% Guideline
Max. Outside Buffer Zone		330	118	36%	170	52%
Rec_001	Wells Park				174	53%
Rec_002	Golf Course				136	41%
Rec_003	Thomas Oval				140	42%
Rec_004	Oval				139	42%
Rec_005	Nearest Residence				145	44%
Rec_006	North Rockingham				138	42%
Rec_007	Residence 3 (SE)				129	39%
Rec_008	Hope Valley				129	39%
Rec_009	Callista Primary School				133	40%
Rec_010	Wombat Wallow Childcare Centre				135	41%
Rec_011	Wellard Road Residence				163	49%

For NO_2, exceedances of the maximum 1-hour average were predicted at various sensitive receptor locations for the start-up operation scenario. Additional analysis was conducted surrounding the number of hours which exceedances were predicted.

The contour maps for NO_2 GLCs for the start-up scenario (Scenario #5) are presented below.

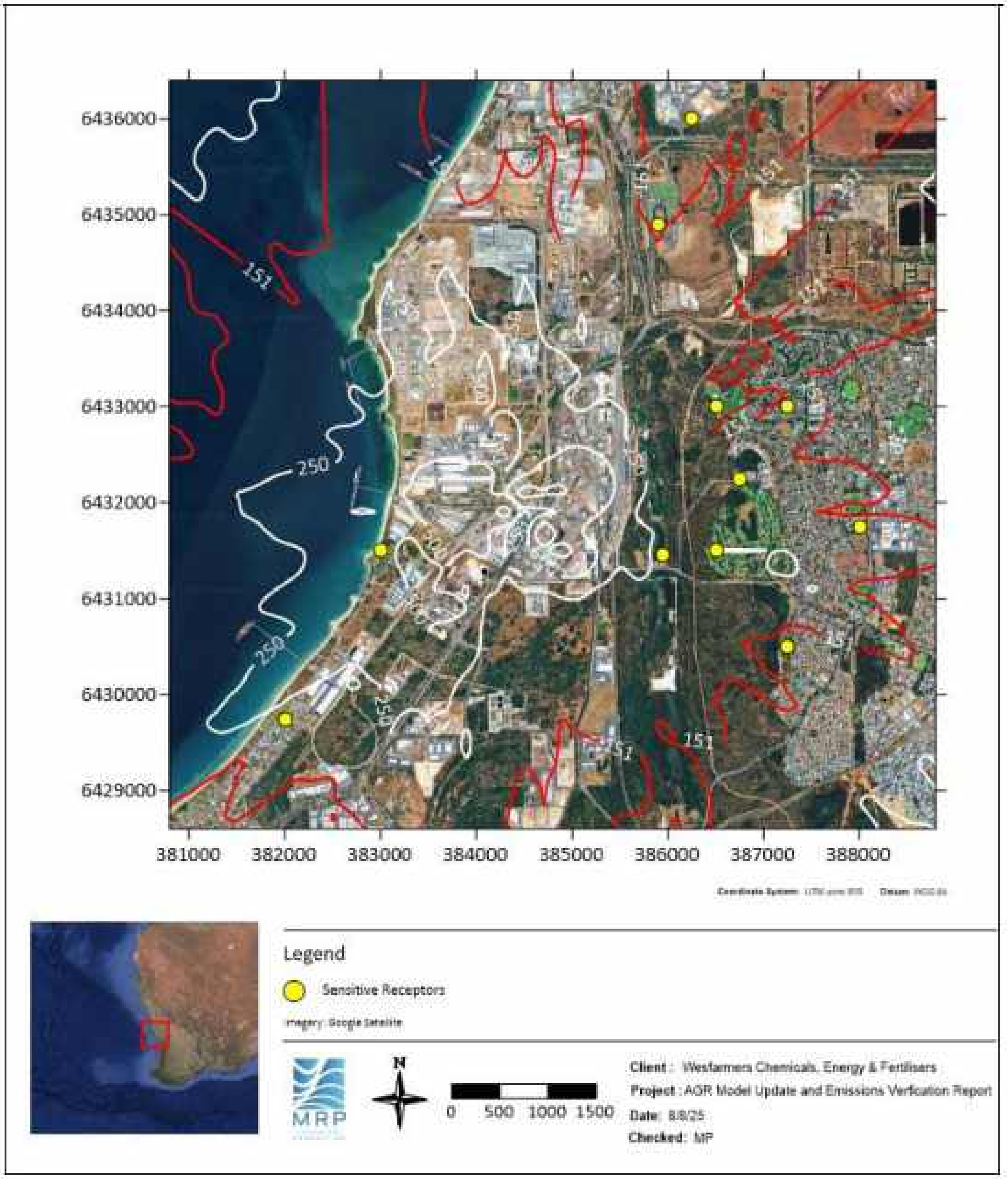


Figure 2814: Start-Up Operations Scenario #5 - **Maximum 1-hour Average Predicted GLCs of NO_2** (MRP, 2025; Appendix 1). AGV = 151 µg/m3.

No exceedances under any start-up scenario (in isolation or cumulative) were predicted for HCN and NH_3 outside the Kwinana Buffer Area or at the nominated sensitive receptors. The maximum HCN predicted HCN GLC (based on emission limits rates) at the nominated sensitive receptors was approximately 12 per cent of the 1-hour average HCN AGV criteria. For NH_3, the maximum GLC was predicted to be approximately 57 per cent of the AGV. This is in direct contrast to current start-ups where these pollutants were considered to be of concern that required specified start-up weather regulatory controls.

The predicted HCN and NH_3 start-up scenario GLCs are presented in Figures 36 to 39.

Figure 2915: Start-Up Operations Scenario #5 - **Maximum 1-hour Average Predicted GLCs of NH_3.** (MRP, 2025; Appendix 1). NH_3 AGV = 330 µg/m^3.

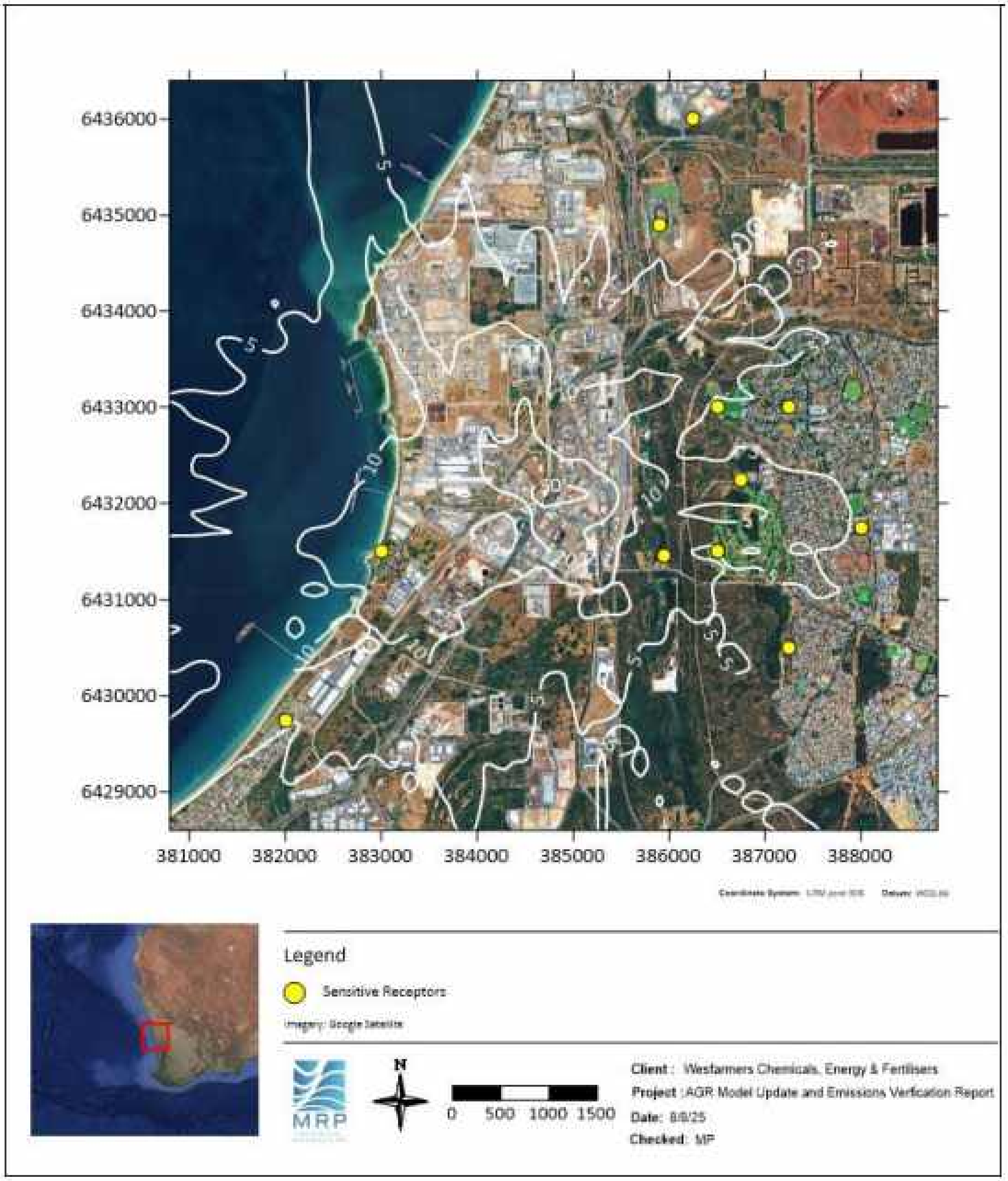


Figure 30 16: Start-Up Operations Scenario #5 - **Maximum 1-hour Average Predicted GLCs of HCN.** (MRP, 2025; Appendix 1). HCN AGV = 200 µg/m^3.

Probability of AGV exceedance

Although NO_2 exceedances are predicted at sensitive receptor locations during the cumulative assessment of the start-up scenario, it's important to note that the modelling conservatively assumed continuous night-time operation. In reality, start-up events are brief—typically lasting less than an hour—and may not occur under worst-case meteorological condition (Table 20).

Table 2015: Hours of exceedance for scenario #5 (Start-Up Operations)

Receptor	# Hours Exceeded Over 1 year	% Of Exceedance Time	Probability of Exceedance Assuming 11 Annual Start-Up Events
Wells Park	157	1.79%	0.0018%
Golf Course	40	0.46%	0.00047%
Thomas Oval	1	0.01%	0.000012%
Oval	4	0.05%	0.000047%
Nearest Residence	7	0.08%	0.000082%
North Rockingham	10	0.11%	0.00012%
Residence 3 (SE)	0	0%	0%
Hope Valley	0	0%	0%
Callista Primary School	1	0.01%	0.000012%
Wombat Wallow Childcare Centre	1	0.01%	0.000012%
Wellard Road Residence	73	0.83%	0.00086%

Assuming continuous operation, the percentage of time where an exceedance occurs at any of the sensitive receptor locations is no more than 2.02 per cent (as at Wells Park – nearest receptor). Assuming eleven (11) start-up events (≤1-hour in duration each) occur annually, the probability that an exceedance would occur at Wells Park or any other sensitive receptor would be ≤0.002 per cent. This conservatism, in combination with the low frequency of start-ups, means the likelihood of an exceedance occurring is rare.

Waste Gas Venting

Waste gas venting operations were assessed on a short-term basis (against 1-hour criteria) for each of the pollutants of concern (NH_3, HCN and NO_2). Modelling assumed the venting to be for an hour at peak emission rates (over the duration of the hour).

A summary of the maximum 1-hour average GLCs predicted outside the Kwinana Buffer Zone and at nominated receptors when operating under waste gas venting conditions is presented in Table 21. The venting scenario includes the Solids Plant trains (SCS1 and SCS2) in operation with a single incinerator trip and dual liquid plants venting. Scenarios considered cumulative impacts from existing sources and these sources with approved KIA sources yet to be commissioned.

Table 2116: Summary of maximum predicted cumulative GLCs outside the Kwinana Buffer Zone and at sensitive receptors during waste gas venting (WGV)

1-hour Maximum NO_2 Ground Level Concentrations						
Receptor		Criteria	Background		Scenario #6 Waste Gas Venting	
			(µg/m³)	% Guideline	(µg/m³)	% Guideline
Max. Outside Buffer Zone		151	35.8	24%	125	83%
Rec_001	Wells Park				90	60%
Rec_002	Golf Course				107	71%
Rec_003	Thomas Oval				94	62%
Rec_004	Oval				103	69%
Rec_005	Nearest Residence				101	67%
Rec_006	North Rockingham				85	56%
Rec_007	Residence 3 (SE)				108	72%
Rec_008	Hope Valley				101	67%
Rec_009	Callista Primary School				96	63%
Rec_010	Wombat Wallow Childcare Centre				92	61%
Rec_011	Wellard Road Residence				101	67%
1-hour Maximum HCN Ground Level Concentrations						
Receptor		Criteria	Background		Scenario #6 Waste Gas Venting	
			(µg/m³)	% Guideline	(µg/m³)	% Guideline
Max. Outside Buffer Zone		200	N/A	N/A	14	7%
Rec_001	Wells Park				13	7%
Rec_002	Golf Course				8	4%
Rec_003	Thomas Oval				6	3%
Rec_004	Oval				6	3%
Rec_005	Nearest Residence				7	4%
Rec_006	North Rockingham				5	2%
Rec_007	Residence 3 (SE)				5	2%
Rec_008	Hope Valley				3	1%
Rec_009	Callista Primary School				4	2%
Rec_010	Wombat Wallow Childcare Centre				5	2%
Rec_011	Wellard Road Residence				11	5%
1-hour Maximum NH_3 Ground Level Concentrations						
Receptor		Criteria	Background		Scenario #6 Waste Gas Venting	
			(µg/m³)	% Guideline	(µg/m³)	% Guideline
Max. Outside Buffer Zone		330	118	36%	900	273%
Rec_001	Wells Park				612	185%
Rec_002	Golf Course				476	144%
Rec_003	Thomas Oval				336	102%
Rec_004	Oval				267	81%
Rec_005	Nearest Residence				344	104%
Rec_006	North Rockingham				259	78%
Rec_007	Residence 3 (SE)				342	104%
Rec_008	Hope Valley				198	60%
Rec_009	Callista Primary School				258	78%
Rec_010	Wombat Wallow Childcare Centre				300	91%
Rec_011	Wellard Road Residence				741	225%

NO_2

The cumulative maximum predicted 1-hour average NO_2 GLCs during waste gas venting remains below the 1-hour AGV across the modelled domain.

HCN

The maximum HCN GLCs predicted for all venting scenarios remain well below the relevant AGV for the 1-hour averaging period across the modelled domain.

NH_3

The maximum NH_3 GLCs predicted are predicted to exceed the AGV at various receptors across the modelled domain.

The maximum predicted GLC outside the Kwinana Buffer Zone (cumulative) is 899 µg/m^3 and the maximum predicted GLC (cumulative) at any receptor is 741 µg/m^3 (Wellard Road residence), approximately 273 per cent and approximately 224 per cent of the 1-hour average NH_3 criteria respectively.

Probability of exceedance

Given the exceedance of criteria, the probability of these events were investigated.

In ascertaining probability, MRP 2025 (section 8.4.3, see Appendix 1) calculated the probability using the maximum number of hours (total) of venting in any recent year – 943 hours in 2019 (maximum) and 303 hours in 2018 – (average) – assuming venting to be for a full hour at peak emission rates, which is an over-estimation.

Single incinerator trips are the most common, with dual incinerator trips being extremely rare. There has only been ~18 hours of dual plant venting between 2018 and 2025. With the TO3 incinerator, which is expected to be more reliable, the prospect of dual incinerator trips and associated venting is expected to reduce (a key reason for replacing the Maxitherm incinerator). With one incinerator trip, AGR will have the ability to redirect the waste gas to the other incinerator via the common waste gas header, with waste gas emissions anticipated to occur for approximately 10 minutes. The increase in production should not affect the number of trips encountered.

It should be noted also that the probabilities were calculated on the assumption of worst-case climatic conditions (over the modelled period) against the number of hours of whereby there is period of waste gas venting (Table 22).

Table 2217: Probability of exceedance of 1-hour NH_3 guideline during waste gas venting

Receptor	# Hours Exceeded Over 1 Year	% Of Exceedance Time	Probability of Exceedance Assuming 303 Hours of WGV Per Year
Wells Park	24	0.27%	0.0081%
Golf Course	5	0.06%	0.0017%
Thomas Oval	1	0.01%	0.00039%
Oval	0	0%	0%
Nearest Residence	3	0.03%	0.0010%
North Rockingham	0	0%	0%
Residence 3 (SE)	2	0.02%	0.00067%
Hope Valley	0	0%	0%
Callista Primary School	0	0%	0%
Wombat Wallow Childcare Centre	0	0%	0%
Wellard Road Residence	7	0.08%	0.0024%

The MRP 2025 calculation for an exceedance event for a single incinerator trip, dual plant venting (Scenario #6 in the report) is based on the following:

303 Hours of Venting (average hours over one year)

(1) Percentage of Time where Venting Occurs out of the year = 303/8760 = 3 per cent
(2) Model Predicted Total Number of Hours where the Criteria is exceeded @ Given Receptor Location (i.e. Wells Park) = 24
(3) Max Number of hours where exceedance happens / Hours of the Year = 24/8760 = 0.27 per cent
(4) Probability of Exceedance at Receptor Location (i.e. Wells Park) = 3 per cent * 0.27 per cent = 0.0095 per cent

Modelling has determined that waste gas venting from one or both liquid plants with the solids plant in operation would result in exceedances of the ammonia air quality guidelines, including at sensitive receptors under conditions where both liquid plants are venting. However given the infrequent occurrence, particularly of simultaneous venting occurring on both liquid plants, the likelihood of adverse impacts at sensitive receptors is expected to be rare.

Shutdowns

There is no change to the frequency of plant shutdowns (planned or trips) expected due to the proposed increase in production.

During a plant shutdown (planned or trip), the reactor gases downstream of the reactant gas mixer through to the cyanide reactor, absorber column and shutdown stack are purged with nitrogen. The process takes eight minutes, and the emissions timeframe during the purge is approximately 2-3 minutes.

Planned shutdown / plant trip operations were assessed on a short-term basis only (against 1-hour criteria) for each of the pollutants of concern (NO_2, HCN and NH_3).

The air quality assessment determined no predicted exceedances of the 1-hour average NO_2, NH_3 or HCN guideline values outside the Kwinana Buffer Zone or at any of the nominated receptors for the shutdown operations scenario.

Given the short duration of emissions during shutdown, the low frequency of shutdown events and the conservative nature of the modelling, the probability of adverse impacts is extremely low.

MRP 2025 (Appendix 1) provide contour plots for all the shutdown scenarios modelled.

6.1.6 HUMAN HEALTH RISK ASSESSMENT

A human health risk assessment (HHRA) provides an assessment of whether the predicted emissions associated with the increased production (and plant upgrades) are likely to cause untoward health effects in the near-by community, which could lead to compromising the EPA Air Quality objective.

A HHRA was completed in 2023 (by Matisons Toxicology Solutions) and submitted with the 2023 EPA referral. It was subsequently updated as an addendum in June 2024 (see Appendix 2) to consider the updated air quality impact assessment that was completed in March 2024. The March 2024 updated air quality impact assessment included expanded background / cumulative impacts.

Human risk assessments presented in the referral document identified health hazard quotients (HQs) as a surrogate for inhalation exposure at receptor sites for the different scenarios.

It should be noted that for scenarios assessed as part of the human health risk assessment, emissions limits reflective of upset conditions (worst case scenario rather than expected operations ≥ 95 per cent of the previous 12 months operating period) was used, which has been identified as being very conservative (i.e. did not consider reduced emission levels identified in Appendix 1).

The updated HQ calculations determined:

- **For** normal **operations** –
  Under normal operations with the new TO3 installed, no untoward health impacts are expected.
- **For start-up scenarios –**
  HQs associated with NO_2 show acceptable risk, with minimal risk at sensitive receptors (negligible risk for NH3 and HCN).
- **For waste-gas venting scenarios –**
  Direct impacts to the community are considered unlikely. Occasional NH_3 odours may be experienced under dual incinerator trip scenarios.

- **Planned shut-down and trips –**
  For waste-gas venting, HQs for HCN and NO2 at negligible at sensitive receptors. NH3 is determined to present acceptable risk where there may be occasions when the local community may detect odours.

Matison concluded that the revised air quality assessment that include broader cumulative impacts did not result in materially different health quotients and that untoward health effects in the nearby community are not anticipated associated with the proposal.

AGR did not update the human health risk assessment again for the Ramboll 2025 and MRP 2025 updated modelling on the basis the that Matison had already concluded the March 2024 air quality assessment predictions did not pose any unacceptable risk, and the additional air quality assessment predicted a further reduction in GLCs (and therefore reduced risk to human health).

6.2 Greenhouse Gas Emissions

Greenhouse gas (GHG) emissions were identified as a key environmental factor in the associated referral to the EPA, approved under MS1196. This allows the emission of up to 97,460 tonnes of carbon dioxide equivalent (tCO_2-e) per annum (MS1196 condition 1-1).

The Scope 1 emissions result predominantly from combustion of process waste gases and fuel (natural gas) in the incinerators, which includes nitrous oxide (N_2O) emissions.

Potential increases in GHG emitted from increased NaCN production will be offset by the improved management of N_2O in the TO3 incinerator (reducing GHG intensity).

AGR is subject to the regulation of the Safeguard Mechanism under the *National Greenhouse and Energy Reporting Act 2007* as a part of the CSBP Kwinana facility that generates over 100,000 tCO_2-e each year. The CSBP Kwinana facility is required meet reduction targets under the Safeguard Mechanism, which culminates in net zero emissions by 2050. This trajectory also aligns to CSBP's decarbonisation roadmap target of net zero emissions by 2050. CSBP's approach to decarbonisation includes improving abatement where technologies allow, implementing carbon capture storage and utilisation initiatives, and sourcing of reduced carbon intensity hydrogen (green/blue) as a feedstock for ammonia production when this becomes available (ammonia being a key ingredient for NaCN manufacturing).

6.3 Discharges to Land / Water

AGR operates two cooling towers at the premises. Through evaporative cooling, salts concentrate and are then partially purged. Make-up water is principally sourced from bore water. Blowdown from the cooling towers is directed from the AGR site to the wastewater management system on the CSBP Kwinana site.

Stormwater and wastewater drainage infrastructure is depicted in Figure 31. Existing management includes:

6.3.1 CYANIDE DESTRUCTION

Cyanide concentration is reduced down to < 1 mg/L. This process is performed in the cyanide destruction plant located adjacent to SCP1.

Wastewater is fed to the destruction unit where it is treated with copper sulphate, hydrogen peroxide (50 per cent strength), and sulphuric acid (98 per cent) to destroy the NaCN content to less than 1 mg/L cyanide. These reagents are stored in individual tanks and are injected directly into the feed by chemical treatment dosing pumps. Reagent flows and injection rates are monitored and altered from the control system.

Following reagent addition, permeate is heated in the wastewater feed/effluent spiral exchanger. Condensate from the heater is returned to the de-aerators on SCP1 and SCP2.

The hot liquor then passes through two residence towers. The function of the towers is to provide residence time for the cyanide destruction reaction to occur. At a flow of 10 m3/hr the residence time in the two towers is approximately one hour. Hot liquor from the second residence tower is cooled by the wastewater feed/effluent exchanger for cooling and directed to fill one of two 40 m3 capacity cyanide destruction tanks. The tanks provide further residence time. The tanks are constructed of mild steel and epoxy lined to prevent the steel being attacked by surplus peroxide in the hot liquor. Both tanks are fitted with agitators and a pump that can be used to circulate the tank contents and discharge to the RO polishing system.

A continuous analyser monitors the batch recirculation tanks and if the concentrations exceed allowable levels additional hydrogen peroxide can be added to the cyanide destruction tank and the contents agitated until the cyanide concentration is reduced to the required level, whilst the solution is recirculated through the treatment system. Once the wastewater is within specification it is fed to the RO polishing system.

6.3.2 RAINWATER AND WASHINGS COLLECTED INSIDE BUNDED AREAS

Includes impervious SCP1, SCP2, SCS process areas, tank farm, natural gas purification plant, and other bunded areas.

The purpose of the waste water collection system is to collect all liquid spills within the process plant and tank farm bunded areas that may contain cyanide. All water having a cyanide concentration greater than one ppm is blended off into the cyanide liquid despatch by either direct addition at the tank farm or indirectly by make up to the weak cyanide system.

Rainwater, spills and equipment washings are collected from numerous bunded locations in the NaCN production area. This water is recycled into the NaCN production plants where possible with excess amounts sent to the cyanide destruction plant prior to final discharge to CSBP's containment pond.

Sumps and pumps are located within the bunds for the cyanide product TK-01 and TK-02 (normally called the tank farm bund) for cyanide product TK-03. TK-03 which was installed after TK-01 and TK-02 has a contaminated and storm water sump. The contaminated sump collects leaks and spills from TK-03 product transfer pump. This water is directed to the tank farm bund sump which because of the absence of a contaminated sump will normally always contain cyanide.

The storm water sump in TK-03 bund collects rain water from the tank roof and bunded area. Providing there has not been leakage from the contaminated sump this liquid is normally cyanide free. Pipe work and valving are provided that allow the contents of the sump to be circulated and testing. If testing done on this water in the plant laboratory gives a pH between six and nine and a cyanide concentration of less than one ppm, this liquid can be pumped directly to the CSBP containment pond and subsequent wetland system. If the cyanide concentration is greater than one ppm and the pH less than six and greater than nine then this material is pumped to the tank farm bund. From the tank farm bund the contaminated water can be pumped to one of two waste water tanks or to the waste water sumps on SCP1 and SCP2. The contents of the waste water tanks can be either transferred to and blended in cyanide product or cyanide storage TK-01 or TK-02 or can be pumped to the waste water sumps on SCP1 and SCP2. Inline controls prevent discharges exceeding licence targets (one mg/L).

If the contents of the TK-03 bund cannot be recycled in the production plants then testing is required. Testing confirms compliance with targets prior to discharge to the CSBP containment pond, without the need to be treated through the cyanide destruction system first.

The same cyanide management process will be implemented for the new TK-04 cyanide storage tank.

6.3.3 COOLING TOWER BLOWDOWN WATER.

Cooling water is used to remove heat from process streams. When returned to the cooling tower, the water is evaporated by air drawn through by cooling tower fans, removing the heat. Dissolved solids in the water increase in concentration due to evaporation. Therefore, the water is purged and replaced to keep dissolved solids at a constant level. Water lost from the system through evaporation and purging is replaced by bore water (from CSBP) via a float valve and RO polishing permeate. Scheme water is available for use in an emergency and enters the cooling tower through a float valve after passing through a backflow preventer.

Both SCP1 & SCP2 have cooling towers which produce a constant volume of blow down water (concentrated water). This blow down water is discharged to the storm water drain which is directed to CSBP's containment pond. The water quality in the two cooling towers is analysed routinely for cyanide as part of internal quality assurance programs. Each cooling tower has capacity for eight cooling fans. Cooling tower 2 received approval to install two additional cells and fans in the vacant cell location (W6952/2024/1).

6.3.4 MAXITHERM AND JOHN ZINK INCINERATOR BLOWDOWN.

Both SCP1 and SCP2 have incinerators which include boilers as part of the waste heat recovery units, with the Maxitherm incinerator boiler to be decommissioned. These boilers have a continuous blowdown of water with a pH ~9.5. The incinerator boiler chemistry is analysed once per shift. Boiler blowdown is directed to the storm water system for discharge to the CSBP containment pond.

A future WHR boiler installed on the TO3 incinerator, associated blowdown will be treated in a similar manner.

6.3.5 RUNOFF COLLECTED OUTSIDE OF BUNDED AREAS.

Run-off and potential spills collected outside of bunded areas is directed to the storm water drainage system. The drainage system consists of four storm water sumps and all run off is diverted to one or all of these sumps. The operations team tests pH and cyanide concentration in the sumps before these are pumped to CSBP's containment pond. If the pH or CN concentration are out of spec then this wastewater is pumped to the tank farm for dilution of finished product, or treatment.

The purpose of the wastewater collection system is to collect all liquid spills within the process plant and tank farm bunded areas that may contain cyanide. All water having a cyanide concentration greater than one ppm is recycled into the process by either direct product addition at the tank farm, or indirectly by make up to the weak cyanide system.

When discharge of wastewater/stormwater from the NaCN plants to the CSBP containment pond occurs, a composite sample is continuously extracted, on a flow-weighted basis, from the wastewater ("effluent") or stormwater discharge line using a peristaltic pump. These daily samples are formed over a 24 hour period, at which stage the sample is collected and transported to the CSBP laboratory for analysis.

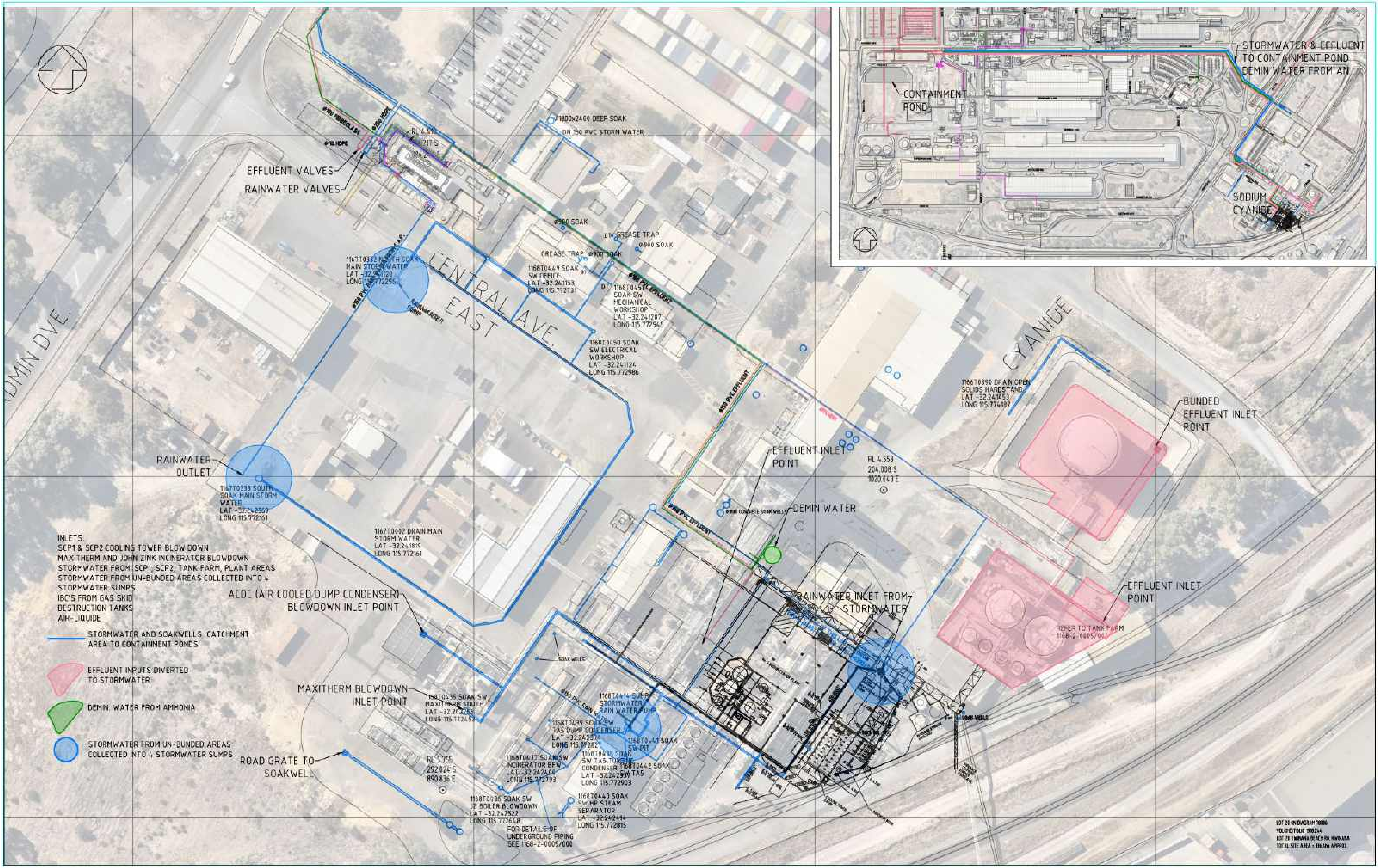


Figure 3117: AGR Wastewater drainage network

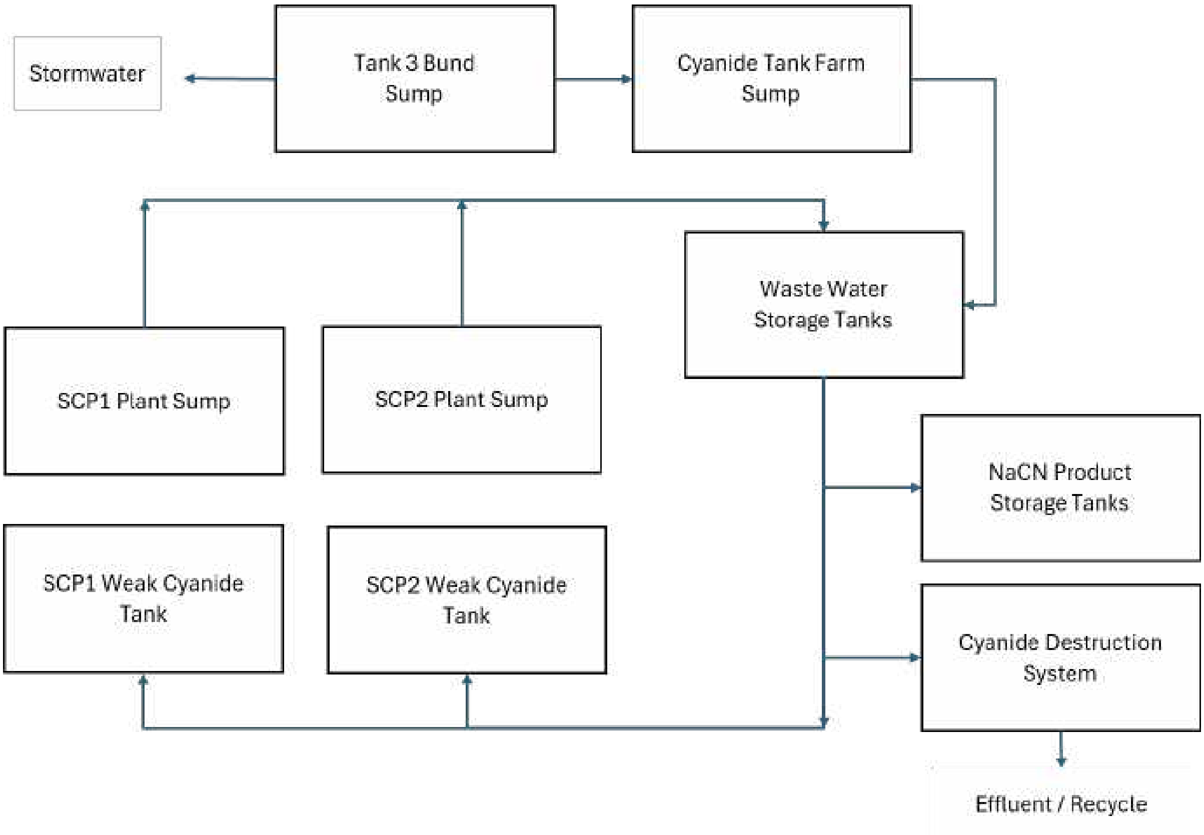


Figure 3218: Wastewater recovery flow path

Containment infrastructure is routinely inspected and repairs made where damage, wear and tear or cracking has been identified.

The following controls are implemented for the management of waste water.

- All potentially contaminated water (including stormwater) is collected and contained.
- All wastewater is tested prior to leaving site to ensure compliance with the 1mg/L NaCN limit prior to further treatment by CSBP and discharge to the Sepia Disposal Ocean Outlet Landline (SDOOL). This discharge is regulated under licence L6107, MS665 and the CSBP Water Corporation Discharge Agreement. The discharges will remain within the authorised limits.
- Implementing improved wastewater recycling (collected from the Solids drying process) through RO treatment approved in Stage 1 expansion.
- Wastewater release discharge target and monitoring for cyanide (licence conditions 12 and 13).
- All environmentally hazardous materials are contained and have maintained impervious secondary compounds with appropriate storage capacity. All spills and leaks (whether into secondary containment compound or not) are immediately recovered, collected and disposed of when detected (irrespective of being in or outside a low permeability compound (licence condition 14).

- The NaCN liquid storage tanks are equipped with overflow protection, which includes level gauges and overflow lines. Larger tanks also have high-level critical alarms.

6.4 Noise

The SCMF operates 24 hour per day. The prominent sound power level sources from the plant operation are the new air blowers (111 dB(A)), with lessor sources associated with the operation of the solids plant, turbine alternators, switching gear, air cooled dump condensers and the RO plant.

Stage 1 and Stage 2 upgrades (this application) were considered as part of the combined noise assessment.

Additional plant assessed:

- TO3 (Stage 2);
- Four air blowers for SCP1 (Stage 1) & SCP2 (two each), attenuated (Stage 1 and Stage 2).
- Cooling Tower No.2 – additional two cooling tower cells (Stage 1).
- Additional steam condensate cooling (air cooled radiator) (Stage 1).
- Reverse osmosis plant (Stage 1).
- Additional power transformer (Stage 1).
- Minor upgrade to solids plant (Stage 1)

Decommissioning of plant considered:

- Maxitherm Incinerator (No. 2) and associated fans/blowers (Stage 2).
- SCP1 (Stage 1) & SCP 2 (Stage 2) air boost blowers.
- SCP1 (Stage 1) & SCP2 (Stage 2) vacuum blowers, located within enclosed structures.

Construction noise will primarily involve the installation of equipment and new TK-04 secondary containment by mobile earth-moving equipment, and is unlikely to contribute to the overall operational noise. Construction activities will occur during live operation and planned shutdowns.

Nearby noise sensitive receptors are situated in residential developments in an arc from the east around to the southwest of the site. The nearest sensitive receptors are 3 km to the east in Medina. These receptors would also be exposed to general noise from the KIA and local traffic. Noise from traffic and other transport activity is not assessable under the Environmental Protection (Noise) Regulations 1997 (Noise Regulations).

The near-field environment comprises industrial premises, with Coogee Chemicals located to the east (separated by a rail corridor), while CSBP abuts the western and northern AGR boundary. The Coogee Chemicals site also operates 24 hours per day, and provides noise barriers in the direction of the large storage tanks to the south and south-east of AGR.

Worst-case conditions for noise impacts occur where there is a temperature inversion in conjunction with light winds in the direction of the noise receiver, resulting in effective sound propagation in that direction. Temperature inversions with light westerly winds are not common (typically western winds are moderate to strong) and the westerly air stream is warmed by the ocean.

Noise emissions from premises are regulated in WA under the Noise Regulations. Generally to achieve compliance with the Noise Regulations, noise levels at sensitive receptors from premises noise should not exceed ‘assigned levels’. For the most stringent regulatory time period, the LA10 noise level at sensitive receptors is required to be below 35 dB(A) plus influencing factors, while in the KIA the LA10 assigned noise level is 75 dB. Under the Noise Regulations, if noise emitted from any premises when received at another premises cannot reasonably be free of intrusive characteristics (tonality, modulation and impulsiveness), a series of adjustments are added to the emitted levels, and the adjusted level must comply with the assigned level.

Additionally, due to the cumulative noise emissions from multiple industrial premises, the application of Noise Regulations (regulation r7(2)) is required during ‘worst case’ sound propagation conditions during the night time period. In effect, for noise emissions from an individual premises (AGR) to be compliant where the cumulative noise from multiple premises exceeds the assigned level, the emission from that premise (being AGR) needs to be 5 dB(A) less than the receptor assigned level. For the key receptors, compliance at night is achieved if the noise emission is predicted to be no greater than an LA10 of 30 dB (if there are no influencing factors to be considered); thereby not seen as contributing to the noise. However, influencing factors exist and are considered in the assessment.

Assessment

AGR engaged SLR Consulting to assess the changes in the noise profile associated with proposed plant upgrades to verify compliance with the Noise Regulations. SLR conducted detailed measurement of the noise sources within the operating AGR facility in mid-2024 to develop a detailed acoustic model with individual noise sources. The Noise Impact Assessment (Appendix 3) included works proposed in Stage 1 and Stage 2 (this application) expansion works.

Figure 33: identifies the existing operation modelled noise contours in relation to sensitive receptors.

Figure 3319: AGR noise emission contours prior to Stage 1 and 2 upgrades, LA_{10}, dB

The assigned levels for the identified sensitive receptors, as well as the existing and predicted noise levels associated with the expansion are presented below.

Table 2318: Assigned, existing (prior to Stage 1 and 2 upgrades) & predicted noise emissions – residential receptors.

ID	Receptor	Influencing factor	Assigned levels LA10 dB			Plant noise level, dB			
			Day	Evening	Night	Existing	Proposed	Predicted change	Predicted compliance margin
R1	South edge Cee & See Caravan Park	7	52	47	42	30	28	-2	8
R2	100m south of Cee & See Caravan Park	3	48	43	38	29	28	-1	5
R3	450m south of Cee & See Caravan Park	1	46	41	36	28	27	-1	4
R4	Hillman residential northern edge	3	48	43	38	25	24	-1	9
R5	Hillman residential - 450m from Dixon Road	0	45	40	35	24	23	-1	7
R6	Rockingham Holiday Village	11	56	51	46	25	24	-1	17
R7	Leda - mid (western side)	0	45	40	35	19	19	0	12
R8	Leda - north (western side)	0	45	40	35	20	19	-1	12
R9	Kwinana - (western side)	0	45	40	35	28	27	0	3
R10	Medina - (western edge)	1	46	41	36	24	24	0	7
R11	Medina - (western side)	0	45	40	35	23	23	0	7
R12	1045 Wellard Road rural residence	11	56	51	46	31	30	-2	12
R13	1059 Wellard Road rural residence	11	56	51	46	31	29	-2	13

Where opportunities to mitigate noise emissions for the proposed plant upgrade have been identified, these have been reviewed by the engineering design team and been incorporated in the proposal.

The proposed upgrade of the AGR facility incorporates practical noise mitigation identified following a detailed review of the project noise sources, e.g., installing SCP1 and SCP2 blowers inside noise enclosures, where external sound attenuated blowers replace the existing vacuum blowers.

The acoustic modelling shows that the proposed AGR plant expansion will be compliant with the requirements of the Noise Regulations at all noise sensitive premises for all hours, with the upgrades showing a small reduction in noise emissions. The reductions are generally associated with the replacement of the existing vacuum blowers with attenuated positive pressure blowers, and decommissioning of the Maxitherm incinerator (Stage 2). Being ≥5 dB(A) below the night-time assigned level, the noise levels are not seen as contributing to the overall noise profile at the receptors.

The proposal predicted noise emissions to adjacent industrial premises (Coogee Chemicals and CSBP Kwinana) are less than 70 dB(A), and following adjustment of +5 dB for 'tonal characteristic' are compliant with the assigned levels.

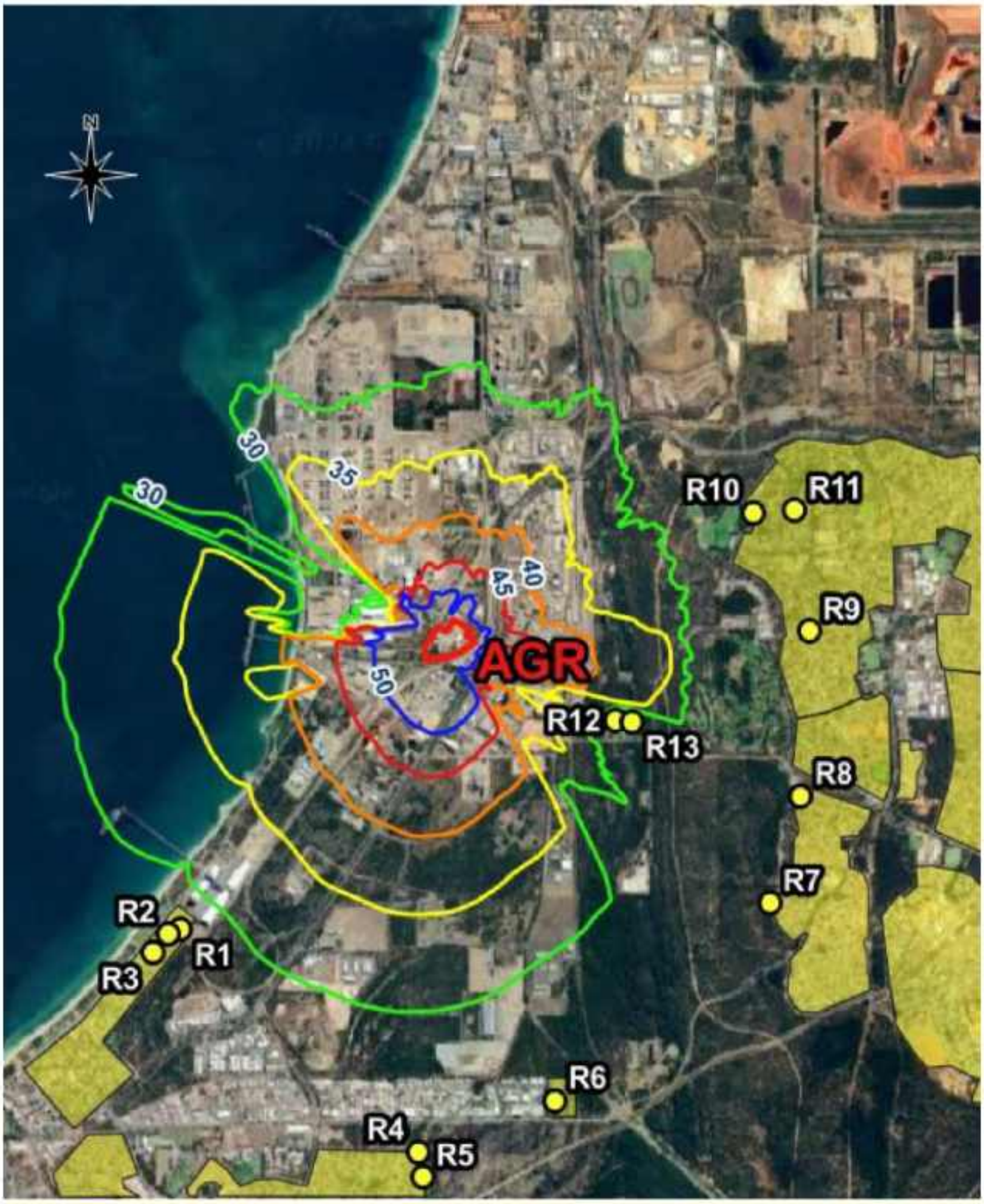


Figure 3420: Proposed AGR expansion noise emission contours, LA10, dB

A breakdown of noise sources by contribution for the proposed upgraded AGR for the R9 – Medina receptor, which is predicted to have the smallest compliance margin during night time assigned levels, is presented below.

Table 2419: Ranked noise emission contribution – proposed upgrade at key receptor R9, LA10 dB

Noise source	Equipment status	Sound power, dB	Noise level contribution, dB
Condensate Cooler Fans	Existing	114	24
Cooling Tower No. 1	Existing	113	20
Condensate Cooler Fans	Additional	108	18
Cooling Tower No. 2	Existing	108	15
Turbo Alternator building	Existing	110	13
SCP Pumps & equipment	Existing	108	12
Cooling Tower No. 2	Additional	103	10
John Zinc blower	Existing	105	10
Solids (SCS) noise sources	Existing	96	9
Gas Purification Plant Reciprocating Pumps	Existing	103	7
John Zinc stack fan No.2 (TO3)	Additional	105	6
SCP Blowers (4 units, combined)	Additional	104	4
RO Plant	Additional	100	4
Maxitherm blower	*To be decommissioned*	*114*	*20*
SCP Vacuum blowers	*To be decommissioned*	*110*	*16*
Boost Blower (SCP1 & SCP2, each)	*To be decommissioned*	*105*	*4*

Predicted cumulative emissions at key receptors was referenced against the KIC noise model. The model considers major noise generation industries within the KIA under worst case conditions, representative of a thermal inversion weather condition. The SLR report (Appendix 3) did note that other background noise associated with road traffic, rail (including freight rail), vessel and aircraft noise is not represented in the KIC noise model, therefore background noise at some locations may be higher than represented due to traffic noise contribution.

The KIC noise model worst case predicted noise emission LA_{10} 40 dB noise contour when compared to the cumulative AGR noise prediction show similar contours. The relevance of the cumulative noise in terms of the regulation requirements is that as the existing KIA noise emission exceeds the assigned level at receptors, noise emissions from other premises are assessed as 'significantly contributing' to the overall emission unless their contribution is 5 dB lower than the LA_{10} assigned level for the receptor.

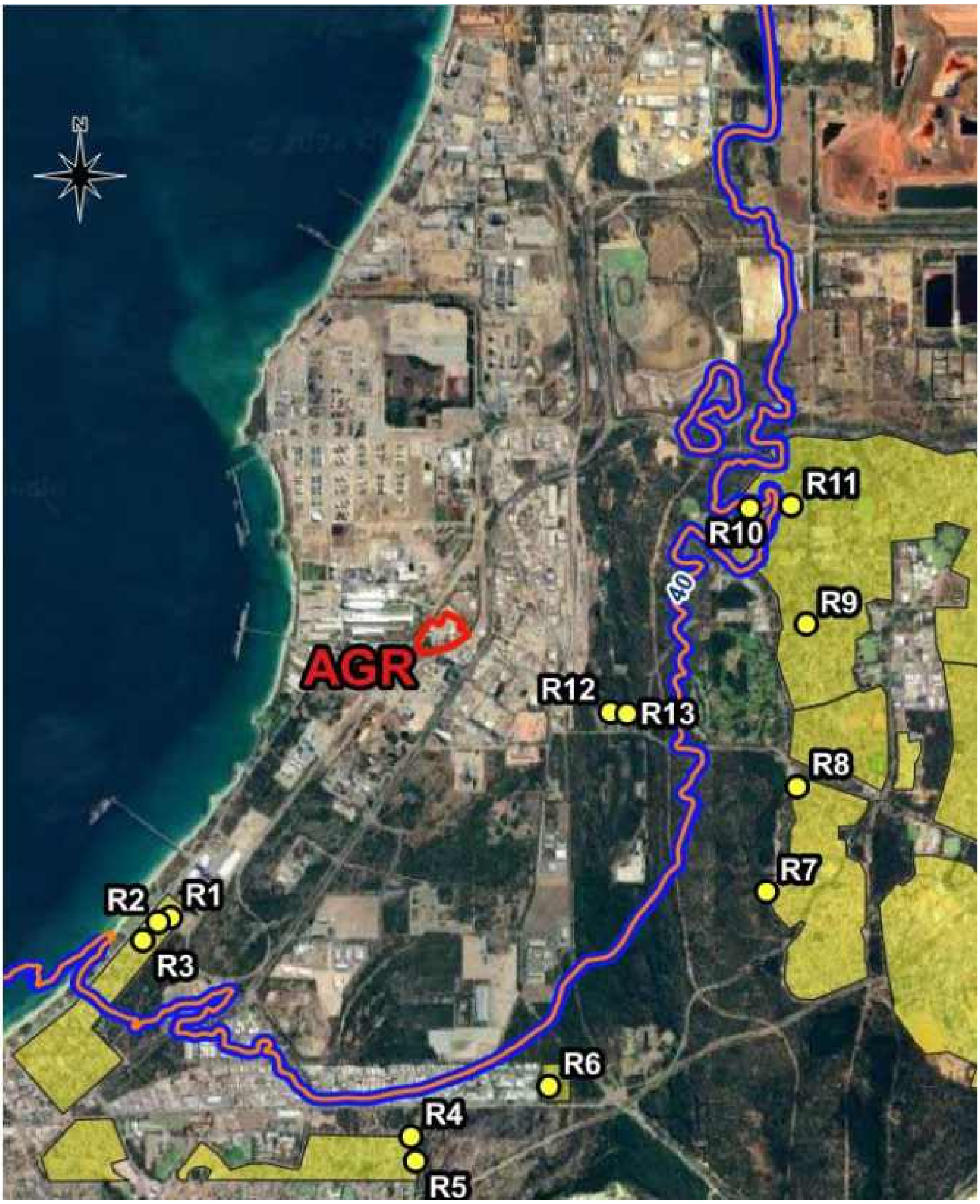


Figure 3521: AGR expansion noise prediction cumulative (blue) with KIC noise emission 40 dBA contour (orange) (worst case night time noise contour), LA10, dB

SLR concluded from their acoustic modelling that the proposed upgrade project noise emissions will be the same or reduced compared to existing noise emissions at far-field residential receptors such as Medina. The predicted noise emission from the AGR upgrade project are predicted to be compliant with the assigned levels of the Noise Regulations.

The assessment concludes that the proposed AGR plant expansion will not significantly affect the social surroundings.

6.5 Particulates (dust)

The formation of the containment area for the new NaCN tank (TK-04) and adjoining area to be prepared for sealing (loading of isotainers onto rail carts and road trailers) will require some short-term earthworks, which could potentially cause dust. Other upgrade activities within the existing operational area are not dusty and will not require significant earthworks.

Given the extent of the works and limited duration, it is not expected that sensitive receptors would be impacted by increased fugitive dust emissions.

The following control measures will be implemented:

- Soils in the in the earthworks construction zone will be wetted down if dry and causing dust lift-off
- A water cart will be maintained on site during the earthworks for dust mitigation, when required
- Works will temporarily cease where dust cannot be controlled within the property (Lot 20) boundary.

Operational areas are sealed and low speed limits on minimise of dust liftoff.

The liquid NaCN production is within a closed system which does not produce particulate matter. The production of solid NaCN is controlled under vacuum, where air emissions are wet-scrubbed prior to discharge.

6.6 Solid Waste Management

The manufacturing of NaCN is within an enclosed system with limited scope of solid waste generation. There will be no material change in solid waste management volumes or practices as part of the proposed expansion.

Spilled product is recovered and re-incorporated into the production process. Solid waste generation is through the replacement of spent catalysts, and soiled PPE which is disposed of into a contaminated waste collection bin located alongside the SCS.

The catalyst used are tabled below.

Table 2520: Catalyst management.

Catalyst	Function	Replacement
Platinum / Rhodium woven gauzes	Production of HCN in reactor	Annually. Spent gauzes are returned to the manufacturer for recycling.
Vanadium pentoxide pelletised	NOx Selective Catalytic Reactor (Maxitherm)	Every ~18 months (with each planned major shutdown). Catalyst is installed and removed within contained modules. Tested for CN after removal, prior to disposal by third party waste contractor. This will cease with the replacement of the Maxitherm incinerator.

The solid waste (e.g. catalysts) is kept contained and tested prior to disposal to ensure it is taken to an appropriate treatment / disposal facility.

Sludge (mainly dust washed into sumps) accumulates in the secondary containment sumps over time. As part of site sump cleanouts, the sludge is pumped into permeable "geo-bags" located on a bunded drying pad adjacent to the tank farm. The filtrate is returned to the stormwater management system. Once dried, the contents of the geo-bags are tested to establish suitable disposal (usually requires Class IV landfill disposal). General wastes are placed in designated skip bins. All wastes are removed from site by a third-party contractor and this is tracked. Controlled waste is accompanied by controlled waste tracking forms.

6.7 Fire and Safety Risk

The proposed expansion does not introduce new fire hazards or materials, however, operating the feed systems and reactors at higher capacity and under positive pressure increases the fire risk.

The NaCN manufacturing facility contains significant volumes of combustible and flammable materials. The primary fire hazard arises from potential loss of containment of flammable gases, with increased leakage risk due to higher reactor pressure and HCN content.

Fire and explosion risks are managed through a closed processing system, safety controls including detection and suppression systems, and air emissions management. Fire hydrants and extinguishers are strategically placed throughout the plant for fire control.

The increased risk of gas leaks and fire has been reviewed and is regulated by DEMIRS. The plant is designed and constructed in accordance with relevant Australian Standards, including but not limited to:

- AS1210: Pressure vessels
- AS/NZS 4041: Pressure piping
- AS/NZS 300: Electrical installations
- AS61511: Functional Safety in the Process Industry; and
- AS/NZS60079: Classification of Hazardous Areas

Compliance of these standards supports the achievement of process safety within the SCMF. The DEMIRS approved Safety Report (currently under review by DEMIRS) articulates the safety management systems.

CSBP maintains a functional emergency response capability and is a member of the Kwinana Industry Mutual Aid (KIMA) group. It therefore has capacity to respond to fires and incidents within its property or the immediate surrounds.

6.8 Process Control

In the SCPs, any potentially dangerous condition results in an automatic emergency shutdown. Multiple conditions can cause emergency shutdowns, including incorrect pressures of feed gases, elevated temperatures, power loss suffered by the main blowers, incorrect flowrates, PLC failures etc. Multiple sensors control the system. The process safety risks and controls are assessed by DEMIRS as part of their required Safety Report .

During an emergency shutdown, fuel feeds are shut off, nitrogen purging valves are automatically opened to initiate purging, and the waste gas stacks are opened to the atmosphere to relieve the purge.

Start up, shut down and operation of the plant is controlled from the control system interface in the SCP control room. The plant has an emergency safety device on NO_X set at < 12 g/s (25 minute average) to ensure the authorised emission limit is not exceeded as an environmental and regulatory risk mitigation strategy.

The solids packaging plant is operated from a local control panel in the packaging plant. It will not start up unless the induced draft fan and scrubbing system is operating. The packaging plant will trip if either stop.

The premises has a range of safety critical controls designed to prevent and/or mitigate loss of containment, fire, and explosion events. Table 26 presents examples of some of the safety critical control measures, which also provide environmental risk mitigation.

Table 26: Sodium cyanide manufacturing safety systems

Safety Critical Control Safety	Critical Control Function
Pressure Integrity Devices	Ensure pressure equipment does not exceed design parameters.
Gas Detection	Gas detectors will either initiate emergency shutdown systems or activate alarms in the control room. Operator intervention is required for gas detectors with alarm function only.
Fire Protection Equipment	Fire systems are designed to mitigate the impact of a loss of containment or fire event. The predominant fire risk is associated with flammable gases entering the front end of the manufacturing process. Systems can be automatic functions or manually operated. Fire supply water is obtained from the CSBP fire water system, scheme water system and bore water system. Equipment includes portable monitors, fire hydrants, hose reels, fire extinguishers, and a gas quenching system. The fire system is inspected, tested, and maintained in accordance with AS1851. Fire hydrants and fire extinguishers are strategically placed throughout the SCMF to respond to any fire scenario. Fire extinguishers are dry chemical extinguishers. CSBP also maintains an emergency response resource for emergency management.
Instrumented Alarms / Operator Actions	Alarm functions that advise the control room panel operator that a defined operational parameter has exceeded a defined specification. The response to the alarm is executed by the control room panel operator.

Safety Critical Control Safety	Critical Control Function
Operational Procedures / Operator Actions	Procedures provide specific instructions on undertaking activities and require operations personnel to follow the specified approach.
Interlocks	Programmed in the control system and prevent a task from progressing if particular conditions are not met.
Basic Process Control Systems (BPCS)	These controls systems prevent a process condition from exceeding defined parameters. Control systems will automatically alter process activities such as flow or pressure to remain within acceptable levels. The BPCS has the capability to shut down the plant.
Safety Instrumented Functions	Designed to make the facility safe in the event of an operational parameter such as temperature, pressure or flow exceeding a defined specification. The SIF can shut down the plant. Plant shutdowns can also be manually activated by emergency stop buttons.
Emergency Shutdown (ESD) System	The ESD on the plant will initiate automatically when process variables exceed limit setpoints. ESD can also be manually activated by push buttons located in the control room and in the plant.

6.9 Summary Risk Assessment

The infrastructure required to increase production will not change the nature of the activities carried out at the premises nor the type of emissions and discharges. While the proposal does potentially result in the increase in air emissions, these have been assessed to not likely have an impact on sensitive receptors as shown in the conservative air quality modelling and human health risk assessment. The proposed production increase will not result in an increase in increase the risk profile of the premises, and the potential environmental impacts can continue to be managed through the existing licence conditions.

The EPA assessed the proposed increase in production, and its implementation is approved by Ministerial Statement 1196. Therefore, the production increase requested in this works approval / licence amendment application is consistent with that authorised through the Ministerial Statement.

7. PROPOSED FEE CALCULATION (ATT. 10 OF DWER APPLICATION FORM)

Cost of works: $100,000,000 (1405 fee units)

Fee unit: $43.45

In accordance with Schedule 3 of the EP Regs, the work approval fee is calculated to be **$ 61,047.25**

8. REFERENCES

DWER 2019. Guideline, Air Emissions. Draft for consultation. Draft-guideline-air-emissions.pdf

Matisons 2024. Addendum to Kwinana Sodium Cyanide Manufacturing Facility Upgrade Human Health Risk Assessment. Report dated 3 June 2024 prepared by Matisons Toxicology Solutions for Australian Gold Reagents. See Appendix 2.

MRP Technical Consulting 2025. AGR Model Update and Emissions Verification Report. Report dated 22 August 2025 prepared for Wesfarmers Chemicals, Energy & Fertlisers. See Appendix 1.

SLR Consulting 2024. *Sodium Cyanide Expansion Project Noise Impact Assessment.* Report (#675.072268.0004-R01 dated 24 July 2024 prepared for Australian Gold Reagents. See Appendix 3.

9. APPENDICES

Appendix 1 – MRP 2025 AGR Model Update and Emissions Verification Report.

Appendix 2 – Matison 2024 Human Health Risk Assessment

Appendix 3 – SLR 2024 AGR Expansion Project Noise assessment

Appendix 4 - Existing NaCN manufacturing process