Government of Western Australia
Department of Water and Environmental Regulation

Licence

Licence number	L8870/2014/1
Licence holder	Tronox Pigment Bunbury Ltd
ACN	008 683 627
Registered business address	Lot 350 Old Coast Road, AUSTRALIND WA 6233
DWER file number	DER2014/003202-1~3
Duration	30/12/2014 to 29/12/2029
Date of amendment	09 May 2024
Premises details	Kemerton Pigment Plant 869 Marriott Road, WELLESLEY WA 6233 Legal description - Part of Lot 1 on Plan 73196 As defined by the premises map in Schedule 1

Prescribed premises category description (Schedule 1, *Environmental Protection Regulations 1987*)	**Assessed production capacity**
Category 31: Chemical manufacturing: premises (other than premises within category 32) on which chemical products are manufactured by a chemical process.	125 000 tonnes per annual period
Category 87: Fuel burning: premises on which gaseous, liquid or solid fuel with a sulphur content of less than 0.25% is burnt in a boiler for the supply of steam or in power generation equipment.	1 140 kg per hour on natural gas; 1 180 kg per hour on diesel
Category 61: Liquid waste facility: premises on which liquid waste produced on other premises (other than sewerage waste) is stored, reprocessed, treated or irrigated.	600,000 tonnes per annual period

This Licence is granted to the works approval holder, subject to the attached conditions, on 09 May 2024, by:

Caron Goodbourn

Digitally signed by Caron Goodbourn
Date: 2024.05.09 10:11:00 +08'00'

Manager, Process Industries

an officer delegated under section 20 of the *Environmental Protection Act 1986* (WA)

Contents

Introduction

This Introduction is not part of the Licence conditions.

DER's industry licensing role
The Department of Environment Regulation (DER) is a government department for the state of Western Australia in the portfolio of the Minister for Environment. DER's purpose is to advise on and implement strategies for a healthy environment for the benefit of all current and future Western Australians.

DER has responsibilities under Part V of the *Environmental Protection Act 1986* (the Act) for the licensing of prescribed premises. Through this process DER regulates to prevent, control and abate pollution and environmental harm to conserve and protect the environment. DER also monitors and audits compliance with works approvals and licence conditions, takes enforcement action as appropriate and develops and implements licensing and industry regulation policy.

Licence requirements
This Licence is issued under Part V of the Act. Conditions contained within the Licence relate to the prevention, reduction or control of emissions and discharges to the environment and to the monitoring and reporting of them.

Where other statutory instruments impose obligations on the Premises/Licensee the intention is not to replicate them in the licence conditions. You should therefore ensure that you are aware of all your statutory obligations under the Act and any other statutory instrument. Legislation can be accessed through the State Law Publisher website using the following link: http://www.slp.wa.gov.au/legislation/statutes.nsf/default.html

For your Premises relevant statutory instruments include but are not limited to obligations under the:

- *Environmental Protection (Unauthorised Discharges) Regulations 2004* – these Regulations make it an offence to discharge certain materials such as contaminated stormwater into the environment other than in the circumstances set out in the Regulations.
- *Environmental Protection (Controlled Waste) Regulations 2004* - these Regulations place obligations on you if you produce, accept, transport or dispose of controlled waste.
- *Environmental Protection (Noise) Regulations 1997* – these Regulations require noise emissions from the Premises to comply with the assigned noise levels set out in the Regulations.

You must comply with your licence. Non-compliance with your licence is an offence and strict penalties exist for those who do not comply.

Licence holders are also reminded of the requirements of section 53 of the Act which places restrictions on making certain changes to prescribed premises unless the changes are in accordance with a works approval, licence, closure notice or environmental protection notice.

Licence fees
If you have a licence that is issued for more than one year, you are required to pay an annual licence fee prior to the anniversary date of issue of your licence. Non-payment of annual licence fees will result in your licence ceasing to have effect meaning that it will no longer be valid and you will need to apply for a new licence for your Premises.

Ministerial conditions
If your Premises has been assessed under Part IV of the Act you may have had conditions imposed by the Minister for Environment. You are required to comply with any conditions imposed by the Minister.

Premises description and Licence summary
Cristal Pigment Australia Ltd (Cristal) operates a titanium dioxide (TiO_2) processing plant (the Plant) under licence L8870/2014/1. The plant was established in 1988 by SCM Chemicals in the Kemerton Industrial Park. In 2007 the plant was acquired by Saudi Arabian-based company National Titanium Dioxide Company and currently trades as a wholly owned subsidiary known as Cristal Pigment. The closest sensitive receptor is a rural residence approximately 2 km south-east of the plant. There is also a residential subdivision approximately 3 km west of the plant. The site is considered a major hazard facility under Dangerous Goods legislation due to the industrial use of chlorine, which is highly toxic and a strong oxidiser in gaseous form.

The plant manufactures titanium dioxide pigment using the chloride process. The process involves the production and oxidation of titanium tetrachloride to yield titanium dioxide and liquid chlorine. Chlorine gas is recovered and returned to the front end of the process. The titanium dioxide is slurried and transported to Cristal's finishing plant at Australind where it is chemically treated. The key environmental considerations include air emissions, water discharges and solid wastes.

The main air emissions are carbon monoxide, carbonyl sulfide, and sulfur oxides from the main stack. Off gas from the chlorinator unit passes through a mixed scrubbing system (spray tower, venturi and packed tower) prior to dilution with other process off gas streams and discharge to the atmosphere via a 66 m stack. The plant has chlorine sensors in the process stream gas that trigger a quench caustic scrubbing system if required; the plant is also interlocked to shut down in the event that chlorine is detected in the process vent.

The main emissions to water are from the discharge of treated effluent to the Indian Ocean via a discrete ocean outfall in the Leschenault Peninsula. All liquid waste streams from pigment production, the air separation plant, and adjacent Chlor-Alkali Plant are directed into the premises neutralisation plant for treatment prior to discharge of the resulting effluent via the ocean outfall pipeline. Treated solid residues (TSR) remaining from the liquid waste treatment process are slurried then transported via road tankers to an approved disposal location at the Banksia Road Landfill Site, Dardanup (L7439/1998/9). A double lined containment cell has been established at the landfill for disposal of TSR remaining from liquid waste treatment at the Kemerton TiO_2 Processing Plant and the Australind TiO_2 Finishing Plant (L6046/1967/15), both operated by Cristal. The containment cell has a leachate recovery system to collect all leachate and contaminated stormwater generated from the TSR containment cell. The collected leachate is transported by road tankers back to the neutralisation plant at the Premises for treatment prior to discharge through the ocean outfall with the Plant's treated effluent stream.

The licences and works approvals issued for the Premises since its establishment in 1987 are:

Instrument log		
Instrument	**Issued**	**Description**
W32	14/10/1987	Works approval to authorise plant construction. Issued by the Environmental Protection Authority (EPA) following ratification of the Pigment Factory Agreement Act and Ministerial Statement 001 on 25/08/1987.
L1002	21/12/1988	Interim licence issued to allow commissioning of the plant. Issued to SCM Chemicals Ltd (SCM).
L1023	20/01/1989	First full operating licence issued to SCM. Issued for one year.
L1697	19/12/1989	New 2-part licence, incorporating water discharge conditions originally issued by WAWA under the revoked pt 111(a) of the *Rights in Water and Irrigation Act 1914*. Issued for one year.
L1697	19/03/1990	Licence amendment to rectify EPA concerns with original licence conditions.
L2876	27/06/1991	Licence renewal.
W687	12/08/1991	Works approval for trial feedstock tests addressing the effects of coke sulphur content on discharges to the atmosphere.
L3347	27/11/1991	Licence renewal.
W749	20/12/1991	Works approval for construction of a solids recycling system.
L3771	23/09/1992	Licence renewal. Issued for one year.

L4606	11/10/1993	Licence renewal. Issued for one year.
L5223	16/09/1994	Licence renewal. Issued for one year. First licence issued by DER, the former Department of Environmental Protection.
W1135	21/09/1994	Works approval for upgrades to the sand mills (de-bottlenecking).
L6078	27/09/1995	Licence renewal. Issued for one year.
L6078/1	11/11/1997	Licence renewal. Issued for one year. First licence issued to Millennium Inorganic Chemicals Ltd and first licence to combine water discharge conditions with the EPA licence.
L6078/2	15/01/1998	Licence renewal. Issued for one year.
L6078/3	27/10/1998	Licence renewal. Issued for one year.
L6078/4	30/09/1999	Licence renewal. Issued for one year.
L6078/5	11/09/2000	Licence renewal. Issued for one year.
W3263/1	27/12/2000	Works approval for de-bottlenecking to increase production capacity to 95 000 tpa.
L6078/6	26/09/2001	Licence renewal. Issued for one year.
L6078/7	25/09/2002	Licence renewal. Issued for one year.
L6078/8	10/11/2003	Licence renewal. Issued for one year.
L6078/9	11/11/2004	Licence renewal. Issued for one year.
L6078/10	14/11/2005	Licence renewal. Issued for one year.
L6078/11	09/11/2006	Licence renewal. Issued for one year.
L6078/1988/12	15/11/2007	Licence renewal. First non-annual licence - issued for three years.
L6078/1988/13	11/11/2010	Licence renewal following full review. Issued in Welker format for three years. Addition of CEMS requirements and updated air modelling.
L6078/1998/13	14/05/2012	Licence amendment to update biomonitoring program at the Kemerton Ocean Outfall and a 12 month extension for compliance with the CEMS Code.
L6078/1998/13	08/02/2013	Licence amendment to change occupier to Cristal Pigment Australia Ltd.
L6078/1998/13	26/04/2013	Licence amendment to remove requirements for CEMS on carbon monoxide, carbonyl sulfide and sulfur dioxide emissions; extend the deadline for CEMS compliance for chlorine to August 2013, such that more realistic and appropriate limits and targets for chlorine can be derived from actual continuous monitoring data.
L6078/1988/14	14/11/2013	Licence renewal. Conversion to REFIRE licence. Issued for 5 years.
L6078/1988/14	27/11/2014	Licence amendment to increase the volumetric flow rate limit for treated effluent discharged to the ocean.
L8870/2014/1	30/12/2014	New licence issued following previous licence ceasing to have effect.
L8870/2014/1	08/10/2015	Licence amendment to include Category 61: Liquid Waste Facility on the licence and revise groundwater monitoring locations.
L8870/2014/1	09/05/2024	Licence amendment application to install a new ocean outfall diffuser and other administrative changes

Severance
It is the intent of these Licence conditions that they shall operate so that, if a condition or a part of a condition is beyond the power of this Licence to impose, or is otherwise *ultra vires* or invalid, that condition or part of a condition shall be severed and the remainder of these conditions shall nevertheless be valid to the extent that they are within the power of this Licence to impose and are not otherwise *ultra vires* or invalid.

END OF INTRODUCTION

Licence conditions

1 General

1.1 Interpretation

1.1.1 In the Licence, definitions from the Environmental Protection Act 1986 apply unless the contrary intention appears.

1.1.2 For the purposes of this Licence, unless the contrary intention appears:

'Act' means the *Environmental Protection Act 1986;*

'AHD' means the Australian height datum;

'annual period' means the inclusive period from 1 January until 31 December in the same year;

'ANZECC' means the Australian and New Zealand Environment Conservation Council (ANZECC) which was a Ministerial Council operating between 1991 and 2001 and which provided a forum for member governments to develop coordinated policies about national and international environment and conservation issues; ANZECC issued a series of Guidelines such as the ANZECC Guidelines for Fresh and Marine Water Quality 2000;

'AS 4323.1' means the Australian Standard AS4323.1 *Stationary Source Emissions Method 1: Selection of sampling positions;*

'AS/NZS 5667.1' means the Australian Standard AS/NZS 5667.1 *Water Quality – Sampling – Guidance of the Design of sampling programs, sampling techniques and the preservation and handling of samples;*

'AS/NZS 5667.9' means the Australian Standard AS/NZS 5667.9 *Water Quality – Sampling – Guidance on sampling from marine waters;*

'AS/NZS 5667.10' means the Australian Standard AS/NZS 5667.10 *Water Quality – Sampling – Guidance on sampling of waste waters;*

'AS/NZS 5667.11' means the Australian Standard AS/NZS 5667.11 *Water Quality – Sampling – Guidance on sampling of groundwaters;*

'AS/NZS 5667.12' means the Australian Standard AS/NZS 5667.12 *Water Quality – Sampling – Guidance on sampling of bottom sediments;*

'averaging period' means the time over which a limit is measured or a monitoring result is obtained;

'biomonitoring' means the measurement of the body burden of toxic chemical compounds, elements, or their metabolites, in biological substances;

'Bq/kg' and **'Bq/L'** means Becquerel per kilogram and Becquerel per litre, respectively;

'CEMS' means continuous emissions monitoring system;

'CEMS Code' means the current version of the Continuous Emission Monitoring System (CEMS) Code for Stationary Source Air Emissions, Department of Environment & Conservation, Government of Western Australia;

'CEO' means Chief Executive Officer of the Department of Water and Environment Regulation;

'CEO' for the purpose of correspondence means;

Director General
Department Administering the *Environmental Protection Act 1986*
Locked Bag 10
Joondalup DC WA 6919
Email: info@dwer.wa.gov.au

'derived measurement' means the derived measurement of stack gas concentrations based on process measurements upstream of the emission point. The values shall be calculated in accordance with the SCM Chemicals Ltd document entitled *Chloride Technical Memo No. 227: Methane Tracer Gas Flow Measurement* and dated 24 May 1994;

'freeboard' means the distance between the maximum water surface elevations and the top of retaining banks or structures at their lowest point;

'Licence' means this Licence numbered L8870/2014/1 and issued under the Act;

'Licensee' means the person or organisation named as Licensee on page 1 of the Licence;

'mixed scrubbing system' means the combination of scrubbing systems from the chlorinator exit including but not limited to the spray tower, venturi and packed tower;

'mixing zone' means the area or volume within the receiving water where the initial dilution of the discharge plume occurs as rapid mixing between waste and ambient water and where the water quality fails to meet the relevant ANZECC guideline;

'NATA' means the National Association of Testing Authorities, Australia;

'NATA accredited' means in relation to the analysis of a sample that the laboratory is NATA accredited for the specified analysis at the time of the analysis;

'normal operating conditions' means any operation of a particular process (including abatement equipment) excluding start-up, shut-down and upset conditions, in relation to stack sampling or monitoring;

'Premises' means the area defined in the Premises Map in Schedule 1 and listed as the Premises address on page 1 of the Licence;

'quarterly' means the 4 inclusive periods from 1 January to 31 March; 1 April to 30 June, 1 July to 30 September, and 1 October to 31 December in the same year,

'Schedule 1' means Schedule 1 of this Licence unless otherwise stated;

'shut-down' means the period when plant or equipment is brought from normal operating conditions to inactivity;

'spot sample' means a discrete sample representative at the time and place at which the sample is taken;

'stack test' means a discrete set of samples taken over a representative period at normal operating conditions;

'start-up' means the period when plant or equipment is brought from inactivity to normal operating conditions;

'STP dry' means standard temperature and pressure (0°Celsius and 101.325 kilopascals respectively), dry;

'triennial' means recurring every 3 years;

'USEPA' means United States (of America) Environmental Protection Agency;

'USEPA Method 6' means the USEPA Method 6 *Determination of Sulfur Dioxide Emissions from Stationary Sources*;

'USEPA Method 8' means the USEPA Method 8 *Determination of Sulfuric Acid and Sulfur Dioxide Emissions from Stationary Sources*;

'USEPA Method 10' means the USEPA Method 10 *Determination of Carbon Monoxide Emissions from Stationary Sources (Instrument Analyser Procedure);*

'USEPA Method 10B' means the USEPA Method 10B *Determination of Carbon Monoxide Emissions from Stationary Sources*;

'USEPA Method 15' means the USEPA Method 15 *Determination of Hydrogen Sulfide, Carbonyl Sulfide and Carbon Disulfide Emissions from Stationary Sources*;

'USEPA Method 26' means the USEPA Method 26 *Determination of Hydrogen Halide and Halogen Emissions from Stationary Sources (Non-Isokinetic Method)*;

'USEPA Method 26A' means the USEPA Method 26A *Determination of Hydrogen Halide and Halogen Emissions from Stationary Sources (Isokinetic Method)*; and

'µS/cm' means microsiemens per centimetre.

1.1.3 Any reference to an Australian or other standard in the Licence means the relevant parts of the standard in force from time to time during the term of this Licence.

1.1.4 Any reference to a guideline or code of practice in the Licence means the version of that guideline or code of practice in force from time to time, and shall include any amendments or replacements to that guideline or code of practice made during the term of this Licence.

1.1.5 Nothing in the Licence shall be taken to authorise any emission that is not mentioned in the Licence, where the emission amounts to:
- (a) pollution;
- (b) unreasonable emission;
- (c) discharge of waste in circumstances likely to cause pollution; or
- (d) being contrary to any written law.

1.2 General conditions

1.2.1 The Licensee shall operate and maintain all pollution control and monitoring equipment to the manufacturer's specification or any relevant and effective internal management system.

1.2.2 The Licensee shall immediately recover, or remove and dispose of spills of environmentally hazardous materials outside an engineered containment system.

1.2.3 The Licensee shall:
- (a) implement all practical measures to prevent stormwater run-off becoming contaminated by the activities on the Premises; and
- (b) treat contaminated or potentially contaminated stormwater as necessary prior to being discharged from the Premises.[1]

Note 1: The *Environmental Protection (Unauthorised Discharges) Regulations 2004* make it an offence to discharge certain materials into the environment.

1.3 Premises operation

1.3.1 The Licensee shall record and investigate the exceedance of any descriptive or numerical limit in this section.

1.3.2 The Licensee shall only allow waste to be accepted on to the Premises if:
(a) it is of a type listed in Table 1.3.1; and
(b) the quantity accepted is below any limit listed in Table 1.3.1; and
(c) it meets any specification listed in Table 1.3.1

Table 1.3.1: Waste acceptance		
Waste	**Quantity Limit**	**Specification**
Leachate from the Cristal TSR Cell at the Banksia Road Landfill Site	500 000 m^3 per annual period	Transferred from the Cristal TSR Cell Leachate Holding Tanks at the Banksia Road Landfill Site via road tankers and discharged into the Dirty Effluent Pond or waste water tank D561.
Treated wastewater from the Kemerton Silicon Smelter	100 000 m^3 per annual period	Transferred from the Kemerton Silicon Smelter reverse osmosis plant and settling pond to the Clean Effluent Pond via an enclosed pipeline.

1.3.3 The Licensee shall ensure that waste water is only stored and/or treated within vessels or compounds provided within the infrastructure detailed in Table 1.3.2.

Table 1.3.2: Containment infrastructure		
Vessel or compound	**Material**	**Infrastructure requirements**
Clean effluent pond	Process wastewater	Lined to achieve a permeability of less than $1x10^{-9}$ m/s or equivalent
Dirty effluent pond		
Effluent overflow sump		
Waste water tank D561		Enclosed tank

1.3.4 The Licensee shall manage the infrastructure listed in Condition 1.3.3 such that:
(a) a minimum top of embankment freeboard of 500 mm is maintained;
(b) overtopping does not occur except as a result of an extreme rainfall event (greater than 1 in 100 year event of 72 hours duration); and
(c) the integrity of the containment infrastructure is maintained.

2 Emissions

2.1 General

2.1.1 The Licensee shall record and investigate the exceedance of any descriptive or numerical limit specified in any part of section 2 of this Licence.

2.2 Point source emissions to air

2.2.1 The Licensee shall ensure that where waste is emitted to air from the emission points in Table 2.2.1 and identified on Map 1 of emission points, monitoring points and containment infrastructure in Schedule 1 it is done so in accordance with the conditions of this Licence.

Table 2.2.1: Emission points to air

Emission point reference and location on Map 1 of emission points, monitoring points and containment infrastructure	Emission Point	Emission point height (m)	Source, including any abatement
A1	Chlorinator unit process scrubber vent stack	66	Chlorinator off-gas via mixed scrubbing system and quench scrubbing circuit (F510)
A2	Oxygen heater stack	40	Oxygen heater (F326)
A3	Titanium tetrachloride heater stack	35	Titanium tetrachloride heater (F306)
A4	Waste minimisation plant stack	25	Waste minimisation plant (F5110)
A5	Chlorinator light up stack	34	Chlorinator (F204)
A6	Chlorinator vent stack	53	Emergency vent from chlorinator (F602)
A7	Slurry tank vent stack		Emergency vent from slurry tank (F601)
A8	Crude tank vent stack		Emergency vent from crude tank (F603)
A9	Vaporiser vent stack		Emergency vent from vaporiser (F604)
A10	Diesel/natural gas boiler #1 stack	10	Diesel/natural gas boiler #1 stack (F690)
A11	Diesel/natural gas boiler #2 stack	12	Diesel/natural gas boiler #2 stack (F6123)

2.2.2 The Licensee shall not cause or allow point source emissions to air greater than the limits listed in Table 2.2.2.

2.2.3 The Licensee is exempt from compliance with condition 2.2.2 if in the case of an event in Table 2.2.3 the corresponding management action is taken.

Table 2.2.2: Point source emission limits to air			
Emission point reference	**Parameter**	**Limit (including units)[1]**	**Averaging period**
A1	Sulfur dioxide	11,400 mg/m^3	Continuous derived measurement (60 minute average) Stack test (min 30 minute average)
	Carbonyl sulfide	26,400 mg/m^3	Continuous derived measurement (60 minute average) Stack test (180 minute average)[2]
	Carbon monoxide	229,000 mg/m^3	Continuous derived measurement (8 hour average) Stack test (min 30 minute average)
	Chlorine	500 mg/m^3	CEMS (60 minute average) Stack test (min 30 minute average)
	Hydrogen chloride	100 mg/m^3	Stack test (min 30 minute average)

Note 1: All units are referenced to STP dry.
Note 2: Averaging time may not be applicable to approved alternative methods.

2.2.4 The Licensee shall take the specified management action in the case of an event in Table 2.2.3.

Table 2.2.3: Management actions			
Emission point reference	**Event/ action reference**	**Event**	**Management action**
A1 & A5	EA1	Start-up	The Licensee shall take all practical measures to minimise emissions.
A1	EA2	Any time the CEMS is indicating that chlorine emissions do not meet the relevant limit in Table 2.2.2	The Licensee shall cease feed within 10 minutes of the start of any event unless chlorine emissions have already returned to levels that meet the relevant limit in Table 2.2.2.
	EA3	Failure of both continuous chlorine detectors in the chlorinator unit process scrubber vent	The Licensee shall immediately commence manual monitoring of chlorine concentrations in the chlorinator unit process scrubber vent using Dräger tubes or equivalent at intervals of 5 minutes or less. If neither of the continuous chlorine detectors can be repaired or replaced within 4 hours of the start of any event, the Licensee shall shut down the chlorinator unit.

2.2.5 Following the cessation of emissions/operation under Condition 2.2.4, the Licensee shall not restart operation of the process until:
(a) the problem that caused the exemption event has been rectified; or
(b) the Licensee records the actions taken to maintain compliance with the Licence until the problem causing the exemption event has been rectified.

2.3 Point source emissions to surface water

2.3.1 The Licensee shall ensure that where waste is emitted to surface water from the emission points in Table 2.3.1 and identified on Map 2 of emission points and monitoring points in Schedule 1 it is done so in accordance with the conditions of this Licence.

Table 2.3.1: Emission points to surface water		
Emission point reference and location on Map 2 of emission points and monitoring points	**Description**	**Source including abatement**
T1[1]	Discharge from the clean effluent pond to the Indian Ocean, via the Kemerton ocean outfall pipeline	Process effluent, neutralised

Note 1: Kemerton ocean outfall diffuser, approximate location 376974 E, 6325754 N.

2.3.2 The Licensee shall not cause or allow point source emissions to surface water greater than the limits listed in Table 2.3.2.

2.3.3 The Licensee is exempt from compliance from Condition 2.3.2 if in the case of an event in Table 2.3.3 the corresponding management action is taken.

Table 2.3.2: Point source emission limits to surface water				
Emission point reference	**Monitoring point reference**	**Parameter**	**Limit (including units)**	**Averaging period**
T1	W1	Volumetric flow rate	190 m^3/hour	Continuous
		pH	6 – 10	
		Total suspended solids	80 mg/L	Daily
		Total dissolved solids[1]	55,000 mg/L	Continuous
		Manganese	3.6 mg/L[2]	Composited weekly sample

Note 1: Calculated from electrical conductivity @ 25°C.
Note 2: For 80% of samples collected in any 12 consecutive calendar months.

2.3.4 The Licensee shall take the specified management action in the case of an event in Table 2.3.3.

Table 2.3.3: Management actions			
Emission point reference	**Event/ action reference**	**Event**	**Management action**
T1	EA4	Any time the continuous monitor on the Kemerton ocean outfall pipeline measuring discharge from the clean effluent pond is indicating the concentration or flow of any parameter(s) does not meet the relevant limit in Table 2.3.2.	The Licensee shall cease discharge to the Kemerton ocean outfall within 10 minutes of the start of any event unless concentration(s) or flow have already returned to levels that meet the relevant limit in Table 2.3.2.
	EA5	Failure of the continuous monitor on the Kemerton ocean outfall pipeline measuring discharge from the clean effluent pond.	The Licensee shall immediately commence manual monitoring of the parameters in Table 3.3.1 at intervals of 4 hours or less. If the continuous monitor cannot be repaired or replaced within 48 hours of the start of any event, the Licensee shall cease discharge from the Kemerton ocean outfall.

3 Monitoring

3.1 General monitoring

3.1.1 The licensee shall ensure that:
- (a) all water samples are collected and preserved in accordance with AS/NZS 5667.1;
- (b) all wastewater sampling is conducted in accordance with AS/NZS 5667.10;
- (c) all surface water sampling is conducted in accordance with AS/NZS 5667.9;
- (d) all groundwater sampling is conducted in accordance with AS/NZS 5667.11;
- (e) all sediment sampling is conducted in accordance with AS/NZS 5667.12; and
- (f) all laboratory samples are submitted to and tested by a laboratory with current NATA accreditation for the parameters being measured unless indicated otherwise in the relevant table.

3.1.2 The Licensee shall ensure that:
- (a) weekly monitoring is undertaken at least 5 days apart;
- (b) quarterly monitoring is undertaken at least 45 days apart;
- (c) annual monitoring is undertaken at least 9 months apart; and
- (d) triennial monitoring is undertaken at least 2 years and 9 months apart.

3.1.3 The Licensee shall record production or throughput data and any other process parameters relevant to any non-continuous or CEMS monitoring undertaken.

3.1.4 The Licensee shall ensure that all monitoring equipment used on the Premises to comply with the conditions of this Licence is calibrated in accordance with the manufacturer's specifications.

3.1.5 The Licensee shall, where the requirements for calibration cannot be practicably met, or a discrepancy exists in the interpretation of the requirements, bring these issues to the attention of the CEO accompanied with a report comprising details of any modifications to the methods.

3.1.6 The Licensee shall ensure the limit of detection of analysis for all samples is:
- (a) one order of magnitude below the relevant ANZECC guideline; or
- (b) the lowest limit of detection (where the laboratory cannot routinely achieve a limit of detection one order of magnitude below the relevant ANZECC guideline).

3.2 Monitoring of point source emissions to air

3.2.1 The Licensee shall undertake the monitoring in Table 3.2.1 according to the specifications in that table.

Table 3.2.1: Monitoring of point source emissions to air

Emission point reference	Parameter	Units[1]	Frequency[2]	Method
A1	Volumetric flow rate	m^3/hour	Continuous	CEMS
	Stack temperature	°C		
	Chlorine	mg/m^3 g/s		
	Carbon monoxide, carbonyl sulfide, sulfur dioxide			Derived measurement
	Sulfur dioxide		Annual	USEPA Method 6 or 8
	Carbonyl sulfide			USEPA Method 15 or equivalent[3]
	Carbon monoxide			USEPA Method 10 or 10B
	Chlorine, hydrochloric acid			USEPA Method 26 or 26A

Note 1: All units are referenced to STP dry.
Note 2: Monitoring shall be undertaken to reflect normal operating conditions and any limits or conditions on inputs or production.
Note 3: DER approved equivalent method.

3.2.2 The Licensee shall ensure that sampling required under Condition 3.2.1 of the Licence is undertaken at sampling locations in accordance with the AS 4323.1 or relevant part of the CEMS Code.

3.2.3 The Licensee shall ensure that all non-continuous sampling and analysis undertaken pursuant to condition 3.2.1 is undertaken by a holder of NATA accreditation for the relevant methods of sampling and analysis.

3.2.4 For any parameter in Table 3.2.1 requiring continuous monitoring, the Licensee shall ensure that the CEMS is regularly operated, maintained and calibrated in accordance with the CEMS Code.

3.3 Monitoring of point source emissions to surface water

3.3.1 The Licensee shall undertake the monitoring in Table 3.3.1 according to the specifications in that table.

Table 3.3.1: Monitoring of point source emissions to surface water

Emission point reference	Monitoring point reference and location on Map 1 of emission points, monitoring points and containment infrastructure	Parameter	Units	Frequency
T1	W1	Volumetric flow rate	m^3/hour	Continuous
		pH	pH unit	
		Total dissolved solids[1]	mg/L	
		Temperature	°C	
		Turbidity	NTU	
		Total suspended solids[2]	mg/L	Daily
		Manganese[2]	mg/L	Weekly
		Aluminium, bicarbonate, cadmium, calcium, chromium, copper, iron, lead, magnesium, mercury, molybdenum, nickel, nitrate, selenium, sodium, sulfate, titanium, total suspended solids, vanadium, zinc	mg/L	Quarterly

Note 1: Calculated from electrical conductivity @ 25°C.
Note 2: In-house non-NATA accredited analysis permitted.

3.4 Ambient environmental quality monitoring

3.4.1 The Licensee shall undertake the monitoring in Tables 3.4.1, 3.4.2, 3.4.3 and 3.4.4 according to the specifications in those tables.

Table 3.4.1: Monitoring of ambient surface water quality				
Monitoring point reference and location on Map 2 of emission points and monitoring points	**Parameter**	**Units**	**Frequency**	**Water column depth**
D1 – D4 T2 – T4[1]	Temperature[3]	°C	Annual	0.5 m below water surface and 0.5 m above sediment surface
	pH[3]	pH unit		
	Salinity[3]	mg/L		
	Dissolved oxygen[3]			0 – 0.5 m above sediment surface
K20N, K20E, K20S, K20W, K1000N & K1000S[2]	Radium-226	Bq/L		Depth integrated

Note 1: 4 initial dilution points in the mixing zone and 4 plume tracking sites which follow the direction of the water movement established through monitoring of the position of a surface drogue.

Note 2: Immediate vicinity of diffuser, 20 m North, South, East and West of diffuser, and reference points 1 000 m North and South of diffuser.

Note 3: In-field non-NATA accredited analysis permitted.

Table 3.4.2: Monitoring of ambient sediment quality			
Monitoring point reference and location on Map 2 of emission points and monitoring points	**Parameter**	**Units**	**Frequency**
K20N, K20E, K20S, K20W, K1000N & K1000S[1]	Grain size distribution	µm	Triennial (commencing 2006)
	Carbonate content, organic matter content	% loss on ignition	
	Aluminium, cadmium, chromium, copper, lead, manganese, magnesium, mercury, selenium, titanium, vanadium, zinc	mg/kg	
	Radionuclides (226_{RA})	Bq/kg	

Note 1: Immediate vicinity of diffuser, 20 m North, South, East and West of diffuser, and reference points 1 000 m North and South of diffuser.

Table 3.4.3: Monitoring of ambient groundwater quality			
Monitoring point reference and location on Map 3 of monitoring locations	**Parameter**	**Units**	**Frequency**
GQ1 – GQ2 GQ4-GQ9 GQ13-GQ15 GQ17 GQ19-21[1]	Standing water level[2]	mAHD	Quarterly
	pH[2]	pH unit	
	Electrical conductivity[2]	µS/cm	
	Bicarbonate, cadmium, calcium, chloride, chromium, copper, iron, lead, magnesium, manganese, mercury, nickel, nitrate, selenium, sodium, sulfate, vanadium, zinc	mg/L	Annual

Note 1: Recovery bores KM4 & KM8, monitoring bores KM1, KM2s, KM2i, KM2d, KM5-KM7, KM9, KM13-KM15, KM17, KM19-KM21.

Note 2: In-field non-NATA accredited analysis permitted.

Table 3.4.4: Monitoring of ambient biomonitor health (whole effluent toxicity (WET) testing)				
WET test	**Dilution series[1]**	**Dilution water**	**Analytes for wastewater**	**Frequency**
72 hour microalgae (*Nitzschia closterium*) growth inhibition test	100% 40% 13.5% 4.5% 1.5% 0.5% wastewater	Marine water from Kemerton marine monitoring program's reference site	Aluminium, ammonium, bicarbonate, cadmium, calcium, carbonate, chloride, chromium, copper, iron, lead, magnesium, manganese, mercury, molybdenum, nickel, nitrate, radionuclides (Radium-226 and Radium-228), selenium, sodium, sulfate, titanium, total phosphorus, total suspended solids, vanadium, zinc	Triennial (commencing 2015)
72 hour sea urchin (*Heliocidaris tuberculata*) development test				
48 hour bivalve (*Mytilus edulis*) larval adnormality test				
72 hour macroalgae (*Ecklonia radiata*) cell germination assay				
96 hour fish imbalance test (Yellowtail Kingfish, *Seriola lalandi* or suitable alternative)				

Note 1: Dilutions salt-adjusted to achieve marine salinity.

4 Information

4.1 Records

4.1.1 All information and records required by the Licence shall:
- (a) be legible;
- (b) if amended, be amended in such a way that the original and subsequent amendments remain legible or are capable of retrieval;
- (c) except for records listed in 4.1.1(d) be retained for at least 6 years from the date the records were made or until the expiry of the Licence or any subsequent licence; and
- (d) for those following records, be retained until the expiry of the Licence and any subsequent licence:
  - (i) off-site environmental effects; or
  - (ii) matters which affect the condition of the land or waters.

4.1.2 The Licensee shall ensure that:
- (a) any person left in charge of the Premises is aware of the conditions of the Licence and has access at all times to the Licence or copies thereof; and
- (b) any person who performs tasks on the Premises is informed of all of the conditions of the Licence that relate to the tasks which that person is performing.

4.1.3 The Licensee shall complete an Annual Audit Compliance Report indicating the extent to which the Licensee has complied with the conditions of the Licence, and any previous licence issued under Part V of the Act for the Premises for the previous annual period.

4.1.4 The Licensee shall implement a complaints management system that as a minimum records the number and details of complaints received concerning the environmental impact of the activities undertaken at the Premises and any action taken in response to the complaint.

4.2 Reporting

4.2.1 The Licensee shall submit to the CEO an Annual Environmental Report by 31 March in each year. The report shall contain the information listed in Table 4.2.1 in the format or form specified in that table.

Table 4.2.1: Annual Environmental Report		
Condition or table (if relevant)	**Parameter**	**Format or form[1]**

-	Summary of any failure or malfunction of any pollution control equipment or any incidents that have occurred during the annual period and any action taken	None specified
2.2.3 & 2.3.3	Summary of any exemption claimed where specified management action is taken following corresponding event	
3.2.4	CEMS performance	RATA1
4.1.3	Compliance	Annual Audit Compliance Report (AACR)
4.1.4	Complaints summary	None specified
Table 3.2.1	Monitoring of point source emissions to air	AR1 and as condition 4.2.4
Table 3.3.1	Monitoring of point source emissions to surface water	As condition 4.2.4
Table 3.4.1	Monitoring of ambient surface water quality	None specified
Table 3.4.2	Monitoring of ambient sediment quality	
Table 3.4.3	Monitoring of ambient groundwater quality	
Table 3.4.4	Monitoring of ambient biomonitor health' Provide a report every three years outlining the details of recently collected biomonitor health data with comparisons to biomonitoring health data taken from previous years, outliningand discussing any trends.	

4.2.2 The Licensee shall ensure that the Annual Environmental Report also contains:
(a) any relevant process, production or operational data recorded under Condition 3.1.3; and
(b) an assessment of the information contained within the report against previous monitoring results and Licence limits.

4.2.3 The Licensee shall submit the information in Table 4.2.2 to the CEO according to the specifications in that table.

Table 4.2.2: Non-annual reporting requirements

Condition or table (if relevant)	Parameter	Reporting period	Reporting date (after end of the reporting period)	Format or form[1]
-	Copies of original monitoring reports submitted to the Licensee by third parties	Not Applicable	Within 14 days of the CEOs request	As received by the Licensee from third parties

Note 1: Forms are in Schedule 2.

4.2.4 The Licensee shall ensure that results from CEMS are made available on request as tabulated data and time series graphs including:
(a) times and dates;
(b) unavailability of abatement;
(c) target or limit exceedances; and
(d) an assessment of the information contained within the report against previous submissions and Licence limits and/or targets.

4.3 Notification

4.3.1 The Licensee shall ensure that the parameters listed in Table 4.3.1 are notified to the CEO in accordance with the notification requirements of the table.

Table 4.3.1: Notification requirements			
Condition or table (if relevant)	**Parameter**	**Notification requirement[1]**	**Format or form[2]**
2.1.1	Breach of any limit specified in the Licence	Part A: As soon as practicable but no later than 5pm of the next usual working day. Part B: As soon as practicable	None specified
2.2.3 & 2.3.3	Limit exceedance where management action taken	As soon as practicable but no later than 5pm of the next usual working day.	None specified
3.1.5	Calibration report	As soon as practicable.	None specified

Note 1: Notification requirements in the Licence shall not negate the requirement to comply with s72 of the Act.
Note 2: Forms are in Schedule 2.

5 Works

5.1 The licence holder must:
(a) construct and install the equipment;
(b) in accordance with the corresponding design and installation requirements; and
(c) at the corresponding infrastructure location,
as set out in Table 5.1

Table 5.1: Design and installation requirements

	Infrastructure	**Design and construction/installation requirements**	**Infrastructure location**
1.	Diffuser with three ports	Three diffuser ports must be spaced 4 meters apart. Each diffuser port must be oriented due-west with an inclination of 60^{o} above the horizontal plane. Diffuser internal port diameter must be no greater than 0.9 m.	As outline in Schedule 1, Map 2 as the diffuser

Compliance reporting

5.2 The works approval holder must within 30 calendar days of equipment required by condition 5.1 being installed:

(a) undertake an audit of their compliance with the requirements of condition 5.1; and

(b) prepare and submit to the CEO an Environmental Compliance Report on that compliance.

5.3 The Environmental Compliance Report required by condition 5.2, must include:
(a) photographic evidence as a minimum that items of infrastructure or component(s) thereof, as specified in condition 5.1, have been constructed by the relevant requirements specified in condition 5.1, and
(b) be signed by a person authorised to represent the licence holder and contains the printed name and position of that person.

Compliance monitoring

5.4 The licence holder must monitor the ambient water in accordance with Table 5.2 when operating the infrastructure/equipment outlined in condition 5.1 within:

(a) 6 months of starting phase 1 operations, where phase 1 is described as existing operating conditions with discharge volumes under 130m^3/hour and salinity less than 25 g/L, and
(b) 6 to 18 months of starting phase 2 operations, where phase 2 is described as modified operating conditions with discharge volumes greater than 150 m^3/hour and salinity greater than 50 g/L.

Table 5.2: Monitoring to ambient water

Monitoring location	Parameter	Unit	Frequency	Duration
Onshore W1 As outlined in Map 1	Velocity	m^3/hour	Continuous	3 weeks
	pH			
	Salinity (TDS)	mg/L		
	Temperature	^{0}C		
Offshore (K20N, K20S, K20E, K20W) – Surface Offshore (K20N, K20S, K20E, K20W) – Bottom Offshore (K1000N, K1000S) – Surface Offshore (K1000N, K1000S) - Bottom As outlined in Map 2	pH		Weekly	3 weeks
	Salinity (TDS)	mg/L		
	Temperature	^{0}C		
	Dissolved oxygen	mg/L		

Note: in field non NATA accredited analysis is permitted.

5.5 The licence holder must submit to the CEO separate phase 1 and phase 2 reports of the ambient water monitoring outlined in Table 5.2 within:
(a) 60 calendar days of the last sample taken within phase 1
(b) 60 calendar days of the last sample taken within phase 2.

5.6 The licence holder must ensure the reports required by condition 5.5 includes the following:
(a) results of monitoring undertaken in Table 5.2, including an appraisal of the results and;
(b) a review of the results in comparison to the *Tronox Outfall Upgrade – Conceptual Design and Dispersion Modelling Report* (BMT 2022),
(c) where dispersal of salinity (TDS) has not been met, what measures will the licence holder take to meet them, and
(d) results of Table 3.4.4 Monitoring of ambient biomonitor health (whole effluent toxicity (WET) testing undertaken in February 2024.

Schedule 1: Maps

Premises map

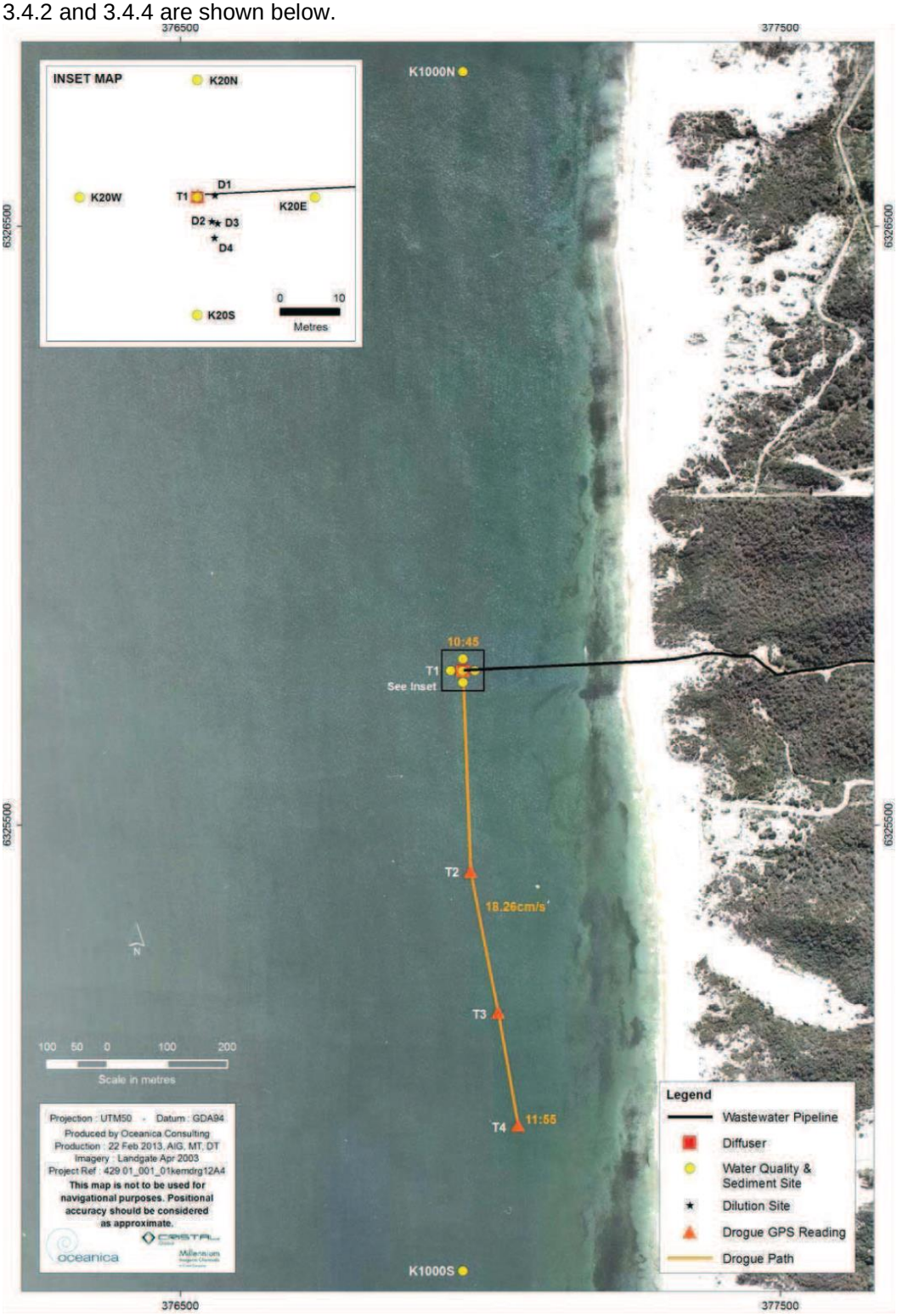
The Premises is shown in the map below. The red line depicts the Premises boundary.

Map 1 of emission points, monitoring points and containment infrastructure

The location of the emission points defined in Table 2.2.1, monitoring point defined in Table 3.3.1, and containment infrastructure described in Table 1.3.2 are shown below.

Map 2 of emission points and monitoring points

The location of the emission point defined in Table 2.3.1 and the monitoring points defined in Tables 3.4.1, 3.4.2 and 3.4.4 are shown below.



Map 3 of monitoring locations

The locations of the monitoring points defined in Table 3.4.3 are shown below.