Decision Report

Application for Licence Amendment

Division 3, Part V *Environmental Protection Act 1986*

Licence Number	L9109/2017/1
Licence Holder	Contract Resources (Karratha) Pty Ltd
ACN	609 929 580
File Number:	DER2017/002200
Premises	Karratha Mercury Treatment Plant 117 Bedrock Turn GAP RIDGE WA 6714 Legal description – Lot 117 on Deposited Plan 76660 As defined by the coordinates in Schedule 1 of the Licence
Date of Report	13 May 2019
Status of Report	Final

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1. Definitions of terms and acronyms

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

Table 1: Definitions

Term	Definition
ACN	Australian Company Number
Amendment Notice	refers to this document
AS 4323	Australian Standard *AS4323.1-1995 Stationary source emissions – Selection of sampling positions*
BTEX	benzene, toluene, ethylbenzene and xylene
Category/ Categories/ Cat.	categories of Prescribed Premises as set out in Schedule 1 of the EP Regulations
CEO	means Chief Executive Officer. CEO for the purposes of notification means: Director General Department Administering the *Environmental Protection Act 1986* Locked Bag 10 JOONDALUP DC WA 6919 info@dwer.wa.gov.au
CS Act	*Contaminated Sites Act 2003* (WA)
Delegated Officer	an officer under section 20 of the EP Act
Department	means the department established under section 35 of the *Public Sector Management Act 1994* and designated as responsible for the administration of Part V, Division 3 of the EP Act.
DWER	Department of Water and Environmental Regulation
EPA	Environmental Protection Authority
EP Act	*Environmental Protection Act 1986* (WA)
EP Regulations	*Environmental Protection Regulations 1987* (WA)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
Existing Licence	The Licence issued under Part V, Division 3 of the EP Act and in force prior to the commencement of and during this Review
HTTU	High Temperature Treatment Unit

Term	Definition
IBCs	intermediate bulk containers
Landfill Definitions	*Landfill Waste Classification and Waste Definitions 1996 (as amended 2018)*, Department of Water and Environmental Regulation, Perth
Licence Holder	Contract Resources (Karratha) Pty Ltd
m^3	cubic metres
mbgl	metres below ground level
Minister	the Minister responsible for the EP Act and associated regulations
MS	Ministerial Statement
NEPM	National Environmental Protection (Ambient Air Quality) Measure
NEPM (Air Toxics)	National Environmental Protection (Air Toxics) Measure
Noise Regulations	*Environmental Protection (Noise) Regulations 1997* (WA)
NORM	naturally occurring radioactive material
Occupier	has the same meaning given to that term under the EP Act.
PM	Particulate Matter
PM_{10}	used to describe particulate matter that is smaller than 10 microns (µm) in diameter.
Prescribed Premises	has the same meaning given to that term under the EP Act.
Premises	refers to the premises to which this Decision Report applies, as specified at the front of this Decision Report.
Risk Event	as described in *Guidance Statement: Risk Assessment*
TDU	VacuDry Thermal Desorption Unit
tpa	tonnes per annum
TOC	total organic carbon
UDR	*Environmental Protection (Unauthorised Discharges) Regulations 2004* (WA)
$\mu g/m^3$	micrograms per cubic metre
VOC	volatile organic compounds

2. Purpose and scope of assessment

Contract Resources (Karratha) Pty Ltd (the Licence Holder) operates the Karratha Mercury Treatment Plant (the Premises) under L9109/2017/1 at 117 Bedrock Turn in the Karratha Gap Ridge Industrial Estate. Construction of the Premises was approved in two stages:

- Stage 1: Liquid Waste Storage Bund and Spent Catalyst Laydown Areas A & B; and
- Stage 2: Evaporation Ponds 1 and 2, washpad and mercury treatment facilities which include the:
    - VacuDry Thermal Desorption Unit (TDU);
    - High Temperature Treatment Unit (HTTU); and
    - Mercury Purification Unit.

The existing licence allows the acceptance and storage of mercury contaminated waste using the Stage 1 infrastructure under Categories 61 and 61A of the *Environmental Protection Regulations 1987* (EP Regulations).

On 11 December 2018, the Licence Holder submitted an application (the Application) to amend Licence L9109/2017/1 to allow the operation of Stage 2 facilities to process mercury contaminated waste under Category 61 and 61A of the EP Regulations. The Delegated Officer has determined that treatment of liquid mercury contaminated waste meets the description of Category 39 of the EP Regulations which includes Premises on which waste liquid hydrocarbons, or chemicals are refined, purified, reformed, separated or processed, due to the separation of mercury and hydrocarbons from waste products for the purpose of resale or recycling. Treatment of solid mercury contaminated wastes falls within Category 61A of the EP Regulations.

The Application also requests the following amendments:

- Relocation of Spent Catalyst Laydown Area B;
- Addition of a naturally occurring radioactive material (NORM) waste storage area, which includes NORM decontamination facilities, to allow the acceptance of NORM waste at the Premises; and
- Allow the acceptance of other liquid wastes (i.e. liquid waste not treated via the mercury treatment facilities or containing NORM) at the washpad for storage, handling, treatment and disposal (either on or offsite).

The Delegated Officer considers that the treatment and handling of other liquid wastes outside of the mercury treatment facilities, is adequately captured under Category 61 of the EP Regulations.

Table 2 below outlines the proposed changes to the Licence categories proposed in the Application.

Table 2: Proposed changes

Category	Current design capacity*	Proposed design capacity	Description of proposed amendment
39	N/A	Not more than 1,000 tonnes per annual period	Addition of a new category for the storage, handling and treatment of mercury contaminated liquid waste
61	1,000 tonnes per annual period	Not more than 3,500 tonnes per annual period	Applies to the: • Acceptance, storage and handling of 500 tonnes of NORM waste; and • Acceptance, storage, handling and treatment of 1,000 tonnes or other liquid waste prior to offsite disposal or disposal into the Evaporation Ponds or offsite; and • Acceptance, storage and handling of 2,000 tonnes of other liquid waste prior to offsite disposal or for direct disposal to the Evaporation Ponds. Acceptance and treatment of liquid wastes contaminated with mercury within the mercury treatment facilities is adequately addressed through the inclusion of Category 39.
61A	2,500 tonnes per annual period	Not more than 3,500 tonnes per annual period	Increased throughput to allow the acceptance of NORM waste in addition to solid mercury contaminated wastes

This Decision Report documents the Delegated Officer's risk assessment of emissions and discharges and determination of the application consistent with the Department of Water and Environmental Regulation's (DWER's) *Guidance Statement: Risk Assessment* and *Guidance Statement: Decision Making* respectively. Risks associated with the acceptance and storage of waste as approved under the Existing Licence have been assessed previously and therefore have not been reassessed as part of this assessment.

2.1 Application details

Table 3 lists the documents submitted during the assessment process.

Table 3: Documents and information submitted during the assessment process

Document/information description	Date received
Application form: Works Approval – Licence / Renewal / Amendment / Registration (v7)	11 December 2018
Karratha Mercury Treatment Plant – Supporting Documentation Licence Amendment Application for Licence L9109-2017-1 including the following appendices: • Appendix A – Environmental Management Plan (Operations) • Appendix B – Emergency Response Plan • Appendix C – ASIC Current Organisation Extract • Appendix D – Spill Management Plan • Appendix E – Cyclone Management Plan • Appendix F – Security Management Plan • Appendix G - Original Equipment Manufacturer Summary of Hot Commissioning for the Thermal Desorption Unit • Appendix H – Original Equipment Manufacturer Summary of Hot Commissioning for the High Temperature Treatment Unit • Appendix I – Original Equipment Manufacturer Summary of Hot Commissioning for the Mercury Purification Unit • Appendix J - Lab Analysis – Feed Material (Analysis 1)	

Document/information description	Date received
• Appendix K – Lab Analysis – Feed Material (Analysis 2) • Appendix L – Lab Analysis – Processed Material (Analysis 1) • Appendix M – Lab Analysis – Processed Material (Analysis 2) • Appendix N – External Flue Stack Testing Report 1 • Appendix O – External Flue Stack Testing Report 2 • Appendix P – Theoretical Air Modelling • Appendix Q – Waste Acceptance Procedure • Appendix R – Materials Handling Procedure • Appendix S – Storm Water Management Plan • Appendix T – Energy Safety Sign-Off Letter • Appendix U – NORM Registration (existing premises) • Appendix V – Application to the West Australian Radiological Council • Appendix W – NORM Management Plan • Appendix X – Parameter Trends (Vacudry) • Appendix Y – Parameter Trends (HTTU)	
Application form: Works Approval – Licence / Renewal / Amendment / Registration (v10)	11 January 2019
Letter dated 10 January 2019 titled *RE: Response to Additional Information Request for Contract Resources Application for An Amendment to Licence (L9109/2017/1)* including the following attachments: • Construction Compliance document (Stage 1) • Construction Compliance document (Stage 2) • Contract Resources Local Rules for the Decontamination and Handling of Naturally Occurring Radioactive Material, Karratha, WA • Contract Resources Local Rules for the Storage of Radioactive Substances, Karratha WA • Procedure: Naturally Occurring Radioactive Material (NORM) • Job Safety & Environmental Analysis: HPW clean of NORM piping • Job Safety & Environmental Analysis: Remove caps from pipework (non-NORM contaminated • Job Safety & Environmental Analysis: Remove caps from pipework (non-NORM contaminated • Job Safety & Environmental Analysis: Collect – Transport - Unload Norm Contaminated Components • Work Method Statement: Contract Resources NORM Decontamination Karratha Yard	
Letter dated 20 February 2019 titled *RE: REQUEST FOR FURTHER INFORMATION - L9109 - Karratha Mercury Treatment Plant - Licence amendment application* including the following attachments: • HTTU – Explanation SIL-rated hydrocarbon feeding • Proposed Mercury Treatment Facility Baseline Groundwater Investigation April 2016 • Waste Acceptance Procedure (February 2019)	20 February 2019
Letter dated 29 April 2019 titled *RE: Comments on Draft Amendment to Licence (L9109/2017/1)*	29 April 2019
Email dated 3 May 2019 titled *RE: APPLICANT NOTIFICATION - L9109/2017/1 Karratha Mercury Treatment Facility - PROPOSED AMENDMENT TO LICENCE*	3 May 2019
Email dated 9 May 2019 titled *RE: APPLICANT NOTIFICATION - L9109/2017/1 Karratha Mercury Treatment Facility – REVISED PROPOSED LICENCE AMENDMENT*	9 May 2019

3. Overview of Premises

3.1 Operational aspects

3.1.1 Mercury Treatment Facilities

The mercury treatment facilities, consisting of the VacuDry TDU, HTTU and Mercury Purification Unit, treat mercury contaminated wastes (MCW) from liquefied natural gas (LNG) projects in Western Australia including sludge, catalysts and filters by separating mercury, hydrocarbons, water and solids.

The process units are situated within the Process Warehouse (or Mercury Treatment Centre) (Figure 1 and Figure 2). The Process Warehouse also includes a separate area for the handling of feed materials for the process units.

A description of the mercury treatment process is provided below:

VacuDry TDU

The TDU is designed for the treatment of sludge that is contaminated with hydrocarbons and mercury, and is also used as a pre-treatment of hydrocarbon contaminated catalysts (prior to treatment in the HTTU). It utilises an indirect heated vacuum thermal desorption process described below and as shown in Figure 3:

1. Prior to treatment in the TDU, waste receptacles containing feed material (solid and liquid waste) are transferred to the materials handling area within the warehouse. Solid material is fed into a steel hopper using an automatic drum tipper and then into the evaporator via a tube chain conveyor. Liquid material is pumped directly from sludge bins or IBCs via the same tube chain conveyor or via vacuum pumps (if the liquid content is too great for the tube chain conveyor).
2. Waste is heated in the Evaporator for the purpose of separating water, hydrocarbons and mercury from the solids material. Waste is initially heated to 250°C for the removal of water and light hydrocarbons. Once all water is removed, temperature is increased up to 340°C and pressure reduced to evaporate remaining hydrocarbons and mercury.
3. Off-gas from the Evaporator passes through a condensation unit where water, hydrocarbon and mercury vapours are cooled and condensed into liquid form prior to collection as follows:
    - recovered mercury is collected in 1t mercury storage vessels and transferred to the Mercury Purification Unit for secondary treatment;
    - wastewaters are collected in a holding tank located in the warehouse prior to being transferred to the Evaporation Ponds for disposal; and
    - recovered hydrocarbons are collected in a storage tank located in the warehouse prior to being used as a fuel source in the HTTU. Should production exceed the HTTU fuel demand, hydrocarbons will be transferred to an oil recycler.
4. The uncondensed off-gas then passes through a droplet catcher to collect any remaining hydrocarbons and then through two activated carbon filters which remove remaining mercury prior to release to atmosphere via the stack.
5. On completion of the drying in the Evaporator, remaining solid waste is discharged from the Evaporator to a steel hopper via a tube chain conveyor. Treated sludge is discharged into a cooling bunker. Treated catalysts are stored in containers capable of holding material >400°C allowing transfer of hot material to the HTTU for further processing.

Solids recovered from sludge material is analysed to determine waste classification as per the Landfill Definitions for landfill disposal. Recovered solids from catalyst material are transferred to the HTTU for further treatment.

HTTU

The HTTU uses a direct heating process for the treatment of catalysts and sludges (pre-treated in the TDU).

The HTTU process is described below and shown in Figure 4:

1. Pre-treated catalysts are transferred to the HTTU from the TDU.
2. Material is directly heated in the combustion chamber which uses a moving bed system to achieve efficient heat transfer. Material is heated to 700°C which decomposes HgS. Additional air is added for the oxidation of sulfur and hydrocarbons by the combustion air fan.
3. Treated inert material is discharged by two discharge screws which uses a cooling unit to that ensure proper cooling of the material to below 50°C. Material is filled into Big-Bags prior to disposal offsite.
4. Off-gas from the combustion chamber is cooled and treated to remove particulates, via a dust filter, and oxidised sulfur (SO_2) via an alkaline scrubber. Full details of off-gas treatment is provided in Section 7.2.
5. Off-gas is then cooled to allow condensation of mercury which is collected in storage vessels. Condensate water containing mercury is also discharged and directed to the water treatment unit.
6. Remaining water droplets in the off-gas are removed via an impact separator and directed to the water filtration unit for treatment and disposal.
7. Final off-gas is heated prior to treatment in two activated carbon filters which remove mercury.

The combustion chamber burner is primarily fuelled by LPG, however, design of the system allows for the burner to run on recycled oil from the TDU for 20% of the time.

The high temperature process of the HTTU breaks the mercury sulphide and mercury chloride bonds to produce three product streams:

- Recovered solids: solids are analysed to confirm the mercury content prior to being transported offsite to a third party processing facility (metal smelter) to reclaim the copper and zinc content.
- Recovered elemental mercury: recovered mercury is collected in 1t mercury storage vessels and transferred to the Mercury Purification Unit for secondary treatment.
- Water: wastewater from the off-gas quench/scrubber system and impact separator are treated via a filtration system to reduce mercury content to <5ppm prior to being pumped to the Evaporation Ponds.

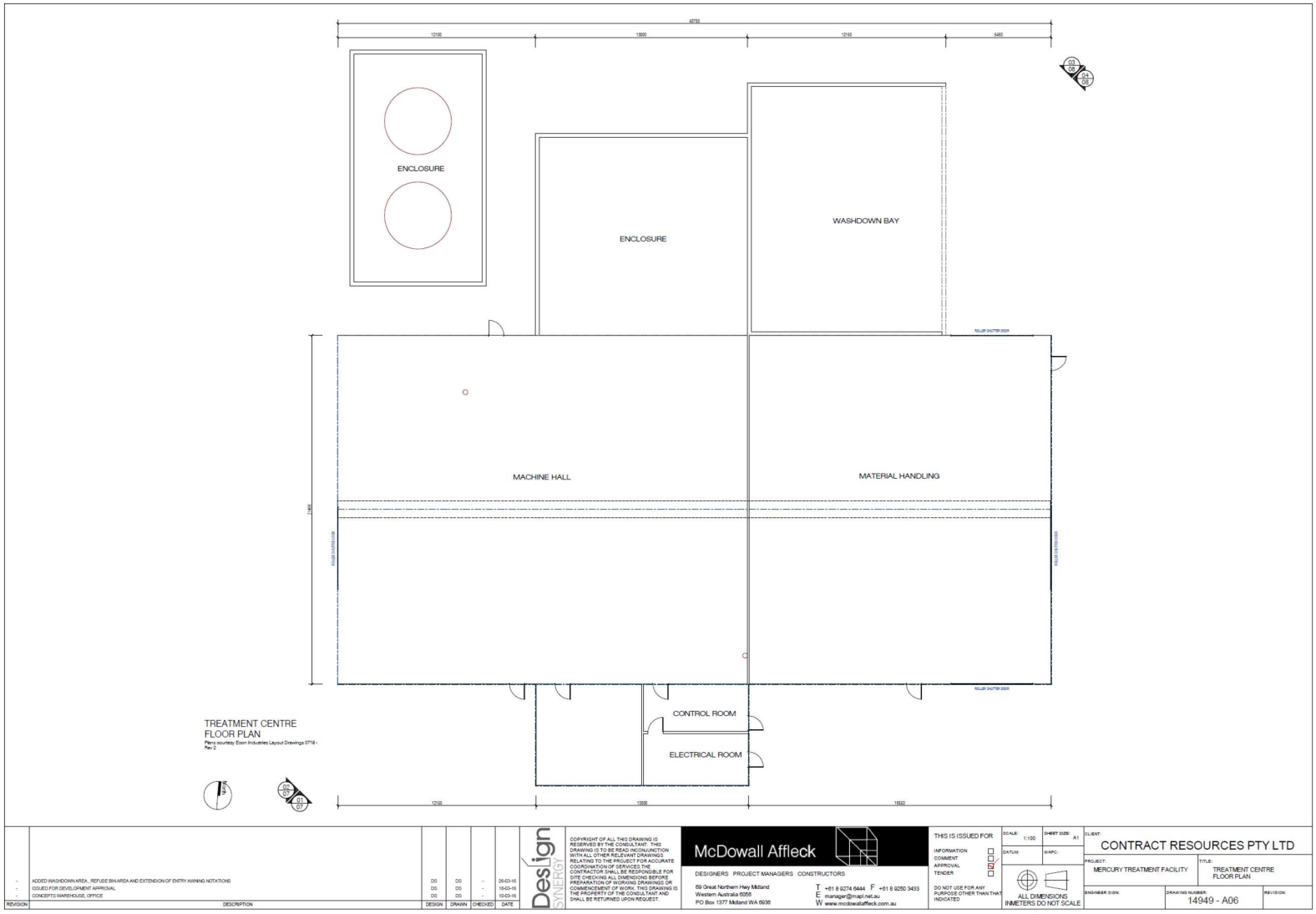

Figure 1: General layout of Process Warehouse.

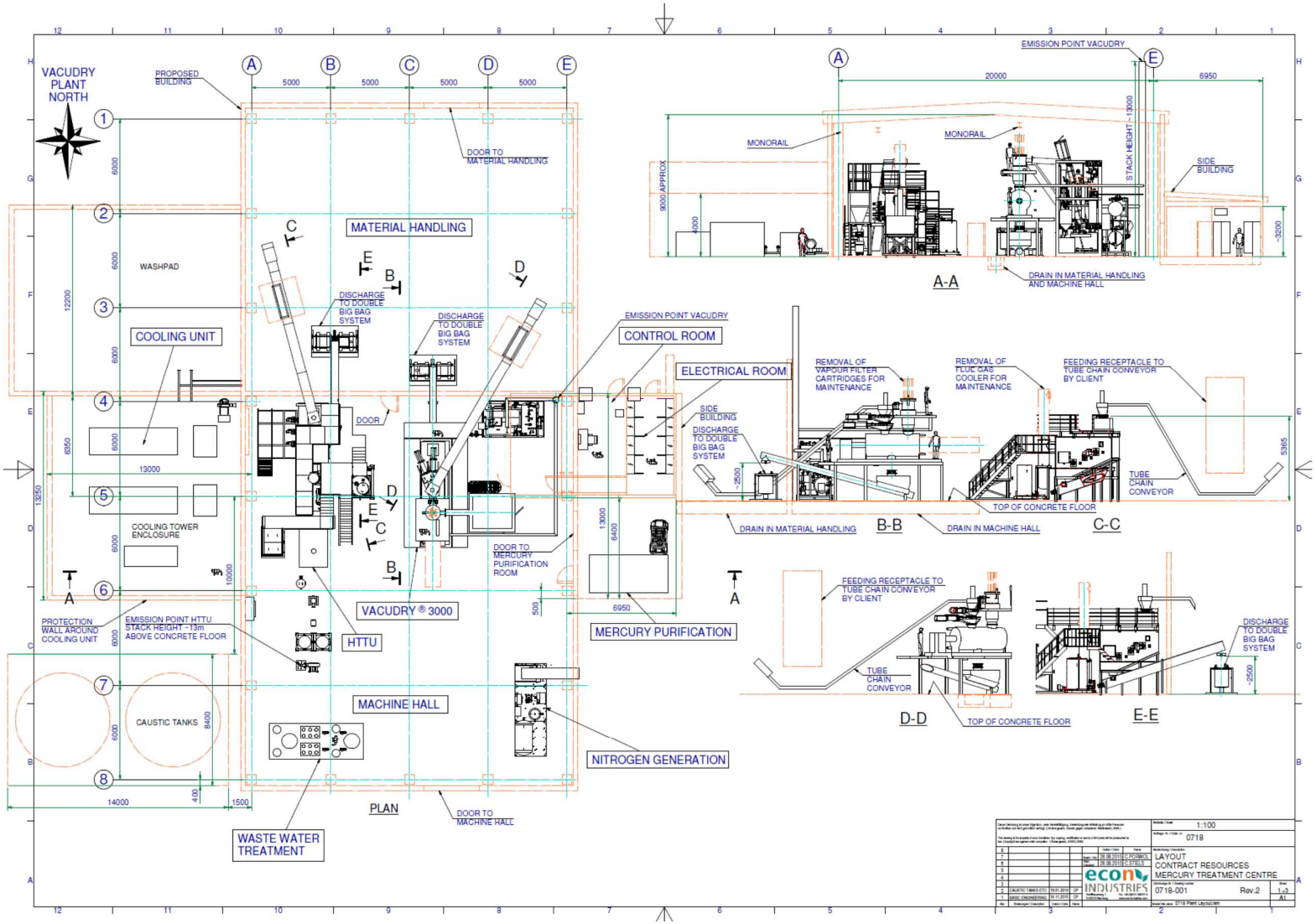

Figure 2: Detailed layout of Process Warehouse.

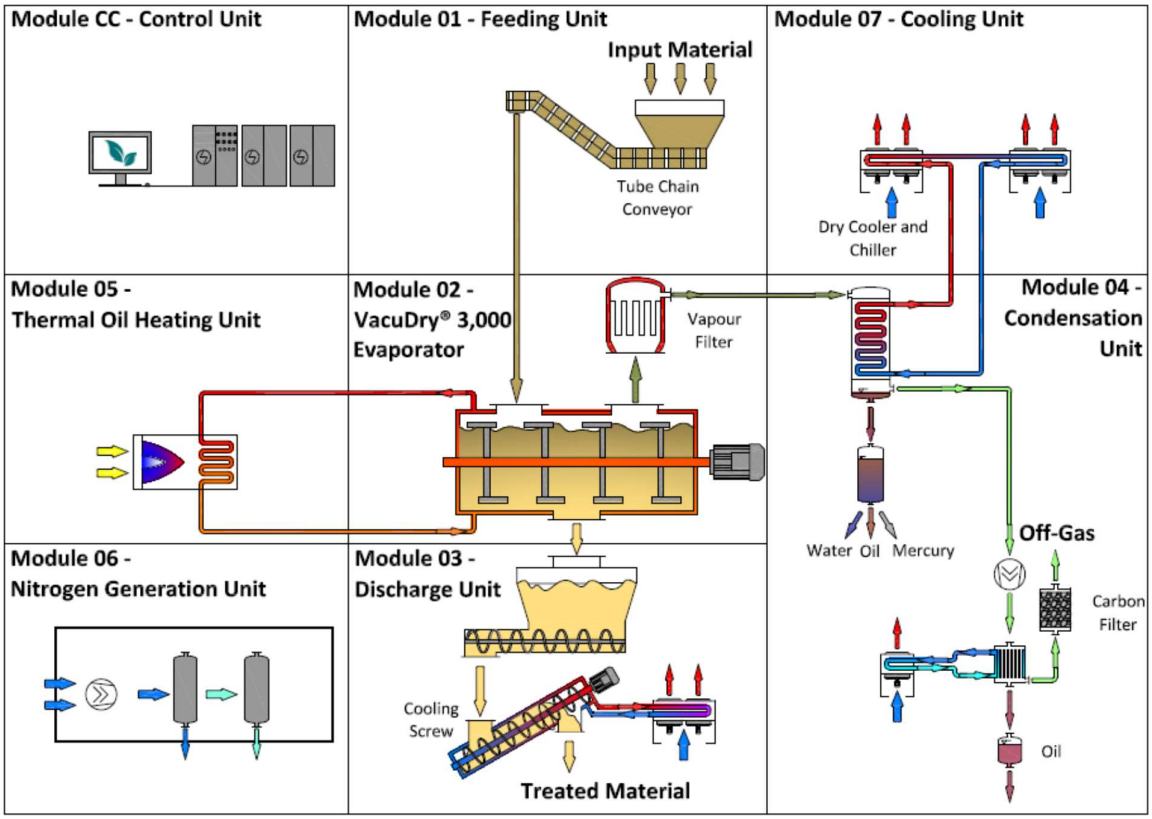

Figure 3: TDU process diagram

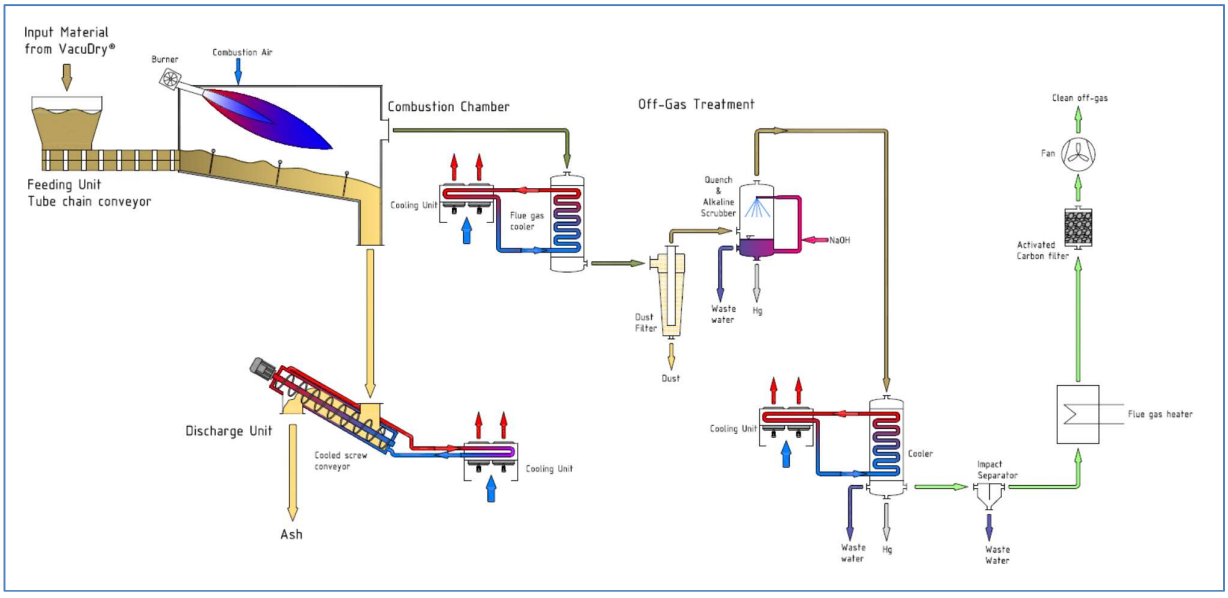

Figure 4: HTTU process diagram

Mercury Purification Unit

The Mercury Purification Unit uses a high vacuum distillation process to purify mercury from the TDU and HTTU (Figure 5). Condensed liquid mercury collected from the TDU and HTTU is fed into the heating chamber of the Unit which operates at a vacuum of <1mbar and with a

temperature between 180-220°C to evaporate mercury from impurities and inorganic solids such as copper and zinc. Mercury vapours are cooled and liquid mercury collected in storage containers. Recovered mercury is 99.99% pure and transferred into metal storage containers prior to being sold offsite as product.

Off-gas from the evaporation chamber is emitted directly to atmosphere within the Process Warehouse via dual activated carbon filters.

The impurities ("dross") are discharged from the evaporation chamber to a mercury sump for further treatment in the HTTU.

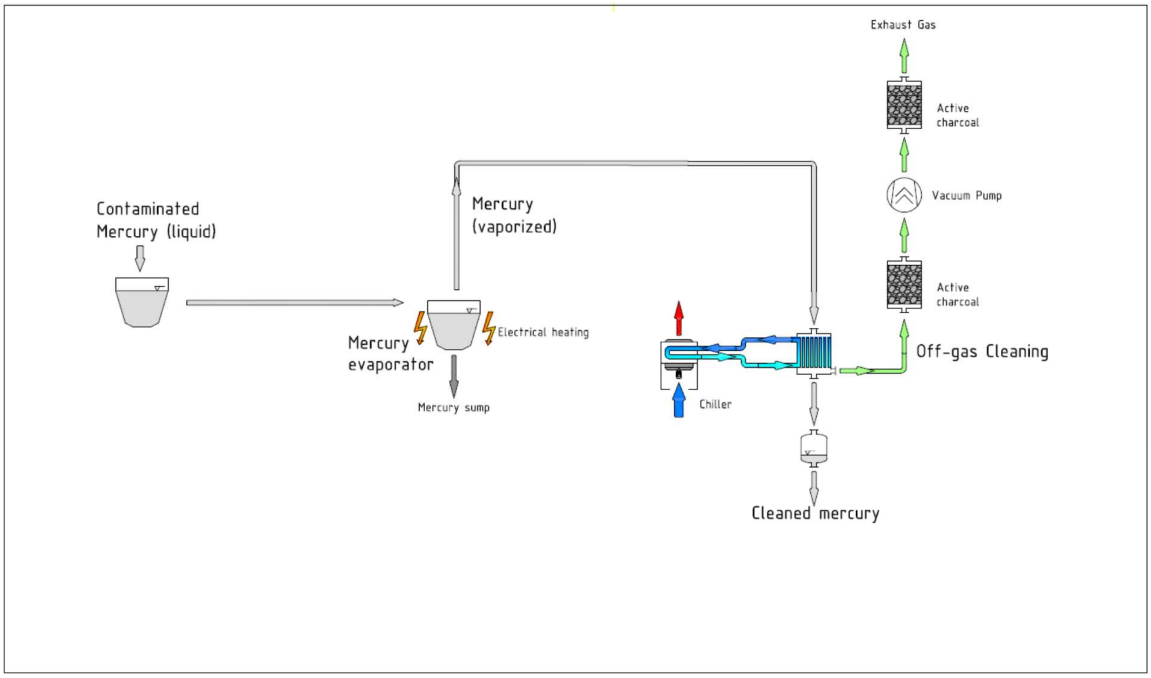

Figure 5: Mercury purification process

3.1.2 Evaporation Ponds

Two Evaporation Ponds are used for the disposal of the following process effluents from the TDU and HTTU:

- Wastewater from the alkaline scrubber (following treatment in the filtration unit), cooling unit and impact separator in the HTTU; and
- Water condensate from the condensation unit within the TDU.

The Evaporation Ponds also receive wastewaters from the Washpad, NORM Decontamination Cell and bund sumps (as required).

Wastewater can be transferred manually to the Evaporation Ponds via the Liquid Waste Transfer Bund which is a concrete sump/bund located between the two ponds. Liquid Wastes are deposited into the bund and drain into the Evaporation Ponds.

3.1.3 Washpad

The Washpad is used for the following activities:

- Quarantine cleaning of equipment in preparation for transport to Barrow Island;
- Cleaning of sludge and catalyst bins after contents have been treated through the mercury treatment facilities;

- High pressure water cleaning of plant and equipment contaminated with a controlled waste;
- Chemical decontamination of plant and equipment contaminated with a controlled waste;
- General cleaning of other various components;
- Decanting and transfer of wastes from one waste receptacle to another; and
- Physiochemical treatment of liquid waste from client sites.

Wastewater from the Washpad drains to two 5,000L underground tanks and then pumped to IBCs or isotainers. Waste is sampled and, depending on results, disposed of by a licenced contractor to a third party facility or to the Evaporation Ponds (via the Liquid Transfer Bund).

3.1.4 Acceptance of other liquid wastes

The Licence Holder provides maintenance services to the LNG sector which may involve the generation or collection of liquid wastes requiring treatment and/or disposal at the Premises. Approximately 3,000 tonnes of liquid waste is expected to be generated from these maintenance activities each year consisting of the following waste types:

- B100 – Acidic solutions or acids in solid form;
- C100 – Basic (alkaline) solutions or bases (alkalis) in solid form;
- J120 – Waste oil and water, mixtures or emulsions and hydrocarbon and water mixtures or emulsions; and
- L150 – Industrial wash waters contaminated with a controlled waste.

Liquid waste is generated offsite and transferred to the Premises by the Licence Holder for treatment and/or disposal as shown in Table 4.

Table 4: Types of Liquid waste accepted for treatment or disposal

Max. volume	Waste processing
2,000 tonnes per annum	Decanting and storage prior to removal from site for treatment and/or disposal to the Evaporation Ponds or offsite at another licensed premises.
1,000 tonnes per annum	Physiochemical treatment processes prior to disposal in the Evaporation Ponds or offsite at another licenses Premises including: • Neutralisation of acidic/alkaline material; or • Separation of hydrocarbons using a portable oil water separator (i.e. plate interceptor) or filtration socks.

3.1.5 Acceptance of NORM Waste

The Licence Holder operates an existing facility for the acceptance of NORM waste within the Karratha Industrial Area and proposes to relocate these activities to this premises. As such, the Licence Holder has applied to amend the Licence to allow the acceptance of wastes defined as radioactive substances under the Western Australian *Radiation Safety Act 1975*.

All NORM waste accepted on the Premises is directed to a dedicated NORM waste area for storage and consolidation prior to disposal offsite to another licensed facility. No waste containing NORM is processed in the mercury treatment facilities. Quantities and types of waste containing NORM to be accepted at the Premises are outlined in Table 5.

Table 5: Types and quantities of waste accepted containing NORM

Volume	Waste type
500 tonnes per annum	Liquid Waste: • J120 Waste oil and water mixtures or emulsions, and hydrocarbon and water mixtures or emulsions • J130 Oil interceptor wastes • J160 Waste tarry residues arising from refining, distillation or pyrolytic treatment • J180 Oil sludge
1,000 tonnes per annum	Solid Waste: • N100 Containers or drums contaminated with residues of a controlled waste • N120 Soils contaminated with a controlled waste • N190 Filter cake containing a controlled waste

Acceptance of NORM waste may also involve decontamination activities involving washing of materials with surface NORM contamination using high pressure water within the NORM Decontamination Cell. Materials requiring decontamination include process pipework, process components, subsea pipework and waste receptacles previously used for the storage of NORM. Decontamination is required to:

- remove the risk of NORM exposure to allow maintenance on a particular component;
- allow the component to be released as scrap metal;
- allow disposal to landfill; and
- allow rehandling and reuse (in the case of waste receptacles).

Objects requiring decontamination are placed within the Decontamination Cell for washing. Wastewater and overspray is captured and drains to Water Recycling Unit which removes NORM contaminated sediment and oil waste material from the process water. Treated water is either reused in the Cell, disposed of to the Evaporation Ponds (if it meet specifications) or re-treated (if specifications not met) prior to disposal.

NORM decontamination activities will occur on an as needed basis and are not expected to be part of daily operations.

3.1.6 Relocation of Catalyst Laydown Area B

During commissioning the Licence Holder identified that the location of Catalyst Laydown Area B impacted other activities on the Premises and posed a high risk of spill due to the high level of vehicular traffic in the area. To mitigate this risk, Catalyst Laydown Area A has primarily been used for solids storage, and the Licence Holder wishes to relocate Catalyst Laydown Area B to the alternative location shown in Figure 6.

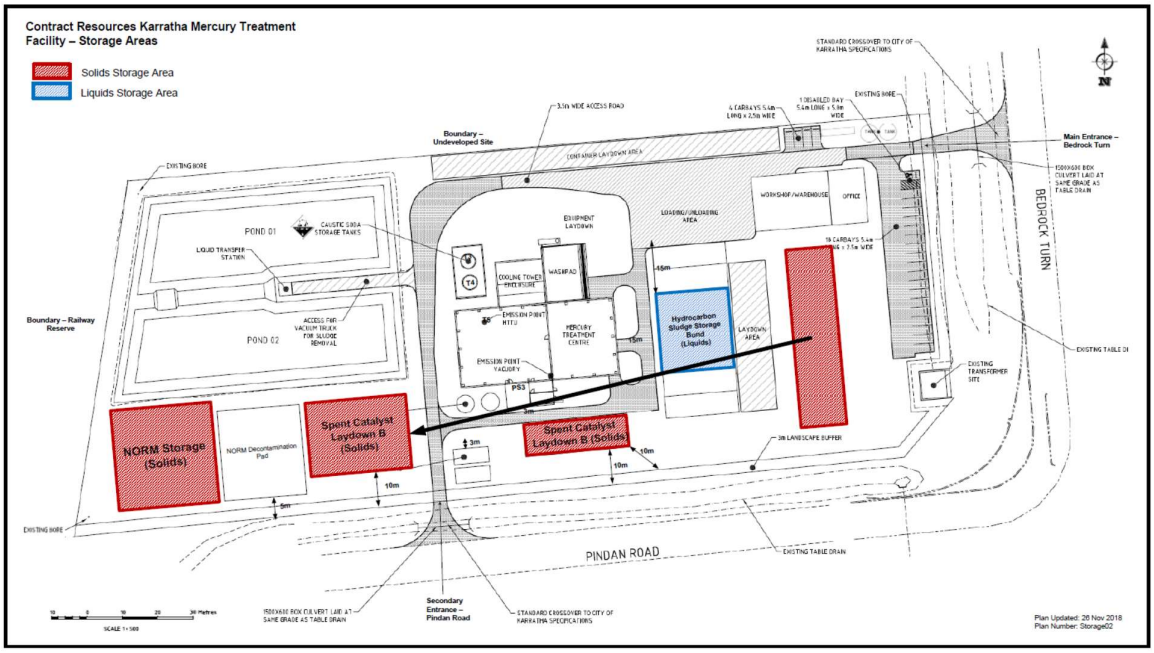

Figure 6: Alternative location for Catalyst Laydown Area B.

3.2 Infrastructure

Table 6 lists the existing infrastructure at the Karratha Mercury Treatment Plant, as well as new infrastructure to be operated as requested by this amendment.

Table 6: Karratha Mercury Treatment Plant infrastructure

	Infrastructure	Site Plan Reference
Category 39 - Existing Infrastructure		
Acceptance, storage and handling of mercury contaminated liquid waste		
1	Liquid Waste Storage Bund	Refer to Schedule 1: Premises Map in attached Revised Licence
Category 39 - New Infrastructure		
Treatment and processing of mercury contaminated liquid waste in the mercury treatment facilities.		
1	High Temperature Treatment Unit	Refer to Schedule 1: Process Warehouse (Mercury Treatment Centre) Layout in attached Revised Licence
2	VacuDry Thermal Desorption Unit	
3	Mercury Purification Unit	
4	Wastewater Treatment Unit	
5	2 x 23kL Caustic Soda Storage Tanks	
Category 61A – Existing Infrastructure		
Acceptance, storage and handling of mercury contaminated solid waste and treatment in the mercury treatment facilities.		
1	Catalyst Laydown Area A	Refer to Schedule 1: Premises Map

	Infrastructure	Site Plan Reference
2	Catalyst Laydown Area B (relocated)	in attached Revised Licence
	Categories 61 and 61A - New infrastructure	
Acceptance, storage and handling of solid and liquid NORM waste, and acceptance, storage, handling and treatment of other liquid wastes prior to offsite disposal or disposal into the Evaporation Ponds or offsite		
1	NORM Storage Area	Refer to Schedule 1: Premises Map in attached Revised Licence
2	NORM Decontamination Cell	
3	Washpad	
	New infrastructure (Directly related activities)	
1	Evaporation Pond 1	Refer to Schedule 1: Premises Map in attached Revised Licence
2	Evaporation Pond 2	
3	Liquid Transfer Bund	

4. Legislative context

The Licence Holder has provided information relating to other approvals as outlined in Table 7.

Table 7: Relevant approvals

Legislation	Number	Approval
Dangerous Goods Safety Act 2004	DGS022313	Licence to store dangerous goods as follows:
Radiation Safety Act 1975	RS 205/2018 30224	Licence for the storage and decontamination of NORM contaminated plant and equipment.

4.1 Department of Mines, Industry Regulation and Safety (DMIRS):

Dangerous goods facilities regulated under the *Dangerous Goods Safety Act 2004* include:

- Mercury treatment facilities;
- Bulk storage consisting of:
  - 2 x 23kL sodium hydrocarbon storage tanks;
  - 2 x 7.5kL LPG storage tanks;
  - Hydrocarbon storage bund capable of holding 650kL of Class 3 waste in 6.5kL capacity transportable steel tanks plus 1kL capacity IBCs; and
- Packaged storage area consisting of:
  - Waste oil store;
  - A Spent Absorbent Store; and
  - A Mercury Store.

4.2 Part V approval history

Table 8 provides the approval history for W5958/2016/1 or L9109/2017/1.

Table 8: Works approval and Licence amendments

Instrument	Issued	Amendment
W5958/2016/1	27/06/2016	Works Approval issued for the construction of the Karratha Mercury Treatment Plant.
	18/05/2018	Amendment Notice 2 Amendment to allow commissioning of HTTU, TDU and mercury purification unit.
	15/10/2018	Amendment Notice 3 Extend the duration
	24/01/2019	Amendment Notice 4 Extend the duration and update commissioning conditions.
L9109/2017/1	02/03/2018	Licence issued for Stage 1 completion of Works Approval W5958/2016/1 to store packaged liquid and solid waste at the Premises
	26/11/2018	Amendment Notice 1 Amendment to implement appeal determination (Appeal No. 005/2018) regarding implementation of conditions to manage potential risks associated with fire.
	13/05/2019	Licence Amendment Operation of Stage 2 which includes HTTU, TDU, mercury purification unit, evaporation ponds, washpad and associated facilities; Relocation of Catalyst Storage Area B; Allow acceptance of NORM waste; and Allow acceptance of third party liquid waste for disposal in the evaporation ponds.

5. Modelling and monitoring data

5.1 Modelling of air emissions

Air quality modelling was undertaken to model the potential ambient air quality as a results of emissions from the:

- TDU stack, which receives combined exhaust gas from the TDU and LPG burner for the thermal oil heating unit; and
- HTTU stack, which includes emissions from the HTTU LPG burners and from chemicals processes within the burning chamber.

The model used AERMOD dispersion model to determine ground level concentrations of mercury (Hg), nitrogen oxides (NO_x), sulfur dioxide (SO_2), carbon monoxide (CO), and particulate matter (PM_{10} and $PM_{2.5}$) as these were considered the key contaminants of concern within the context of normal operations (refer to page 36 for relevant criteria used).

According to the Works Approval Application (Contract Resources, 2016b), total organic carbon (TOC), which includes all volatile organic compounds (VOCs) such as benzene,

toluene, ethylbenzene and xylene (BTEX), was considered to account for a very small component of the emissions profile. Noting this and the small size of the plant, TOC emissions were deemed insignificant and therefore not considered in the modelling assessment.

The assessment considered the stack design and emission estimates for the key contaminants as per the table below.

Table 9: Summary of emission parameters from the Premises (Astron, 2016)

Parameter	Units	HTTU System Stack	VacuDry Stack		
			Thermal Oil Heating Component	VacuDry Process Component	Combined Vacudry Emissions
Stack Heights	m	13	-	-	13
Stack Tip Internal Diameter	m	0.1317	-	-	0.3
Flow Rate	Nm^3/hr, dry	430	420.4	30	450.4
Temperature	deg C	60	377	30	357
Flow Rate (Actual)	m^3/hr, wet	530	1158	33.3	1191.3
Exit Velocity	m/s	10.81	-	-	4.68
Emission Concentration					
NO_X	mg/Nm_3, dry	≤150	≤150	Negl	NA
Hg	mg/Nm^3	0.05	Negl	0.05	NA
SO_2	mg/Nm^3	50	0	50	NA
CO	mg/Nm_3, dry	≤150	≤60	≤50	NA
TOC	mg/Nm^3	50	5	50	NA
PM	mg/Nm^3	10	5	10	NA
Emission Rate					
NO_X	g/s	0.0179	0.0175	0	0.0175
Hg	g/s	5.97E-06	0	4.17E-07	4.17E-07
SO_2	g/s	5.97E-03	0	4.17E-04	4.17E-04
CO	g/s	5.97E-03	7.01E-03	4.17E-04	7.42E-03
TOC	g/s	5.97E-03	5.84E-04	4.17E-04	1.00E-03
PM	g/s	1.19E-03	5.84E-04	8.33E-05	6.67E-04

Air quality modelling was reviewed the determined to be fit for purpose and undertaken appropriately.

The results of the modelling are presented in Table 10. The modelled ground level concentrations for all pollutants modelled were well below the relevant assessment criteria. The highest modelled ground level concentration was for NO_2 which was predicted to be 11% of the ambient air quality criteria at the plant boundary (1 hour averaging period). Concentrations of NO_2 at the nearest residential receptor were predicted to be <1%. Mercury concentrations were predicted to be <1% anywhere on the modelled grid.

Table 10: Predicted ground level concentrations from modelling (Astron, 2016)

Pollutant	Averaging Period	Criteria[1]	Predicted Concentration (µg/m³)			Percentage of Criteria (%)		
			Plant boundary	Karratha Village	Baynton/ Nickol West	Plant boundary	Karratha Village	Baynton/ Nickol West
	1-hour	226	25	0.9	0.75	11.1	0.4	0.33
NO_2	Annual	56	1	0.025	0.014	1.79	0.045	0.025
CO	8-hour	10,000	4.3	0.18	0.12	0.043	0.002	0.001
	1-hour	524	10	0.22	0.19	1.75	0.042	0.036
	24-hour	210	1.3	0.035	0.028	0.57	0.017	0.013
SO_2	Annual	52	0.22	0.0057	0.0031	0.37	0.011	0.006
PM_{10}	24-hour	50	0.33	0.01	0.0077	0.66	0.02	0.015
	24-hour	25	0.33	0.01	0.0077	1.32	0.04	0.031
$PM_{2.5}$	Annual	8	0.05	0.0015	0.00085	0.63	0.019	0.011
	1-hour	1.8	0.006	0.0002	0.00016	0.33	0.011	0.009
Mercury	Annual	0.2	0.00021	5.80E-06	3.10E-06	0.11	0.003	0.002

Note [1]: Refer to page 37 for relevant criteria used.

5.1.1 Monitoring data

Stack testing was undertaken on flue gas from the TDU and HTTU Stacks in November and December 2018 as required by the Works Approval W5958/2016/1. Stack testing was required to be undertaken in accordance with the requirements of the Works Approval.

Testing of the TDU was undertaken when the TDU was processing two different waste streams; hydrocarbons, and hydrocarbons and mercury. With the exception of mercury and particulate matter (PM), testing was undertaken in accordance with the relevant USEPA test methods.

Results of stack testing are provided in Table 11 and show that all measured emission rates are below those modelled. With the exception of CO, the measured concentrations of all parameters are below those estimated or used in the modelling (refer to Table 9).

Table 11: Results of stack testing carried out on the TDU and HTTU stacks in 2018.

Pollutant	Unit	TDU[1]				HTTU[2]	
		Hydrocarbons		Hydrocarbons and mercury		Spent catalyst	
		Test 1	Test 2	Test 1	Test 2	Test 1	Test 2
NOx	mg/m³	<3	<3	5.3	<3	120	120
	g/s	<0.00002	<0.00002	<0.00003	<0.00002	0.012	0.011
CO	mg/m³	31	86	450	640	<2	5.2
	g/s	<0.0002	<0.0005	<0.003	<0.004	<0.0002	0.0005
SO_2	mg/m³	<5	<5	<5	<5	<5	<5
	g/s	<0.00003	<0.00003	<0.00003	<0.00003	<0.0005	<0.0004
PM	mg/m³	<8	<6	<7	<6	<4	<4
	g/s	<0.00005	<0.00004	<0.00004	<0.00004	<0.0004	<0.0004
TOC[3]	mg/m³	<4	<4	12	5.9	<4	<4
	g/s	<0.00002	<0.00002	<0.00007	<0.00002	<0.0004	<0.0004
Mercury[4]	µg/m³	0	1.62		9.95	16.50	12.93

Note 1: Oxygen concentration were measured to be <1% during Test and 10.2% - 11.1% during Test 2.
Note 2: Oxygen concentration were measured to be 10.9% during Test and 9.4% during Test 2.
Note 3: TOC measured "as propane".
Note 4: Sampling was undertaken using a Jerome analyser provided by the Licence Holder. Two spot samples were taken from each emission point during each process phase and the maximum is recorded in this table. This test method is not covered by the testing contractor's NATA accreditation.

The Delegated Officer has reviewed the information regarding air quality modelling and monitoring data and has found:

1. Modelling only assessed emissions from the HTTU LPG burner operating on LPG, not operating on recovered oil from the TDU.
2. Stack testing results do not demonstrate emissions from the HTTU while operating on recovered oil from the TDU.

6. Location and receptors

6.1 Residential and sensitive Premises

Table 12 below lists the relevant sensitive land uses in the vicinity of the Prescribed Premises which may be receptors relevant to the proposed amendment.

Table 12: Receptors and distance from activity boundary

Residential and sensitive premises	Distance from Prescribed Premises
Civeo Accommodation Camp	2.5km north west of the Premises
Residential premises	3km north west of the Premises
Industrial Premises (Karratha Recycling Pty Ltd)	Bounding lot on the east of the Premises. Process Warehouse is approximately 130m to the boundary fence of Karratha Recycling Pty Ltd
Industrial Premises (City of Karratha – Seven Mile Waste Facility)	<50m to the south of the Premises

6.2 Environmental Receptors

Table 13 below lists the relevant environmental receptors in the vicinity of the Prescribed Premises which may be receptors relevant to the proposed amendment.

Table 13: Environmental receptors and distance from activity boundary

Environmental receptors	Distance from Prescribed Premises
Threatened Ecological Communities (TEC)	The site is located within the buffer of the Roebourne Plains Gilgai Grasslands TEC. The TEC exists in is many areas surrounding the Karratha Townsite. The Premises is also located approximately 600m south west of the Horseflat Land System TEC buffer which is also common near the Karratha Townsite and surrounding areas.
Threatened Fauna	The Northern Quoll (*Dasyurus hallucatus*), listed as Endangered under the *Biodiversity Conservation Act 2016* and EPBC Act, has been recorded within 2.5km of the Premises. Five migratory bird species, as listed under the EPBC Act, have been recorded within1.5km from the Premises.

6.3 Groundwater and water sources

Three groundwater monitoring bores were installed to allow accurate determination of groundwater flow direction and the potential direction for contaminant migration. The bores were positioned hydraulically up-gradient and down gradient from the site. The bores were installed to a maximum depth of 15 metres below ground level (mbgl).

The distances to groundwater and water sources are shown in Table 14.

Table 14: Groundwater and water sources

Groundwater and water sources	Distance from Premises	Environmental value
Groundwater	Depth to groundwater at the site is approximately 10 metres below ground level. Groundwater flows in an east-north-east direction across the Premises. The Premises is located within the Gap Ridge Industrial Estate and situated adjacent to a known contaminated site (immediately west and north-west of the site), which is associated with the presence of hydrocarbons in groundwater. Baseline groundwater monitoring undertaken in December 2015 indicates that groundwater is brackish to saline ranging from 1,277 µS/cm to 7,244 µS/cm.	Site is located within the Pilbara Groundwater Area No known potable or industrial uses in the area due to depth below ground level. No WIN sites are located within 2km of the Premises (based on available GIS dataset – WIN Groundwater Sites).
Seven Mile Creek	Groundwater flows in an east-north-east direction towards Seven Mile Creek, which is located 1.2 km east of the Premises.	Site is located within the Pilbara Surface Water Area. Seven Mile Creek is an ephemeral drainage system which contains water after large rainfall events. During flow events, the creek discharges to the saline coastal flats to the north and eventually Nickol Bay.

6.4 Meteorology

Karratha lies within the Pilbara region of WA and has a tropical arid climate with two main seasons: a hot wet summer (October to April) and a warm dry winter (May to September). The region is characterised by highly variable, but generally low rainfall and high year-round temperatures. The nearest official weather station is Karratha Aero. The average annual rainfall at Karratha Aero is 293.8 mm, with most rainfall occurring between January and March. Karratha Aero has average monthly temperatures that peak at 36˚C in January and reach a low of 13.6˚C in July. Cyclonic activity is significant with several systems affecting the area annually.

Predominant winds are from the north-west to south-west, and south-east with a less dominant north-easterly breeze (Figure 7).

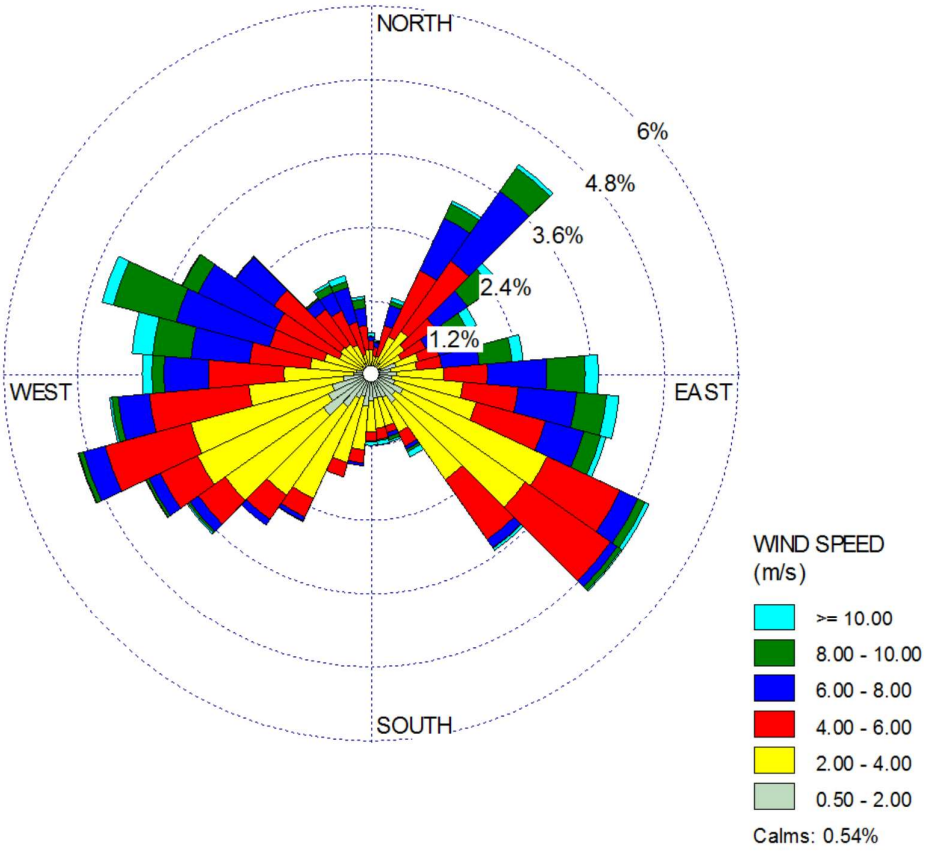

Figure 7: Wind rose at Karratha Meteorological Site from March 1999 to March 2000 (Astron, 2016).

7. Risk assessment

Table 15 below describe the Risk Events associated with the amendment consistent with the *Guidance Statement: Risk Assessments*. Both tables identify whether the emissions present a material risk to public health or the environment, requiring regulatory controls.

Table 15: Risk assessment for proposed amendments during operation

Risk Event						Continue to detailed risk assessment	Reasoning
Source/Activities		**Potential emissions**	**Potential receptors**	**Potential pathway**	**Potential adverse impacts**		
Category 39 **HTTU, TDU and mercury purification unit**	Transfer of waste from storage areas into the HTTU, TDU and mercury purification unit	Leakage of liquid mercury components, hydrocarbons or wastewater to ground	Shallow groundwater (8-10m below ground level) Seven Mile Creek 1km west	Infiltration through soil to groundwater, which may recharge nearby surface waters	Ecological impacts	Yes	Refer to section 7.1
		Fugitive emissions (dust) generated during handling of waste	Personnel at neighbouring industrial premises Residential receptors ≥2.5km northwest	Air / wind dispersion	Health / Amenity	No	The Delegated Officer has considered the distance to sensitive receptors (2.5km) and the following controls: • Solid waste material is stored within enclosed containers; • Handling of MCW prior to processing occurs in the Process Warehouse; • Processed MCW is stored in bulk bags. Any dust generated can be regulated by Section 49 and the general provisions of the EP Act.
		Noise from operation of machinery and equipment	Personnel at neighbouring industrial premises Residential receptors ≥2.5km northwest	Air / wind dispersion	Amenity	No	The Premises will generally operate for 12 hour day shifts, Monday to Friday, although this may be extended to include nightshifts and weekends. The Premises is located in the Gap Ridge Industrial Estate and therefore sensitive receptors are subject to higher assigned levels under the Noise Regulations. The following Licence Holder controls minimise noise

Risk Event						Continue to detailed risk assessment	Reasoning
Source/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
							emissions: • The Process Warehouse doors will be kept closed where possible subject to operational, temperature and airflow requirements; • Equipment will be properly maintained in accordance with manufacturer specifications; and • All equipment not in use will be turned off. Noise generated from the Premises is regulated by the Noise Regulations.
	Operation of the HTTU, TDU and mercury purification unit	Point source air emissions (Hg, VOCs, NOx, CO, SOx, PM) from the TDU and HTTU stacks and mercury purification unit	Personnel at neighbouring industrial premises Residential receptors ≥2.5km northwest	Air / wind dispersion	Health / Amenity	Yes	Refer to section 7.2
		Noise from operation of machinery and equipment	Personnel at neighbouring industrial premises Residential receptors ≥2.5km northwest	Air / wind dispersion	Amenity	No	As above.
		Leakage of liquid mercury components, hydrocarbons or wastewater to ground	Shallow groundwater (8-10m below ground level) Seven Mile Creek 1km west	Infiltration through soil to groundwater, which may recharge nearby surface waters	Ecological impacts	Yes	Refer to section 7.1

Risk Event						Continue to detailed risk assessment	Reasoning
Source/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
	Storage and transfer of purified mercury	Fugitive emissions of mercury vapour	Personnel at neighbouring industrial premises Residential receptors ≥2.5km northwest	Air / wind dispersion	Amenity and public health (inhalation)	No	The following Licence Holder controls minimise the consequence and likelihood of a Risk Event: • Processing of mercury occurs within the Process Warehouse; and • Metallic mercury is stored in the Mercury Purification Room within the Process Warehouse and in steel flasks designed to meet Australian Standard *AS 3780 The storage and handling of corrosive substances*. These controls are suitable for regulatory control under the Licence to maintain a low risk profile.
		Spillage or leakage of mercury to ground	Shallow groundwater (8-10m below ground level) Seven Mile Creek 1km west	Infiltration through soil to groundwater, which may recharge nearby surface waters	Ecological impacts	Yes	Refer to section 7.1
	Storage and transfer of residual solid waste (ash/flyash, dross, solid waste from HTTU)	Spillage or leakage of mercury components to ground	Shallow groundwater (8-10m below ground level) Seven Mile Creek 1km west	Infiltration through soil to groundwater, which may recharge nearby surface waters	Ecological impacts	Yes	Refer to section 7.1
	Transfer and disposal of wastewater from TDU and HTTU into evaporation	Overtopping of ponds	Shallow groundwater (8-10m below ground level) Seven Mile Creek	Infiltration through soil to groundwater, which may recharge	Ecological impacts	Yes	Refer to section 7.3

Risk Event						Continue to detailed risk assessment	Reasoning
Source/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
	ponds		1km west	nearby surface waters			
		Spillage or leakage of wastewater during transfer	Shallow groundwater (8-10m below ground level) Seven Mile Creek 1km west	Infiltration through soil to groundwater, which may recharge nearby surface waters	Ecological impacts	Yes	Refer to section 7.1
		Seepage of waste through pond liner	Shallow groundwater (8-10m below ground level) Seven Mile Creek 1km west	Infiltration through soil to groundwater, which may recharge nearby surface waters	Ecological impacts	Yes	Refer to section 7.4
	Storage of hazardous materials (processed oil, NaOH, activated carbon filters)	Spillage or leakage of contaminated stormwater, leachate or hazardous chemicals to ground	Shallow groundwater (8-10m below ground level) Seven Mile Creek 1km west	Infiltration through soil to groundwater, which may recharge nearby surface waters	Ecological impacts	Yes	Refer to section 7.1
Category 61 and 62 **Receipt, storage,**	Receipt, storage, handling of NORM Waste	Spillage or leakage of contaminated stormwater,	Shallow groundwater (8-10m below ground level)	Infiltration through soil to groundwater,	Ecological impacts	Yes	Refer to section 7.1

Risk Event						Continue to detailed risk assessment	Reasoning
Source/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
handling & decontamination of NORM waste	Decontamination of NORM waste receptacles	leachate or hazardous chemicals to ground	Seven Mile Creek 1km west	which may recharge nearby surface waters			
	Transfer and disposal of wastewater associated decontamination of NORM waste receptacles to evaporation ponds	Overtopping of ponds	Shallow groundwater (8-10m below ground level) Seven Mile Creek 1km west	Infiltration through soil to groundwater, which may recharge nearby surface waters	Ecological impacts	Yes	Refer to section 7.3
		Seepage of waste	Shallow groundwater (8-10m below ground level) Seven Mile Creek 1km west	Infiltration through soil to groundwater, which may recharge nearby surface waters	Ecological impacts	Yes	Refer to section 7.4
Category 61 **Receipt of third party liquid waste**	Transfer and disposal of third party wastewater to evaporation ponds	Overtopping of ponds	Shallow groundwater (8-10m below ground level) Seven Mile Creek 1km west	Infiltration through soil to groundwater, which may recharge nearby surface waters	Ecological impacts	Yes	Refer to section 7.3
		Seepage of waste	Shallow groundwater (8-10m below ground level) Seven Mile Creek 1km west	Infiltration through soil to groundwater, which may recharge nearby	Ecological impacts	Yes	Refer to section 7.4

Risk Event						Continue to detailed risk assessment	Reasoning
Source/Activities		Potential emissions	Potential receptors	Potential pathway	Potential adverse impacts		
				surface waters			
		Spillage of hazardous chemicals to ground	Shallow groundwater (8-10m below ground level) Seven Mile Creek 1km west	Infiltration through soil to groundwater, which may recharge nearby surface waters	Ecological impacts	Yes	Refer to section 7.1
All activities	Non-standard operation: accidental fire outbreak within the NORM waste storage areas.	Emissions of potentially toxic smoke to air from the burning of infrastructure and NORM contaminated waste	Personnel at neighbouring industrial premises Residential receptors ≥2.5km northwest	Air / wind dispersion	Public health	No	Risks associated with the emergency outbreak of fire within the warehouse, Liquid Waste Storage Bund and Catalyst Laydown Areas have been previously assessed (refer to Appeal 005/18). The Delegated Officer considers that existing controls are adequate for mitigating the risk of dark smoke associated with a fire.
		Contaminated firefighting water discharge to ground	Shallow groundwater (8-10m below ground level) Seven Mile Creek 1km west	Infiltration through soil to groundwater, which may recharge nearby surface waters	Ecological impacts	Yes	Refer to section 7.5

7.1 Risk Assessment – Spillage or leakage to ground

7.1.1 Description of Risk Event

Release of waste, recovered products (i.e. mercury, oil and wastewater) and process reagents (i.e. sodium hydroxide) (Emission) from overtopping or mechanical failure of storage containers, or failures of bunding, (Source) to ground (Pathway/Receptor) causing contamination of soil and groundwater (Adverse Impacts).

7.1.2 Identification and general characterisation of emission

There is a significant amount of hazardous material stored, handled and processed on the Premises. Inadequate containment of these materials could potentially result in material entering the environment through spills, leaks, overtopping of storage containers or failures of containment infrastructure (e.g. storage containers or bunds). Activities that are a potential source of contamination include

- Storage of sodium hydroxide;
- Storage of material recovered from the treatment of mercury contaminated waste in the TDU, HTTU and Mercury Purification Unit such as hydrocarbons, wastewater and metallic mercury;
- Waste handling within the Washpad including the collection and storage of subsequent waste/wastewater;
- Transfer of waste into the Evaporation Ponds via the Waste Transfer Bund;
- Storage of waste materials within the Recovered Solids Laydown Area and NORM Waste Storage Area; and
- Washing activities within the NORM Decontamination Cell.

7.1.3 Description of potential adverse impact from the emission

Breach of containment infrastructure such as tanks, bunds, piping, etc. may result in contamination of ground in the vicinity of the spills/leak resulting in adverse impacts to soil and vegetation. Contaminants may also infiltrate groundwater impacting groundwater ecosystems.

7.1.4 Criteria for assessment

Relevant quality criteria include ANZECC & ARMCANZ 2000 guidelines for fresh and marine waters, and the *National Environment Protection (Assessment of Site Contamination) Measure 1999* for soils and groundwater.

7.1.5 Licence Holder controls

This assessment has reviewed the controls set out in Table 16 below.

Table 16: Licence Holder's proposed controls for spillage or leakage to ground (from Application)

Site infrastructure	Description
General	• Excluding NORM contaminated waste, transfer of liquids between waste receptacles will occur within the washpad or liquid Waste Storage Bund • Groundwater monitoring is undertaken at the Premises to identify potential contamination sources in the event of a leak of spill.

Site infrastructure	Description
Washpad	• Constructed of reinforced concrete with a 2% fall draining to two 5,000L underground tanks. • Wastewater captured within the underground tanks is transferred to the Evaporation Ponds. • When the washpad is used for physiochemical treatment (i.e. acid/base neaturalisation), treated wastewater from the tanks will be transferred into intermediate bulk containers (IBC) or an isotainer, sampled and, depending on results of the analysis, disposed of to the Evaporation Ponds via the Liquid Waste Transfer Bund or to an approved offsite facility. • Designed to capture a 1:20 year 72-hours rainfall event.
Liquid Waste Transfer Bund	• Concrete construction draining to the Evaporation Ponds. • The Liquid Waste Transfer Bund is capable of storing 12,000L of wastewater which is equivalent to the contents of a vacuum truck.
Mercury treatment facilities (i.e. TDU, HTTU and mercury purification unit)	• The Mercury treatment facilities are situated within the Process Warehouse which is constructed with concrete bunds and 0.5% slope directed to two central sumps. • Recovered hydrocarbons from the TDU will be collected and stored in an intermediate tank prior to being reused as a fuel source in the HTTU. The tank is situated within a concrete bund that drains to an independent sump. • Recovered elemental mercury from the TDU, HTTU and Mercury Purification Unit is collected in 1 tonne mercury storage vessels • Caustic soda (NaOH) used in the alkaline scrubber is stored in two 23m^3 polyethylene storage tanks located within concrete bunds in accordance with requirements of AS 3780.
Recovered Solids Laydown Area	• Recovered solids from the TDU and HTTU are stored in bulka bags within the Recovered Solids Laydown Area. Mercury and hydrocarbon content is expected to be low. • Material is analysed to determine waste classification in accordance with the Landfill Definitions (DWER 2018) prior to offsite disposal options. • A lab analysis of material to be processed will be conducted prior to processing and if results indicate the presence of high concentrations of a specific hazardous metal the processed material will be stored within the concrete bund.
NORM Waste Storage Area	• NORM waste will be stored in containers on compacted ground within approved storage containers in accordance with approval under the *Radiation Safety Act 1975*. • Waste received in United Nations (UN) rated drums (namely liquid waste) will be stored in portable bunds for secondary containment. • Solid waste will be stored in skip bins on the compacted pad. • All containers are enclosed/covered to prevent stormwater ingress. • All waste receptacle are inspected on arrival to site to confirm integrity (i.e. not damaged). • Visual inspections of storage are and containers will be undertaken regularly

Site infrastructure	Description
	to identify potential spills/leaks. • Decanting or re-packaging of NORM waste will occur in the decontamination cell to capture spills.
NORM Decontaminated Cell	• Decontamination activities occur within Decontamination Cells. • Objects requiring decontamination are placed within the Cell for washing with wastewater and overspray captured and draining to a Water Recycling Unit which removes NORM contaminated sediment and oil waste material from the process water. • NORM decontamination activities will occur on an as needed basis and are not expected to be part of daily operations. • Treated water is either reused in the Cell, disposed of to the Evaporation Ponds (if it meet specifications) or re-treated (if specifications not met) prior to disposal. • Filtered washwater generated from the Decontamination Cell will be stored in IBCs within temporary bunds prior to reuse, disposal to the Evaporation Ponds or retreatment. • Storage within IBCs will be short term. • Solid waste material from the Decontaminated Cell wastewater treatment system will be stored in plastic lined drums prior to waste classification (sampling) and disposal offsite.

The Delegated Officer has reviewed the information regarding spillage or leakage to ground and has found:

Risks associated with radiation exposure have not been assessed as these are regulated under the *Radiation Safety Act 1975*.

7.1.6 Consequence

The Delegated Officer has considered the location of sensitive receptors (i.e. groundwater and Seven Mile Creek), location of nearby contaminated sites and the size of individual storage containers, and determined that spills or leaks to ground may result in low level onsite impacts with minimal off-site impacts on a local scale. Therefore, the Delegated Officer considers the consequence of spills or leaks to be **Minor**.

7.1.7 Likelihood of Risk Event

The Delegated Officer has determined that negative impacts associated with spills or leaks will probably not occur in most circumstances. Therefore, the Delegated Officer considers the likelihood of spills or leaks to be **Unlikely**.

7.1.8 Overall rating of Risk Event

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix in the *Guidance Statement: Risk Assessments* and determined that the overall rating for the risk of spills or leaks is **Medium**.

7.2 Risk Assessment – Point source emissions to air

7.2.1 Description of Risk Event

Emissions of NO_x, SO_2, CO, hydrocarbons (TOC), particulates and mercury (Emission) from the mercury treatment process (Source) enter the atmosphere via the TDU and HTTU stacks within the Process Warehouse (Pathway) causing negative amenity and public health impacts (Adverse Impact) on people outside the Premises (Receptors).

7.2.2 Identification and general characterisation of emission

The main sources of emissions to air are from the TDU and HTTU stacks and consist of the following:

- TDU: Off-gas consisting of mercury from the TDU. These are combined with combustion gases such as NO_x, SO_2, CO, VOCs and particulates from the thermal oil heating unit and discharged via the shared TDU stack; and
- HTTU: Combustion gases such as NO_x, SO_2, CO, VOCs and particulates from the HTTU burner unit and off-gas consisting of mercury from the mercury treatment within the TDU.

The thermal oil heating unit in the TDU and HTTU burner generally operate on LPG, however, recovered hydrocarbons from the TDU may be substituted as fuel in the HTTU burner. The HTTU burner is expected to operate on recovered oil for approximately 20% of the time.

Heavy metals are not expected in the exit-gases due to the volatility of mercury. Waste will be heated to the temperature required to break organic mercury bonds, but significantly lower than required for any other heavy metals.

The Licence Holder states that halogens such as dioxins and furans are not considered to be present in the waste gas stream for the following reasons:

- The TDU does not operate at a temperature significant enough to break $HgCl_2$ bonds to facilitate formation of dioxins or furans;
- The HTTU will operate at a temperature greater than 750°C while formation of dioxins and furans generally form at temperatures between 300°C and 600°C; and
- Material containing halogens such as dioxins and furans will not be treated by the HTTU.

Predicted emission rates for the operation of the Premises (under normal operating conditions) are provided in Table 9. The expected emission rates, stack design and local meteorological data were used by the Licence Holder in an air modelling assessment (refer to “Modelling of air emissions” on page 20 for full details) to determine the potential ground level concentrations outside the Premises resulting from the stack emissions. A summary of the results of the modelling are presented in Table 17.

Table 17: Predicted ground level concentrations from modelling (Astron, 2016)

Pollutant	Averaging Period	Criteria[1]	Percentage of Criteria		
			Plant boundary	Karratha Village	Baynton/ Nickol West
NO_2	1-hour	226	11.1%	0.4%	0.33%
	Annual	56	1.79%	0.045%	0.025%
CO	8-hour	10,000	0.043%	0.002%	0.001%
SO_2	1-hour	524	1.75%	0.042%	0.036%
	24-hour	210	0.57%	0.017%	0.013%

Pollutant	Averaging Period	Criteria[1]	Percentage of Criteria		
			Plant boundary	Karratha Village	Baynton/ Nickol West
	Annual	52	0.37%	0.011%	0.006%
PM_{10}	24-hour	50	0.66%	0.02%	0.015%
	24-hour	25	1.32%	0.04%	0.031%
$PM_{2.5}$	Annual	8	0.63%	0.019%	0.011%
	1-hour	1.8	0.33%	0.011%	0.009%
Mercury	Annual	0.2	0.11%	0.003%	0.002%

Note 1: Refer to Table 18 and Table 19 below for relevant assessment criteria for each pollutant.

Stack testing was also carried out to verify the model predictions. Based on results of modelling and stack testing the following conclusions can be made:

- All human health criteria will be met with the highest modelled ground level concentration predicted for NO_2, which was predicted to be 11% of the ambient air quality criteria at the Premises boundary (1 hour averaging period) and <1% at the nearest residential receptor (CIVEO Accommodation Camp).
- The highest predicted ground level concentration of mercury was predicted to be <1% of the assessment criteria.
- Results of stack testing indicates that emissions are comparative to those used in the model assessment.

The Delegated Officer notes that the modelling did not consider upset conditions such as the failure/breakthrough of the activated carbon filters, or other component failures within the process and how these could result in the above adopted assessment criteria not being met. It is noted that because of its high volatility and ability to be recovered through the process, mercury is unlikely to be present in significant levels in stack emissions upstream of the first activated carbon filter even under a scenario where both activated carbon filters fail. Additionally, should other significant process failures occur that result in mercury vapours reaching the stack, these are likely to be captured by the activated carbon filtration system.

7.2.3 Description of potential adverse impact from the emission

The emission of NO_x, SO_2, CO, VOCs, particulates and mercury from the stack at levels which result in ambient air concentrations that exceed public health criteria could have public health impacts. Staff, contractors and visitors to the Premises are not considered to be receptors in this assessment because they are covered by other state legislation with regards to occupational health and safety; however any person outside the Premises boundary within the Gap Ridge Industrial Estate is considered to be a potential receptor to public health impacts. The nearest residential receptor is located at the Civeo Accommodation Camp which is located 2.5km west of the Premises.

Combustion emissions (NO_x, SO_2 and CO)

Gases (NO_x, SO_2, CO) and PM are common pollutants produced by industrial processes and motor vehicles as a result of fuel combustion. The ratio and rate of pollutants produced are dependent on fuel type and combustion efficiency. For humans; both short-term exposure and long-term exposure to increased levels of NO_x and SO_2 may cause respiratory irritation and problems, particularly for those with asthma. Exposure to CO at high concentrations for short periods may affect the amount of oxygen in the bloodstream, leading to fatigue and dizziness.

Acid deposition occurs when SO_2 and NOx react with water, oxygen and other oxidants in the atmosphere to form acidic compounds which precipitate in rain or in dry form as gas or particles.

Deposition of SO_2 and NO_x can contribute to acidification of surface waters and potentially damage vegetation.

Particulates

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

Mercury

Exposure of people to unacceptable levels of mercury via inhalation into the lungs and systemic circulation through the body via the circulatory system could result in damage to the nervous system as well as impacts to other organ systems such as the respiratory system, digestive system, immune system, skin and kidneys (Risher *et al.* 2002).

VOCs

Exposure to high levels of VOCs including benzene may result in acute narcosis and eye or skin irritation. Benzene is a known carcinogen and therefore chronic exposure could result in the development of cancers such as leukaemia in humans, amongst other potential issues such as aplastic anaemia and immune-toxicity and suppression (WHO 2010).

7.2.4 Criteria for assessment

Air quality criteria which are considered by the Delegated Officer to be relevant for the assessment of risks to public health for this Application are listed below. The criteria apply at the nearest human receptors, being any person located outside and/or adjacent to the Premises.

NEPM

The NEPM sets ambient air quality standards for CO, NO_2, SO_2 and particulates for the protection of human health and well-being. These standards are outlined in Table 18.

Table 18: NEPM ambient air quality standards for CO, NO_2, SO_2 and particulates.

Pollutant	Maximum concentration standard	Averaging period	Maximum allowable exceedances
CO	9 ppm	8-hour	1 day a year
NO_2	0.12 ppm	1-hour	1 day a year
	0.03 ppm	1-year	None
SO_2	0.2 ppm	1-hour	1 day a year
	0.08 ppm	24-hour	1 day a year
	0.02 ppm	1-year	None
PM_{10}	50 µg/m^3	24-hour	None[1]
	25 µg/m^3	1-year	None
$PM_{2.5}$	25 µg/m^3	24-hour	None[1]
	8 µg/m^3	1-year	None

Note 1: Until February 2016, the NEPM PM_{10} daily standard was set at 50 µg/m^3, with allowance for up to five exceedances per year under specific circumstances. However, the NEPM PM_{10} daily standard was varied in February 2016 to remove the maximum five allowable exceedances and rename the allowable exceedance to 'exceptional events', and to clarify these were to apply only to bushfires, dust storms and fuel reduction burning for fire management purposes. Reporting measured data against 'exceptional events' also applies to $PM_{2.5}$.

Mercury

Ambient air quality standards for mercury for the protection of human health and well-being are outlined in Table 19.

Table 19: Ambient air quality standards for mercury

Pollutant	Maximum concentration standard	Averaging period	Source
Mercury, inorganic	1.8 µg/m^3	1-hour	NSW EPA 2017
Mercury, elemental vapour	0.2 µg/m^3	1-year	WHO 2003

The European Council Directive 2010/75/EU for industrial emissions specifies a limit of mercury from waste incinerator stacks of 0.05mg/m^3 (with a sampling time of 30 minutes to 8 hours).

VOCs

Assessment criteria for VOC compounds in ambient air are provided in the NEPM (Air Toxics) and are detailed in Table 20.

Table 20: NEPM (Air Toxics) standards for BTEX

Pollutant	Averaging period	Monitoring investigation level		Goal (Maximum allowable exceedance)
		ppm	µg/m^3	
Benzene [2]	1 year	0.003	9.6	-
Toluene [2]	1 day	1.0	3780	-
	1 year	0.1	380	-
Xylene [2]	1 day	0.25	1085	-
	1 year	0.2	870	-

The European Union Directive 2010/75/EU for industrial emissions specifies a limit of organic substances (expressed as TOC) from waste incinerator stacks of 20mg/m^3 (100% of the time) and 10mg/m^3 (97% of the time) when measured over a half hour period.

7.2.5 Licence Holder controls

This assessment has reviewed the controls set out in Table 21 below.

Table 21: Licence Holder's proposed controls for point source emissions to air (from Application)

Site infrastructure	Description
Waste acceptance	• All waste is sampled prior to acceptance onto the Premises to confirm composition. • No waste containing NORM is accepted for treatment in the mercury treatment facilities. Waste may be tested on acceptance to the Premises to confirm NORM content using a handheld monitor if it is considered to be at risk of NORM contamination. All waste is collected and packaged for delivery to the Premises by the Licence Holder who determines the risk of NORM contamination at the source based on its location with the LNG processing

Site infrastructure	Description
	stream. • Material containing halogens such as dioxins and furans will not be treated by the HTTU.
TDU	• LPG fired burner for thermal oil heating. • Exhaust gas from burner and flue-gas from evaporation unit are discharged via a 13m high stack to enable dispersion. • 15µm vapour filter to treat off-gas from the evaporation chamber following drying to remove particulate emissions. • Volatised hydrocarbons are condensed in the Condensation Unit and removed from the off-gas. • Off-gas enters a chiller unit to remove any residual hydrocarbons which are directed to a hydrocarbon storage tank located in the processing area of the Process Warehouse. • Demister pads are installed and maintained post-heat exchanger to remove any moisture remaining in the flue gas. • Flue gas passes through dual sulfur impregnated activated carbon filters prior to discharge to atmosphere. The dual filter system allows for back up should the first filter become saturated.
HTTU	• Material is pre-treated in the TDU which removes hydrocarbons and water and therefore potential for hydrocarbons in the waste gas. • Dust filter (baghouse) situated to remove particulates in flue gas exiting the combustion chamber. The baghouse features a jet cleaning system to maintain efficiency which is triggered automatically by a pressure drop. Dust from the filter is collected in a hopper and bagged prior to disposal offsite. • A rotary feeder is installed to avoid dust emissions and air intrusion into the off-gas system from the dust filter discharge hopper. • The combustion chamber is operated at slight pressure to avoid fumes and dust emissions. • HTTU uses high temperature to oxidise HgS to produce Hg and SO_2. Alkaline scrubber is installed which converts SO_2 to H_2SO_3 on contact with water and then neautralises the H_2SO_3 to Na_2SO_3 via the addition of NaOH. • The scrubber is fitted to pH sensor to monitor performance and automatic NaOH dosing system. • An impact separator is installed post cooling unit to remove moisture remaining in the flue gas. • Flue gas passes through dual sulfur impregnated activated carbon filters to reduce mercury concentrations to <0.05mg/m^3. Off-gas is heated to 60°C prior to treatment in the carbon filters to avoid co-adsorption of water that would reduce adsorption capacity of the carbon filters. • Flue-gas is discharged via a 13m high stack to enable dispersion. • Recycled oil will only be used as a fuel source for approximately 20% of the operating time at a rate of approximately 30kg/hr and during this time LPG will also be used a fuel source. • Waste oil used in the HTTU burner will meet USEPA specification 40CFR

Site infrastructure	Description
	Part 279.1 as follows: ○ Arsenic – 5 ppm (max.) ○ Cadmium – 2 ppm (max.) ○ Chromium – 10 ppm (max.) ○ Lead – 100 ppm (max.) ○ Flash point – 100°F [37.78°C] (min.) ○ Total halogens – 4,000 ppm (max.) Due to its volatility, mercury is not expected to be present in the recovered oil as it will be separated during the desorption process. • The system features interlocks which restrict the use of recycled oil as a burner fuel to when operating temperatures are above 800°C to ensure combustion efficiency. Once use of recycled oil commences, it can only continue to be used while the combustion chamber operates above 750°C.
Mercury Purification Unit	• Flue gas passes through dual sulfur impregnated activated carbon filters before exiting the Mercury Purification Unit. Waste gas is discharged to atmosphere within the Process Warehouse. • Handheld mercury analysers are used frequently to determine levels of mercury within the building.
Carbon filters	• Life span analysis of carbon filters has been conducted which indicates that the theoretical life of the HTTU carbon filters is 300 days. The HTTU exhaust gas is considered to have the greatest mercury content and therefore the shortest lifespan. • The first carbon filter within each system shall be sampled every 4 months to determine saturation levels. Once the first carbon filter reaches 80% of its saturation capacity, the activated carbon within the filter will be replaced. If the analysis indicates that the saturation level is greater than 80% in the first filter, the second (redundant) filter will be sampled to confirm saturation capacity. • Activated carbon will be reprocessed in the TDU and HTTU to allow regeneration or offsite disposal.
Stack testing	• Sampling of flue gas from the TDU and HTTU stacks will be undertaken on an annual basis. • Sampling planes are constructed and are to be maintained in accordance with AS 4323.

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

1. Given the low modelled ground level concentrations, persons immediately outside the Premises are considered to be most affected by the emissions.
2. Stack testing results demonstrate emissions from the HTTU while operating on LPG only, not recovered oil from the TDU.
3. The air modelling assessment is taken to relate to normal operation only and does not address upset conditions (e.g. failure of the activated carbon filter, process failures) or emissions from the HTTU burner operating on recovered oil from the TDU. DWER's assessment must consider upset and alternative operating conditions with worst case scenario impacts as well as normal operations. In the absence of modelling or other numeric estimation, it is assumed that the above assessment criteria would be at risk of not being met during upset conditions or when the HTTU burner is operating on recovered oil.

7.2.6 Consequence

Normal operation

The Delegated Officer has determined that during normal operations the specific consequence criteria relating to public health will be met. Therefore, the Delegated Officer considers the consequence of point source emissions to air to be **Slight**.

Upset conditions (failure of controls) / HTTU burner operating on recovered oil

The Delegated Officer has determined that during upset conditions (e.g. failure of control equipment, critical process failures) and when the HTTU burner is operating on recovered oil, the specific consequence criteria relating to public health are at risk of being met. Therefore, the Delegated Officer considers the consequence of point source emissions to air to be **Moderate**.

7.2.7 Likelihood of Risk Event

Normal operation / Upset conditions (failure of controls)

The Delegated Officer has determined that point source emissions to air causing negative public health impacts will only occur in exceptional circumstances. Therefore, the Delegated Officer considers the likelihood of point source emissions to air causing negative public health impacts is **Rare**.

HTTU burner operating on recovered oil

Noting that the HTTU burner will only operate on recovered oil for approximately 20% of the time, the Delegated Officer has determined that point source emissions to air causing negative public health impacts will probably not occur in most circumstances. Therefore, the Delegated Officer considers the likelihood of point source emissions to air causing negative public health impacts is **Unlikely**.

7.2.8 Overall rating of Risk Event

Normal operation

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix in the *Guidance Statement: Risk Assessments* and determined that the overall rating for Risk Event during normal operations is **Low***.*

Upset conditions (failure of controls) / HTTU burner operating on recovered oil

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix in the *Guidance Statement: Risk Assessments* and determined that the overall rating for Risk Event during upset conditions is **Medium**.

7.3 Risk Assessment – Discharge to land (overtopping of evaporation ponds)

7.3.1 Description of Risk Event

Overflow of wastewater and liquid wastes (Emissions) of the Evaporation Ponds (Source), discharging to ground, and infiltrating groundwater (Pathway/Receptor) causing contamination of soil and groundwater (Adverse Impacts).

7.3.2 Identification and general characterisation of emission

The Evaporation Ponds will receive the following waste streams:

Table 22: Waste discharged to the Evaporation Ponds

Source/Waste type	Waste characterisation	Volume
Process effluents from the TDU Condensation Unit	Wastewater containing mercury & hydrocarbons	Approximately 1-2m^3/hr
Process effluents from the following components of the HTTU: ○ Alkaline scrubber; ○ Flue gas cooling unit and ○ Impact separator	Wastewater containing mercury & sodium sulfite	
Washwater from the NORM Decontamination Cell	Radiation with low risk of mercury and hydrocarbon contamination	As required
Other third party liquid waste types	Controlled waste types listed below meeting Class II criteria as specified in the Landfill Definitions: • B100 – Acidic solutions or acids in solid form; • C100 – Basic (alkaline) solutions or bases (alkalis) in solid form; • J120 – Waste oil and water, mixtures or emulsions and hydrocarbon and water mixtures or emulsions; and • L150 – Industrial wash waters contaminated with a controlled waste.	3,000 tonnes (kL) per year
Other wastes such as captured stormwater from bunds, Washpad, etc.	Dependent on the source.	As required

7.3.3 Description of potential adverse impact from the emission

Overflow of wastewater contained within the Evaporation Pond may results in contamination of land in the path of the overflow resulting in adverse impacts to soil and vegetation.

Contaminants may also infiltrate groundwater impacting groundwater ecosystems.

7.3.4 Criteria for assessment

Relevant land and groundwater quality criteria include ANZECC & ARMCANZ 2000 guidelines for fresh and marine waters, and the *National Environment Protection (Assessment of Site Contamination) Measure 1999* for soils and groundwater.

7.3.5 Licence Holder controls

This assessment has reviewed the controls set out in Table 23 below.

Table 23: Licence Holder's proposed controls for discharge to land (overtopping of evaporation ponds)

Site infrastructure	Description
Evaporation Ponds	• Ponds are designed to allow 51% name plate utilisation of the HTTU (i.e. processing of 1,253t of high sulfur content spent mercury absorber per year) although throughput in the HTTU is expected to be less than 800t per year. • Water levels are monitored visually on a daily basis and HTTU operations will cease once water levels reach the maximum for that month or prior to a high rainfall event (i.e. cyclone). • Ponds are connected via pipeline with overflow from Pond 1 directed to Pond 2. • A freeboard of 0.5m is maintained on the ponds at all times. • Wastewater received from other sites will only be disposed of to the Evaporation Ponds if it meets Class II waste criteria as outlined in the Landfill Definitions (DWER 2018). • The capacity of the ponds will be checked prior to a cyclone to confirm available capacity is sufficient for capturing expected rainfall.
Water filtration Unit	• Effluents from the TDU and HTTU will be treated in the Water Filtration Unit which will reduce mercury content to <5mg/kg (i.e. 5mg/L) prior to disposal to the Evaporation Ponds. • The Water Filtration Unit consists of 2 filter modules with a capacity of 2.5m^3/hr each which allows for redundancy should one be unavailable. • Automatic back-washing system that cleans the filtration modules depending on the pressure difference of the membranes. • Although the ultrafiltration system is considered sufficient to treat wastewater to meet the specified criteria (<5mg/L), a mixed-bed filter is also included as nano-filtration as additional treatment contingency for mercury.
NORM Decontamination Cell	• Wastewater is captured and treated via filtration unit that primarily removes radiation but also removes particles containing hydrocarbons and mercury. • Wastewater is stored in IBCs prior to disposal to the Evaporation Pond and tested to determine radiation levels using an onsite handheld monitor. Radiation is considered a key indicator of treatment performance and therefore if radiation levels are below specifications, treatment of hydrocarbons and mercury are also considered to be effective.

7.3.6 Consequence

The Delegated Officer has considered the location of sensitive receptors (i.e. groundwater and Seven Mile Creek) and location of nearby contaminated sites and determined that overtopping of the Evaporation Ponds may result in low level onsite impacts with minimal off-site impacts on a local scale. Therefore, the Delegated Officer considers the consequence of overtopping of the Evaporation Ponds to be **Minor**.

7.3.7 Likelihood of Risk Event

The Delegated Officer has determined that negative impacts associated with overtopping of the Evaporation Ponds will only occur in exceptional circumstances. Therefore, the Delegated Officer considers the likelihood of overtopping of the Evaporation Ponds to be **Rare**.

7.3.8 Overall rating of Risk Event

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix in the *Guidance Statement: Risk Assessments* and determined that the overall rating for the risk of overtopping of the Evaporation Ponds is **Low**.

7.4 Risk Assessment – Discharge to land (seepage of waste)

7.4.1 Description of Risk Event

The release of wastewater and liquid waste (Emission) from the Evaporation Ponds due to seepage (Source) resulting in discharge of waste to ground, and infiltrating groundwater (Pathway/Receptor) causing contamination of soil and groundwater impacting groundwater quality (Adverse Impacts).

7.4.2 Identification and general characterisation of emission

Waste received by the Evaporation Ponds are described in Table 22: Waste discharged to the Evaporation PondsTable 22.

7.4.3 Description of potential adverse impact from the emission

Seepage from the Evaporation Pond has the potential to cause contamination of soil and groundwater.

7.4.4 Criteria for assessment

Relevant land and groundwater quality criteria include ANZECC & ARMCANZ 2000 guidelines for fresh and marine waters, and the *National Environment Protection (Assessment of Site Contamination) Measure 1999* for soils and groundwater.

7.4.5 Licence Holder controls

This assessment has reviewed the controls set out in Table 24 below.

Table 24: Licence Holder's proposed controls for discharge to land (seepage of waste).

Site infrastructure	Description
Evaporation Ponds	• Lined with HDPE liner with permeability of 2 x 10^{-10} m/s • Ponds are expected to require cleaning/de-sludging every 2-3 years. Following de-sludging, detailed inspections of the liners will be undertaken to confirm integrity.

Site infrastructure	Description
	• Sludge collected from the ponds will be analysed to confirm waste classification in accordance with the Landfill Definitions prior to being disposed of offsite or reprocessed in the TDU.
Wastewater treatment unit	Refer to Table 23.
Groundwater monitoring	3 groundwater monitoring bores are installed: • BH01 is positioned hydraulically up-gradient of the site on the south-west boundary to identify potential contaminants migrating on to the site from any off-site sources; • BH02 is positioned on the north-west boundary to monitor potential contaminants migrating from the known neighbouring contaminated site; and • BH03 is positioned hydraulically down-gradient of the site on the north-east boundary to monitor potential contaminants down-gradient of the site. Bores are sampled on an annual basis to detect contamination resulting from seepage due to liner failure.

7.4.6 Consequence

The Delegated Officer has considered the location of sensitive receptors (i.e. groundwater and Seven Mile Creek) and location of nearby contaminated sites and determined that seepage from the Evaporation Ponds may result in low level onsite impacts with minimal off-site impacts on a local scale. Therefore, the Delegated Officer considers the consequence of seepage from the Evaporation Ponds to be **Minor**.

7.4.7 Likelihood of Risk Event

The Delegated Officer has determined that negative impacts associated with seepage from the Evaporation Ponds will only occur in exceptional circumstances. Therefore, the Delegated Officer considers the likelihood of seepage from the Evaporation Ponds to be **Rare**.

7.4.8 Overall rating of Risk Event

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix in the *Guidance Statement: Risk Assessments* and determined that the overall rating for the risk of seepage from the Evaporation Ponds is **Low**.

7.5 Risk Assessment – Fire outbreak (non-standard operation, worst case scenario)

7.5.1 Description of Risk Event

Discharges of contaminated fire water (Emission) from firefighting activities in the case of a fire outbreak within the NORM Storage Area (Source) being released to unsealed ground (Pathway) causing contamination of local soils and groundwater (Adverse impact) affecting people outside the Premises and subsequent owners of the Premises (Receptors).

The Delegated Officer considers this to be secondary risk event resulting from the outbreak of a fire.

7.5.2 Identification and general characterisation of emission

The generation emissions from a fire outbreak are not considered to be a part of normal operation, and would only occur in an exceptional emergency circumstance.

Potential emissions would be dependent on the severity and extent of the fire affecting the Premises. Given the complicated and uncertain nature of fire outbreak, emissions are considered in the DWER's assessment from a worst-case scenario event such as a large fire affecting all or part of the NORM Storage Area where waste is stored in bulk.

Secondary emissions from large fire outbreak include the escape of contaminated water used in firefighting on local soils and/or surface waters, and leaching to groundwater.

7.5.3 Description of potential adverse impact from the emission

Failure to contain firewater that has been in contact with waste could result in the contamination of land and waters with hydrocarbons and other contaminants posing a risk to the natural ecology of those systems.

7.5.4 Criteria for assessment

Relevant land and groundwater quality criteria include ANZECC & ARMCANZ 2000 guidelines for fresh and marine waters, and the *National Environment Protection (Assessment of Site Contamination) Measure 1999* for soils and groundwater.

7.5.5 Licence Holder controls

The Licence Holder has indicated that the risk of fire occurring is low due to the following factors:

- Onsite permitting system limiting ignition sources in work areas;
- Controlled vehicle access; and
- NORM Storage Area is segregated from other storage areas and therefore risk of ignition is low.

In the event of a fire, firewater will be contained using portable spill kits which includes spill booms. Water contained within the spill booms will be manually removed via suck trucks. Affected areas will be assessed for contamination and contaminated material removed as required.

7.5.6 Consequence

The Delegated Officer has considered the location of sensitive receptors (i.e. groundwater and Seven Mile Creek) and location of nearby contaminated sites and determined that the release firewater in the event of a fire may result in low level onsite impacts with minimal off-site impacts on a local scale. Therefore, the Delegated Officer considers the consequence of the release of firewater to be **Minor**.

7.5.7 Likelihood of Risk Event

Noting that the NORM Storage Area consists of only compacted ground with no formal containment infrastructure in place to ensure the capture of firewater, the Delegated Officer has determined that negative impacts associated with the release of firewater will probably occur in the event of fire. Therefore, the Delegated Officer considers the likelihood of impacts associated with the release of firewater in the event of a fire to be **Likely**.

7.5.8 Overall rating of Risk Event

The Delegated Officer has compared the consequence and likelihood ratings described above

with the risk rating matrix in the *Guidance Statement: Risk Assessments* and determined that the overall rating for the risk of impacts associated with the release of firewater in the event of a fire is **Medium**.

8. Decision

The Delegated Officer has considered information provided by the Licence Holder and determined to grant the amendment subject to the following regulatory controls:

8.1 Works

The Revised Licence includes a condition requiring that within twelve months of the Revised Licence being issued, the Licence Holder install bunding or other suitable containment infrastructure to ensure that in the event of a fire, all firewater occurring within the NORM Storage Area is contained. A period of 12 months has been given to allow time to design and construct appropriate containment infrastructure at the NORM Storage Area.

Certification confirming that the works have been completed will be required to be submitted to DWER.

Grounds: Impacts associated with the contamination of ground or groundwater associated with the release of firewater in the event of a fire has been assessed as medium risk (refer to section 7.5). The Delegated Officer considers that the Licence Holder does not have sufficient controls in place reduce the likelihood of impact occurring and to mitigate potential impacts. Licence Holder controls are considered to be reactive mechanisms and do not sufficiently prevent the risk of contamination from firewater occurring. Therefore, in accordance with the *Guidance Statement: Risk Assessment*, the Delegated Officer has determined that additional controls are required to regulate the risk.

8.2 Infrastructure and equipment

Conditions setting requirements for infrastructure and equipment (Condition 2) have been updated to include requirements relating to the operation of the new infrastructure (i.e. mercury treatment facilities, NORM waste storage area, washpad and Evaporation Ponds).

Grounds: The condition has relevance to the risk assessments for spillage/leakage risks, emissions to air, and overtopping and seepage risks during operation, and are derived from Licence Holder controls as detailed above.

8.3 Waste acceptance

Condition 3 has been updated to restrict the incoming wastes to those waste types proposed in the Application, and to restrict the acceptance/processing of any waste containing NORM within the mercury treatment facilities.

Condition 7 has also been included requiring monitoring of all waste accepted onto the Premises for the purpose of verifying the waste types and quantities received as assessed under this Application.

Grounds: The restriction on incoming wastes is relevant to the following emission risks:

- Stack emissions – maintaining control over the potential stack outputs through the control of incoming wastes; and
- Radiation risks – the risk of radiation is controlled through preventing the entry of radioactive wastes to the Premises.

8.4 Emissions to air (emission limits)

A limit of 0.05mg/m^3 has been set on the Licence for mercury emitted from the HTTU and TDU

stacks.

Grounds: The risk assessment for air emissions identified that there is a potential risk public health associated with emissions to air. The Delegated Officer notes that modelling did not consider worst case air emissions experienced during upset conditions (i.e. failure of pollution controls) or when the HTTU burner is operating on recovered oil from the TDU.

A limit of 0.05mg/m^3 has been set on the Licence which is consistent with the concentration used to model ground level concentrations and is considered to be sufficient for the protection of public health.

8.5 Emissions to air (monitoring)

Conditions are included on the licence requiring the monitoring of emissions exiting via the TDU and HTTU stacks. Emissions monitoring is required biannual for the first year of operation, and then annually thereafter, for NO_x, CO, SO_2, mercury, TOC and particulates, from a sampling port that is compliant with AS4323.1-1995.

The licence also requires stack sampling while the HTTU is operating on waste oil for other metals and halogens (hydrogen chloride and fluoride). Sampling is required once per year for two years.

Grounds: Stack emissions monitoring validate predictions made in the modelling assessment.

Biannual monitoring has been set initially to verify the risk assessment with monitoring frequency reduced following the initial year of operation. Ongoing monitoring requirements may be reviewed should results indicate a higher risk.

In order to verify emissions from the HTTU while operating on recovered oil from the TDU, the Licence requires that at least one stack sample is collected under these operating conditions. Additional parameters have been included (e.g. metals and halogens) to verify that these pollutants are not contained within the waste gas stream. To ensure that there is a correlation between emissions from the HTTU and the quality of recovered oil used in the burner, stack testing is required to be undertaken following compositional analysis of recovered oil as required by condition 19 of the licence.

The Delegated Office notes that the Works Approval (W5958/2016/1) includes requirements for stack testing to be undertaken and acknowledges that results of testing required under the Works Approval can be submitted to fulfil part of the licence requirements.

8.6 Emissions to air (specified actions)

Prior to the initial use of recovered oil in the HTTU burner, the Licence Holder is required to take composite samples of the recovered oil to confirm its composition. Samples are required to be analysed for Arsenic, Cadmium, Chromium, Lead, Flash point, Total halogens and Mercury.

Grounds: Risks associated with emissions to air have been assessed as Medium and conditions are derived from the controls outlined by the Applicant.

The Delegated Officer notes that the HTTU burner generally operates on LPG fuel, however, recovered hydrocarbons from the TDU may be substituted as fuel. Waste oil used in the HTTU burner will meet US EPA specification 40CFR Part 279.1 as follows:

- Arsenic – 5 ppm (max.)
- Cadmium – 2 ppm (max.)
- Chromium – 10 ppm (max.)
- Lead – 100 ppm (max.)
- Flash point – 100°F [37.78°C] (min.)

- Total halogens – 4,000 ppm (max.)

Due to its volatility, mercury is not expected to be present in the recovered oil as it will be separated during the desorption process.

Monitoring requirements are specified to confirm the composition of waste oil and provide certainty of potential risks associated with emissions to air when using recovered oil as a fuel.

Noting that the HTTU burner is expected to operate primarily on LPG and on recovered oil for approximately 20% of the time at a rate of approximately 30kg/hour, sampling is required initially to validate the risk assessment. Ongoing monitoring requirements may be reviewed should results indicate a higher risk.

Methods for testing have been derived from US EPA specification 40CFR Part 279.1 and NSW EPA "Eligible Waste Fuels Guidelines".

8.7 Groundwater monitoring

The Applicant is required to carry out groundwater monitoring on an annual basis at the 3 installed monitoring bores for the following parameters:

- pH;
- Electrical conductivity;
- Arsenic;
- Chromium;
- Copper;
- Mercury;
- Nickel;
- Lead;
- Zinc;
- Total Recoverable Hydrocarbons; and
- Polycyclic Aromatic Hydrocarbons.

Grounds: Groundwater monitoring is relevant to the risks associated with spills and leaks, and seepage from the Evaporation Ponds, and is derived from Licence Holder controls. Groundwater monitoring allows for the detection of contamination sources. Results of monitoring is required to be reporting the Annual Environmental Report with an analysis of trends.

8.8 Reporting

The following reporting requirements have been included on the Licence:

- Submission of an Annual Environmental Reporting consisting of monitoring data as required under the conditions of the Licence with a requirement to analyse trends where appropriate;

Grounds: Reporting requirements are necessary for the administration of the Licence and validating ongoing acceptability of the Premises operation.

9. Licence Holder's comments

The Licence Holder was provided with the draft Revised Licence on 11 April 2019. The Licence Holder provided a response on 29 April 2019 with clarifications regarding information in the Revised Licence and Decision Report but did not request any changes to the draft Revised Licence. A second draft Revised Licence was provided to the Licence Holder on 8 May 2019. The Licence Holder provided a response on 9 May 2019 requesting the timeframe

for completing the NORM Waste Storage Area containment works be increased to 12 months to allow adequate time to plan, design and construct appropriate containment infrastructure for the NORM Waste Storage Area. The Delegated Officer considers the requested change will not increase the risk and the Revised Licence was amended to include a timeframe of 12 months to complete the works.

10. Conclusion

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

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

Caron Goodbourn
Manager, Process Industries
Delegated Officer
under section 20 of the *Environmental Protection Act 1986*

Appendix 1: Key documents

	Document title	In text ref	Availability
1.	Licence L9109/2017/1 – Karratha Mercury Treatment Plant	L9109/2017/1	accessed at www.dwer.wa.gov.au
2.	Works Approval W5958/2016/1 – Karratha Mercury Treatment Plant	W5958/2016/1	DWER records (A1117925)
3.	Works Approval W5958/2016/1– Karratha Mercury Treatment Plant - Amendment Notice 2	W5958/2016/1	DWER records (A1678785)
4.	ANZECC & ARMCANZ (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality – Volume 1. National Water Quality Management Strategy.	ANZECC & ARMCANZ 2000	Accessed at http://www.waterquality.gov.au
5.	Astron Environmental Services Pty Ltd, 2016. Prescribed Premises Works Approval Supporting Information Karratha Mercury Treatment Facility	Astron, 2016	DWER records (A1057781)
6.	Letter dated 1 April 2016 from Jeffrey Kerferd (Contact Resources) titled *RE: Karratha Mercury Treatment Facility at Lot 117 Bedrock Turn, Gap Ridge Industrial Estate, Works Approval Application*	Contract Resources, 2016a	DWER records (A1075258)
7.	Letter dated 5 May 2016 from Jeffrey Kerferd (Contact Resources) titled *RE: Karratha Mercury Treatment Facility at Lot 117 Bedrock Turn, Gap Ridge Industrial Estate, Works Approval Application*	Contract Resources, 2016b	DWER records (A1095473)
8.	Contract Resources, 2017. *Karratha Mercury Treatment Plant – Supporting Documentation Works Approval Amendment (Commissioning) for Materials Handling*	Contract Resources, 2017	DWER records (A1628304)
9.	DER, July 2015. *Guidance Statement: Regulatory principles.* Department of Environment Regulation, Perth.	DER 2015a	accessed at www.dwer.wa.gov.au
10.0	DER, October 2015. *Guidance Statement: Setting conditions.* Department of Environment Regulation, Perth.	DER 2015b	
11.1	DER, August 2016. *Guidance Statement: Licence duration.* Department of Environment Regulation, Perth.	DER 2016a	
12.1	DER, November 2016. *Guidance Statement: Risk Assessments*. Department of Environment Regulation, Perth.	DER 2016b	
13.1	DER, November 2016. *Guidance Statement: Decision Making*. Department of Environment Regulation, Perth.	DER 2016c	
14.1	DWER, April 2018. *Landfill Waste Classification and Waste Definitions 1996 (as amended 2018)*, Department of Water and Environmental Regulation, Perth	DWER, 2018	

	Document title	In text ref	Availability
15.1	European Commission, 2010. *Directive 2010/75/EU of the European Parliament and of the Council on Industrial Emissions (integrated pollution and prevention and control)*, Official Journal of the European Union	European Commission 2010	Accessed at http://eippcb.jrc.ec.europa.eu/reference/
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18.1	National Environment Protection Council (NEPC), 2016. *National Environmental Protection (Ambient Air Quality) Measure*	NEPC 2016	
19.	New South Wales Environmental Protection Authority (NSW EPA), 2017. *Eligible Waste Fuels Guidelines*	NSW EPA 2016	Available online at: http://www.epa.nsw.gov.au/
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21.2	Risher, J.F., Murray, H. E. and Prince, G. R., 2002. *Organic mercury compounds: human exposure and its relevance to public health*. Toxicology and Industrial Health 2002; 18: 109-160	Risher *et al.* 2002	Available online at: https://pdfs.semanticscholar.org/fca1/0665979562808b62b648f75f6dc899288d85.pdf
22.2	World Health Organization (WHO), 2003. *Concise International Chemical Assessment Document 50; Elemental mercury and inorganic mercury compounds: Human Health Aspects*	WHO 2003	Available online at: http://www.who.int/ipcs/publications/en/
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