Government of Western Australia
Department of Environment Regulation

Works Approval

Environmental Protection Act 1986, Part V

Works Approval Holder: Contract Resources (Karratha) Pty Ltd

Works Approval Number: W5958/2016/1

Registered office: 6 Sheriffs Road
LONSDALE SA 5160

ACN: 609 929 580

Premises address: Karratha Mercury Treatment Plant
117 Bedrock Turn
GAP RIDGE WA 6714
Lot 117 on Deposited Plan 76660
as depicted in Schedule 1 and bound by the coordinates:

GPS point	Easting	Northing	Zone
1	475344	7703872	50
2	475564	7703891	50
3	475570	7703821	50
4	475561	7703820	50
5	475561	7703812	50
6	475570	7703813	50
7	475557	7703797	50
8	475329	7703775	50

Issue date: Tuesday, 21 June 2016

Commencement date: Monday, 27 June 2016

Expiry date: Friday, 15 June 2018

The following category/s from the *Environmental Protection Regulations 1987* cause this Premises to be a prescribed premises for the purposes of the *Environmental Protection Act 1986*:

Category number	Category description	Category production or design capacity	Approved premises production or design capacity
39	Chemical or oil recycling: premises on which waste liquid hydrocarbons or chemicals are refined, purified, reformed, separated or processed.	Not applicable	1,000 tonnes per annual period
61	Liquid waste facility: premises, on which liquid waste produced on other premises (other than sewerage waste) is stored, reprocessed, treated or irrigated.	100 tonnes or more per year	3,500 tonnes per annual period
61A	Solid waste facility: premises (other than premises within category 67A) on which solid waste produced on other premises is stored, reprocessed, treated, or discharged onto land.	1,000 tonnes or more per year	3,500 tonnes per annual period

Conditions
This Works Approval is subject to the conditions set out in the attached pages.

Date signed: 21 June 2016
.....
Steve Checker
MANAGER LICENSING (WASTE INDUSTRIES)
Officer delegated under section 20
of the *Environmental Protection Act 1986*

Works Approval Conditions

1 General

1.1 Interpretation

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

1.1.2 In the Works Approval, unless the contrary intention appears:

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

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

'CEO' for the purpose of correspondence means;
Chief Executive Officer
Department Administering the Environmental Protection Act 1986
Locked Bag 33
CLOISTERS SQUARE WA 6850
Email: info@der.wa.gov.au

'Commissioning' means the process of operation and testing that verifies the works and all relevant systems, plant, machinery and equipment have been installed and are performing in accordance with the design specification set out in the works approval application;

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

'Schedule 1' means Schedule 1 of this Works Approval unless otherwise stated;

'Stage 1' means construction of the liquid waste storage bund, compacted road base laydown area, main service road and perimeter fencing;

'Stage 2' means the construction of the washpad, evaporation ponds, process warehouse liquid transfer station and installation of the Thermal Desorption Unit, High Temperature Treatment Unit, and Mercury Purification Process Module;

'Works Approval' means this Works Approval numbered W5958/2016/1 and issued under the Act; and

'Works Approval Holder' means the person or organisation named as the Works Approval Holder on page 1 of the Works Approval.

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

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

1.2 General conditions

1.2.1 The Works Approval Holder shall construct the works in accordance with the documentation detailed in Table 1.2.1:

Table 1.2.1: Construction Requirements[1]

Document[1]	Parts	Date of Document
Works Approval Application Form	All	26 February 2016
Prescribed Premises Works Approval Supporting Information Karratha Mercury Treatment Facility, February 2016	All, including Drawings and Appendices	26 February 2016
Email Correspondence titled 'RE: Karratha Mercury Treatment Plant. Clarification Required, author Jeffery Kerferd	All, including Drawings and Attachments	4 April 2016
RE: Karratha Mercury Treatment Facility at Lot 117 Bedrock Turn, Gap Ridge Industrial Estate, Works Approval Application	All, including Drawings and Attachments	26 April 2016
RE: Karratha Mercury Treatment Facility at Lot 117 Bedrock Turn, Gap Ridge Industrial Estate, Works Approval Application – Clarifications to queries	All, including Drawings and Attachments	5 May 2016

Note 1: Where the details and commitments of the documents listed in condition 1.2.1 are inconsistent with any other condition of this works approval, the conditions of this works approval shall prevail.

1.2.2 The Works Approval Holder must ensure that the Works specified in Column 1 of Table 1.2.2 meet or exceed the specifications in Column 2 of Table 1.2.2 for the infrastructure in each row of Table 1.2.2.

Table 1.2.2: Works specifications

Column 1 Infrastructure	Column 2 Specifications (design and construction)
Washpad	• To be constructed with reinforced concrete to achieve a permeability of 1 x10^{-9} metres per second (m/s) or less; and • Be constructed with a 2% fall resulting in surface water draining down to the western side of the washpad and flow down into a 10 kL underground tank.
Evaporation ponds	• To be constructed with High Density Polyethylene (HDPE) to achieve a permeability of 2 x 10^{-10} m/s or less; and • To be constructed to not overtop from ingress of runoff or rainfall from a 1 in 20 year 72 hour average rainfall event.
Liquid waste storage bund	• To be constructed with reinforced concrete to achieve a permeability of 1 x10^{-9} m/s or less and designed not to overtop from ingress of runoff or rainfall from a 1 in 20 year 72 hour average rainfall event.
Process warehouse	• To be constructed with reinforced concrete to achieve a permeability of 1 x10^{-9} m/s or less and contain 2 self-draining 1 kL sumps.
Liquid transfer station	• To be constructed with reinforced concrete to achieve a permeability of 1 x10^{-9} m/s or less and be able to retain the full volume of a vacuum truck (12,000 L).
Thermal Desorption Unit; High Temperature Treatment Unit and Mercury Purification Process Module	• Pre-constructed units to be installed in accordance with manufacturer's instructions.

1.2.3 The Licensee must not depart from the specifications in Table 1.2.2 except:
(a) where such departure is minor in nature and does not materially change or affect the infrastructure; or

(b) where such departure improves the functionality of the infrastructure and does not increase risks to public health, public amenity or the environment;

and all other Conditions in this Licence are still satisfied.

2 Information

2.1 Reporting

2.1.1 The Licensee must submit a construction compliance document to the CEO following the construction of Stage 1 and Stage 2 of the infrastructure specified in Table 1.2.2 at the Premises.

2.1.2 The Licensee must ensure the construction compliance document:

(a) is certified by a suitably qualified professional engineer or builder that each item of infrastructure specified in Condition 1.2.2, Table 1.2.2 has been constructed in accordance with the Conditions of the Licence with no material defects; and

(b) be signed by a person authorised to represent the Licensee and contain the printed name and position of that person within the company.

2.1.3 If Condition 1.2.3 applies, then the Licensee must provide the CEO with a list of departures which are certified as complying with Condition 1.2.3 at the same time as the certifications under Condition 2.1.2.

Schedule 1: Maps

Premises map

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

ID	X_EAST	Y_NORTH
1	475344	7703872
2	475564	7703891
3	475570	7703821
4	475561	7703820
5	475561	7703812
6	475570	7703813
7	475557	7703797
8	475329	7703775

Government of Western Australia
Department of Environment Regulation

Decision Document

Environmental Protection Act 1986, Part V

Proponent: Contract Resources (Karratha) Pty Ltd

Works Approval: W5958/2016/1

Registered office: 6 Sheriffs Road
LONSDALE SA 5160

ACN: 609 929 580

Premises address: Karratha Mercury Treatment Plant
117 Bedrock Turn
GAP RIDGE WA 6714
Lot 117 on Deposited Plan 76660 and bound by the coordinates:

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Expiry date: Friday, 15 June 2018

Decision

Based on the assessment detailed in this document, a decision has been made to issue a Works Approval. It is considered that in reaching this decision, all relevant considerations have been taken into account.

Decision Document prepared by: Chris Slavin
Licensing Officer

Decision Document authorised by: Steve Checker
Delegated Officer

Contents

1 Purpose of this Document

This decision document explains how DER has assessed and determined the application and provides a record of DER's decision-making process and how relevant factors have been taken into account. Stakeholders should note that this document is limited to DER's assessment and decision making under Part V of the *Environmental Protection Act 1986.* Other approvals may be required for the proposal, and it is the proponent's responsibility to ensure they have all relevant approvals for their Premises.

2 Administrative summary

Administrative details		
Application type	Works Approval ☒ New Licence ☐ Licence amendment ☐ Works Approval amendment ☐	
Activities that cause the premises to become prescribed premises	**Category number(s)**	**Assessed design capacity**
	39	1,000 tonnes per annual period
	61	3,500 tonnes per annual period
	61A	3,500 tonnes per annual period
Application verified Application fee paid	Date: 09/03/2016 Date: 10/03/2016	
Works Approval has been complied with Compliance Certificate received	Yes☐ No☐ N/A☒ Yes☐ No☐ N/A☒	
Commercial-in-confidence claim	Yes☐ No☒	
Commercial-in-confidence claim outcome	N/A	
Is the proposal a Major Resource Project?	Yes☐ No☒	
Was the proposal referred to the Environmental Protection Authority (EPA) under Part IV of the *Environmental Protection Act 1986*?	Yes☐ No☒	Referral decision No: Managed under Part V☐ Assessed under Part IV☐
Is the proposal subject to Ministerial Conditions?	Yes☐ No☒	Ministerial statement No: EPA Report No:
Does the proposal involve a discharge of waste into a designated area (as defined in section 57 of the *Environmental Protection Act 1986*)?	Yes☐ No☒ Department of Water consulted Yes ☐ No ☒	
Is the Premises within an Environmental Protection Policy (EPP) Area Yes☐ No☒ If Yes include details of which EPP(s) here.		
Is the Premises subject to any EPP requirements? Yes☐ No☒ If Yes, include details here, eg Site is subject to SO_2 requirements of Kwinana EPP.		

3 Executive summary of proposal and assessment

Contract Resources Karratha Pty Ltd (Contract Resources) are proposing to operate a Mercury Treatment Facility (MTF) at Lot 117 Bedrock Turn, Gap Ridge Industrial Estate Karratha, Western Australia. The MTF will be able to separate mercury, hydrocarbons, water and solids from a range of mercury contaminated wastes including spent absorbents and hydrocarbon sludge products from the oil and gas industry.

When extracting gas from reserves located in the northern gas fields of Australia, producers of liquefied natural gas (LNG) are finding increased levels of mercury within their gas streams. To prevent this mercury from coming into contact with aluminium components, usually found within LNG cooling systems, a mercury guard bed is installed. If this mercury was to come into contact with aluminium components it could cause rapid corrosion, which could result in significant production losses and increased process safety risks. As the quantity of mercury builds up within these mercury guard beds over time, the catalyst that sits within them requires changing out.

Once removed from the guard beds the spent catalysts are considered to be a controlled waste, due to the high mercury, copper and zinc content. Currently there are no industrial sized treatment facilities within Australia that have the capability of recovering the mercury and other heavy metals. As no safe disposal mechanism currently exists in Australia the majority of mercury contaminated wastes and spent catalysts are been shipped from Australia to Europe for treatment.

The MTF will consist of the following components that are core to the operation:

Thermal Desorption Process Module
This is an 'off the shelf' module which utilises a thermal desorption process to distil water, hydrocarbons and mercury from solids. This process utilises indirect heating (310^0C) under vacuum (50 millibars (mbar)) to separate the feed material into four product streams:

- **Recovered solids:** These will be analysed post treatment for total petroleum hydrocarbons and mercury content. In combination with the pre-treatment lab analysis a landfill will be selected for disposal in accordance with Landfill Waste Classification and Waste Definitions 1996 (the Landfill Definitions). If the feed material is catalyst, the recovered solids will be transferred across to the High Temperature Treatment Unit (HTTU) process module for secondary treatment;
- **Recovered elemental mercury:** This will be collected in a 1t mercury storage vessel and moved across to the mercury purification module for secondary treatment.
- **Water:** Water will be collected in an intermediate holding tank prior to been pumped into the onsite evaporation ponds; and
- **Hydrocarbons:** Recovered hydrocarbons will be collected and stored in an intermediate tank before being utilised as fuel source for the HTTU. In the event that hydrocarbon recovery surpasses fuel requirements for the HTTU excess supply will be directed to an approved oil recycler.

High Temperature Treatment Unit (HTTU) Process Module
This unit is an 'off the shelf' module that utilises high temperatures of 700°C with oxygen injection (at a given stoichiometric ratio) to break mercury sulphide and mercury chloride bonds. This is a direct heating process and is only used for the treatment of catalysts after they have initially been treated in the TDU. This high temperature unit breaks the mercury sulphide and mercury chloride bonds to produce three product streams:

- **Recovered solids:** These will be analysed posted treatment to ensure mercury is <20 ppm. The material will then be transported, as a non-dangerous good, to a metal smelter. The smelter doses this product into their existing process system, which will reclaim the copper and zinc content.
- **Recovered elemental mercury:** This will be collected in a 1t mercury storage vessel and moved across to the mercury purification module for secondary treatment.

- **Wastewater from wet scrubber:** The waste water is initially treated via a filtration system reducing mercury content to <5 ppm via ultrafiltration. Once the mercury content has been removed from the wastewater it will then be pumped into the evaporation pond. Following the commissioning stage a maintenance plan for the removal of sludge from the evaporation pond will be implemented. No set maintenance schedule can be provided at this point in time as waste water generation will vary depending on the sulphur content of the HTTU process module feed material. Once removed a sample of the sludge, expected to consist primarily of sodium sulphite, will be sent to a National Association of Testing Authorities (NATA) certified laboratory for analysis. Dependent on the results the sludge will be disposed of in accordance with the Landfill Definitions.

Mercury Purification Process Module
This is an 'off the shelf' module with a capacity of 500kg/day. This process utilises a high vacuum distillation system to purify mercury to a quality of 99.999%. The mercury purification unit produces 2 product streams:

- **Purified mercury:** Once laboratory tests have confirmed a purity of 99.999% the mercury will be transferred into 2L steel flasks. These flasks will then be transported, in accordance with The Australian Dangerous Goods Code 7.3, to an ethical end user; and
- **Dross**: The dross is a metal sludge that will consist of inorganic solids such as copper and zinc. It will be manually discharged by the operator and stored in a steel flask. Once the steel flask has been filled with dross it will re-treated in the TDU Module whereby the solids will be recovered.

Storage of Solid Waste:
All solids wastes brought onto site will be stored in approved waste receptacles i.e. United Nations (UN) approved drums, Intermediate Bulk Containers (IBC's), Bulka bags and Dangerous Goods certified vessels or isotanks. These receptacles will be stored in a laydown area before their contents can be treated. Some catalysts, such as High Temperature Shift Convertor Catalyst, contain other heavy metals like chromium, which the facility will not be able to recover. These catalysts will require shipment to Europe for treatment. Interim storage of this material at an appropriately licenced facility will still be required prior to receipt of transit permits under the Basel Convention. A laydown area has been designed in accordance with Australian Standard AS 1940 – The Storage and Handling of Flammable and Combustible Liquids (AS 1940) and to withstand a 1:20 year Annual Recurrence Interval (ARI) weather event to store the solid waste.

Storage of Hydrocarbon Sludge (mercury and non-mercury contaminated):
Liquid wastes will be stored within approved waste receptacles. These receptacles will be stored within a concrete bund prior to their contents been treated in the plant. The bund has been designed for a 1:20 year weather event in accordance with AS 1940.

Evaporation Ponds
Two evaporation ponds are required for disposal of wastewater recovered from sludge material that has been treated in the TDU, wastewater generated by the HTTU wet scrubber, and potentially contaminated storm water. The wet scrubber will be responsible for majority of produced wastewater as it is required to remove sulphur dioxide from the flue gas prior to its discharge to the environment. The evaporation ponds have been designed for a 1:20 year weather event and in accordance with Western Australia Department of Water: Water Quality Protection Note 26.

Please refer to Appendix A for information regarding the TDU, HTTU and Mercury Purification Process Module. The main emissions from the premises will be emissions to air from the flue gas stack of combined exhaust emissions from the thermal oil heating system and process exhaust of the TDU and the flue stack of the HTTU. The Mercury Purification Unit is an electrically powered, closed process circuit. As a result no emissions are produced. Other potential emissions include spills and discharges of solid and liquid wastes such as hydrocarbon sludges and wastewater from the wet

scrubber. All solid and liquid waste will be stored and sorted in designated hardstand areas to prevent potential emissions and discharges to the environment.

Contract Resource's intend to Stage the construction of the MTF. Contract Resources intend to stockpile mercury contaminated material at the facility prior to the installation of the TDU, HTTU and the Mercury Purification Process Module

To allow this to occur, Contract Resources requests that the following infrastructure be covered under Stage 1 of the Works Approval;

- Liquid Storage Bund for Hydrocarbons (Storage of Mercury & Hydrocarbon Contaminated Sludge's) and
- Compacted Road Base Laydown (Spent Catalyst Stores)

Contract Resources intends to conduct a stack air test of the MTF 3 months after commissioning the MTF (cold commissioning). A stack air monitoring report (hot commissioning) will be requirement of the impending Licence. Refer to Appendix B for further information.

Stockpiling of feed material onsite is planned to commence once the following construction work-scopes have been completed;

- Main Service Road
- Perimeter Fencing
- Liquid Storage Bund for Hydrocarbons (Storage of Mercury & Hydrocarbon Contaminated Sludge's) and
- Compacted Road Base Laydown (Spent Catalyst Stores)

It is anticipated that these construction works will be completed by the 5th October 2016.

Stage 2 construction will involve construction of the washpad, evaporation ponds, process warehouse liquid transfer station. The TDU, HTTU and Mercury Purification Process Module will be brought onto site during Stage two. The TDU, HTTU and Mercury Purification Process Module will be housed permanently in the process warehouse.

4 Decision table

All applications are assessed in line with the *Environmental Protection Act1986*, the *Environmental Protection Regulations 1987*and DER's Operational Procedure on Assessing Emissions and Discharges from Prescribed Premises. Where other references have been used in making the decision they are detailed in the decision document.

DECISION TABLE			
Works Approval / Licence section	**Condition number** **W = Works Approval** **L= Licence**	**Justification (including risk description & decision methodology where relevant)**	**Reference documents**
General conditions	W1.2.1 – W1.2.3 Licence	**Construction** Conditions 1.2.1 to 1.2.3 have been included to specify the requirement for construction of all relevant infrastructure and to ensure all works are considered and assessed. **Commissioning/Operation** <u>Emission Description</u> *Emission: S*tormwater runoff contaminated with hydrocarbons, metals (including mercury) from waste storage and processing leaving the site and flowing onto neighbouring properties or to Seven Mile Creek drainage system. *Impact:* Contamination of surrounding land and surface water drainage systems. Potential impacts on ecology of surface water from the addition of nutrients, hydrocarbons and heavy metals. Controls: Contract Resources will direct uncontaminated stormwater from the site via existing stormwater drains. Potentially contaminated stormwater from the liquid waste storage bund will be captured within the bund and pumped into one of the lined evaporation ponds. Contract Resources will also collect potentially contaminated stormwater into IBC's and sent through to a Contract Resources approved, NATA certified laboratory for analysis. Subject to laboratory results the storm water will undergo further separation treatment or be pumped into the evaporation pond. <u>Risk Assessment</u> *Consequence*: Minor *Likelihood:* Rare	General provisions of the *Environmental Protection Act 1986* *Environmental Protection (Unauthorised Discharges) Regulations, 2004* Application supporting documentation

DECISION TABLE			
Works Approval / Licence section	**Condition number W = Works Approval L= Licence**	**Justification (including risk description & decision methodology where relevant)**	**Reference documents**
		Risk Rating: Low Regulatory Controls A condition requiring Contract Resources to manage stormwater so that contaminated stormwater is not discharged from the premises will be added to the subsequent Licence. Residual Risk *Consequence*: Minor *Likelihood:* Rare *Risk Rating:* Low	
Premises operation	N/A Licence	**Construction** There are no works approval conditions relating to premises operation. **Operation** Emission Description *Emission:* Spill and/or discharge of mercury contaminated hydrocarbon waste sludge, overtopping of evaporation ponds to land potentially contaminating soils and groundwater. *Impact:* Contamination of surrounding land and surface water drainage systems. Potential impacts on ecology of surface water from the addition of heavy metals and hydrocarbons. Groundwater is located 8-10 metres below ground level (mbgl). The nearest sensitive receptor is a residential area located 2.27km northeast of the premises. Seven Mile Creek is located 1.2km west of the premises. *Controls:* Contract Resources will only accept mercury contaminated hydrocarbon wastes that is stored in appropriately designed enclosed waste receptacles, such as UN drums, IBC's and Bulka bags. Once accepted onsite receptacles will be transferred to a concrete bund where they will be stored until the contents can be processed through the MTF. Mercury contaminated solids, such as spent mercury guard bed catalyst, will only be accepted onto site in approved waste receptacles. If these waste receptacles are United Nations rated drums or	

DECISION TABLE			
Works Approval / Licence section	**Condition number W = Works Approval L= Licence**	**Justification (including risk description & decision methodology where relevant)**	**Reference documents**
		Bulka bags they will be stored in a shipping container prior to been transferred for interim storage. In the event of a spill, Contract Resources Spill Procedure will be implemented. Any contaminated soil will be collected and processed through the TDU. Soil samples will be taken pre and post remediation to validate success of remediation. All chemicals will be stored in accordance with the manufactures Safety Data Sheet (SDS). A level indicator will be installed in pond 1 with maximum water levels displayed for each month of the year. The plant manager will monitor water levels on a daily basis and HTTU operations will cease once water levels reach the maximum for that month. Any overflow that does occur from pond 1 flows into pond 2. The TDU, HTTU and Mercury Purification Process Module, will be stored on a bunded concrete hardstand area in the process warehouse. <u>Risk Assessment</u> *Consequence*: Minor *Likelihood:* Rare *Risk Rating:* Low <u>Regulatory Controls</u> Conditions relating to Premises operation will be added to the subsequent Licence. These will include waste acceptance and processing requirements, secondary containment requirements and spill management procedures. Contract Resources will also need to apply for a Controlled Waste Licence in order to accept and treat controlled wastes at the premises. <u>Residual Risk</u> *Consequence*: Minor *Likelihood:* Rare *Risk Rating:* Low	

DECISION TABLE			
Works Approval / Licence section	**Condition number W = Works Approval L= Licence**	**Justification (including risk description & decision methodology where relevant)**	**Reference documents**
Emissions general	N/A Licence	**Construction** There are no works approval conditions required relating to emissions. **Operation** Limits for general emissions may be applied to the subsequent Licence	
Point source emissions to air including monitoring	N/A Licence	**Construction** There are no point source emissions to air during construction. **Operation** DER's assessment and decision making are detailed in Appendix B.	Ambient Air Assessment Criteria, National Environmental Protection Measure (Ambient Air Quality) Application supporting documentation
Point source emissions to surface water including monitoring	N/A	There will be no point source emissions to surface water during the construction or operation of the MTF. No specific conditions relating to point source emissions to surface water will added to the Works Approval or Licence.	Application supporting documentation.
Point source emissions to groundwater including monitoring	N/A	There will be no point source emissions to groundwater during the construction or operation of the MTF. No specific conditions relating to point source emissions to groundwater will added to the Works Approval or Licence.	Application supporting documentation.
Emissions to land including monitoring	N/A	There will be no emissions to land during the construction or operation of the MTF No specific conditions relating to point source emissions to land will added to the Works Approval or Licence.	Application supporting documentation.

DECISION TABLE			
Works Approval / Licence section	**Condition number W = Works Approval L= Licence**	**Justification (including risk description & decision methodology where relevant)**	**Reference documents**
Fugitive emissions	N/A	**Construction** Emission Description *Emission:* Low level fugitive dust emissions are expected from forklift and vehicular movements onsite. *Impact:* Reduced local air quality. Nuisance for persons no onsite. The nearest sensitive residential receptor is 2.27km from the premises. A combined liquid waste facility and asphalt manufacturing plant operates on the adjacent premises. *Controls*: The majority of truck and forklift movements will be occurring on sealed surfaces Speed limit on site will be restricted to 30 km/hr and dust suppression using a water cart will be implemented if necessary. Risk Assessment *Consequence*: Insignificant *Likelihood:* Rare *Risk Rating:* Low Regulatory Controls Fugitive dust conditions will not be included in the licence in accordance with Departmental reform as published on DER's website under "*Administrative changes implemented within the Department of Environment Regulation*" www.der.wa.gov.au. Dust emissions can be sufficiently regulated under section 49 of the *Environmental Protection Act 1986.* Residual Risk *Consequence*: Insignificant *Likelihood:* Rare *Risk Rating:* Low **Operation** Due to the nature of the proposed activities, dust emissions can be sufficiently regulated under section 49 of the *Environmental Protection Act 1986*. The premises all waste handling areas	S49 of the *Environmental Protection Act 1986* Application supporting documentation.

DECISION TABLE			
Works Approval / Licence section	**Condition number W = Works Approval L= Licence**	**Justification (including risk description & decision methodology where relevant)**	**Reference documents**
		as well as truck and machinery operations will be conducted on sealed areas where there is no fugitive dust emissions expected.	
Odour	N/A	**Construction** There will be no odour emissions during construction of the MTF. **Operation** *Emission Description*: Odour emissions generate from waste handling activities odour generated from the Evaporation Ponds. *Impact*: Reduced local air quality. Nuisance for persons no onsite. The nearest sensitive residential receptor is 2.27km from the premises. A combined liquid waste facility and asphalt manufacturing plant operates on the adjacent premises. *Controls*: All wastes coming into the WTF will be sealed and only accepted if waste is in an approved receptacle. Air emission control equipment on the TDU and HTTU will also reduce potential odour emissions. Contract Resources will ensure that only treated wastewater will be disposed of in the Evaporation Ponds <u>Risk Assessment</u> *Consequence*: Minor *Likelihood:* Rare *Risk Rating:* Low <u>Regulatory Controls</u> Odour conditions will not be included in the licence in accordance with Departmental reform as published on DER's website under "*Administrative changes implemented within the Department of Environment Regulation*" www.der.wa.gov.au. Odour emissions can be sufficiently regulated under section 49 of the *Environmental Protection Act 1986.* <u>Residual Risk</u> *Consequence*: Minor *Likelihood:* Rare	*Environmental Protection Act 1986* Application supporting documentation.

DECISION TABLE			
Works Approval / Licence section	**Condition number W = Works Approval L= Licence**	**Justification (including risk description & decision methodology where relevant)**	**Reference documents**
		Risk Rating: Low	
Noise	N/A	**Construction** Emission Description *Emission:* Noise generated from earthworks machinery and construction of onsite facilities. *Impact*: Reduced local air quality. Nuisance for persons no onsite. The nearest sensitive receptor is 2.27km from the premises. *Controls*: All equipment will be properly maintained in accordance with the manufacturer's directions. Equipment found to be causing excessive noise shall be removed offsite. No equipment will be left on after use. Risk Assessment *Consequence*: Insignificant *Likelihood:* Rare *Risk Rating:* Low Regulatory Controls Contract Resources are required to operate in accordance with the *Environmental Protection (Noise) Regulations 1997*. No specific noise conditions are included in the Works Approval. Residual Risk *Consequence*: Insignificant *Likelihood:* Rare *Risk Rating:* Low **Operation** Emission Description *Emission:* Noise generated from operation of the TDU, HTTU and Mercury Purification Process. Noise generated from forklift, moving waste receptacles around the premises.	*Environmental Protection (Noise) Regulations 1997*. Application supporting documentation.

DECISION TABLE			
Works Approval / Licence section	**Condition number W = Works Approval L= Licence**	**Justification (including risk description & decision methodology where relevant)**	**Reference documents**
		Impact: Reduced local air quality. Nuisance for persons no onsite. The nearest sensitive receptor is 2.27km from the premises. *Controls*: Contract Resources will ensure the following noise mitigation measures during operation of the MTF: • All noise generating process plant equipment, with the exception of the cooling unit, is located within the main processing warehouse. The design will help reduce the transmission of sound from the processing equipment to any receptors that may be located near-by. The cooling unit has been located within a louvered annex to the main building, which will also help to reduce noise transmission. • Subject to operational, temperature and airflow requirements, closure of warehouse roller doors may also be used to minimize noise transmission. • All plant & equipment used onsite will be properly maintained in accordance with the manufacturer's directions. Equipment found to be causing excessive noise shall be removed offsite. • All equipment shall be switched off after use. • Where possible high noise generating activities will be restricted to day-time operations. The MTF is a batch process operation and the MTF (including TDU and HTTU) will not be in continual operation. <u>Residual Risk</u> *Consequence*: Insignificant *Likelihood:* Unlikely *Risk Rating:* Low <u>Regulatory Controls</u> Contract Resources are required to operate in accordance with the *Environmental Protection (Noise) Regulations 1997*. <u>Residual Risk</u> *Consequence*: Insignificant	

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		Likelihood: Unlikely *Risk Rating:* Low	
Monitoring of inputs and outputs	N/A	**Construction** There are no conditions relating to monitoring of inputs or outputs required for the Works Approval. **Operation** Conditions relating to the monitoring of inputs and outputs may be added to the Licence to ensure there is accurate monitoring of waste material coming to the premises for treatment and waste material leaving the premises.	N/A
Process monitoring	N/A	**Construction** There are no conditions relating process monitoring required to be added to the Works Approval. **Operation** Conditions relating to process monitoring may be added to the Licence.	N/A
Ambient quality monitoring	N/A Licence	**Construction** There are no conditions relating to ambient quality monitoring required to be added to the Works Approval. **Operation** Contract Resources have installed 3 groundwater monitoring bores on the premises. Conditions related to ambient groundwater monitoring may be added to the Licence.	Application supporting documentation
Information	W2.1.1 – W2.1.3	**Construction** Conditions 2.1.1, 2.1.2 and 2.1.3 have been added to the Works Approval, which requires Contract Resources to submit a compliance certificate following construction of the works for Stage 1 and Stage 2 of the works to certify that the works were constructed in accordance with the conditions of the Works Approval.	Application supporting documentation.

DECISION TABLE			
Works Approval / Licence section	**Condition number** **W = Works Approval** **L= Licence**	**Justification (including risk description & decision methodology where relevant)**	**Reference documents**
	Licence	**Operation** Contract Resources intends to conduct a stack air test of the MTF 3 months after commissioning. A stack air monitoring report will be requirement of the impending Licence. Refer to Appendix B for further information.	
Works Approval Duration	N/A	The Works Approval has been granted for 2 years to align with planning approval granted under the *Planning and Development (Development Assessment Panels) Regulations 2011*. Contract Resources wish to start construction of the Facility immediately upon being granted the Works Approval. Commissioning of the entire facility will take up to 12 months.	Application supporting documentation

5 Advertisement and consultation table

Date	Event	Comments received/Notes	How comments were taken into consideration
21/03/2015	Application advertised in the West Australian	No comments received	N/A
21/03/2015	Application referred to interested parties listed	No comments received	N/A
12/05/2016	Proponent sent a copy of draft instrument	Minor comments received regarding technical aspects of the proposal. Request to remove information deemed as commercial in confidence as per *S.33* of the *Freedom of Information Act 1992*.	Comments taken into consideration and changed as requested. Requested information removed.
17/06/20106	Planning approval received.	Planning approval granted under the *Planning and Development (Development Assessment Panels) Regulations 2011.*	Expiry date of Works Approval aligned with expiry of planning approval.

6 Risk Assessment

Note: This matrix is taken from the DER Corporate Policy Statement No. 07 - Operational Risk Management

Table 1: Emissions Risk Matrix

Likelihood	Consequence				
	Insignificant	Minor	Moderate	Major	Severe
Almost Certain	Moderate	High	High	Extreme	Extreme
Likely	Moderate	Moderate	High	High	Extreme
Possible	Low	Moderate	Moderate	High	Extreme
Unlikely	Low	Moderate	Moderate	Moderate	High
Rare	Low	Low	Moderate	Moderate	High

Appendix A

The following information is summarised from the application in regards to the operation of the facility.

Thermal Desorption Unit

The TDU is designed for the treatment of sludge contaminated with hydrocarbons and mercury and will be used as a pre-treatment of hydrocarbon contaminated catalysts, which will be treated subsequently by the High Temperature Treatment Unit (HTTU). The TDU uses an indirect heated vacuum thermal desorption technology for the thermal separation of hydrocarbons, water and mercury from the contaminated material in order to achieve a significant volume and pollution reduction. To reach the required throughput capacity, the unit is equipped with a batch-wise working dryer with a gross volume of 3 kL. The TDU is made up of several modules. Each module has a specific purpose in the treatment process. The following units will include:

- **Feeding Unit:** The feeding unit conveys an appropriate quantity of the material into the Evaporator (see below). To avoid over filling, the feeding is automatically stopped once the pre-set filling level has been reached. The filling level is automatically detected inside. The material is directly conveyed into the dryer by the tube chain conveyer. The whole tube chain conveyor feeding system is gas tight. The discs of the tube chain conveyer are made of Polytetrafluoroethylene (PTFE) and are both chemically resistant and wear-resistant. Once the discs are worn-out they can be replaced through an inspection flap.

- **Evaporator:** The main purpose of the Evaporator is for the thermal separation of water, hydrocarbons and mercury from the contaminated material inside the dryer. During the feeding the dryer is filled up with a maximum of 2.2 m^3 of cold material. The feeding stops once the maximum filling level (~85 %) has been reached. After the feeding process, the dryer is closed by the vacuum valve, which is located at the top of the dryer. To enable the operator to feed material into the hot dryer, a separate nitrogen blanketing system achieves low oxygen content before feeding. Once the drying has been started, the nitrogen/oxygen atmosphere is quickly removed by steam formation. In case of an emergency or critical plant failure the system is purged by nitrogen. The first drying stage is the water evaporation. A slight vacuum is applied to the dryer while the heating temperature is set to moderate temperatures of ~250 °C. Thus, the water evaporates at temperatures between 95 and 130 °C at a pressure of approx. 800 mbar(abs). Since some of the short-chained hydrocarbons have been evaporated already at these conditions, the water condensate is not pure. During the water evaporation, the material will become more and more viscous as the water content decreases. Agglomerates or a pasty mass will form and finally break up. An increase in product temperature as well as a drop in power consumption of the dryer motor indicates the end of the water evaporation phase. At this point the heating temperature of the thermal oil is set to higher values of up to 340 °C. Additionally, a lower pressure of less than 100 mbar (abs) is established step by step as the product heats up. The whole range of hydrocarbons will evaporate as well as the mercury. The final product temperature and vacuum depends on the required output parameters. During the later stage of the drying process the product will change its condition. Dust will emerge from the product and has to be kept inside the dryer vessel. The vapour filter is installed on top of the dryer, retaining the dust inside the dryer vessel. The vapour filter is equipped with metal filter cartridges with a mesh size of around 15 µm (capable of collecting PM10). To reduce the filter surface loading during the water evaporation (high volume flow), a bypass can be opened during water evaporation. This is possible because the material is still wet and raises no dust. After this phase the bypass has to be closed. After the drying process has been completed, the vacuum gate valve and the dryer flap at the bottom of the dryer will be opened and the material will be discharged into the bunker of the Discharge Unit.

- **Discharge Unit:** The main purposes of the Discharge Unit is to cool down the cleaned material from product temperatures of up to 300 °C to temperatures below 80 °C. Prior to discharging the material from the dryer to the bunker and during the cooling process, the bunker is blanketed by

nitrogen. The nitrogen atmosphere inside the bunker is mainly to prevent the remaining organic solids which may have temperatures up to 300 °C from self-ignition. In addition, the oxygen content inside the evaporator shall not increase significantly whilst discharging to the bunker. At the end of cooling screw the material will be filled into bags. In order to fasten the discharge process, a material switch is installed. With this switch, one bag can be filled, while another one is changed. There is also the possibility to discharge the hot treated material directly from the dryer into an intermediate storage container. The empty container will be connected to the discharge flap of the dryer (hermetically sealed). Then the vessel will be purged with nitrogen and is ready to be filled. After discharging the hot material into the container, the container will be placed at a storage site and cools down to ambient temperature.

- **Condensation Unit:** The main purpose of the condensation unit is the transformation of vapours emerging during evaporation into water and oil based condensates. The steam, evaporated oil and gaseous mercury from the evaporator are led to the condenser, where the vapours are condensed and collected. The condenser is cooled by the cooling water provided from the Cooling water unit. The condensate is collected in condensate tank, which has to be emptied several times during the process, which is located in a concrete bunded area. In order to empty the vessel it will be separated from the vacuum system and purged by nitrogen. After the discharge, the vacuum system will bring the vessel back to the system pressure before reopening the valve to the condenser. During the phase of mercury and hydrocarbon evaporation, the condensate will be discharged into a conical vessel to separate mercury from oil. Immediately after the condenser a droplet catcher collects nearly all droplets which may have escaped from the condenser. The droplet catcher is also connected to the condensate vessel to discharge the trapped water and oil. The condensation unit is followed by a vacuum control valve, which allows the operator to adjust the pressure of the system. A vacuum reservoir which also works as droplet catcher is installed downstream to protect the following vacuum pumps against remaining oil. Two screw vacuum pumps maintain the vacuum of <100 mbar(abs) inside the vacuum system. One screw vacuum pump would be sufficient to run the process, but to back it up a second pump is installed in parallel. Both pumps are designed to run in explosive atmosphere and with fluent material like oil. Since it is likely, that the exhaust still contains water and oil, when the plant is running under full vacuum, the pumps are designed in a way that they push through water and oil droplets. A chiller operating as an exhaust cooler is installed directly after the pumps. The chiller is operated by a chilled water circuit to establish cooling temperatures of approx. 20 °C. Directly after the exhaust cooler a droplet catcher filled with demisters removes remaining droplets from the exhaust. This additional droplet catcher is installed to protect the two active carbon filters which, are installed at the end of the process from fluids. After the process gas leaves the last filter it is released as clean off-gas into the atmosphere via a chimney.

- **Thermal Oil Heating Unit**: The main purpose of the thermal oil heating unit is to heat up the dryer to 350 °C thermal oil temperature. It is designed to supply the required energy to the dryer. The burner of the unit is driven by LPG. It predominantly adds the thermal energy the plant is actually consuming for the evaporation plus minimum loss of thermal energy through the piping and dryer insulation.

- **Nitrogen Generation Unit:** The purpose of the Nitrogen Generation Unit is for pressurised air to pass through a compressor. Pre filtration dries and cleans the air. The pressurised air is collected in the instrument air storage vessel. Part of it is directly used as instrument air for all the pneumatically driven valves, but the majority is used to produce nitrogen via a membrane nitrogen generation system. It generates nitrogen with a purity of ~ 99.0 %.

- **Cooling Unit:** The main purpose of the cooling unit is the supply of appropriate amount and quality of cooling water and chilled water to the various consumers throughout the plant. Both cooling water and chilled water circuit operating in a closed loop. The discharge unit, the condensation unit and thermal oil heating unit are connected to the cooling unit which is providing the needed cooling capacity and water volume. Therefore two cooling water pumps are installed.

Again, one would be sufficient but the second pump is installed as contingency in case the first pump fails.

- **Control Unit:** The control container is a 40' foot container split into a control room and an electrical room. The entire plant can be controlled from the control room via PC-control. The operator has to supervise the plant at all times. However, some routines like the feeding of the evaporator, discharge of the treated material and condensate discharge as well as all safety related interlocks are managed by the system. A remote access to the Human Machine Interface (HMI) and Programmable Logic Controller (PLC) enables remote service regarding the control system as well as monitoring the system in regards of process optimization.

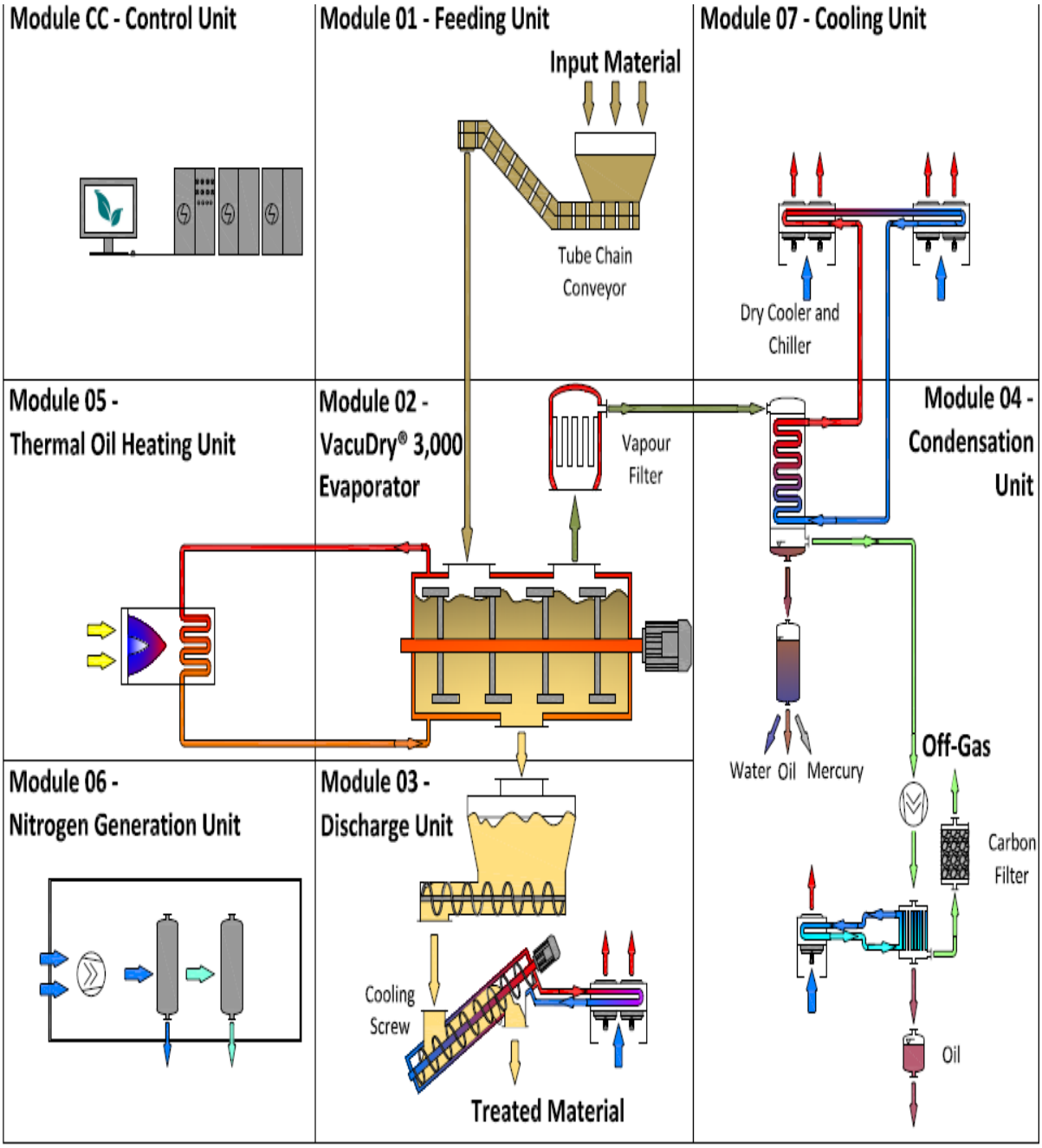

Figure 1: Process flow diagram of the Thermal Desorption Unit

High Temperature Treatment Unit

The High Temperature Treatment Unit Consist of the following Stages:

- **Feeding:** The pre-treated material from the TDU drying process is conveyed to an intermediate storage bin. This storage bin is connected is connected to a tube chain conveyor that feeds and maters the material to the thermal treatment system. A top loader with double flap valve will serve as a suitable air seal. The HTTU is used to treat material that contains mercury sulphides and to treat both catalysts and pre-treated sludges. The catalysts and sludges are pre-treated in the TDU to remove any moisture and hydrocarbons from the material.

- **Thermal Treatment:** The material will be directly heated in the combustion chamber. To achieve a high mass and efficient transfer a moving bed system is used .The system consists of a burner and 3 water cooled paddle units, which intensively mixes the materials and transport the material from the inlet to the material discharge system. Additional air for oxidation of sulphur and hydrocarbons is added by the combustion air fan. The contaminated material is heated up from the inlet temperature to 700^{0}C or more. Under these conditions, the Mercury sulphide (HgS) will be completely decomposed and the released Sulfur will be oxidised; it is a controlled desorption and oxidation process. The moving bed system is directly heated by a gas burner. The thermal treatment is operated slightly under pressure to avoid fumes and dust emissions. The residence time of the material within the system can be set for periods of between 5mins to 45mins. A residence time of 30mins is usually sufficient for thermal desorption (i.e. production of an inert carbon and mercury free material. The treated inert material is discharged by two discharge screws that ensure proper cooling of the material below 50 ^{0}C. To avoid air intrusion into the combustion chamber a rotary feeder is installed. Downstream, the material is filled into bags by a filling station. The off-gas is directed to the off gas cleaning and Mercury recovery system.

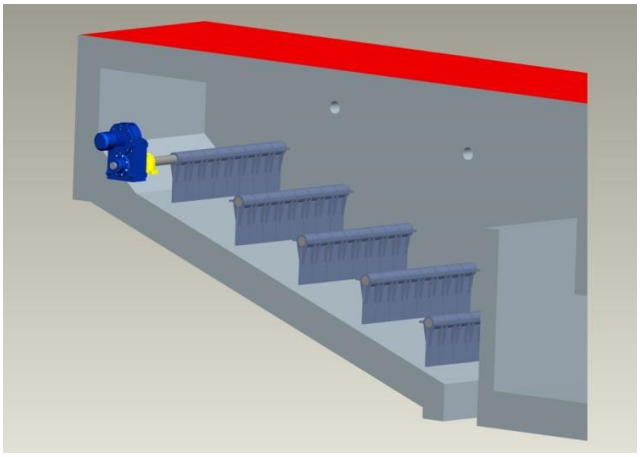

Figure 2: Moving bed system

Off-Gas Treatment will consist of the following processes and infrastructure:

- **Tube Heat Exchanger**: The off-gas from the thermal unit is directed to a cooler where it is cooled there from 800^{0}C to 220- 260^{0}C. The cooling medium is water supplied by a dry cooler. Tubes and the shell of the heat exchanger are made of stainless steel 1.4571 (316Ti) which is resistant against Sulfurous acid (H_2SO_3).

- **Dust Filtration**: A dust filter will be installed for the removal of fly ash. If the pressure drop of the dust filter rises a jet cleaning system, automatically removes the dust from the filter bags. The dust is collected at the bottom of the filter and filled in a filter ash bin. The rotary feeder will significantly reduce dust emissions and air intrusion into the off gas system.

- **Quench and alkaline scrubber:** After the dust removal the off gas enters a quench and is cooled down to <85^{0}C, with the off-gas Sulfur dioxide (SO_2) and Hg vapour entering the quench and the alkaline scrubber. The SO_2 from oxidising the sulfur is transferred to H_2SO_3 immediately when it gets in contact with water or moisture. To neutralise this strong acid the alkaline scrubber is equipped with a pH-measurement and sodium hydroxide dosage (NaOH intermediate storage tank). Depending on the measured pH-valve NaOH is dosed to the wash water and acts as a neutralization agent. The H_2SO_3 reacts with the NaOH to the neutral and non-toxic salt Na_2SO_3. The alkaline scrubber has several spray planes to ensure maximum efficiency. To have a regular output of the continuously generated Na_2SO_3, a part of the wash water has to be discharged

continuously. The wastewater will be pre-treated by the wastewater treatment plant to reduce the mercury content to <5mg/L. The mercury sediments to the bottom of the reservoir tank from where it is discharged to a mercury certified storage vessel. A small contingent still remains in the wastewater and will be removed in the wastewater treatment system. The wastewater from the wet scrubber will be treated within the wastewater treatment system prior to been discharged to the evaporation ponds. The wastewater treatment system utilizes a 4 system (pre-filter, ultrafiltration, backwashing and a mixed-bed filter) purification process to reduce the mercury content within the waste water to <5ppm.

- **Flue gas cooler:** After the scrubber unit the off-gas will be cooled down in a downstream flue-gas cooler executed as a tube bundle heat exchanger. Cooling medium is cool water of 5^0C, which is supplied by a water cooler. In the flue-gas almost all Hg will condensate according to the vapour pressure of Hg at 10^0C. The Hg sediments to the bottom on the flue gas cooler from where it is discharged to a Hg certified vessel. The condensate water with small parts of Hg is discharged from a point slightly elevated from the flue-gas cooler bottom to ensure proper separation of water and Hg.

- **Impact Separator:** The main purpose of the impact separator is to remove the last remaining droplets of aerosols out of the off-gas.

- **Flue gas heater:** The off-gas leaves the impact separator at 10^0C and is saturated with water vapour. Before entering the fine cleaning stage, the activated carbon filter is heated up to avoid co-adsorption of water. The co-adsorption of water will reduce the adsorption capacity of the activated carbon filters for Hg. In the flue gas heater the off-gas warmed from 10^0C to 60^0C.

- **Activated carbon filters:** To keep the required limit for Hg <50 µg/m^3 in the off-gas two activated carbon filters filled with sulfur impregnated activated carbon will be used. Sulfur doped activated carbon is highly effective for Hg removal Two filters are installed in serial connection to ensure meeting the required limits and allowing an optimal use of the activated carbon.

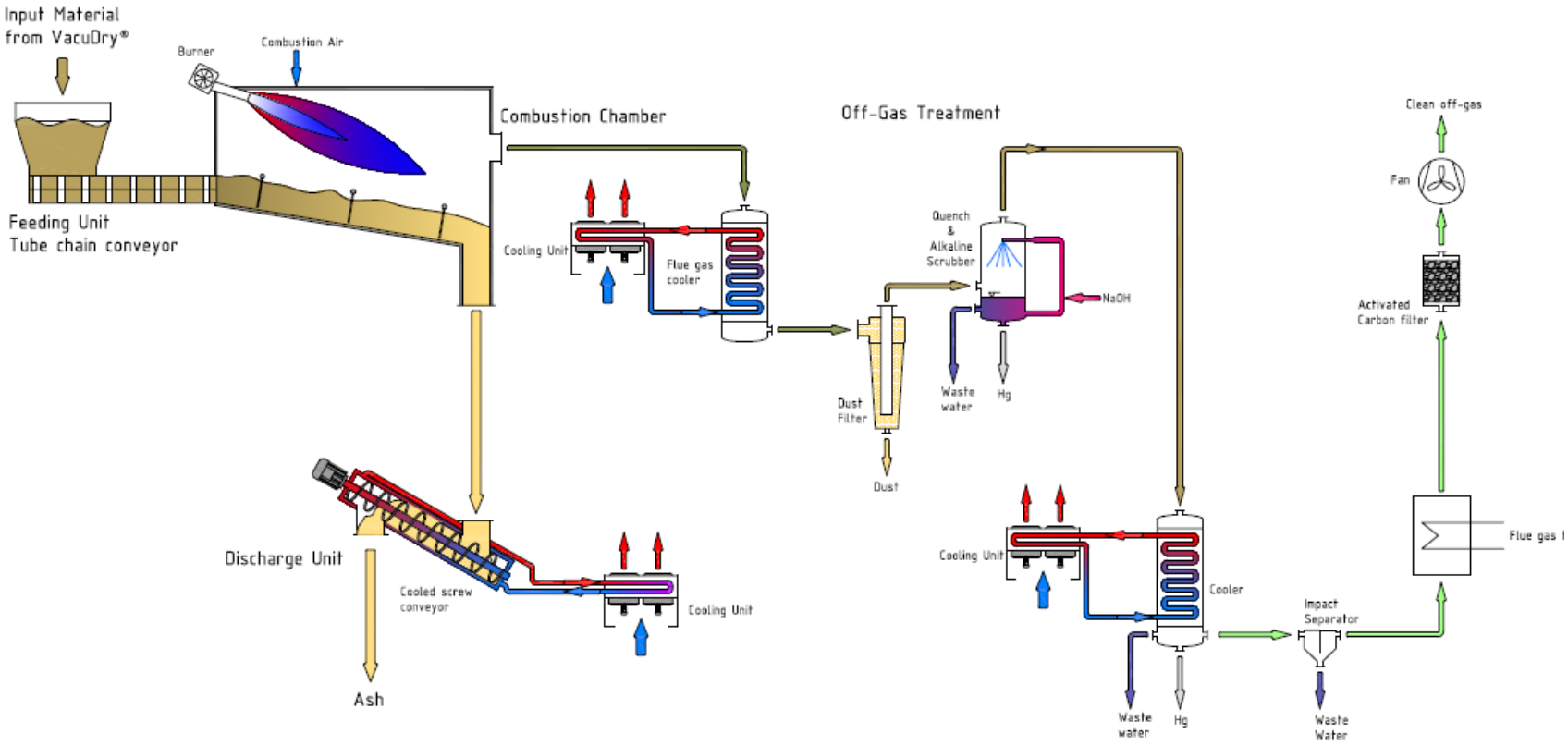

Figure 3: Process flow diagram of the HTTU process

Mercury Purification Process Description

The mercury purification is a high vacuum distillation process to purify Mercury to at least 5N Mercury (Purity 99.999%). The process is a semi continuous process in a closed system. The unit is equipped with pressure and temperature sensors to ensure the purification process is operating sufficiently.

The collected Mercury from the TDU and the HTTU is taken directly from the mercury storage containers into the feeding vessel without any further handling. In order to ensure safe handling procedures, an adapter is fixed on the mercury storage containers, which will also ensure the mercury storage containers are set under limited pressure to press the mercury through a closed piping directly into the feeding vessel.

Purified mercury is discharged into the collection tank, which is controlled by a level sensor. The level sensor actuates a solenoid valve in order to always the guarantee the required filling height. The evaporated mercury is led to a condenser where the pure liquid mercury is collected into a tank.

Inorganic solids as well as metals like copper, zinc or others remain in the evaporator and from a floating layer of mercury with a high amount of impurities. The contaminated mercury is regularly discharged into a mercury sump in order to keep the process running. The contaminated mercury in the mercury sump is added to the HTTU for final treatment.

Contract Resources have identified an ethical end user within Australia as an end user for the recovered mercury. In the event that demand from this procurer is no longer large enough to keep up with supply or if commercial conditions no longer become viable Contract Resources will look to export the recovered mercury overseas. This will require an export permit from the Federal Department of Agriculture and will be subject to the *Customs (Prohibited Exports) Regulations 1958*.

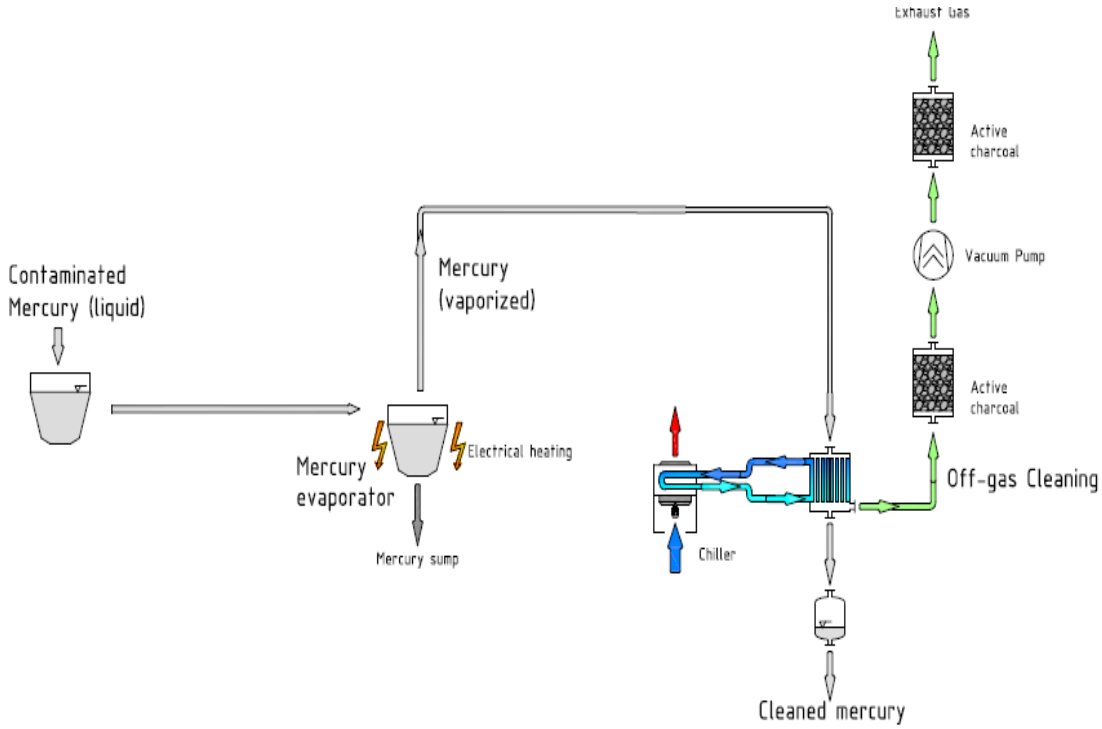

Figure 4: Process flow diagram of the mercury purification process.

Wastewater Treatment System in HTTU

With the thermal treatment of waste catalyst an effluent which contains mercury and sodium sulphite will be generated by the flue gas scrubber system of the HTTU. The wastewater volume will be varying depending on the sulfur content of the catalyst between 1-2m^3/h.

To separate the sodium sulphite as a solid residue the wastewater is intended to be evaporated in the onsite evaporation ponds. The remaining solid sodium sulfite will be disposed of afterwards. The mercury limit for disposal to landfill is 70mg/kg. To meet this requirement, the wastewater has to be treated to reduce the mercury content before it can be taken to the evaporation pond.

The untreated wastewater is expected to contain less than 1,000mg/L of mercury according to empirical values. Most of the mercury can be separated by standard filtration, due to metallic mercury having a low solubility in water and most of the mercury will occur as small droplets or will be attached to small solid particles.

Further mercury will be dispersed as colloidal mercury or nanodroplets in the wastewater. To separate even these smallest particles an ultrafiltration is an efficient and proved method to clean the wastewater to <5/mg/L of mercury.

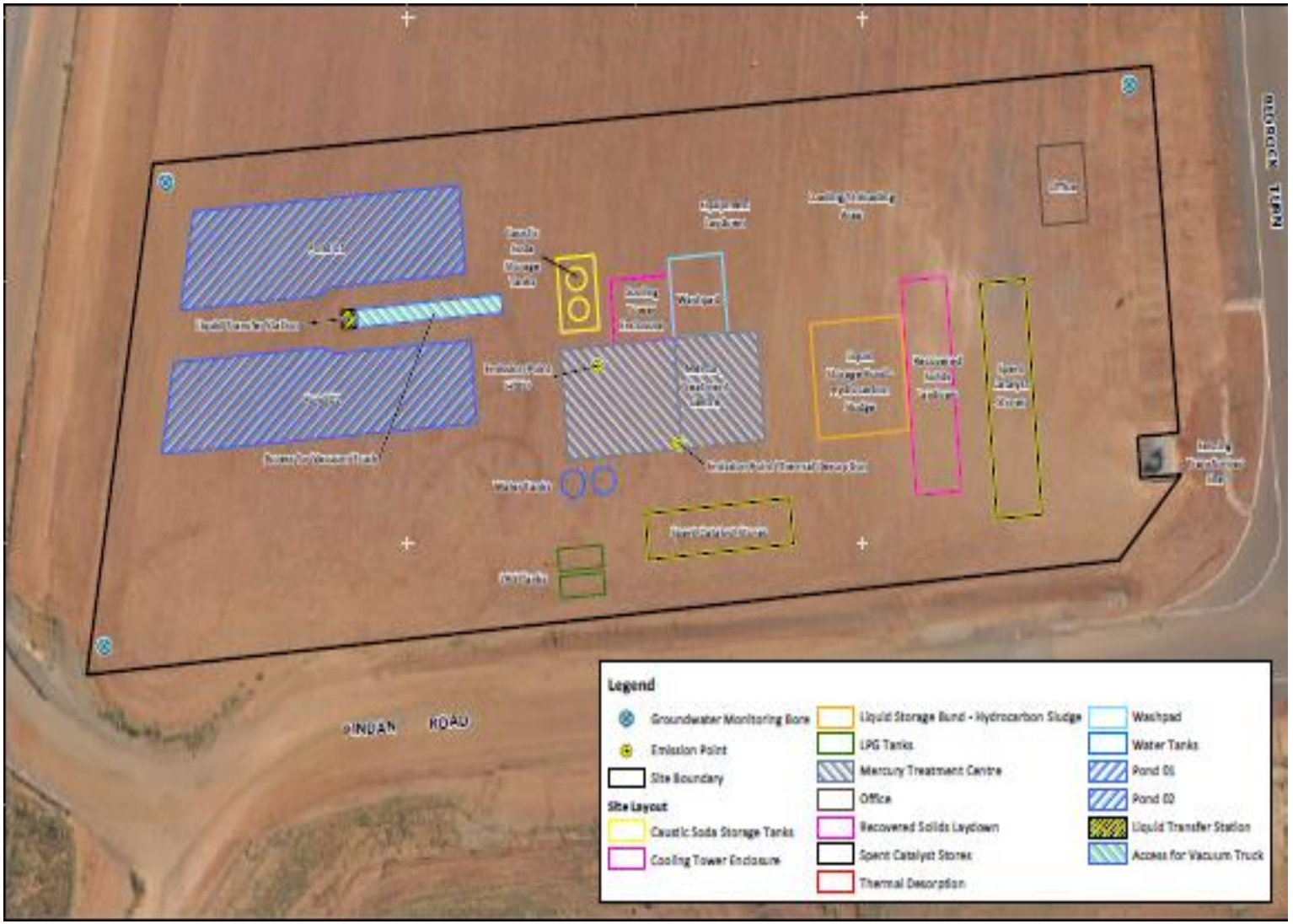

Figure 5: Site layout of the MTF.

Appendix B

Point source emissions to air including monitoring

During commissioning and operations, there will be two potential emissions sources:

- Flue stack of combined exhaust emissions from the thermal oil heating system and process exhaust of the TDU; and
- Flue stack for the HTTU.

The Mercury Purification Unit is a closed process circuit, which is electrically powered. As a result no emissions are produced.

The TDU stack will emit from two sources, the thermal oil heating process and the TDU process, with the emissions combined in the stack before being released to air via the stack. The thermal oil heating system will use LPG burners to heat up the thermal oil which transfers the energy to the TDU thermal desorption process.

The HTTU vent stack emits emissions from the LPG burners and from chemical processes in the burner chamber, mainly the oxidation of sulphur and the oxidation of cinnabar (HgS). Emissions are passed to a flue gas treatment system and scrubber to remove sulphur and mercury from the off gas. Two on-line activated charcoal filters act as police filters before the off gas is discharged to the atmosphere.

Theoretical air quality modelling was undertaken by Air Assessments to predict ground level concentrations of for the surrounding area. Air emissions will consist of mercury NO_x, CO, SO_2 and PM. Three months after commissioning Contract Resources will engage a contractor to perform a field assessment of flue stack emissions in accordance with Australian Standard AS 4323 – *Stationary Source Emissions*.

Emission Risk Assessment – Commissioning and Operations

Emission Description

Emission: NO_x, CO, SO_2 and PM discharged from the thermal oil heating system and process exhaust of the TDU and from the flue stack of the HTTU. Mercury chloride ($HgCl_2$) bonds emitted from the HTTU in the form of dioxins and furans.

Impact: Reduction in local air quality. High concentrations of NO_2, SO_2 and $HgCl_2$ can have adverse effects on human health. The nearest sensitive residential receptor is an accommodation village 2.27km from the premises. Air quality modelling indicates that the highest concentrations will occur on the site itself. At the nearest residential areas, the modelled concentrations are at most 0.40% of any of the criteria, this being the 1-hour NO_2 NEPM standard. At the plant boundary the predicted concentrations are also well below the criteria, at most 11.1% of the 1-hour NO_2 NEPM standard. Mercury concentrations are predicted to be very low, at most 0.011% of the criteria at the nearest residential area and 0.33% at the plant boundary.

Controls: Emissions from the TDU are mostly combustion products from LPG, namely oxides of nitrogen (NOX) carbon monoxide (CO) and particulate matter (PM). The TDU process takes place in a completely encapsulated chamber under vacuum. Emissions from the process are only due to leakages, with these expected to be of the order of 0.3 m^3/hr under normal operations. As a worst case estimate, the leakage volume has been modelled using 30 m^3/hr. The gas from the TDU process consists primarily of nitrogen (N_2) 96% by volume, oxygen 3% and other non condensable substances including CO_2 at 1% and small quantity of mercury. This gas stream is passed to a sulphur impregnated activated carbon filter, which results in negligible (<0.05 mg/Nm^3) mercury

emitted. Contract Resources have committed to utilising the following control measures during commissioning and operation of the TDU:

- Energy efficient thermal oil heating system to reduce CO_2 emissions;
- LPG fuel source utilised;
- Particulate filter to reduce potential for particulate emissions;
- Demister pads in sequence post heat exchangers to remove any moisture from flue gas;
- 2x sulphide activated carbon filters in series prior to emission discharge.

Contract Resources have committed to utilising the following control measures during commissioning and operation of the HTTU:

- Particulate filter on the exhaust off gas system to remove dust particulates;
- Caustic soda wet scrubber to remove sulphur dioxide and mercury from flue gas;
- Impact separator in sequence post the condenser to remove moisture content from the flue gas;
- 2 x sulphide activated carbon filters in series prior to emission discharge; and
- Flue gas stack at a height of 13m above grade to improve dispersion.

The high temperature of the HTTU is utilized to break mercury chloride bonds. There is limited potential for the formation of either dioxins or furans as there will be no organic compounds within the feed material. All spent catalysts containing $HgCL_2$ will be pre-treated within the TDU. The TDU does not have sufficient temperature to break the $HgCL_2$ bonds, however it is sufficient enough to remove any hydrocarbons that maybe present within the spent catalyst. Input material which contains mercury chlorides will be treated at a temperature of no less than 850°C within the HTTU. Dioxins/furan formation is usually formed in a temperature range of between 300°-600°C. The treatment will be done with a controlled and continuously ensured supply of oxygen, which will guarantee full combustion of any existing hydrocarbons that may not have been removed via the TDU.

During commissioning carbon filters will be monitored to determine the predicted life span of the first sulphur impregnated activated carbon filter. The flue stack has been designed with two filters in series, with the second acting as a redundant back-up filter in the event that the first filter becomes saturated. In addition to predictive life span analysis the first filter will have samples removed from it every 4 months. These samples are to be sent through to a NATA certified laboratory for analysis. The analysis will be used to verify saturation levels and confirm the predicted lifespan of the filter. Once the first filter reaches 80% of its saturation capacity the activated carbon within it will be changed out. If the lab analysis indicates a saturation level of higher than 80% a sample of the second, redundant, filter will also be taken and analysed. All saturated activated carbon will be treated within the TDU and then the HTTU. This will recover any mercury from within it and allow for the activated carbon to either be re-generated or disposed of at landfill (no copper or zinc is present in this media).

The bag house is separated from the surrounding area by a rotary feeder to avoid air and dust exchange. The dust is collected at the bottom of the bag house and is removed at fixed intervals by the rotary feeder into a UN rate drum. A sample of this dust will then be sent for analysis at a NATA certified laboratory.

Risk Assessment
Consequence: Minor
Likelihood: Unlikely
Risk Rating: Moderate

Regulatory Controls

Commissioning of the MTF will occur under the Licence. The Licence will have commissioning conditions including, but not limited to, commencement of commissioning and submission of a commissioning report outlining the environmental performance on the MTF, which will be based on the stack test conducted in accordance with Australian Standard AS 4323 - *Stationary Source Emissions*. The Licence will also include monitoring of emissions to air, which will include parameters such as NO_x, CO, SO_2 and PM to be monitored on an annual basis. Table 1 below outlines the expected emissions rates from the TDU and HTTU.

Residual Risk
Consequence: Minor
Likelihood: Unlikely
Risk Rating: Moderate

Table 1: Summary of emission parameters from the MTF.

Parameter	Units	HTTU System Stack	VacuDry Stack		
			Thermal Oil Heating Component	VacuDry Process Component	Combined VacuDry Emissions
Stack Height	(m)	13	-	-	13
Stack Tip Internal Diameter	(m)	0.1317	-	-	0.30
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
Ext 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