Response to EPA RFI

Report for Quantem
31154

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Customer:

QUANTEM Bulk Liquid Storage & Handling

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1	16/08/2021	Draft for Review
2	17/08/2021	Final Document
3	4/11/2021	Updated Document
4	9/11/2021	Updated Final Document

Table of contents

1 Executive Summary

Terminals Pty Limited trading as Quantem Bulk Liquid Storage & Handling (Quantem) wishes to install a second thermal oxidiser (TO) at its Botany facility to treat both vapour and liquid wastes resulting from site operations.

Ricardo Energy, Environment and Planning (Ricardo) was appointed by Quantem to assist with the review, compilation, collation and summarisation of Quantem's supporting information in response to NSW EPA's document 'Request for more Information on Environmental Impacts' dated 29 April 2021.

Ricardo notes that EPA have provided further advice in a letter dated 31/08/2021 (DOC21/761845) confirming the status of the proposed TO as a Group 6 treatment plant and confirming that the concession under clause 33(1) of the Clean Air Regulation that allows the existing TO to comply to Group 5 specifications is not available to the proposed new TO.

Specific responses to NSW EPA's questions, referencing a number of reports separately commissioned by Quantem, are provided herein.

Overall, Ricardo notes that thermal oxidation of liquid wastes is an established technology and according to an international literature search its use is consistent with best practice where the flammable components are concentrated and cannot be further separated. In particular:

- Quantem has used a similar process for the thermal oxidation of liquid wastes at its West Melbourne facility since 2007.
- The equipment vendor has provided similar systems for treatment of liquid wastes at: Queensland Alumina Ltd; APA Group (Orbost Gas Plant); Leigh Creek Energy, and Northern Oil Refinery.

With regard to the Waste Hierarchy in the Waste Avoidance and Resource Recovery Act 2001:

- Avoid and reduce waste: Quantem has implemented steps over the last 5 years to reduce waste as far as practicable. This has reduced flammable and combustible liquid waste volume by approximately 25%, to only about 0.2% of site throughput.
- Reuse waste: Given the relatively low volumes and low value of the end products, it was not considered practicable to re-use the waste.
- Recycle waste: Separable hydrocarbon wastes (i.e. not in the aqueous phase) are recycled by third parties, including approximately 25,000L of base oils per annum and 80,000L of waste oil recycling.
- Recover energy: Recovery of energy from the thermal oxidiser was not considered practical for reasons including a lack of heat demand in the vicinity and insufficient load for commercially available steam turbines.
- Treat waste: This option treats waste on-site as opposed to off-site waste disposal.
- Dispose of waste: Off-site waste disposal will be avoided.

In addition to the ongoing waste avoidance and recycling programs, installation of the thermal oxidiser will allow treatment of liquid wastes on-site, rather than off-site disposal. This will reduce a range of environmental impacts associated with off-site transport and disposal and increase control over the destruction of harmful components.

2 Introduction

Terminals Pty Limited trading as Quantem Bulk Liquid Storage & Handling (Quantem) wishes to install a second thermal oxidiser (TO) at its Botany facility to treat both vapour and liquid wastes resulting from site operations. This TO will provide redundancy in the treatment of vapour emissions which cannot be stored and improve the treatment of flammable and combustible liquid wastes.

Ricardo Energy, Environment and Planning (Ricardo) was appointed by Quantem to assist with the review, compilation, collation and summarisation of Quantem's supporting information in response to NSW EPA's document 'Request for more Information on Environmental Impacts' dated 28 April 2021.

Ricardo has reviewed the previous discussions with EPA and notes that EPA has asked specific questions related to Air Emissions and Waste Management aspects of this application. Quantem and Ricardo have developed responses to these questions in this document.

Ricardo notes that EPA have provided further advice in a letter dated 31/08/2021 (DOC21/761845) confirming the status of the proposed TO as a Group 6 treatment plant and confirming that the concession under clause 33(1) of the Clean Air Regulation that allows the existing TO to comply to Group 5 specifications is not available to the proposed new TO.

The following includes a summary of the attached reports that form Quantem's response to the questions and outlines how these reports respond to EPA's queries regarding the environmental performance of the proposed TO.

3 Response to Questions

3.1 Air Quality

Question: 1 (a) Details of the composition of the liquid waste (e.g. waste types, contaminants, volumes) that is proposed to be treated by the thermal oxidiser. The proponent is to consider the variability of the liquid waste proposed to be treated by the thermal oxidiser and to demonstrate that it will take all reasonable steps to reduce the aqueous component to the minimum amount possible so that the waste stream is as concentrated and homogeneous as possible.

Response:

The steps implemented by Quantem to reduce wastes, and the composition of the remaining wastes, are described below.

The Quantem Port Botany site is a multi-purpose storage facility and handles a range of chemicals including:

- automotive fuels,
- jet fuel,
- alcohols,
- base oils,
- lubricants,
- and corrosives.

The operation of the site generates a range of wastes as shown in **Table 3-1** below.

Table 3-1 Waste generation activities

Waste generating activity	Typical wastes generated
Routine Operations	Cleaning solvents such as Methyl Ethyl Ketone (1-butanone), acetone and iso-propyl alcohol (IPA) Wastes from the cleaning and flushing of docklines used to deliver product to ships Light hydrocarbon water from carbon bed regeneration
Environmental Events	Stormwater contaminated with minor quantities of product
Routine and Planned Maintenance	Mixed composition waste that may include flammable base solvents, cleaning solvents and water, de-greasers, scale and general heavy sludge Mixed hydrocarbon/water waste from pipeline and equipment maintenance

The liquid waste to be treated in the proposed Thermal Oxidiser (TO) is a component of the liquid waste generated onsite.

Quantem has undertaken a range of activities to minimise the aqueous component of the waste stream over the past 5 years. This has resulted in a reduction of 25% in waste volumes over this period.

The management of liquid waste onsite included a review of site docklines to reduce the waste produced when cleaning docklines between products while still maintaining the quality requirements for customers. Reduction in waste produced was achieved by dedicating one dockline to benzene, toluene and xylene (BTX) ship loading as this product is difficult to clean back to a level required to accept other products down the same dockline and would result in a large amount of flammable waste. Of the 3 remaining docklines, one was dedicated to food grade product, one to base oils and one to general flammable chemicals reducing cleaning requirements due to compatible products. This also allows the separation of non-flammable cleaning wastes.

Separation of waste containing recyclable base oils is conducted into a dedicated tank where these oils can be collected for recycling periodically. In addition to this, approximately 25,000L of waste oil products (in smaller 3000L containers) are collected for recycling annually.

A complete outline of the waste reduction activities is provided in *Attachment H (Waste Management and Heat Recovery Report) of the Statement of Environmental Effects.*

Quantem considers the current generation of waste is minimised as far as practicable and concluded:

- Further separation of product to recycle is not feasible due to various miscible products
- Filtration to recycle is not feasible
- reuse not viable due to the array of products handled and infrastructure requirements are not possible with the footprint required for the multitude of products.

This process demonstrates Quantem's application of the waste hierarchy including avoiding generation of waste and maximising opportunities to recycle material, as well as targeting the flammable wastes for energy recovery, thus avoiding disposal of wastes unnecessarily.

In summary, Quantem has implemented a number of strategies to reduce wastes over the last 5 years, as summarised in **Table 3-2** below:

Table 3-2 Waste reduction summary

Strategy	Hierarchy Level	Level of Achievement Against Waste Hierarchy	Waste Reduction Achieved	Volume Reduced (L)
VECS Optimisation	Minimisation	High	Yes	140,000
Dockline Cleaning Optimisation	Minimisation	High	Yes	50,000
Waste Oil Recycling	Reuse	Medium	Yes	80,000
Rainwater Waste Reduction	Minimisation	High	Yes	50,000
Flammable Waste / Water Separation	Minimisation	N/A	No	N/A

These strategies have reduced waste by over 300,000L per annum.

The composition of the remaining liquid flammable waste is described in *Attachment G (Waste Management and Impact Assessment) of the Statement of Environmental Effects* and summarised below.

The waste proposed for the TO is currently collected in two tanks. To investigate the waste composition, grab samples from these two waste tanks were taken at various levels in the tanks. The moisture, density and pH were measured, Table 2 in the above report shows the results obtained at various levels in the tanks. Some samples formed 2 phases, with the water content measured in both phases. The results indicate the waste can be separated in most cases into an aqueous and hydrocarbon phase; however, the results of the aqueous phase testing that show values in the ranges of 65 – 84 % water indicate that these phases also contain something other than water. Given the miscibility with water of the cleaning/flushing solvents used in the process, this will include acid and alkalis, alcohols, acetone and methyl ethyl ketone.

These wastes have been the subject of further separation attempts, including filtration and adsorption on activated carbon media as outlined in *Attachment H (Waste Management and Heat Recovery Report) of the Statement of Environmental Effects*.

The collection of these wastes in a single tank (T261) with a capacity of 200kL with mixing capability will provide buffering against the variability in composition due to daily and weekly activities. An average of 20kL of waste is generated per week.

The measures outlined above produce a waste stream that is as concentrated and homogenous as practicable.

Quantem has specified the proposed TO to handle the remaining variability, as outlined in *Attachment I (Technical Specification VOC and Liquid Waste) of the Statement of Environmental Effects*.

In summary, the wastes generated are highly variable, and reflective of the products handled on-site. A balancing tank is used to buffer this variability, and the thermal oxidiser has been designed to manage the range of wastes expected.

Question: 1(b) Advice and justification that the thermal oxidiser is designed to maintain the required temperature and destruction efficiency when treating the liquid waste.

Response:

Further to a meeting with EPA on 23 August 2021, EPA confirmed by letter dated 31 August 2021 that the TO was required to meet the requirements of a Group 6 Treatment Plant under the Protection of the Environment Operations (Clean Air) Regulation 2010. This includes a residence time of 2 seconds and a combustion temperature of 980ºC. The TO is designed to operate at 980ºC with a 2 second residence time and details of the specification for the TO can be found in *Attachment I (Technical Specification VOC and Liquid Waste) of the Statement of Environmental Effects*.

The TO is able to operate 24 hours a day, 7 days a week to manage the input streams and natural gas usage will modulate depending on the calorific value of the inputs.

The specification of the TO includes a liquid waste feed rate to thermal oxidiser of a maximum 6.5 L/min. The maximum throughput (based on 20 hrs/day, 7 days/week 50 weeks/annum operation) could be 2722 tonnes/annum, which is well in excess of the anticipated liquid waste stream volume. This allows the flexibility to treat variations in liquid waste generation, manage shut downs and maintenance activities and minimise the usage of natural gas by optimising the calorific value of the combined air and liquid waste streams.

The TO specification includes the following measures to ensure that liquid waste can be effectively treated:

> "*The thermal oxidiser shall be designed to thermal oxidise a liquid waste stream. The design shall consider the following:*
> - *The liquid waste stream may contain both aqueous and/or flammable liquid waste.*
> - *The burning of liquid waste shall occur at the same time as a peak thermal load from a rich VOC vapour stream -refer to section 4 and Appendix B for maximum thermal load requirements.*
> - *Burning of the liquid waste stream shall not foul the burners and thermal oxidiser's critical components nor effect the long-term performance of the unit.*
> - *The oxidiser shall be able to be easily inspected to ensure fouling is not occurring and also have the ability to be easily clean, should it occur.*
> - *The tender shall allow for a dedicated spigot to be positioned on the thermal oxidiser and provide a liquid waste injection/spray nozzle. The injection/spray nozzle shall be a compressed air/liquid internal mix nozzle and shall be positioned as not to impact the performance of the flame detectors. The injection/spray nozzle should be positioned in a manner that permits cooling/supplementary air around to be added around the injection/spray nozzle when needed*".

The letter from GASCO (provided in *Attachment J (GASCO Letter) of the Statement of Environmental Effects*) confirms that the TO is designed to operate with up to 6.5L/min of liquid waste. Further, the TO can operate with this waste consisting of anything from 100% water to 100% liquid benzene.

Two illustrative heat and mass balance scenarios are provided to confirm the capacity of the TO to operate under both a very low calorific value input (HMB 1 with inert gas and water inputs) and a very high calorific value input (HMB 2 with 100% flammable inputs). The TO is capable of operating effectively and within the required emissions limits under each extreme case:

- HMB 1: Inert waste gas + 100% water, where required burner heat release is 18 GJ/h in order to maintain chamber temperature at 980º C.

- HMB 2: Waste gas of maximum benzene content + 100% liquid benzene. This is the sizing/design case for the TO where the burner is operated at minimum firing (for combustion stabilization). In this case, cooling air (19,250 kg/h) is required to maintain the nominal 980ºC chamber temperature.

This worst case scenario has been replaced with a 100% liquid hexene scenario since the date of the letter and an updated Heat and Mass Balance (Updated HMB 2) has been provided in Appendix A of this report to reflect this scenario. The 100% benzene scenario, however, is considered to be a more conservative design basis due to the higher calorific value of benzene requiring higher cooling air capacity to maintain the target operating temperature.

The TO will be operated at nominally 980ºC, which is auto-controlled through a temperature controller, with a minimum 2s residence time. The method for maintaining temperature setpoint in simple terms is:

- If chamber temperature is too low, the temperature controller will call for increase in burner output, and
- If chamber temperature is too high, the temperature controller will call for decreased burner output and then more secondary air (cooling air).

Opportunities will be pursued to minimise gas consumption while maintaining destruction efficiency and licence compliance through adaptive management of the TO appliance. This might include operating at reduced temperatures (subject to any agreed operational requirements) when principal toxic air pollutants are not being treated. Through the commissioning phase, the appliance will be optimised through testing to balance gas usage and operating temperature while maintaining destruction efficiency. A similar process has been undertaken with the existing TO, with EPA's involvement.

A summary of operating parameters under these scenarios is presented in **Table 3-3.**

Table 3-3 Thermal Oxidiser extreme scenario operating parameters

Operating Parameter	Inert Waste Gas + 100% Water (HMB 1)	Waste Gas of Max Benzene + 100% Liquid Benzene (HMB 2)
Chamber Temperature, degC	980	980
Heat Release of TO, GJ/h	18	24.6
Heat Release of Burner, GJ/h	18	1.2
Primary Air, kg/h	5,593	372
Secondary (Cooling) Air, kg/h	4,639	19,250
Exhaust Gas Free O2, % (dry)	8.4	12.2
Exhaust Gas Volume, Am3/s	13.4	21.2

In summary, the equipment vendor has confirmed the thermal oxidiser will achieve a combustion temperature of 980ºC and a residence time of 2 seconds as required for a Group 6 treatment plant. The appliance is capable of managing wastes ranging from inert gas + 100% water to 100% benzene vapour plus 100% liquid benzene or 100% liquid hexene.

Question: 1(c) Verification of the assumption that the assessed and modelled scenario in the AQIA is adequately worst-case and encompasses the burning of the liquid waste.

Response:

The AQIA is provided in *Attachment F (Air Quality Assessment) of the Statement of Environmental Effects*. The report includes the following modelling assumptions:

- The AQIA notes the second oxidiser will be used for the burning of liquid waste.
- Modelling includes the maximum emission rate from the current TO, plus simultaneous worst case emissions from existing discharge points DP4 (existing TO), DP7 (bitumen combustor) and DP9 (vapour recovery unit).
- Emission rates for benzene and sulphur dioxide were based on worst case calculations as outlined in *Attachment I of the Statement of Environmental Effects.*
- Emission rates for carbon monoxide were based on NPI Emission Estimates for peak gas consumption.
- Emission rates for nitrogen dioxide were based on the maximum EPL limits for the existing oxidiser of 350 mg/m^3.
- Local receptor and meteorological data was used in the modelling.

Using these conservative inputs, none of the modelled parameters exceeded acceptable concentrations at the identified receptors. The maximum predicted peak Ground Level Concentrations (GLCs) as a percentage of each impact assessment criterion were: benzene, 0.6%; sulphur dioxide, 20%; carbon monoxide, 7.2%; nitrogen dioxide, 57%. It was considered that the predicted emissions from both oxidisers would have a negligible impact on ambient concentrations of PM_{10}. Notably, no changes in predicted peak level concentrations of benzene were observed despite updating the emissions rates to account for a 100% liquid hexene scenario, indicating that the output of the TO has no discernible impact on these results.

The AQIA is consistent with an adequately worst case scenario as described above, encompasses the burning of liquid waste and the updated emissions scenario made no impact on GLCs at the identified receptors.

3.2 Waste Management

Question: 2 (a) Details of the thermal oxidiser and its performance are not provided. The proposed liquid waste management strategy is not demonstrated as suitable or consistent with current international best practice. The WMIA or other assessment documents do not include details of the proposed thermal oxidiser, such as its type, design, capacity or capability. Consequently it is not possible to confirm the technology and plant proposed to manage the liquid wastes (noting 1a) above) generated at Terminals at Port Botany is suitable or appropriate for its intended purpose.

Recommendation: The proponent provide further information on proposed liquid waste management strategy to demonstrate it is suitable and fit for purpose, including an assessment against current international best practice for the management of similar wastes.

Response:

Quantem has undertaken significant literature review to identify an appropriate reference site to demonstrate that the thermal oxidation of liquid waste is current international best practice for the management of such wastes.

The assessment conducted in *Attachment G (Waste Management and Impact Assessment) of the Statement of Environmental Effects* identifies that the European Union Joint Research Centre (JRC) has published briefing manuals and guides for waste management that arises from chemical manufacturing and storage. These guides typically concentrate on lower strength wastes that are treated in the liquid phase, however the "*Best Available Techniques (BAT) Reference Document for Common Waste Water and Waste Gas Treatment/Management Systems in the Chemical Sector*" includes a note that thermal oxidation is a suitable technique for the disposal of VOC wastes from the storing and loading/unloading of volatile organic liquids, and vessel cleaning (rail tank cars, road tankers, and barges).

This is further explained through a review focused on wastewater treatment from pharmaceutical industries "*Physicochemical treatment of pharmaceutical process wastewater: distillation and membrane processes*", which highlights that when there are no halogens in the waste stream and the waste has a VOC-COD greater than 1,000 mg/L, thermal oxidation is an appropriate outcome, given that an azeotropic mixture cannot be easily distilled. This decision tree is highlighted in the extract from *Attachment G (Waste Management and Impact Assessment) of the Statement of Environmental Effects* provided in **Figure 3-1** below.

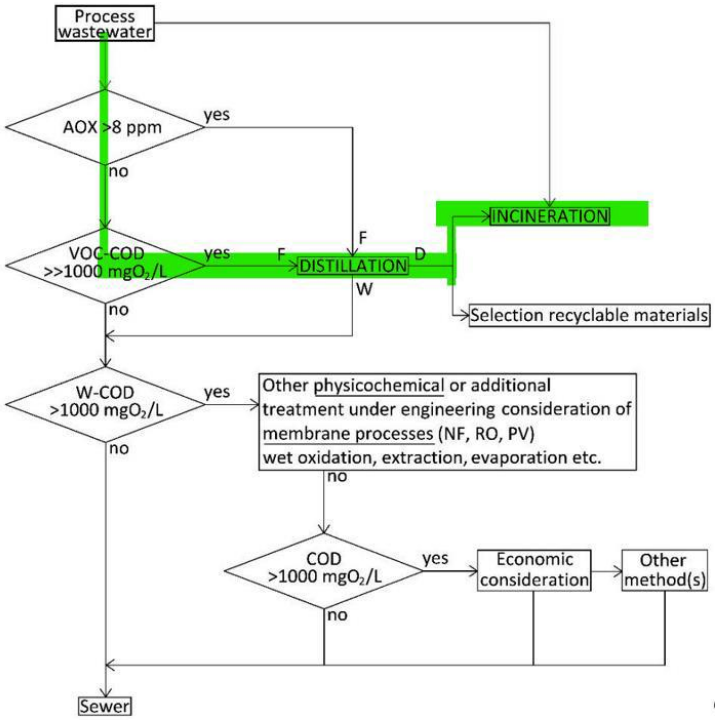

Figure 3-1 Extract from *Waste Management and Impact Assessment*

Quantem operates a similar TO for their liquid waste stream at the West Melbourne Site in Victoria. This site has comparable waste chemical composition to Port Botany site due to similar operating parameters and the TO combusts both gaseous and liquid wastes. The Melbourne TO was established in 2002. From late 2007 onwards, this site commenced thermal oxidation of the liquid waste stream from the site in addition to the vapour stream. Operational data from the West Melbourne site pre-2008 and post-2008 demonstrates no deleterious impacts on the operation of the TO from the introduction of the liquid waste stream.

Further to this, the existing methodology for offsite treatment of liquid waste from the Port Botany facility (following recent changes in management practices) is to transport the liquid waste material interstate to a thermal oxidiser facility.

Both Quantem's investigations in Melbourne and the recent GASCO investigations in designing the proposed TO (See *Attachment J (GASCO Letter) of the Statement of Environmental Effects*) verify that the proposed afterburner type TO design is the appropriate technology, in comparison to other oxidation processes including:

- Catalytic oxidation
- Regenerative thermal oxidation
- Recuperative thermal oxidation

The GASCO investigations also note that similar TO installations to treat liquid wastes have been conducted at

- Queensland Alumina Ltd,
- APA Group (Orbost Gas Plant),
- Leigh Creek Energy, and
- Northern Oil Refinery.

The waste composition at the Quantem Port Botany site is internationally unique as far as publicly available documentation has demonstrated, however the combination of academic literature and industry guidelines outlined above, along with the reference sites identified in Australia that also treat flammable liquid waste mixtures, demonstrate that the proposed TO technology to treat this waste stream provide evidence that TO is a suitable and fit-for-purpose technology for treating high VOC liquid hydrocarbon wastes.

Question: 2(b) The greenhouse gas emission estimates cannot be verified as details of the emission calculations are not provided. In addition, justification is lacking for the assumptions used in these calculations.

To evaluate environmental impacts of the change in waste management strategy the WMIA includes a comparative assessment of the current process against the proposed process. The comparative assessment concludes the overall environmental impacts, measured in CO2-equivalent emissions, will be significantly reduced, from 7,641 tonnes CO2-equivalent from the current process to 1,746 tonnes of CO2-equivalent for the proposed waste management process.

However the EPA notes that the WMIA does not include details of the calculations and consequently the emissions estimates cannot be verified. In addition the WMIA does not include detailed justification of all the assumptions used to calculate greenhouse gas emissions. Justification of all assumptions is required to confirm they are appropriate and reasonable, and to demonstrate the estimated emissions are reliable.

Recommendation: The proponent provide detailed information on the calculations and assumptions used for the comparative greenhouse gas emissions assessment.

Response:

The Waste Management Impact Assessment has been updated (see *Attachment G (Waste Management and Impact Assessment) of the Statement of Environmental Effects)*. This includes additional information on the assumptions and calculations used in the assessment. The scenarios include:

- **Scenario 1. Current off-site treatment with gravity separation and a combination of biological treatment in Sydney and transport to a cement kiln in Gladstone.**
- **Scenario 2. Current off-site treatment with all waste being transported to a cement kiln in Gladstone.**
- **Scenario 3. Proposed treatment on-site by thermal oxidation.**

The CO_2 equivalent emissions from Scenarios 1 – 3 are: 4,950t; 1,360t; and 1,316t per annum respectively based on an approximate liquid waste quantity of 1,000 tonnes.

It is noted that the greenhouse gas emissions assessment is only one aspect of the environmental impacts of the proposed change in waste management strategy, as noted in the response to Question 2(c) below.

c) The quantitative comparative assessment is limited to greenhouse gas emissions and does not consider all environmental aspects or impacts.

The WMIA includes a quantitative comparative assessment of project greenhouse gas emissions against current greenhouse gas emissions, however a comparative assessment of other project impacts however has not been made.

Recommendation: Note that the comparative assessment in the WMIA is limited and its weighting with respect to project benefits needs to be considered in this context.

Response:

The assessment in *Attachment G (Waste Management and Impact Assessment) of the Statement of Environmental Effects* has been updated to include a qualitative assessment of the relative environmental impacts of the current disposal practices and the environmental impacts of the proposed TO facility. These are summarised below:

- Air Emissions
    - The current case for treatment of this waste stream is to combust the material in a facility interstate. This facility may operate at a higher temperature (up to 1200ºC) however this cannot be verified by Quantem. As the proposed TO meets the requirements of a Group 6 treatment plant, any additional destruction achieved by this higher temperature is unlikely to be material and may be offset by other emissions involved in transport, including NOx and VOC emissions. The proposed TO includes strict emissions controls and measurement protocols that are specific to combusting this mixture of waste and therefore Quantem have a high degree of confidence in the air emissions performance of the proposed facility.
- Water emissions
    - Previously, the liquid waste stream was treated offsite and a component of it was disposed of to sewer, where it was biologically treated. With the proposed TO, no emissions to water are proposed to occur.
- GHG emissions
    - The GHG emissions benefits of the proposed solution are outlined in *Attachment G (Waste Management and Impact Assessment) of the Statement of Environmental Effects*
- Emissions to land
    - The proposed TO does not generate biological treatment residues as were previously generated. The current case for treatment of this waste stream is to combust the material in a facility interstate. There is no anticipated change in fly ash or other solids generation that is quantifiable as Quantem are unable to verify the conditions under which it is currently combusted.

As shown by the international literature search, there are very limited practicable options to manage flammable and combustible liquid wastes of the type generated by Quantem Port Botany and waste management companies currently utilise a similar process to manage the waste if it is taken offsite. Therefore undertaking a thorough comparative assessment is limited due to a lack of available reference projects. As demonstrated in *Attachment H (Waste Management and Heat Recovery Report) of the Statement of Environmental Effects,* a range of initiatives have been undertaken to achieve alternative treatment solutions for materials in the waste stream.

An assessment of the proposal against the waste hierarchy is presented to provide further review of potential alternative waste management strategies.

With regard to the Waste Hierarchy in the Waste Avoidance and Resource Recovery Act 2001:

- Avoidance and reduce waste: As outlined above, Quantem has implemented steps over the last 5 years to reduce waste as far as practical. This has reduced flammable and combustible liquid waste volume by approximately 25%, to only about 0.2% of site throughput.
- Reuse waste: Given the relatively low volumes and low value of the end products, it was not considered practicable to re-use the waste.
- Recycle waste: Separable hydrocarbon wastes (i.e. not in the aqueous phase) are separated and recycled by third parties, including approximately 25,000L of base oils per annum.
- Recover energy: Recovery of energy from the thermal oxidiser was not considered practical for reasons including a lack of heat demand in the vicinity and insufficient load for commercially available steam turbines.
- Treat waste: The proposed option treats waste on-site as opposed to off-site waste disposal.
- Dispose of waste: Off-site waste disposal will be avoided.

In addition to the ongoing waste avoidance and recycling programs, installation of the thermal oxidiser will allow treatment of liquid wastes on-site, rather than off-site disposal. This will also reduce a range of environmental impacts associated with off-site transport and disposal and increase control over the destruction of harmful components.

4 Notes on this report

The sole purpose of this Report and the associated services performed by Ricardo Energy, Environment and Planning (Ricardo) is to develop a response to EPA NSW's Request for Information letter dated 29/04/2021, in accordance with the scope of services set out in the contract between Ricardo and Terminals Pty Ltd.

In preparing this report, Ricardo has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the Report, Ricardo has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

This report outlines how the associated reports respond to the EPA NSW Request for Information. Ricardo derived the data in this Report from information sourced from the Client (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination of the project and subsequent data analysis, and re-evaluation of the data, findings, observations and conclusions expressed in this Report. Ricardo has prepared this Report in accordance with reasonable skill and care of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this Report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this Report, to the extent permitted by law.

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Appendix A Updated HMB 2

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