



## **Department of the Environment**

Thermal Augment Project

### **Report on Thermal Capacity Opportunities in Australian Hazardous Waste Infrastructure**

October 2016



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# 1. Glossary

**Autoclave** - a pressure chamber used to carry out industrial processes requiring elevated temperature and pressure different from ambient air pressure. Autoclaves are used in medical applications to perform sterilisation.

**Incineration** - is a waste treatment process that involves the combustion of organic substances contained in waste materials. Incineration of waste materials converts the waste into ash, flue gas, and heat. The ash is mostly formed by the inorganic constituents of the waste and may take the form of solid lumps or particulates carried by the flue gas. The flue gases must be cleaned of gaseous and particulate pollutants before they are dispersed into the atmosphere. In some cases, the heat generated by incineration can be used to generate electric power.

**Thermal desorption**- is often used as an environmental remediation technology that utilises heat to increase the volatility of contaminants such that they can be removed (separated) from the solid matrix (typically soil, sludge or filter cake). Thermal desorption is not incineration. The volatilised contaminants are then either collected or thermally destroyed. A thermal desorption system therefore has two major components; the desorber itself and the offgas treatment system.

**tpa** – tonnes per annum

**POP** – persistent organic pollutant, such as chlorinated hydrocarbons.



## 2. Introduction

The Department of the Environment (the Department) has recently commissioned a number of studies investigating the needs and capacity of hazardous waste infrastructure in Australia. The *Hazardous waste infrastructure needs and capacity assessment* project, completed in July 2015, developed projections for the quantity of hazardous waste to 2034 and investigated the capacity of existing waste infrastructure to treat hazardous waste.

Following from the infrastructure needs and capacity assessment, the Department has commissioned this assessment to assess the opportunities of existing thermal facilities in Australia to receive and treat a wider range or larger quantities of hazardous waste.

### 2.1 Purpose of this report

The objective of the study is to assess where opportunities exist to improve the management of hazardous waste through thermal treatment, by understanding the types and volumes of waste produced and the capacity of thermal facilities to treat those wastes.

This study undertakes analysis and assessment of existing thermal facilities in Australia to identify opportunities to receive and treat a wider range or larger quantities of hazardous waste. Consideration is also given to the waste types suitable for thermal treatment, supplementing the previous assessment.

The study focuses on those facilities, which would not trigger major redevelopment, even if some variation to environmental operational licences were required. Facilities including cement kilns, smelters and sites processing contaminated soil waste are also considered in this study, extending the facility based beyond traditional hazardous waste facilities.

### 2.2 Scope and limitations

*This report: has been prepared by GHD for Department of the Environment and may only be used and relied on by Department of the Environment for the purpose agreed between GHD and the Department of the Environment as set out in section 1.1 of this report.*

*GHD otherwise disclaims responsibility to any person other than Department of the Environment arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.*

*The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.*

*The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.*

*The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section 5). GHD disclaims liability arising from any of the assumptions being incorrect.*

*GHD has prepared this report on the basis of information provided by Department of the Environment and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.*

## 3. Previous Work

In 2013, GHD conducted an independent assessment on the capacity to treat certain types of POPs wastes. The following sections summarise the work undertaken at that time.

### 3.1 Scope of assessment

The technical independent assessment has been undertaken on all available technologies currently operating in Australia with respect to their capability to treat a specific POPs stockpile. The minimal criteria to establish a viable treatment option included:

- Proven capacity to safely treat hazardous waste materials
- The capacity to treat the POPs within a reasonable time frame
- The necessary technology to pre-treat waste prior to destruction considering its heterogeneous and combustible nature
- The ability based on evidence to destroy POPs materials
- The technical and operational capacity to manage environmental hazards and emissions from the destruction of the POPs
- The ability to permit and license a facility to treat the stockpile

The assessment was undertaken in respect to the technologies' capability to treat a specific POPs stockpile and did not evaluate their technical capacity to treat other materials.

### 3.2 Technologies considered

Five technologies were shortlisted for assessment as part of this study based on the criteria above and considered current available technologies operating in Australia in 2013, capable of treating industrial hazardous waste. The five technologies considered in 2013 were:

- **Plascon** – owned by ToxFree Solutions Ltd
- **Hydrodec** – owned by Hydrodec Group PLC
- **Base-Catalysed Dechlorination (BCD)** – owned by ToxFree Solutions Ltd
- **Entech** – owned by Entech Renewable Energy Technologies Pty Ltd
- **High temperature incineration (HTI)** – the largest facility in Australia owned by ToxFree Solutions Ltd at Port Hedland

The Stockholm Convention advises that the only method of disposing of POPs is final destruction or irreversible transformation; therefore, methodologies such as long-term storage were not included in this assessment.

### 3.3 Conclusions

The timeframes for technology development, project approvals, plant modifications and scalable treatment are significant. All technologies assessed would take in excess of the seven-year period for current available technology. In fact, all five technologies would exceed a period of fifteen years to develop, permit, modify and process the POPs stockpile. These periods do not allow for significant risk factors, which are present with developing the current technologies.



### 3.4 Subsequent hazardous waste capacity assessment

A report was later conducted in 2015 by blue environment pty ltd for the Department to assess Australia's current and future hazardous waste infrastructure capacity and needs at that time. The report outlined projections for hazardous waste volumes and types of the coming 20 years, the estimate of waste infrastructure capacity and distribution of waste and formed an assessment of existing infrastructure being able to meet those future waste needs.

An infrastructure database was produced for the report, outlining the type, scale and potential capacity to accept waste. A total 241 sites were recorded and these were allocated into 17 infrastructure groups based on main wastes received and primary form of waste treatment (e.g. thermal, chemical, landfill, recycling etc.). The scope and coverage of the infrastructure database constrains the assessment of infrastructure capacity against projections of increased waste volume. Some hazardous wastes were managed in facilities that were not included in the infrastructure database, such as landfills and cement kilns; others were sent to infrastructure with limited coverage in the database, such as organics recycling facilities and POPs thermal destruction facilities. These would have limited or no coverage in the capacity assessment.

Developing future scenarios is an inherently uncertain task. With regard to understanding waste capacity, a number of factors limit the certainty of the assessment, including changing industrial markets, government regulations and waste definitions and 'language'. The infrastructure itself was also difficult to characterise and information on activities was limited or hard to obtain. The following conclusions were reached for varying waste facilities:

- Sufficient capacity to handle waste arisings over 20 years to 2034 in all scenarios:
  - Mercury recycling facilities
  - E-waste major physical, chemical and disassembly facilities
  - Contaminated soils treatment facilities
- Mixed capacity to handle waste arisings over 20 years to 2034 (subject to scenario):
  - Oil re-refining facilities – sufficient capacity under low scenario; exceeded capacity in 2023 under best scenario
  - Lead recycling facilities – sufficient capacity under low scenario; exceed capacity in 2031 under high scenario
  - Solvents/paints energy recovery facilities – sufficient capacity under best and low scenarios; exceeded capacity in 2030 under high scenario
  - Chemical and physical treatment plant facilities – sufficient capacity under best and low scenarios; exceeded capacity in 2030 under high scenario
  - Clinical waste treatment facilities – sufficient capacity under low scenario; exceeded capacity in 2026 under best scenario and 2020 under high scenario
  - Clinical waste thermal destruction facilities – sufficient capacity under low scenario; exceeded capacity in 2024 under best scenario and 2019 under high scenario
- Exceeded capacity to handle waste arisings over 20 years to 2034 in all scenarios:
  - Solvents/paints recycling facilities
  - Organics recycling facilities – very high uncertainty of capacity assessment
  - Hazardous waste landfill facilities – constrained under all scenarios though modelling assessment for this infrastructure group was deemed incorrect due to lower response rate and difficulty to define site potential annual capacity
  - Transfer station or temporary storage facilities.

## 4. Assessment Method

The following process was undertaken to identify the suitability of thermal waste facilities for further assessment:

- Comparison of the characteristics required to treat each waste type with the characteristics of thermal facility types
- Where thermal facilities did not satisfy the minimum requirements for treating waste types, identification of the facility upgrades required (e.g. upgrading gas treatment equipment)
- Classification of the required upgrades as either minor upgrades or major redevelopments
- Consideration of the scale of wastes that could be treated if a minor upgrade was undertaken
- Identification of facilities that potentially have existing capacity to receive waste or could increase capacity
- Identification of waste types and facilities that could be treated, reused or components recovered, compared with a final disposal option such as incineration or landfill
- Identify and discuss constraints such as timeframes, technical challenges, licence or permit conditions, facility location and waste projections.

### 4.1 Stakeholder consultation outcomes

A targeted stakeholder consultation process of the facilities identified as suitable to be further investigated was undertaken. The consultation process involved:

- An initial discussion to understand the facility's willingness to participate in the project
- For facilities wishing to participate, a letter outlining the objectives of the project
- A teleconference to confirm the characteristics of the specific facility and the constraints associated with any modification.

Note that not all facilities listed in Table 2 provided input into the stakeholder consultation process. Table 3 to Table 7 describe the information received from those facilities willing to participate in this process.

## 5. Assessment of thermal facilities

### 5.1 Identification of suitable waste types for thermal treatment

An assessment of the suitable waste types for thermal treatment was undertaken based on the existing NEPM codes and descriptions and the waste categories and types.

The relevance to thermal treatment was used to assess the final waste types, which were used as the basis for comparison of treatment options in this assessment. The identified waste types used in the assessment are provided in Table 1.

**Table 1 Suitable waste types for thermal treatment**

Waste Category	Waste Description
Inorganic Chemicals	Inorganic fluorine compounds excluding calcium fluoride
Inorganic Chemicals	Antimony; antimony compounds
Inorganic Chemicals	Thallium; thallium compounds
Inorganic Chemicals	Copper compounds
Inorganic Chemicals	Cobalt compounds
Inorganic Chemicals	Nickel compounds
Inorganic Chemicals	Lead; lead compounds
Inorganic Chemicals	Zinc compounds
Paints, Lacquers, Varnish, Resins, Inks, Adhesives	Waste from the production, formulation and use of inks, dyes, pigments, paints, lacquers and varnish
Paints, Lacquers, Varnish, Resins, Inks, Adhesives	Waste from the production, formulation and use of resins, latex, plasticisers, glues and adhesives
Organic Solvents, Solvents, Residues	Ethers
Organic Solvents, Solvents, Residues	Organic solvents excluding halogenated solvents
Organic Solvents, Solvents, Residues	Halogenated organic solvents
Organic Solvents, Solvents, Residues	Waste from the production, formulation and use of organic solvents
Pesticides	Waste from the production, formulation and use of biocides and phytopharmaceuticals
Pesticides	Organic phosphorous compounds
Oils, Hydrocarbons, Emulsions	Waste mineral oils unfit for their original intended use
Oils, Hydrocarbons, Emulsions	Waste tarry residues arising from refining, distillation, and any pyrolytic treatment
Putrescible / Organic Wastes	Tannery wastes (including leather dust, ash, sludges and flours)
Putrescible / Organic Wastes	Wool scouring wastes
Organic Chemicals	Waste substances and articles containing or contaminated with polychlorinated biphenyls, polychlorinated naphthalenes, polychlorinated terphenyls and/or polybrominated biphenyls
Organic Chemicals	Phenols, phenol compounds including chlorophenols
Organic Chemicals	Organo halogen compounds—other than substances referred to in this list
Organic Chemicals	Polychlorinated dibenzo-furan (any congener)
Organic Chemicals	Polychlorinated dibenzo-p-dioxin (any congener)
Cyanides	Cyanides (organic) / nitriles

Waste Category	Waste Description
Organic Chemicals	Isocyanate compounds
Organic Chemicals	Triethylamine catalysts for setting foundry sands
Organic Chemicals	Surface active agents (surfactants), containing principally organic constituents and which may contain metals and inorganic materials
Organic Chemicals	Highly odorous organic chemicals (including mercaptans and acrylates)
Solids / Sludges requiring Special Handling	Soils contaminated with a controlled waste
Clinical and Pharmaceutical Wastes	Clinical and related wastes
Clinical and Pharmaceutical Wastes	Waste pharmaceuticals, drugs and medicines
Clinical and Pharmaceutical Wastes	Waste from the production and preparation of pharmaceutical products
Miscellaneous	Waste chemical substances arising from research and development or teaching activities, including those which are not identified and/or are new and whose effects on human health and/or the environment are not known
Miscellaneous	Waste from the production, formulation and use of photographic chemicals and processing materials
Tyres	Tyres
Reactive Chemicals	Waste of an explosive nature not subject to other legislation

## 5.2 Identification of thermal facilities

The thermal waste facilities considered in this study were based on previous assessments completed for the Department. These included clinical waste facilities, recovery facilities and other general hazardous waste sites. From this initial list, the facilities were refined to consider those that were identified as having capacity for thermal treatment. In addition, other thermal facilities were added to the study, such as cement kilns and smelters.

The list of thermal facilities is categorised into the following six types:

- Cement kilns
- Smelters
- Thermal processing plants for contaminated soil waste treatment
- Clinical waste facilities
- Other thermal waste treatment plants
- Mobile plants

Facilities such as cement kilns and smelters undertake a thermal process but might not be immediately considered for treatment of waste. It was identified by the Department that such facilities could present ideal locations for thermal waste treatment, for a number of reasons:

- There is a physical capability to undergo treatment at high temperatures
- Facilities have a potential capacity to accept waste given the size of the site and asset components that provide a thermal process
- These facilities would already consider and be subject to environmental, health and safety regulations to minimise impact to surrounding environments and receptors

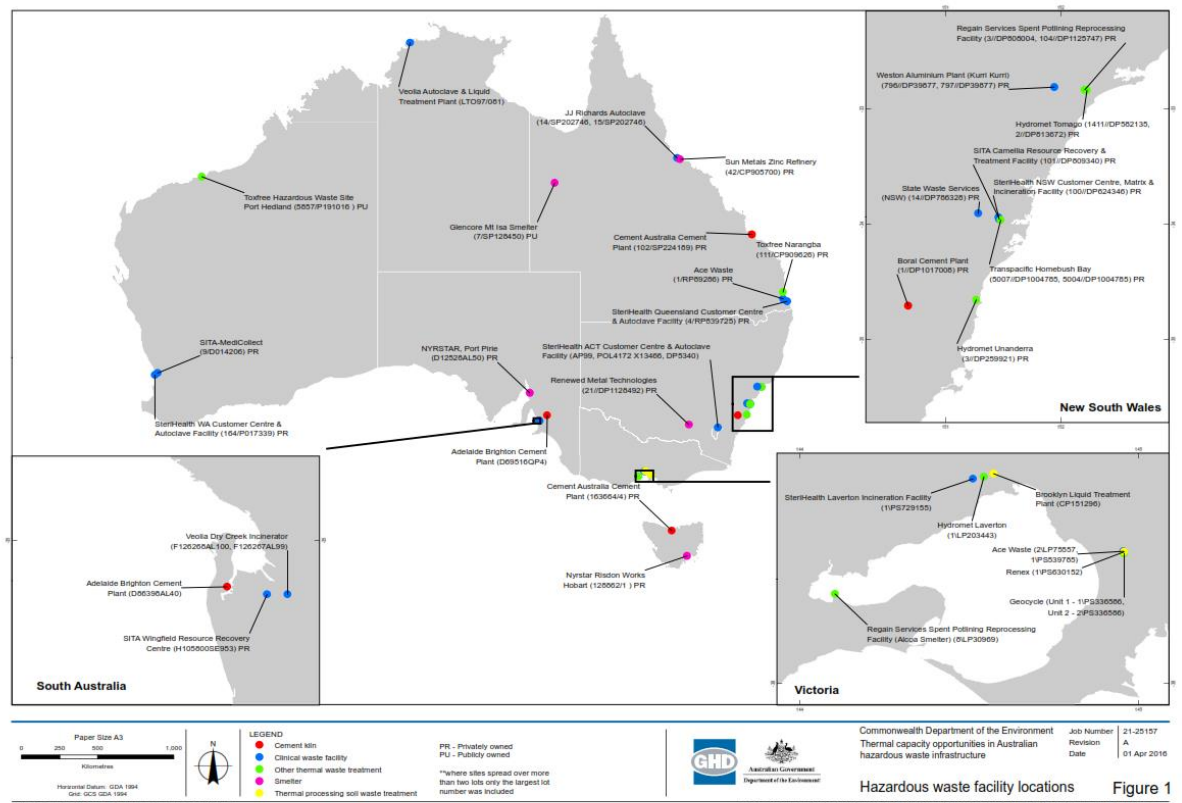
- Using existing facilities is also favourable to selecting a greenfield site for hazardous waste treatment

Table 2 outlines the details of each facility considered in this study. Facilities are also identified in Figure 1 to show location, lot on plan number, facility type and whether the site is publically or privately owned. Where the site occupied more than two lots, only one lot is listed on the figure, with full details provided in Table 2.

By definition, a private Australian company is not listed on the stock exchange and is not included in the description of Australian public company or cooperative. A public company is a non-individual client type. A public company is defined to include a body corporate and any other unincorporated association or body of persons but does not include a partnership or a non-entity joint venture.

Federal and State & Territory Governments generally have two types of organisations – government departments that are normally funded through budget appropriations and Corporations/Business Enterprises, which are more commercial in their operations and funding.

**Figure 1 Hazardous waste facility locations**



**Table 2 Thermal facilities identified for the study**

Facility Name	Facility Address	Facility Type	Lot on Plan	Registered Owner
Ace Waste	64-68 Ordish Road, Dandenong South VIC 3175	Clinical waste facility	2\LP75557, 1\PS539785	Private - ACE WASTE PTY. LTD.
Ace Waste	491 Gooderham Road, Willawong QLD 4110	Clinical waste facility	1/RP89286	Private - ACE PROPERTY HOLDINGS PTY LTD
Adelaide Brighton Cement Plant	62 Elder Road, Birkenhead SA 5015	Cement kiln	D86398AL40	Public - ADELAIDE BRIGHTON CEMENT LIMITED
Adelaide Brighton Cement Plant	Stockwell Road, Angaston SA 5353	Cement kiln	D69516QP4	Public - ADELAIDE BRIGHTON CEMENT LIMITED
Boral Cement Plant	Taylor Avenue, New Berrima NSW 2577	Cement kiln	1//DP1022632, 1//DP1017008, 1//DP582277, 2//DP774598	Private - BORAL LTD
Cement Australia Cement Plant	Landing Road, Fishermans Landing, Gladstone QLD 4680	Cement kiln	101/SP224189, 102/SP224189, 1/RP614356	Private - CEMENT AUSTRALIA (QUEENSLAND) PTY LIMITED
Cement Australia Cement Plant	Cement Works Road, Railton TAS 7305	Cement kiln	138574/1, 163664/1, 163664/2, 163664/3, 163664/4, 163665/5, 163665/6, 163665/7, 163666/1	Private - CEMENT AUSTRALIA (GOLIATH) PTY LTD
Geocycle	92 Ordish Road, Dandenong VIC 3175	Other thermal waste treatment	Unit 1 - 1\PS336586, Unit 2 - 2\PS336586	Private - GEOCYCLE PTY LTD
Glencore Mt Isa Smelter	Hilton Mine Barkly Highway, Mt Isa QLD 4825	Smelter	7/SP128450	Public - STATE OF QLD (DNRM)
Hydromet	201 Five Islands Road, Unanderra NSW 2526	Other thermal waste treatment	3//DP259921	Private - HYDROMET CORPORATION PTY LTD
Hydromet Laverton	19 Little Boundary Road, Laverton North VIC 3026	Other thermal waste treatment	1\LP203443	Not available
Hydromet Tomago	25 School Drive, Tomago NSW 2322	Other thermal waste treatment	1411//DP582135, 2//DP813672	Private - HYDROMET CORPORATION PTY LTD
JJ Richards Autoclave	638 Ingham Road, Bohle QLD 4818	Clinical waste facility	14/SP202746, 15/SP202746	Private - JJ RICHARDS & SONS PTY LTD
Sun Metals Zinc Refinery	60 Zinc Road, Stuart QLD 4811	Smelter	42/CP905700	Private - SUN METALS CORPORATION PTY LTD

Facility Name	Facility Address	Facility Type	Lot on Plan	Registered Owner
Nyrstar Risdon Works Hobart	Risdon Road, Lutana TAS 7009	Smelter	149974/1, 127361/1, 127360/1, 148502/1, 30/7889, 199803/10, 205469/1, 198280/1, 123530/1, 198336/1, 226629/1, 123531/1, 123532/1, 128862/1, 168677/1, 168677/2, 245094/1, 12592/1	Private - NYRSTAR HOBART PTY LTD
NYRSTAR, Port Pirie	Ellen Street, Port Pirie SA 5540	Smelter	D76999AL503, D57808AL201, F11180AL1, D12528AL50, F213879AL93, F213879AL94, F213879AL95, F213879AL96, D67822QP307, H241000SE1145, D23903AL2, D24051AL10, H241000SE638, H241000SE637	Private - NYRSTAR PORT PIRIE PTY LTD
Regain Services Spent Pot Lining Reprocessing Facility	638 Tomago Road, Tomago NSW 2322	Other thermal waste treatment	3//DP808004, 104//DP1125747	Private - MACQUARIE GENERATION
Regain Services Spent Pot Lining Reprocessing Facility (Alcoa Smelter)	420-430 Point Henry Road, Moolap VIC 3224	Other thermal waste treatment	68 parcels listed 8/LP30969 identified in Figure	Private - REGAIN SERVICES PTY LTD
Renewed Metal Technologies	509 Byrnes Road, Bomen NSW 2650	Smelter	21//DP1128492	Private - RENEWED METAL TECHNOLOGIES PTY LTD
Renex	109-131 Ordish Road, Dandenong South VIC 3175	Thermal processing soil waste treatment	1\PS630152	Not available
SITA Camellia Resource Recovery & Treatment Facility	Grand Avenue (opp Thackeray Street), Camellia NSW 2142	Clinical waste facility	101//DP809340	Private - SHELL REFINING (AUSTRALIA) PTY LTD
SITA Wingfield Resource Recovery Centre	34-38 Bowyer Road, Wingfield SA 5013	Clinical waste facility	H105800SE953	Private - DEPALMA ESTATES PTY LTD
SITA-MediCollect	1 Felspar Street, Welshpool WA 6106	Clinical waste facility	9/D014206	Private - FRANCIS STEPHENSON
State Waste Services (NSW)	9 Kenoma Place, Arndell Park NSW 2148	Clinical waste facility	14//DP786328	Private - C & S LINEY PROPERTY NOMINEES PTY LTD
SteriHealth ACT Customer Centre & Autoclave Facility	9 Sandford St, Mitchell ACT 2911	Clinical waste facility	AP99, POL4172, X13466, DP5340	Not available



Facility Name	Facility Address	Facility Type	Lot on Plan	Registered Owner
SteriHealth Laverton Incineration Facility	110 Dohertys Rd, Laverton North VIC 3026	Clinical waste facility	1\PS729155	Private - DANIELS HEALTH NSW PTY LTD
SteriHealth NSW Customer Centre, Matrix & Incineration Facility	2 Wiblin St, Silverwater NSW 2128	Clinical waste facility	100//DP624346	Private - DANIELS HEALTH NSW PTY LTD
SteriHealth Queensland Customer Centre & Autoclave Facility	4/63 Burnside Rd, Stapylton QLD 4207	Clinical waste facility	4/RP839725	Not available
SteriHealth WA Customer Centre & Autoclave Facility	19 Coolibah Way, Bibra Lake WA 6163	Clinical waste facility	164/P017339	Private - FOTI SUPER SERVICES PTY LTD
Toxfree Hazardous Waste Site Port Hedland	20 Schillaman Street, Wedgefield WA 6722	Other thermal waste treatment	5857/P191016	Public - STATE OF WA
Toxfree Narangba	8-12 Krypton Street , Narangba QLD 4504	Other thermal waste treatment	111/CP909626	Private - DOLOMATRIX ENVIRONMENTAL SOLUTIONS LIMITED
Transpacific Homebush Bay	Cnr Hill Road & Pondage Link, Homebush Bay NSW 2127	Other thermal waste treatment	5007//DP1004785, 5004//DP1004785	Private - WASTE ASSETS MANAGEMENT CORPORATION
Veolia Autoclave & Liquid Treatment Plant	5 Dennis Court, Berrimah NT 0828	Clinical waste facility	LTO97/081	Not available
Veolia Dry Creek Incinerator	31-35 Churchill Road, Dry Creek SA 5094	Clinical waste facility	F126268AL100, F126267AL99	Not available
Weston Aluminium Plant (Kurri Kurri)	129 Mitchell Avenue, Kurri Kurri NSW 2326	Clinical waste facility	796//DP39877, 797//DP39877	Private - WESTON ALUMINIUM PTY LTD
Brooklyn Liquid Treatment Plant	15 McDonald Road, Brooklyn VIC 3012	Thermal processing soil waste treatment	CP151296	Not available

Not available – there is no separate ABN listed for the business

## **6. Outcomes of the assessment**

During the assessment process, 28 stakeholders were contacted to discuss the characteristics and constraints of 36 facilities. Note that some stakeholders may have multiple facilities. Section 6 provides a list of facilities willing to participate in the study.

Facilities were reluctant to provide details on types of waste and quantities received for treatment, as this information is considered commercial in confidence and inappropriate for an assessment of this nature.

The following sections describe the treatment facilities according to the treatment process, their current waste treatment capacity and their potential to treat additional waste types and quantities. Note that total treatment capacity includes non-hazardous and hazardous wastes.

## 6.1 Thermal desorption facilities

Table 3 describes the facilities that use thermal desorption processes to treat hazardous wastes.

**Table 3 Description of thermal desorption facilities**

Facility	Description	Total Treatment Capacity	Waste type and source	Capacity to accept other waste	Potential for upgrade or expansion	Summary
Veolia Thermal Desorption Plant, Brooklyn, VIC	Natural gas fired thermal desorption plant	20,000 tpa	Any hydrocarbon affected prescribed industrial wastes including soils. Sludges are limited in liquid content to about 50% due to the feeding system (conveyors). Predominantly Melbourne metro region.	Additional volumes of prescribed industrial waste, ethers, organic solvents, contaminated soils	A minor upgrade would be required to allow treatment of sludges that have a higher liquid content. Composition of the waste would affect the treatment time and therefore the throughput (i.e. the wetter the waste, the longer the treatment time). Minor plant modifications may also enable treatment of organic solvents and halogenated organic solvents. Licence changes would be required to treat non-scheduled wastes, minor technical changes to feed and thermal systems to take additional waste streams.	The Veolia thermal desorption facility has reasonable capacity to take additional specific hazardous waste streams that are suitable for neutralisation. The facility treats the waste through a desorption process and does not destroy the waste, with residual material requiring disposal. Although costly, the facility could be relocated to another location to manage/treat specific stockpiles or waste streams. The estimated cost of relocation is approximately \$500k.

## 6.2 Incineration type facilities

Table 4 describes the facilities that use combustion processes to treat hazardous wastes.

**Table 4 Description of incineration facilities**

Facility	Description	Total Treatment Capacity	Waste type and source	Capacity to accept other waste	Potential for upgrade or expansion	Summary
Ace Waste Incinerator, Dandenong, VIC	Stepped hearth incinerator	11,500 tpa	Currently treats medical waste, solvents, oily rags and cartridges (50% is medical and pharmaceutical). Predominantly Melbourne metro region and pharmaceuticals from Australia's east coast	The facility currently treats about 3,500 tpa and has significant capacity to treat more of the same waste type plus additional sources such as more solvents or quarantine waste. Solid waste is preferred due to the stepped hearth process.	Few modifications would be required to treat additional volume of solid hazardous waste. To take liquid waste, a liquid injection system would be required for the rotary kiln. This would be considered a major upgrade/redevelopment. Current focus is on using the facility's current capacity. Ace Waste is considering the viability of a rotary kiln as a second chamber and also energy recovery options with a feasibility assessment of a boiler and turbine. This would be undertaken to accept more diverse liquid waste streams and enable an energy recovery option as a preferred approach to the waste hierarchy in Victoria. Approvals for the rotary kiln and energy recovery option would take approximately 12 months.	The Ace Waste Dandenong facility is a large five-hectare site providing a solid base for expansion in Victoria. The hazardous treatment facility has significant capacity to treat additional waste, though preferably solid waste due to the stepped hearth process. Major improvements have occurred on the site since acquisition in 2006 and Ace Waste is considering other approaches including rotary kiln and energy recovery options.

Facility	Description	Total Treatment Capacity	Waste type and source	Capacity to accept other waste	Potential for upgrade or expansion	Summary
Ace Waste Incinerator, Willawong, QLD	Stepped hearth incinerator	10,600 tpa	Currently treats medical waste, quarantine waste, drugs, oil filters and solvents. Predominantly southeast Queensland and some volumes from Australia's east coast	The facility currently treats about 7,000 tonnes of waste per annum and has approximately 3,600 tpa additional capacity. It can treat additional volumes of similar waste if required.	There are currently no plans to modify or upgrade this facility other than to consider energy recovery options. Energy recovery options would require a boiler and turbine to be retrofitted to the plant/site. This could be undertaken in approximately 12-24 months.	The Ace Waste Willawong facility is currently a key hazardous treatment facility in Queensland and has additional capacity to treat similar types of waste (3,600 tonnes per annum). The process uses a stepped hearth systems so is not suitable for treatment of liquid waste.
Renex, Dandenong, VIC	Waste incinerator operating at 1100 - 1200 °C.	70,000 tpa	Facility recently commissioned taking contaminated soil and hazardous waste with a high calorific value. Mostly Victorian region.	The facility can potentially take a broad range of hazardous waste types predominantly contaminated solid and liquid wastes. As this is a new facility, many wastes have not been applied at this stage.	The current facility can take both a significant volume of similar waste and additional hazardous waste. The facility has continuous monitoring 24/7. The primary requirement will be licence amendments as materials are proven to be treated through the existing system.	A small thermal facility that has potential capacity to treat additional hazardous waste streams. Veolia are interested in exploring these options.

Facility	Description	Total Treatment Capacity	Waste type and source	Capacity to accept other waste	Potential for upgrade or expansion	Summary
Veolia Incinerator, Dry Creek, SA	Stepped hearth waste incinerator.	4,000 tpa	Currently treats medical, quarantine and some chemical wastes. Local SA region.	The facility has a liquid injection feed and good emission controls so can take additional volumes of similar waste and other solid hazardous waste/ liquid streams. The plant has about 50% utilisation.	The facility can treat additional quantities of hazardous waste with minimal modifications. Upsizing waste feed options could enable treatment of additional wastes that are problematic due to size or format. Modifications or treatment of different waste will require EPA approval and trials.	A small thermal facility that has potential capacity to treat additional hazardous waste streams. Veolia are interested in exploring these options.

### 6.3 Smelters

Table 5 describes the facilities that use smelting processes to treat hazardous wastes. All smelting facilities in Australia are listed, however only those which treat hazardous wastes are summarised.

**Table 5 Description of smelting facilities**

Facility	Description	Total Treatment Capacity	Waste type and source	Capacity to accept other waste	Potential for upgrade or expansion	Summary
Korea Zinc Smelter, Townsville, QLD	2 fluidised bed roasters	350,000 tpa	Spent sulphuric acid from local galvanizer, site's own waste such as filter cloth	Potential to take other hazardous waste streams in existing facility with 850 °C treatment	Sun Metals have undertaken trials to treat other waste streams, however these have been expensive and timely to undertake. There is interest to	The Korea Zinc Smelter in Townsville has potential capacity to treat hazardous wastes in Northern Queensland that are

Facility	Description	Total Treatment Capacity	Waste type and source	Capacity to accept other waste	Potential for upgrade or expansion	Summary
			and filter cake. Local businesses in Townsville.	and dry process emission controls.	explore treatment of other reliable waste streams such as industrial/commercial wastes in the broader region. The cost and time frames for trialling treatment of alternative waste streams is a significant deterrent, although this has been undertaken and can be undertaken for commercially viable waste streams.	commercially viable and appropriate for feed into the smelter.
Pacific Aluminium	Does not treat hazardous waste					
TEMCO	Does not treat hazardous waste					
BHP Port Kembla	Does not treat hazardous waste					
Arrium, Whyalla	Does not treat hazardous waste					
Mt Isa Smelters	Does not treat hazardous waste					
Queensland Nickel Industries	Does not treat hazardous waste					
Nyrstar Hobart Zinc Smelter	Does not treat hazardous waste					
Nyrstar Port Pirie Smelter	Does not treat hazardous waste					

Facility	Description	Total Treatment Capacity	Waste type and source	Capacity to accept other waste	Potential for upgrade or expansion	Summary
Tomago Aluminium					Does not treat hazardous waste	
BHP Olympic Dam Copper Smelter					Does not treat hazardous waste	
BHP Kalgoorlie Nickel Smelter					Does not treat hazardous waste	

## 6.4 Rotary furnaces and kilns

Table 6 describes the facilities that use rotary furnaces or kilns to treat hazardous wastes.

**Table 6 Description of rotary furnace and kiln facilities**

Facility	Description	Total Treatment Capacity	Waste type and source	Capacity to accept other waste	Potential for upgrade or expansion	Summary
Adelaide Brighton Cement Kiln, Birkenhead, SA	Cement kiln – large single kiln	750,000 tpa	Currently takes woodchip derived fuel, carbon powder, waste fuel and various miscellaneous wastes. Waste is approximately 23-24% of the	The facility can take a diverse range of alternative waste such as medical waste, liquid and solid fuels and waste tyres. The primary focus on hazardous waste is material with	Modifications can be made to the facility, which relate to the feed process into the kiln and waste handling/storage facilities/procedures. Adelaide Brighton would need to work with licensing authorities in SA to evaluate options and undertake a feasibility study. The company expressed	Further evaluation of suitable problem waste streams should be considered and feasibility of the Birkenhead facility to be modified to take additional volumes. This will also need to include evaluation of air emission impacts.



Facility	Description	Total Treatment Capacity	Waste type and source	Capacity to accept other waste	Potential for upgrade or expansion	Summary
			fuel feed. Mostly local SA region	relatively high calorific value to assist kiln operations (operating temperature is approximately 1600 °C)	concerns regarding consistent waste supply requirements to warrant the effort of further investigation.	
Adelaide Brighton Cement, Angaston, SA	Cement kiln – three kilns	250,000 tpa	Currently treats < 20% woodchip derived fuel, carbon powder, waste fuel and some miscellaneous waste streams. Predominantly SA region	The facility can treat additional volumes of existing waste streams and additional wastes that may require adaptation of feed and handling systems.	Modifications can be made to the facility regarding the feed process into the kiln and waste handling/storage facilities/procedures. Having three kilns potentially provides some flexibility of feed types. Adelaide Brighton would need to work with licensing authorities in SA to evaluate options and undertake feasibility. The company expressed concerns regarding consistent waste supply to warrant the effort of further investigation.	Further evaluation of suitable problem waste streams should be considered and feasibility of the Angaston facility to be modified to take additional volumes. This will also need to include evaluation of air emission impacts.

Facility	Description	Total Treatment Capacity	Waste type and source	Capacity to accept other waste	Potential for upgrade or expansion	Summary
Cement Australia*, Gladstone, QLD	Cement kiln	1.7 million tpa	Currently the facility treats between 15,000-20,000 tpa of hazardous waste in part prepared by Geocycle in Victoria. Most waste streams from Australia's east coast.	The facility can potentially treat a significant increase in the volume of hazardous waste and has identified SPL, hazardous soils, pharmaceuticals, fuel products, solvent-based waste and AQIS waste as potential waste streams. Other hazardous waste streams may be potentially treated in this facility. Current thermal energy replacement from waste is about 12%. Cement Australia has indicated similar plants in Europe are processing 70-80% thermal	The facility can treat significant additional quantities of hazardous waste with minimal modifications. Modifications are likely to be in feed systems and waste handling and review/ evaluation of thermal displacement on kiln performance and air emissions. Licensing changes are also likely to be required. Depending on the scale and feasibility of changes, this could be undertaken in relatively short time frames.	Cement Australia has expressed interest in optimising facilities to take significant additional volumes of hazardous waste that meet the kiln operating requirements. Further evaluation of waste streams and feasibility of modifications should be considered.

Facility	Description	Total Treatment Capacity	Waste type and source	Capacity to accept other waste	Potential for upgrade or expansion	Summary
				displacement from waste sources.		
Cement Australia*, Railton, TAS	Cement kiln	1 million tpa	Currently the facility treats between about 25,000 tonnes per annum of hazardous waste in part prepared by Geocycle in Victoria. Mostly Tasmania and waste streams from Australia's east coast.	The facility can potentially treat a significant increase in the volume of hazardous waste and has identified SPL, hazardous soils, pharmaceuticals, fuel products, solvent-based waste and AQIS waste as potential waste streams. Other hazardous waste streams may be potentially treated in this facility. Current thermal energy replacement from waste is about 12%. Cement Australia has indicated similar	The facility can treat significant additional quantities of hazardous waste with minimal modifications. Modifications are likely to be in feed systems and waste handling and review/ evaluation of thermal displacement on kiln performance and air emissions. Licensing changes are also likely to be required. Depending on the scale and feasibility of changes, this could be undertaken in relatively short time frames.	Cement Australia has expressed interest in optimising facilities to take significant additional volumes of hazardous waste that meet the kiln operating requirements. Further evaluation of waste streams and feasibility of modifications should be considered.

Facility	Description	Total Treatment Capacity	Waste type and source	Capacity to accept other waste	Potential for upgrade or expansion	Summary
				plants in Europe are processing 70-80% thermal displacement from waste sources.		
Renewed Metal Technologies, Bomen, NSW	Rotary kiln and non-titling rotary furnace	42,000 tpa from four processes.	Lead acid batteries, Australia wide	Mostly running at full capacity. Can potentially treat other waste streams if an expansion is undertaken.	Each new furnace is approximately 45,000 tonnes and the waste treatment demand and volume would need to support the cost of an expansion. Evaluating options for expansion with NSW Government.	There is the potential to expand the facility for the treatment of lead acid batteries and potentially other hazardous waste streams. The existing facility/operation is able to increase the volume of waste for thermal treatment, thereby avoiding the requirements for a greenfield site in NSW.
Regain Services Spent Pot Lining Reprocessing Facility – Tomago, NSW and Point Henry, VIC	Rotary kiln operating at 600-700 °C.	45,000 – 50,000 tpa	Spent pot lining (SPL) from host <sup>1</sup> facilities. Host <sup>2</sup> plants include Tomago, NSW and Point Henry, Victoria.	Both facilities have capacity for approximately an additional 10-15,000 tpa.	Expansion or modification may be challenging as facilities operate on host <sup>3</sup> sites under host <sup>4</sup> licence. Potential to explore other waste streams including additional volumes of SPL and other streams	Minor opportunity for treatment of similar industrial waste streams at the two sites. Changes required to licence would generally be avoided. There is potential to treat SPL from other aluminium smelting

<sup>1</sup> Host facility is a waste treatment facility located for the purposes of treating site-generated waste. They are usually not available for other commercial waste treatment operations.

<sup>2</sup> Ibid

<sup>3</sup> Ibid

<sup>4</sup> Ibid

Facility	Description	Total Treatment Capacity	Waste type and source	Capacity to accept other waste	Potential for upgrade or expansion	Summary
					suitable for the process that do not require any significant handling/storage constraints.	sites that would involve interstate transport.
Weston Aluminium, Kurri Kurri, NSW	Rotary furnace.	8,000 tpa	Quarantine, medical waste and paints. Local Hunter and other NSW regions.	Can treat additional volumes and additional waste streams without modifications.	Capacity to treat additional hazardous waste volumes would require an additional rotary kiln to be accommodated within the existing baghouse system capacity. Significant challenges in achieving cooperation with NSW EPA and or Cessnock Council. Attempting to build an industrial ecology park to promote waste treatment and industrial resource recovery.	The facility has potential to treat a broad range of additional waste streams and types. Weston Aluminium is motivated to explore doing this but have had major challenges educating or achieving cooperation from state or local government authorities.

\* - Geocycle Pty Ltd is wholly owned subsidiary of Cement Australia in the business of processing of flammable and hazardous waste into alternative fuel and raw materials, for use in cement kilns, such as: paints; resins; solvents; oils and greases; tars and fats.

## 6.5 Other technologies

Table 7 describes other technologies for hazardous waste treatment.

**Table 7 Description of other treatment technologies for hazardous waste**

Facility	Description	Total Treatment Capacity	Waste type and source	Capacity to accept other waste	Potential for upgrade or expansion	Summary
Toxfree, – Narangba, QLD and Laverton, VIC	Plasma Arc Furnaces – 10,000 °C.	Not available	Dedicated industrial waste from host <sup>5</sup> sites – PCB and organochlorines.	Could potentially treat other wastes but the operating cost is high. Recently have explored the potential treatment of fluorinated refrigerant gasses and firefighting foam.	Not being considered at this time. Price point for treatment of waste is the most significant issue.	The Narangba and Laverton facilities are currently operating on host <sup>6</sup> sites and there is limited appeal to expand or take additional waste if not commercially viable. Toxfree would explore options, if appropriate waste streams were required for special treatment.
Veolia Autoclave & Liquid Treatment Plant, Berrimah, NT	Autoclave facility.	Not available	Quarantine waste (Darwin Port incinerator is closed). Darwin region.	Can also take medical waste but is not cost competitive with the deep burial option being used at the local landfill.	Not proposed at this time due to limited waste volumes.	In addition to quarantine waste, the facility should be taking appropriate medical waste to avoid landfilling.

## 6.6 Mobile and packaged waste treatment plants

Table 8 describes the mobile and packaged waste treatment plants currently available in Australia.

<sup>5</sup> Host facility is a waste treatment facility located for the purposes of treating site-generated waste. They are usually not available for other commercial waste treatment operations.

<sup>6</sup> Ibid

A mobile plant is usually defined as a facility that is readily relocatable and only requires the connection of services to become operational. A packaged plant is usually defined as a plant that consists of discrete operational components that can be readily assembled. Minimal commissioning is required to make the plant operational.

**Table 8 Description of mobile and packaged waste treatment plants**

Facility	Description	Total Treatment Capacity	Waste type and source	Capacity to accept other waste	Potential for upgrade or expansion	Summary
Thiess Direct heat Thermal Desorption Plant (DTD)	Mobile heat treatment plant	35t/hour	Hydrocarbon and POP contaminated soil	Unknown	Unknown	<p>Direct thermal desorption plants are purchased and imported from overseas for use on specific projects in Australia. Thiess Services Pty Ltd purchased and imported a DTD plant from the US in 2008 to remediate contaminated soil at the former Lednez/Union Carbide located at Rhodes, Sydney NSW.</p> <p>In 2010, the DTD plant was disassembled from the Rhodes site to be reassembled at Orica Port Botany,</p>

## 6.7 Treatment of POPs waste

Based on previous work and the analysis of the existing thermal facilities outlined in the sections above, there is currently no thermal treatment facility with the capability of treating POPs waste. A prefeasibility study on suitable thermal facilities, such as cement kilns or other high temperature incineration processes would be required to assess the potential capability of treating POPs wastes.

## 7. Potential treatment capacity

### 7.1 Facilities with potential additional treatment capacity

Table 9 shows the facilities listed in Table 3 to Table 7 and their potential additional waste treatment capacity, including the certainty associated with the additional capacity estimates.

**Table 9 Potential additional capacity of waste treatment facilities**

Facility	Additional potential capacity estimates for hazardous waste treatment	Certainty (%)
Veolia Thermal Desorption Plant, Brooklyn, VIC	6,500 tpa	50%
Ace Waste Incinerator, Dandenong, VIC	8,000 tpa	80%
Ace Waste Incinerator, Willawong, QLD	3,600 tpa	80%
Renex, Dandenong, VIC	70,000 tpa	90%
Veolia Incinerator, Dry Creek, SA	2,000 tpa	80%
Korea Zinc Smelter, Townsville, QLD	30,000 tpa	40%
Adelaide Brighton Cement Kiln, Birkenhead, SA	60,000 tpa	40%
Adelaide Brighton Cement, Angaston, SA	20,000 tpa	40%
Cement Australia*, Gladstone, QLD	70,000 tpa	60%
Cement Australia*, Railton, TAS	62,500 tpa	60%
Renewed Metal Technologies, Bomen, NSW	45,000 tpa	80%
Regain Services Spent Pot Lining Reprocessing Facility – Tomago, NSW and Point Henry, VIC	30,000 tpa	80%
Weston Aluminium, Kurri Kurri, NSW	25,000 tpa	50%
Toxfree, – Narangba, QLD and Laverton, VIC	Not Considered – gate fee too high	90%



Facility	Additional potential capacity estimates for hazardous waste treatment	Certainty (%)
Veolia Autoclave & Liquid Treatment Plant, Berrimah, NT	N/A	80%

## 7.2 Prefeasibility studies

In order to obtain accurate figures regarding the potential of the existing thermal facilities to treat additional hazardous wastes, prefeasibility studies would be required for the thermal facilities with existing capacity to treat more waste.

The prefeasibility studies will also need to consider the logistics and costs of transporting hazardous waste from the point of generation to final disposal.

As mentioned in section 6.7, prefeasibility studies would be required for any thermal facility seeking to treat POPs waste.

## 8. Conclusion

The assessment undertaken by GHD of thermal facilities across Australia has identified significant existing and potential capacity for the safe treatment of hazardous waste. In addition to existing waste treatment facilities, there is considerable capacity for waste treatment in non-traditional facilities such as cement kilns and smelters, who often have highly controlled processes and adequate emission management systems.

The greatest challenge with utilisation of existing capacity is often the variable nature of waste streams and the commercial barriers that exist, with the requirement to undertake trials to manage the expectations of state and local government authorities.

The most significant opportunity for expansion of thermal waste treatment comes from non-traditional treatment facilities such as cement kilns and metal producing smelters. The most significant changes required for these facilities is the need to upgrade front end waste handling and plant feed systems, as thermal process and emission control systems are often adequate to cater for most hazardous waste types. The exception to this would be POPs waste.

This study identifies that further prefeasibility assessment should be undertaken on a number of facilities and that existing approaches to hazardous waste disposal and hazardous waste export should be reconsidered in light of both existing and potential capacity for safe and appropriate treatment of hazardous waste.





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