

Hazardous waste stockpiles and approved long-term storages in Australia

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Hazardous waste stockpiles and approved long-term storages in Australia

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Executive Summary

The Department of the Environment and Energy (DoEE) engaged Randell Environmental Consulting (REC) in association with Ascend Waste and Environment to complete this report on hazardous waste stockpiles in Australia in 2016/17.

Project scope

The project scope can be summarised as follows.

1. Analyse Australian and select international policy frameworks for **preventing, managing and clearing** hazardous *and* controlled waste¹ stockpiles. In this report hazardous and controlled waste are referred to simply as hazardous waste henceforth.
2. Based on the above, develop a **definition** for 'hazardous waste stockpiles'.
3. Develop a **baseline dataset** for hazardous waste stockpiles in Australia. The dataset focuses on the known major hazardous waste stockpiles in Australia and describes the amount, age, composition, reasons for stockpiling and generating industries.

DoEE requested an expansive definition of 'hazardous waste stockpile' be considered in this project (including solids, sludges, and liquids). For example, the following stockpiles were included in project scope: contaminated biosolids, end-of-life tyres (EOLTs), the HCB stockpile, 'stranded' wastes connected to company failures, site closures or acquisitions. The project scope also considers and discusses contaminated soil wastes and contaminated sites; however, it was recognised that it is not possible to provide quantitative analysis of the total 'stockpile' of the waste type. Mining and mineral processing wastes are within the project scope but are not the focus of the study.

Hazardous waste stockpile or approved long-term on-site storage?

One of the key findings of the project is that there needs to be a clear distinction between a *stockpile* and an *approved long-term on-site storage*. Definitions for both are provided in Section 2 and the analysis supporting the definitions is provided in Section 14. Stockpiles are the focus of this report. For completeness, long-term on-site storages are also discussed.

E1 Policy analysis: stockpile prevention, management and clearance

Analysing the policy frameworks in Australia, the US and EU for stockpile prevention, management and clearance resulted in identifying a set of 'key elements' which allowed for a targeted literature review and collation of comparable information across jurisdictions. This collation enabled the identification of issues, innovations and opportunities for improvement in how Australia prevents, manages and clears hazardous waste stockpiles. Table E1 below provides a summary.

¹ Controlled waste are defined in the [National Environment Protection \(Movement of Controlled Waste between States and Territories\) Measure](#).

Table E1 Summary of policy key elements and implementation

Key element	Discussion/findings
1. Generator hazardous waste minimisation reporting required	Hazardous waste minimisation plans are not required in Australia. However, the waste hierarchy is legislated in all jurisdictions, which prioritises waste minimisation. Note: US EPA have set up a sliding scale of requirements for waste minimisation, <u>and all other elements discussed below</u> , based on the amount and toxicity of the waste being stockpiled.
2. Licence/permit required to stockpile hazardous waste	In all Australian jurisdictions and in many developed countries, sites that are generating and/or stockpiling hazardous wastes (such as liquid wastes and chemically intractable solid wastes) are required to have an environmental permit or licence in place.
2.1. EOLT licence required to stockpile	EOLT stockpiling is licensed in all Australian jurisdictions apart from Qld and Tas. However, the thresholds of storage that are regulated vary significantly from about 1 tonne in WA up to 40 tonnes in Vic. Both SA and NSW regulate storage of EOLT stockpiles of 5 tonnes.
2.2. 'Mass balance' reporting and upfront landfill levy liability to receive wastes	NSW is the only Australian jurisdiction to have implemented 'mass balance' reporting and upfront levy payment for waste stockpiles. SA is likely to implement a similar system in 2017. The landfill levy is payable if: the stockpile of material remains unprocessed for 12-months; is stockpiled above lawful limits; waste is transported for unlawful disposal.
3. Hazardous waste tracking (transport and receipt)	All Australian jurisdictions, apart from ACT, Tas, NT, and many developed countries track the collection, transport, and receipt of hazardous wastes (such as liquid wastes and chemically intractable solid wastes).
3.1. EOLT tracking (transport and receipt)	EOLTs collection, transport and receipt is tracked in NSW, Qld, SA and WA only. ACT, Tas, NT and Vic do not track EOLTs. Vic is the only large and populous state in Australia that do not track EOLT and this has likely contributed to the significant stockpiling issue for EOLT in Vic.
4. Enforcement against illegal dumping	A dedicated resource to enforce against illegal dumping was only identified in NSW, SA and Vic. We note that all states have the ability to fine or prosecute offenders, however, this element refers to dedicated resources to actively find and prosecute offenders.
4.1. Specific policy to recover illegally obtained economic benefit from stockpiling	South Australia is proposing to introduce specific policy that will outline the specific circumstances, method and process for the recovery of funds from illegal stockpiling. This should be a more effective deterrent than a general head of power to recover profits made from 'breaking the law'.
5. Landfill levy	<p>Most jurisdictions have a landfill levy in place, Qld, Tas, and NT do not. The cost of landfilling in Qld, Tas, and NT is therefore generally cheaper than other states.</p> <p>Asbestos levy: it is widely accepted that the best fate for waste asbestos is disposal to a licensed landfill. Government policy settings should to be set to encourage the safe disposal of asbestos to a licensed landfill. WA and SA (since July 2017) have implemented a \$0 landfill levy for waste asbestos containing material (ACM) (e.g. roofing, cement sheeting) disposal. All other jurisdictions with a landfill levy (Vic, NSW) still levy waste asbestos disposal to landfill. ACT landfill fees also apply to waste asbestos loads.</p>

Key element	Discussion/findings
6. Stockpile quantity limits set for all sites	US EPA set a limit of 6 tonnes for storage from small quantity generators and have no limit for large generators. NSW and SA (under proposed reforms) set the limits on a case by case basis, depending on the waste type.
6.1. EOLT stockpile quantity limit set for all sites	ACT set a tonnage limit of 25 for EOLT storage, Vic sets a limit on the volume of EOLT that can be stockpiled, NSW and SA set the limit within the site license.
7. Stockpiling time limits set for all sites	US EPA sets explicit time limits on stockpiling of 90 days for large generators and for small generators 180 days or 270 days (if transporting greater than 200 miles). NSW and SA (under proposed reforms) require payment of landfill levy after 12 months. Whilst this is not a time limit per se, after this time the NSW and SA would be able to require removal of the material from the site, as it is effectively being treated as a waste disposed to landfill.
8. Reporting required on stockpile status and change	NSW and SA (under proposed reforms) require annual report of stockpile status under the mass balance and upfront levy liability framework. US EPA require biannual reporting from large generators and Wales in the UK require sites to apply for a new permit to stockpile wastes every 12 months, effectively requiring annual reporting.
9. Stockpile site controls required	All jurisdictions in Australia and most developed countries have stockpile site control requirements in place. Controls including bunding for liquid waste, dust control, and prohibition on mixing or diluting hazardous wastes. Whilst these requirements are common, how effectively they are enforced varies significantly.
10. Emergency plan required for stockpiles	US EPA is the only jurisdiction that has published required emergency planning for hazardous waste generators for stockpiles. SA provide some guidance for emergency planning and NSW EPA commented that it is required in licences for higher risk sites. However, no Australian jurisdiction has published requirements for emergency planning for stockpiles, including specification of minimum equipment onsite, maintenance, and planning with local emergency departments.
10.1. EOLT fire plan required	Vic, Qld, SA and NSW all have guidelines and or requirements in place to prevent and manage fire at EOLT stockpiling sites. No guidance or requirement was identified in ACT, NT, Tas, or WA to specifically manage the risk of fire at EOLT sites.
11. Financial assurance for site clean-up	The US EPA, under US Code of Federal Regulations (CFR) section Subpart H—Financial Requirements requires a financial assurance to cover both site clean-up and site aftercare. All Australia jurisdictions have a legislative framework in place to require financial assurances. There is however, significant variability in the application of this legislation it should not be assumed that all hazardous waste stockpiles in Australia have a financial assurance in places to cover the cost of clean-up.
12. Government trust or funds set up to deal with abandoned stockpiles/contaminated site	The US Superfund is a trust funds established to clean-up contaminated sites (stockpiles). No Australian jurisdictions have set up central trusts to specifically fund clean-up of abandoned sites, preferring the site-specific financial assurance approach. NSW EPA commented that the NSW Environmental Trust has provided site clear-up funds in the past. However, this funding appears to be incidental as opposed to a permanent and dedicated contaminated site fund.

E2 Definition of a hazardous waste stockpile

Figure E1 provides an illustration of the definition for hazardous waste stockpiles that is discussed below and applied in this report. For the purposes of this project, a solid or liquid hazardous waste is defined as a stockpile where all of the following apply:

- it has not been treated or processed
- a significant proportion (i.e. 75%) has been stored for more than one year
- it requires ongoing management or monitoring to prevent impacts to human health or the environment
- it is subject to 'clearance' requirements set out by relevant environmental legislation.

A hazardous waste stockpile may be stored above ground or below ground and be located on the site it was generated or elsewhere.

For clarity, the following are not a hazardous waste stockpile:

- Hazardous materials, such as asbestos, that are still in use (they are yet to enter the 'waste' stream).
- A product derived from hazardous waste that meets a defined specification after processing.
- Hazardous waste this is stored in an 'approved long-term on-site storage' (discussed below).
- Hazardous waste that is landfilled or contained in long-term storage facilities off-site under approval from a state or territory regulator.
- Hazardous waste that does not require ongoing management or monitoring to prevent impacts to human health or the environment because permanent controls are in place or the current form of the waste presents insignificant risk to human health or the environment. Examples would include in-situ low level contaminated soils, or small stockpiles of waste tyres.

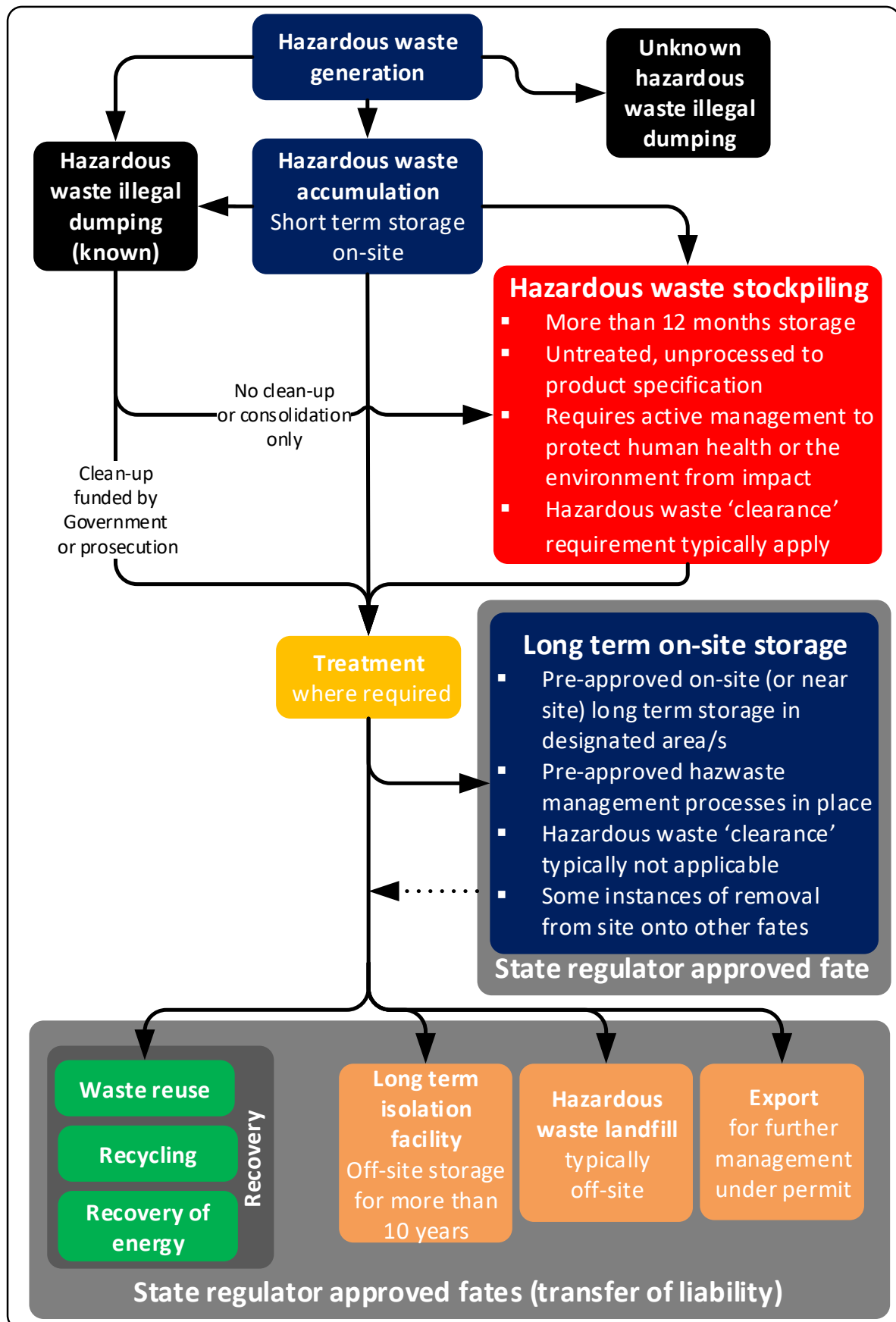
Definition of an approved hazardous waste long-term on-site storage

There needs to be a clear distinction between a 'stockpile' and an 'approved long-term on-site storage'. For the purposes of this project, approved long-term on-site storage refers to waste storage that is:

- on-site (or near site)
- in designated area/s
- pre-approved² for long-term storage (i.e. greater than 10 years) by state or territory regulator and has pre-approved management processes in place
- typically, not required to meet stockpiled waste 'clearance' requirements
- still under management by waste generator (i.e. liability has not been transferred to a third party/facility such as a hazardous waste landfill or isolation facility).

² The storage of the waste was planned and approved by environment regulators prior to placement including management requirements to protect human health and the environment.

Figure E1 Defining hazardous waste stockpiling versus other fates of hazardous wastes



E3 Baseline dataset for hazardous waste stockpiles in Australia

The dataset provided below (see Table E3) focuses on listing the known major hazardous waste stockpiles in Australia (standing and recurrent) and describes their age, location, amount and composition. For completeness, this sections also provides a baseline dataset for approved long-term on-site storages that this project has identified and analysed during project delivery.

The national dataset was derived from:

- a literature review and research completed by the authors
- consultation with state regulators
- consultation with the waste management industry
- consultation and validation of stockpile or storage data with stockpile/storages 'owners', where the owner could be clearly identified (i.e. where there is a small number of stockpiles/storages).

Appendix B includes the dataset for each Australian state and territory.

Appendix C includes details of the stockpile or approved long-term on-site storage estimation methods (only where required) to explain the assumptions and calculations that the authors have completed in providing the estimations.

The stockpile data is redacted (see **red blocks**) where the supporting data is commercial-in-confidence as there are few sites and/or stockpile 'owner' companies. It is important to note the 'data quality' assessment (see definitions below).

Explanation of dataset reporting

Table E2 provides details of each of the reporting columns that are included in the dataset.

Table E2 Explanation of dataset reporting

Reporting	Explanation
Est. tonnes	This is the estimate of the <u>total</u> tonnage of stockpiled or approved long-term on-site stored wastes in Australia or in each state and territory (Appendix B)
Est. average age (years)	This is the average age in years of all of the stockpiled or stored wastes by waste type.
Primary contam. or risk (NEPM)	This is the authors' understanding of the primary contaminant or risk of concern for each stockpile or storage waste type based on the <i>National Environment Protection (Movement of Controlled Waste between States and Territories) Measure, Schedule A List 1: Waste categories</i> .
Second. contam. or risk (NEPM)	This is the authors' understanding of the secondary contaminant or risk of concern for each stockpile or storage waste type based on the <i>National Environment Protection (Movement of Controlled Waste between States and Territories) Measure (Controlled Waste NEPM) Schedule A List 1: Waste categories</i> . For reference a list of the NEPM codes is included in Appendix D.
Hazwaste each state territory? (Y/N)	This is a simple 'yes' or 'no' analysis of the classification as a hazardous waste for each stockpile or storage type. If the waste is a classified as a hazardous waste (or the jurisdictional equivalent) in each state, then it is listed as yes. If any state or territory does not classify the waste as a hazardous waste then it is listed as no.

Reporting	Explanation
Primary reason for stockpiling or storage (suggested)	<p>This is a subjective assessment based on research and consultation of the most likely reason for the hazardous waste stockpiling or approved long-term on-site storage. The main reasons that the project has identified are included in full text below.</p> <ol style="list-style-type: none"> 1. Financial costs of processing 2. Lack of (or unstable) off-take markets 3. Limited technical ability to treat 4. Insufficient installed capacity for treatment 5. Insufficient regulatory controls 6. Market behaviour of processing companies to secure hazardous wastes and the associated gate fee, with insufficient or capacity to process the hazardous wastes 7. Historical industrial practices contaminating sites or building a stockpile that require clean up, with limited/no capital set aside to manage the legacy 8. Commodity linked strongly to global market and commodity prices 9. Transport distances to processing facilities.
Secondary reason for stockpiling or storage (suggested)	<p>This is a subjective assessment based on research and consultation of the secondary likely reason for the hazardous waste stockpiling or approved long-term on-site storage, based on the same list of reasons as identified above.</p>
ANZISC code/s gen. sector	<p>This refers to the Australian and New Zealand Standard Industrial Classification (ANZSIC) for the <u>generating</u> sector of the stockpile or storage.</p>
Data quality ass.	<p>Refers to the quality of the data and information gathered within the scope of this project. The quality is assessed as high, medium or low according to the groupings explained below. Data quality is presented as the percentage of stockpile or storage sites that are high, med or low (totalling 100% for each waste).</p>
High	<p>Most data supplied directly or from credible published sources with no additional estimates or assumptions required.</p>
Med	<p>Some data provided directly or from published sources and some additional data estimates or assumptions required.</p>
Low	<p>Most data estimated based on credible references but still requiring significant estimations and assumptions and therefore is of lower quality. Low quality data estimates need to be used with caution.</p>

Table E3 National hazardous waste stockpiles and approved long-term on-site storage

Hazwaste stockpile waste type	Est. tonnes	Est. average age (years)	Primary contam. or risk (NEMP)	Second. contam. or risk (NEPM)	Hazwaste in all States?	Primary reason for stockpiling or storage (suggested)	Secondary reason for stockpiling or storage (suggested)	ANZISC code/s gen. sector	Comments	Data quality ass.		
										High	Med	Low
Aluminium dross recycling salt cake		55	D300	D110	Y	4. Insuff. installed capacity to treat.	2. Lack of/unstable off-take market	21		100%		
Arsenic wastes (speiss)	17,000		D130		Y	2. Lack of/unstable off-take market	1. Financial costs of processing	21		100%		
Asbestos	3,020,000	54	N220		Y	7. Historical industrial practices	5. Insufficient regulatory controls	09			38%	63%
Contaminated biosolids	1,378,000	70	D150	D220	N	3. Limited technical ability to treat	7. Historical industrial practices	28		100%		
CRT glass		3	D220		Y	6. Processor market behaviour	1. Financial costs of processing	29	Stockpiles identified cleared		100%	
Dieldrin-impregnated timber	60,000	30	H100		Y	1. Financial costs of processing	3. Limited technical ability to treat	08		100%		
End-of-life tyres	696,250	3	T140		N	6. Processor market behaviour	2. Lack of/unstable off-take market	39				100%
E-waste		3	D220	M160	N	1. Financial costs of processing	6. Processor market behaviour	29	Stockpiles identified cleared		100%	
HCB	14,500	50	M160		Y	4. Insuff. installed capacity to treat.	7. Historical industrial practices	18	No tonnage data	100%		
Sig. Cont. Soils PFAS			N120		Y	3. Limited technical ability to treat	5. Insufficient regulatory controls	77	No tonnage data			100%
Mercury waste			D120		Y	6. Processor market behaviour	5. Insufficient regulatory controls	29	No tonnage data	83%		17%
PCB			M100		Y	3. Limited technical ability to treat		21	Stockpiles identified cleared			100%
PFOS			M160		Y	3. Limited technical ability to treat		76			57%	43%
Spent dry-cleaning solvents (PERC)					Y				None identified			
Spent pot liner	533,553	31	D110	A130	Y	1. Financial costs of processing	3. Limited technical ability to treat	21		100%		
Used lead acid batteries (auto & ind.)	25,983	3	D220	B100	Y	9. Transport distances to process	6. Processor market behaviour	29			100%	
Approved long-term storage waste type												
CSG salt brine wastes	9,543,000	8	D300		N	3. Limited technical ability to treat	1. Financial costs of processing	07		100%		
SiMn slag		20	D290		Y			21		100%		
Stockpiles only total:	6,204,366											
All total:												

Important: blank 'tonnage estimate' column does not mean zero tonnage stockpile

The list of stockpile waste types is based on research and consultation that found that there are likely stockpiles of each of these waste types in Australia. However, for some wastes there was insufficient information to provide an estimate. For example, there are significant PFAS contaminated soils sites around Australia that are likely to require clean-up, requiring treatment infrastructure capacity to clear the stocks. There was insufficient data available to provide an estimate for this significant stockpile of contaminated soils. See discussion below for further information about each waste type.

Overall

There are an estimated 6.2 million tonnes of 'hazardous waste'³ in stockpiles around Australia. It should be noted that the stockpile number would likely be significantly higher if data were available for PFAS contaminated soils and groundwater in Australia. When approved long-term on-site storages are included, more than double the tonnages **CIC** of hazardous waste are estimated to be either stockpiled or in approved long-term on-site storages in Australia.

CIC

Reporting and discussion of both stockpiles and approved long-term on-site storages has merit, but they need to be reported as separate line items and it needs to be recognised that in most instances 'clearance' requirements are not applied to approved long-term on-site storages.

The main reasons for reporting approved long-term on-site storages in the dataset, reported separately as a sub-total, include:

1. As these wastes do not leave the site, typically the wastes are not tracked via state waste tracking systems, and there may be little or no reporting of generation and disposal rates to state environment departments
2. These wastes typically differ from those sent off-site to a licensed landfill (for example) where there is a transfer of the waste 'ownership' and liability for the long-term management.

Of the estimated 6.2 million tonnes of stockpiled wastes in Australia some 72% of the wastes are asbestos waste and contaminated biosolids. Spent pot lining from aluminium smelting and end-of-life tyres both make up about 10% each and the remaining waste types combine to make up 5% of the 6.2 million tonnes.

It is important not to focus too much on the total tonnages of different hazardous wastes. For example, the HCB stockpile at 15,000 tonnes, or just 0.2% of the 6.2 million tonne stockpile, is not a significant proportion. However, this is [reportedly](#) the largest stockpile of HCB in the world and it is highly hazardous and has been extremely difficult to manage and is likely to be exported for treatment due to a lack of local treatment infrastructure capabilities and development.

Average age

The average age for both stockpiles and approved long-term on-site storages is around 28 years. Stockpiles and storages resulting from older industrial development in Australia include contaminated biosolids (70 years), asbestos and HCB (50 years), followed by waste from alumina and aluminium production at around 40 years. Waste from oil and gas production (in the specific context of the coal seam gas industry) have been stockpiled or stored over the past decade or more.

More recently, stockpiling of e-waste has become an issue with the changeover of products such as CRT TVs.

³ Refer to definition included in Section 2

The analysis has assumed a limited stockpiling period for some wastes, such as end-of-life tyres and used lead acid batteries. After three years these wastes are assumed to be either recovered or permanently 'lost' to an unknown fate (tyres).

Contaminant types

Looking at the Controlled Waste NEPM codes by number of listings, the D codes (inorganics chemicals /metals) dominate making up 50%, followed by M codes (organic chemicals) and N codes (soils and sludges) at 14 % each.

Reasons for stockpiling and long-term on-site storage

The most frequent primary reason identified for both stockpiling and long-term on-site storage was limited technical ability to treat the waste type at around 30%. This was listed almost twice as many times as financial costs of processing, lack of/unstable off-take market, or processor market behaviour which were all listed for about 15% of the waste types.

Interestingly a lack of regulation was listed as the most common secondary reason at almost 30%, followed by financial costs of processing at around 20% and limited technical ability to treat, and processor market behaviour both at around 10%.

These results suggest that Australia's waste management industry is well established enough to treat hazardous waste stockpiles, but is often limited by capabilities. More elaborate treatment capabilities typically require significant capital and have high gate fees. The results suggest a lack of regulatory drivers and controls for some waste could be impacting on the waste industries' investment in additional capabilities.

Generating-industry sectors

Around 30% of stockpiles and approved long-term on-site storages listed were generated by ANZSIC code 21 *Primary Metal and Metal Product Manufacturing* reflecting the high rate of NEPM 'D' waste type contamination. ANZSIC code 29 *Waste Collection, Treatment and Disposal Services* accounted for around 20% of listing and code 7 *Oil and Gas Extraction* accounted for around 15% of listing.

Missing stockpiles data

This project aimed to build a baseline dataset and analysis and it was not expected that all stockpiles listed would have full account. The stockpile number and tonnages would likely be significantly higher if data were available for:

- PFAS contaminated soils and groundwater in Australia
- Other mining and minerals waste that are not reported here.

1 Introduction

The Department of the Environment and Energy (DoEE) engaged Randell Environmental Consulting (REC) in association with Ascend Waste and Environment to complete this report of hazardous waste stockpiles in Australia in 2016/17.

1.1 Project scope

DoEE defined the project scope as follows.

1. Analyse Australian and select international policy frameworks for **preventing, managing and clearing** hazardous *and* controlled waste⁴ stockpiles. In this report hazardous and controlled waste are referred to simply as hazardous waste henceforth.
2. Analyse the United States of America (USA) and the European Union (EU) frameworks for preventing, managing, and clearing hazardous waste stockpiles.
3. Based on the above, develop a definition for ‘hazardous waste stockpiles’.
4. Develop a **baseline**⁵ dataset for hazardous waste stockpiles in Australia based on an agreed definition for hazardous waste stockpiles. The project focuses on building a baseline dataset of the known major hazardous waste stockpiles in Australia (standing and recurrent) and describes their age, location, amount and composition.
5. Analyse the most common reasons why hazardous wastes are stockpiled. Where relevant, this includes the effect of the stockpile position in a supply chain and identifying stockpiles linked to global markets and trends.
6. Where the project analysis supports it, making recommendations regarding hazardous waste stockpile prevention, management, and clearance in Australia.

DoEE requested an expansive definition of ‘hazardous waste stockpile’ be considered in this project (including solids, sludges, and liquids). For example, the following stockpiles were included in project scope: contaminated biosolids, end-of-life tyres (EOLTs), the HCB stockpile, ‘stranded’ wastes connected to company failures, site closures or acquisitions. The project scope also considers and discusses contaminated soil wastes and contaminated sites; however, it was recognised that it is not possible to provide quantitative analysis of this ‘stockpile’ within this project scope. Where appropriate, mining and mineral processing wastes are to be discussed in brief but not in depth as these wastes are not the focus of the study.

Hazardous waste *stockpile* or *approved long-term on-site storage*?

Part of the project scope is to develop a better definition of a hazardous waste stockpile. One of the key findings of the project is that there needs to be a clear distinction between a *stockpile* and an *approved long-term on-site storage*. Definitions for both are provided in Section 2 and the analysis supporting the definitions is provided in Section 14. Stockpiles are the focus of this report. For completeness, long-term on-site storages are also discussed.

⁴ Controlled waste are defined in the [National Environment Protection \(Movement of Controlled Waste between States and Territories\) Measure](#).

⁵ This is an initial (mostly desktop) study only and the database should not be seen as definitive.

1.2 Report structure

Section 2 provides a set of key terms and definitions that are used throughout the report. This section is provided in addition to **Section 14** which analyses and provides the definition for a stockpile as discussed below.

Section 3 provides a summary of the ‘key elements’ this study has identified that make up a comprehensive framework for stockpile prevention, management and clearance.

Section 4 through to Section 12 provide detailed analysis of how Australian and international frameworks implement the ‘key elements’. To provide a detailed understanding of these frameworks, these sections includes the most relevant extracts from each jurisdiction’s literature.⁶

Section 13 provides a summary analysis of each jurisdiction’s framework and implementation of the key elements to prevent, manage and clear stockpiles.

Section 14 analyses and provides a definition for hazardous waste stockpiles that is based on the analysis of each jurisdiction’s framework. To ensure clear differentiation, this section also provides a definition for approved long-term on-site storages.

Section 15 provides the ‘baseline’ Australian national stockpiles dataset including a concise description of each stockpile type and likely reasons for stockpiling. For completeness, this section also provides a baseline dataset for approved long-term on-site storages that this project has identified and analysed during project delivery.

Section 16 provides conclusions and recommendations regarding hazardous waste stockpile prevention, management, and clearance in Australia.

Appendix A provides a summary of hazardous waste types that are not ‘tracked’ in jurisdictional hazardous waste tracking systems (where tracking is required).

Appendix B provides the stockpiles dataset broken down by each state and territory.

Appendix C details of the stockpile or approved long-term on-site storage estimation methods, where required, to explain the assumptions and calculations that the authors have completed in providing the estimations.

Appendix D includes the list of waste codes from the *National Environment Protection (Movement of Controlled Waste between States and Territories) Measure, Schedule A List 1: Waste categories* which are referenced in the database.

The report is supported by a Microsoft Excel workbook that includes site specific detailed information regarding each stockpile and approved long-term on-site storage. This database is confidential and is not intended for publication as it includes site specific information that may be confidential.

Note: there are several instances in the report where the stockpile data or information is redacted (see **red blocks**) where the content is commercial-in-confidence or confidential.

⁶ Note: where text extracts from the reference document are included in the report they are included within single quotation marks. Where a significant ‘block’ of text is extracted from a reference the text is indented and enclosed in single quotation marks.

2 Key terms and definitions

This section provides a set of key terms and definitions that are used throughout the report. Terms are listed in alphabetical order.

Approved long-term on-site storage (of hazardous waste)

For the purposes of this project, approved long-term on-site storage refers to waste storage that is:

- on-site (or near site)
- long-term (greater than 10 years)
- in designated area/s
- pre-approved⁷ and has pre-approved management processes in place
- typically, not required to meet stockpiled waste 'clearance' requirements
- still under management by waste generator (i.e. liability has not been transferred to a third party/facility such as a hazardous waste landfill or isolation facility).

See Section 14 for further discussion.

Fate (of hazardous waste)

Waste fate refers to the ultimate destination of the waste within the management system. Types of fate may include recycling, energy recovery, long-term storage and disposal, each of which can be divided into more specific fates. Treatment, transfer and short-term storage are not fates, but are rather part of the pathway leading to a fate.

Hazardous waste

Waste that, by its characteristics, poses a threat or risk to public health, safety or to the environment⁸. In national reporting, this term is taken to correspond with:

- wastes that cannot be imported or exported from Australia without a permit under the *Hazardous Waste (Regulation of Exports and Imports) Act 1989*
- wastes that any jurisdiction regulates as requiring particularly high levels of management and control, namely: regulated waste (Queensland); trackable waste (New South Wales); prescribed waste (Victoria); listed waste (South Australia and NT); or controlled waste (ACT, Tasmania and Western Australia)
- additional wastes nominated as hazardous by the Australian Government⁹.

In addition, waste that has hazardous characteristics and has been stored on a site for more than one year should be considered hazardous waste.

NSW (along with the ACT¹⁰, due to their adoption of NSW classification procedures) uses the term 'hazardous waste' in a specific regulatory sense. The NSW *Protection of the Environment Operations*

⁷ The storage of the waste was planned and approved by environment regulators prior to placement including management requirements to protect human health and the environment.

⁸ From AS/NZS 3831:1998 *Waste Management – Glossary of Terms*.

⁹ For example, the Australian Government has considered waste lithium ion batteries as hazardous in assessing the adequacy of hazardous waste infrastructure.

¹⁰ Environment ACT (2000) *ACT Environmental Standards: Assessment and Classification of Liquid & Non-liquid Wastes*, June, available from: http://www.environment.act.gov.au/_data/assets/pdf_file/0005/585500/wastestandards.pdf

(Waste) Regulation 2005 and associated guidance defines 'hazardous waste' as one of six classes of waste – and it typically cannot be disposed at landfill without hazard reduction treatment such as immobilisation. 'Hazardous waste' in this strict NSW (ACT) regulatory interpretation is equivalent only to those *hazardous wastes* (in national reporting terminology) that would be categorised at the higher hazard end of the range.

Stockpile (of hazardous waste)

For the purposes of this project, a solid or liquid hazardous waste is defined as a stockpile where all of the following apply:

- it has not been substantially treated or processed
- a significant proportion has been stored for more than one year
- it requires ongoing management or monitoring to prevent impacts to human health or the environment.

A hazardous waste stockpile may be stored above ground or below ground and be located on the site it was generated or elsewhere.

Unlike 'approved long-term on-site storages', stockpiles are typically subject to 'clearance' requirements and legislation set out by relevant environmental legislation.

See Section 14 for further discussion.

3 Analysing frameworks for stockpiles prevention, management and clearance

To analyse the frameworks that are in place in Australia, the USA and the EU we have identified 'key elements' that provide for stockpile prevention, management and clearance.

Identifying these key elements allows for a targeted literature review and collation of comparable information across jurisdictions; which ultimately enables the identification of opportunities for improvement in how Australia prevents, manages and clears hazardous waste stockpiles.

Each of the key elements are introduced in the table below and the relevance of each is also provided. How each of these elements are utilised is then detailed in the jurisdictional sections that follow.

Note: the analysis presented below was **current for the 2016/17 period** and changes that have occurred since then are not presented.

Scope of framework analysis

The report focuses on stockpiling of waste rather than illegal dumping, although we recognise that there is some connection between illegal dumping and stockpiling. In some jurisdictions, there are significant programs in place for the prevention of illegal dumping in particular that are not the focus of this study. For example, a jurisdiction's programmes to catch illegal dumping offenders is not the focus of this study.

Also, it is important to note that the key elements identified in Table 1 are focused on waste management policies, regulations, programs and market settings that are targeted to stockpile prevention, management and clearance. In every jurisdiction in Australia, and in most developed countries, there are generic enforcement powers to manage and clear stockpiles of hazardous waste. For example, legislation prohibiting the pollution of land and water that enables prosecution and clearance of a hazardous waste stockpile. Generic environmental protection legislation and its use for stockpiles management and clearance is not the focus of this report.

Table 1 Key elements of frameworks providing for stockpile prevention, management and clearance

Key element	Relevance
Prevention	
1. Generator hazardous waste minimisation reporting required	Arguably the most effective way to prevent hazardous waste stockpiles is to prevent the generation of the waste in the first instance. Refers to requirements to <u>report on</u> how generation is being minimised.
2. Licence/permit required to stockpile hazardous waste	Having a licensing/permitting requirement in place to store or stockpile hazardous wastes can both deter (prevent) stockpiling and provide for the management elements that are discussed below.

Key element	Relevance
	The thresholds for site licensing are a key element to any framework and they may be set for specific waste types such as end of life tyres (EOLTs).
3. Hazardous waste tracking (transport and receipt)	The tracking of hazardous waste transport and receipt ensures that wastes are only taken to a facility that is licensed to receive the waste, which ensures appropriate management. Tracking systems help to prevent illegal dumping and illegal stockpiling.
4. Enforcement against illegal dumping	<p>Illegal dumping of hazardous waste can lead to the development of stockpiles of hazardous waste, as illustrated in Section 14, Figure 1. Stockpiles which result from illegal dumping can be particularly problematic as there is often no opportunity for regulators to recover funds for the stockpile clean-up.</p> <p>Resources and programs are required to prevent illegal dumping of hazardous wastes, especially in jurisdictions where the disposal options for hazardous waste are limited and or expensive.</p>
5. Landfill levy settings	Landfill levies are indirectly relevant to this study. As the cost of licensed landfill disposal increases, so does the financial driver for hazardous waste illegal dumping and with it the risk of hazardous waste stockpile formation.
Management	
6. Stockpile quantity limits set for all sites	Limiting the amount of hazardous waste allowed onsite is fundamental to being able to regulate the stockpile's management.
7. Stockpiling time limits set for all sites	Limiting the time hazardous waste can remain onsite is arguably the more effective management control for stockpiling, assuming the time of stockpiling can be effectively proven.
8. Reporting required on stockpile status and change	Reporting to regulators on an annual basis, for example, ensures that licensing limits are monitored by the site owner and helps regulators in monitoring high risk sites.
9. Stockpile site controls required	These are the practical, onsite requirements that are put in place specifically to control stockpiles' impacts on the environment. They include requirements such as bunding, shedding, dust suppression, odour management, etc. This key element refers to specific and published requirements to have site controls in place.
10. Emergency plan required for stockpiles	Stockpiles of hazardous waste are likely to present a significant environmental and potentially human health risk in the event of an emergency such as a fire or flood. This key element refers to specific and published requirements to have an emergency plan in place for hazardous waste stockpiles.
Clearance	
11. Financial assurance (FA) for site clean-up	Financial assurance legislation allows for regulators to access site owner funds, typically available via bank guarantee, bond, or insurance policy, to clean-up a hazardous waste stockpile. Where effectively implemented, FA's can provide effective means of funding stockpile clearance.
12. Government trust or funds to deal with abandoned stockpiles	<p>Government trusts or funds are usually funded by governments setting aside revenue from sites licensing fees or landfill levies. The funds are held in a central account and are able to be made available for clean-up of sites where there is no other funding option available.</p> <p>These funds typically are set-up specifically to fund contaminated sites/stockpile clean-up and are additional to more generic environment trust funds that typically focus on improving and protecting the environment and biodiversity.</p>

4 ACT framework for hazardous waste stockpiles

4.1 Prevention

Hazardous waste minimisation reporting for generators

No reporting requirements were identified that specifically require waste generators to report on minimising hazardous waste generation.

It's worth noting that the ACT does not generate significant volumes of hazardous waste because of a lack of industry in the ACT.

Site permits to receive and store hazardous waste

Schedule 1 of the ACT [Environment Protection Act 1997](#) details activities requiring environmental authorisation. The following extracts are relevant:

- 'the treatment (other than by incineration), storage or handling of more than 1,000m³ of contaminated soil from land outside the parcel of land where the contaminated soil is treated, stored or handled
- the treatment (other than by incineration), storage or handling of more than 10,000m³ of contaminated soil from land'.

ACT EPA also commented that the following require authorisation:

- the operation of a facility that recovers, processes or disposes, or is intended by the operator to recover, process or dispose, of more than 20t of waste petroleum products per year
- the operation of a waste transfer station receiving 30,000t or more of waste each year
- the operation of a commercial facility for the treatment of the hazardous components of electronic waste.

Hazardous waste tracking

There is no hazardous waste tracking system in place in the ACT for hazardous waste movements within the jurisdiction.

Enforcement against illegal dumping

The ACT Government (via Access Canberra and Transport Canberra and City Services) encourage public reporting of illegal dumping activities (not specifically focused on hazardous waste) and have significant monetary penalties for successful convictions against the relevant provisions of their legislation. The ACT has penalties – up to \$1 million – for convictions of the relevant offence under the [Dangerous Substances Act 2004](#), relevant for dumping of hazardous wastes.

ACT and bordering NSW council areas such as Palerang, Yass Valley, Cooma-Monaro and Queanbeyan are part of the ACT–NSW Cross Border Program, one of NSW's levy-funded Regional Illegal Dumping (RID) Squads. These are typically focused on wastes that may not be hazardous waste.

Landfill levy settings

ACT does not have specific 'landfill levy' as ACT government operate the only landfills in the ACT. The [Waste Minimisation \(Fees\) Determination 2016](#) details the ACT landfill fees, which are relevant to this study as the cost of landfill at a licensed site impacts on the amount of illegal dumping.

Schedule 1 of regulations sets out the landfill fees payable. The relevant extract is included below.

3.1.	Commercial industrial and other waste not dealt with elsewhere in this instrument- less than 0.25 tonne	\$36.50 per load
3.2.	Commercial industrial and other waste not dealt with elsewhere in this instrument- 0.25 tonne or more	\$146.20 per tonne
4.1.	Asbestos or products containing asbestos (by arrangement) – from commercial services less than 0.25 tonne	\$41.00 per load
4.2.	Asbestos or products containing asbestos (by arrangement) – 0.25 tonne or more; or arriving at the landfill in a package larger than 80 cm x 80 cm	\$164.10 per tonne
6.3.	Receipt and Recycling of whole tyres from vehicles: clean and without rim (more than 0.25 tonne)	\$341.75 per tonne
6.4.	Receipt and Recycling of whole tyres from vehicles: dirty or with rim (more than 0.25 tonne) Note: Appointment required for 10 or more tyres'	\$477.90 per tonne

Note: that from 1 July 2017 the [Waste Minimisation Act 2001](#) will be replaced by [Waste Management and Resource Recovery Act 2016](#).

4.2 Management

Stockpile quantity and time restrictions

Examples were found in site licences where storage of EOLT is limited to 25 tonnes and areas must be clearly marked and segregated.

ACT EPA noted that they have few issues with stockpiles management due to the lack of generating industry in the territory.

Stockpile reporting

No reporting requirements were identified that specifically relate to hazardous waste stockpiles.

Stockpile controls

No controls were identified that specifically relate to hazardous waste stockpiles.

Emergency planning

No specific emergency planning requirements were identified for hazardous waste stockpiles.

4.3 Clearance

Financial assurance

The ACT EPA [General environment protection policy](#) details the requirements for financial assurance.

The following content is relevant to this study.

'What is a financial assurance?

A financial assurance is a type of bond or security and acts as a financial guarantee that certain environmental harm will not result from the actions of the activity manager. An

assurance can take several forms, including a bank guarantee, bond, or insurance policy (see Section 85). Financial assurances are held by the EPA and are only claimed in circumstances where the EPA has incurred certain costs in remedying serious or material environmental harm caused by the activities concerned (see Section 88).

When can the EPA require a financial assurance?

Under Section 85 of the Act, the EPA can require a financial assurance as a condition of an environmental authorisation if, after considering:

- the likelihood of the activity causing serious or material environmental harm
- the likelihood of action being needed to remedy such harm
- the activity manager's environmental record.

What is the EPA's approach to financial assurances?

The EPA takes the view that financial assurances will be required in relatively unusual situations, involving a fine balancing of risks, benefits, rights and interests. One example would be where the activity manager had a poor environmental record, but not poor enough to justify rejecting the application for authorisation. Another example would be where a proposed activity offered significant public benefits, but also entailed atypically high risks of serious or material environmental harm. Note that the Act provides the usual procedural protections such as a requirement for "show cause" notice, together with appeal rights' (page 14).

Government trust or funds for abandoned stockpiles

No government trust or funds for abandoned stockpiles were identified.

5 NSW framework for hazardous waste stockpiles

5.1 Stockpile prevention

Hazardous waste minimisation reporting for generators

No reporting requirements were identified that specifically require waste generators to report on minimising hazardous waste generation.

Site permits to receive and store hazardous waste

Schedule 1 (Part 1) of the [Protection of the Environment Operations Act 1997](#) (POEO Act) sets out the licensing requirement for NSW, including the following relevant thresholds.

'Activity'	Licensing thresholds
Waste resource recovery (recycling)	1000 tonnes or 1000 m ³ on-site at any one time (2500 tonnes for facilities outside regulated area); or
Waste processing	processing more than 6000 tonnes a year (12,000 tonnes for facilities outside the regulated area).
Waste storage	
Waste disposal	Zero threshold for most waste types; or Building and demolition waste: 200 tonnes (20,000 tonnes for waste generated outside the regulated area)
Waste tyres: storage	More than 5 tonnes of waste tyres or 500 waste tyres stored on-site at any one time; or processing more than
processing	5000 tonnes of waste tyres per year.'

NSW is the only Australian jurisdiction that sets out different licensing thresholds for urban areas and more remote rural areas, allowing two and a half times the waste storage without licensing outside of the NSW 'regulated area'.

Changes to the POEO Act and Waste Regs introduced in 2015, described in [Changes to the NSW waste levy for resource recovery facilities – Fact Sheet](#), discourage stockpiling (of any waste) by waste receival facilities for longer than 12 months through triggering payment of levy liability. The system operates via a 'mass balance' approach, where the amount of material in the site gate and out of the site gate is reported. Operators of scheduled waste facilities hold a levy liability on all waste received at their facility, but this liability is extinguished once the waste is transported off-site for lawful re-use or disposal.

Payment of the levy is triggered when:

- waste is stockpiled on-site for more than 12 months, unless the waste has been processed at the facility to a standard required by a resource recovery order
- waste is stockpiled above lawful limits
- waste is transported for unlawful disposal.

NSW is the only Australian jurisdiction that has implemented 'mass balance' reporting and levy liability for wastes that are unprocessed or stockpiled above the licence limits.

Hazardous waste tracking

There is a hazardous waste tracking system in place in NSW for hazardous waste movements within the jurisdiction. Hazardous waste must be tracked when transported into, within or out of NSW. The waste consignor, transporter and receiving facility all have obligations to ensure that the waste is properly tracked. There are several tracking exemptions in place in NSW, that are detailed in Appendix A.

In addition to waste tracking, those involved in the EOLT tyre value chain and waste asbestos management in NSW are required to register and report through the mobile application [WasteLocate](#) system, which provides live tracking of the movement and locations of the collected wastes. This system allows the tracking of EOLT and waste asbestos consignments from the consigner, transporter and receiver.

Enforcement against illegal dumping

Through landfill levy funding, EPA NSW has established dedicated Regional Illegal Dumping (RID) Squads. There are four RID Squads in operation in the following areas: Western Sydney (the longest-running at 15 years), Sydney, Southern Councils and Hunter/Central Coast, plus a specific cross-border program with the ACT.

Education, engagement and awareness raising focuses mainly on illegal dumping and its impacts.

Landfill levy settings

NSW has a range of levies for different wastes. [NSW EPA website](#) details levy is currently set at:

Solid waste disposal to landfill

- Metropolitan levy area \$135.70/t
- Regional levy area \$78.20/t
- Virgin excavated natural material \$122.13/t (metropolitan levy area) \$70.38/t (regional levy area)
- Shredder floc - \$67.85/t (metropolitan levy area) \$39.10/t (regional levy area)
- Coal washery rejects - \$14.20

'Trackable' liquid wastes disposal to a treatment facility

- \$72.20/t.

NSW and SA are the only jurisdictions that have a levy on liquid waste facilities receiving trackable or hazardous liquid wastes in Australia.

5.2 Management

Stockpile restrictions

NSW EPA sets site stockpile limits on a case by case basis, depending on the waste type. The 'mass balance' levy system approach enables the triggering of levy payment after 12 months or once a site tonnage limit is breached. This system places strong financial pressure on sites to control stockpiling.

Once a site has stockpiled the material for more than 12 months there is a landfill levy liability and presumably the stockpile material is also considered a waste and that requires disposal to a licensed landfill facility, which would enable EPA to prosecute the site for illegal stockpiling of waste.

Stockpile reporting

The NSW mass balance levy system requires annual reporting of wastes received, wastes processed into fit-for-purpose materials, waste or materials removed from site. The remainder is the amount of waste stockpiled onsite.

[NSW EPA](#) website also notes:

‘Regardless of the method of stockpiling, each stockpile must be given a unique stockpile identification number and the amount and type of waste added to or removed from the stockpile each day must be recorded. Each stockpile will be surveyed at least twice a year in accordance with Waste Levy Guideline 5 – Topographical and Volumetric Surveys in the [Waste Levy Guidelines \(PDF 509KB\)](#). Also refer to the [volumetric surveys](#) webpage.’

Stockpile controls

No specific controls were identified for hazardous waste stockpile controls. Management of emissions from or other impacts as a consequence of stockpiled waste are governed by NSW’s Environment Protection Licensing system, which may put in place site specific controls.

Emergency planning

No specific emergency planning requirements were identified for hazardous waste stockpiles. NSW EPA noted that for licensed sites with higher risk profiles, such as waste treatment facilities, there are standard license conditions for emergency planning.

NSW Fire Brigade [Guidelines for Bulk Storage of Rubber Tyres](#) set requirements for open and indoor storage of waste tyres.

5.3 Clearance

Financial assurance

The NSW EPA require financial assurances to be in place. The [Guide to licensing for the waste industry](#) states:

‘Most waste facilities must provide a financial assurance or bank guarantee. This ensures funds are available to the EPA for remedial works and post-closure care if licensees are unwilling or unable to pay. The amount and terms of this guarantee will depend on the size of your business, its potential environmental impacts, and your compliance history’.

During consultation NSW EPA commented that licence holders are not able to surrender their licence until all stockpiles have been cleared and this is another means of EPA enforcing stockpile clearance, due to the costs of maintaining a license (annual reporting, fees and monitoring).

Government trust or funds to deal with abandoned stockpiles

The NSW Environmental Trust is an independent statutory body established by the NSW government to fund a broad range of organisations to undertake projects that enhance the environment of NSW.

The Environment Trust [website](#) states the following objectives:

'Objectives

The objectives of the NSW Environmental Trust are:

- encourage and support restoration and rehabilitation projects in both the public and private sectors that will, or are likely to, prevent or reduce pollution, the waste stream or environmental degradation, of any kind, within any part of NSW
- promote research in both the public and private sectors into environmental problems of any kind and, in particular, to encourage and support:
 - research into and development of local solutions to environmental problems
 - discovery of new methods of operation for NSW industries that are less harmful to the environment
 - research into general environmental problems
 - assessment of environmental degradation
- promote environmental education and, in particular, to encourage the development of educational programs in both the public and private sectors that will increase public awareness of environmental issues of any kind
- fund the acquisition of land for national parks and other categories of dedicated and reserved land for the national parks estate
- fund the declaration of areas for marine parks and related purposes
- promote waste avoidance, resource recovery and waste management (including funding enforcement and regulation, and local government programs)
- fund environmental community groups
- fund the purchase of water entitlements for the purposes of increasing environmental flows for the state's rivers, and restoring or rehabilitating major wetlands'.

Some of the above objectives could be relevant to hazardous waste stockpile clearance. However, review of funding grants available did not identify specific funds for contaminated site clean-up or stockpile clearance.

6 NT framework for hazardous waste stockpiles

6.1 Stockpile prevention

Hazardous waste minimisation reporting for generators

No reporting requirements were identified that specifically require waste generators to report on minimising hazardous waste generation.

Site permits to receive and store hazardous waste

The NT [Waste Management and Pollution Control Act](#) and [Waste Management and Pollution Control \(Administration\) Regulations](#) requires an environmental protection licence for sites that are recycling, treating or disposing of 'listed wastes' (which includes a comprehensive range of hazardous wastes and includes EOLT and waste asbestos). No threshold for licensing was identified.

Hazardous waste tracking

There is no hazardous waste tracking system in place in the NT for hazardous waste movements within the jurisdiction.

Enforcement against illegal dumping

NT does not have a waste levy, and consequently does not have dedicated compliance and enforcement teams. However, they encourage public reporting of illegal dumping activities (not specifically focused on hazardous waste) through their reporting hotline, and are developing stronger enforcement mechanisms.

Landfill levy settings

No landfill levy is in place in the NT.

6.2 Management

Stockpile restrictions

No specific stockpiling restrictions were identified.

Stockpile reporting

No specific reporting requirements were identified for hazardous waste stockpiles.

Stockpile controls

No specific controls were identified for hazardous waste stockpile controls.

Emergency planning

No specific emergency planning requirements were identified for hazardous waste stockpiles.

6.3 Clearance

Financial assurance

Holders of Waste Discharge Licences, Environment Protection Licences and/or Environment Protection Approvals may be directed to clean up or improve management of onsite stockpiles of waste.

The NT [Waste management and pollution control act - sect 103](#) includes the following regarding financial assurance requirement:

‘Claims against financial assurances

(1) The NT EPA or a person authorised by the NT EPA may take action necessary to prevent, minimise or make good environmental damage that results from or may result from a contravention of or a failure to comply with an environment protection approval or a licence, where it is a condition of the approval or licence that a financial assurance is to be provided.

(2) The cost of performing an action under subsection (1) may be recovered by the NT EPA by making a claim on, utilising or realising the financial assurance in relation to the environment protection approval or the licence.

(3) Costs may be recovered in accordance with subsection (2) even though the costs, or part of the costs, can be attributed to actions taken, or a failure to take action, at a time before the financial assurance was provided to the NT EPA.’

7 Qld framework for hazardous waste stockpiles

7.1 Stockpile prevention

Hazardous waste minimisation reporting for generators

No reporting requirements were identified that specifically require waste generators to report on minimising hazardous waste generation.

Site permits to receive and store hazardous waste

In Qld the [Environmental Protection Act 1994](#) (EP Act) and *Schedule 2 Prescribed ERAs and aggregate environmental scores* of the [Environmental Protection Regulation 2008](#) detail the licensing thresholds for a range of ‘environmentally relevant activities’ (ERAs) including hazardous waste (‘regulated waste’) storage. The most relevant content is Section 56 Regulated waste storage which includes the extract below.

‘56 Regulated waste storage

(1) Regulated waste storage (the **relevant activity**) consists of operating a facility for receiving and storing regulated waste for more than 24 hours.

(2) The relevant activity does **not** include—

- (a) storing tyres or parts of tyres; or
- (b) storing regulated waste in transit; or
- (c) storing at a facility, for no more than 28 days, any of the following, awaiting removal from the facility for recycling, reprocessing, treatment or disposal—
 - (i) pharmaceuticals;
 - (ii) body parts;
 - (iii) clinical waste consisting only of sharps in sharps containers that comply with AS 4031 or AS/NZS4261; or
- d) storing at a facility chemically treated power poles awaiting removal from the facility for recycling, reprocessing or treatment; or
- (e) storing at a facility any of the following, awaiting removal from the facility for recycling, reprocessing or treatment—

- (i) not more than 3000 used lead-acid batteries, up to a total mass of 45t;
- (ii) not more than 5000L of waste oil; or
- (f) carrying out an activity to which section 20, 25, 27, 53, 60, 61 or 62 would apply if the activity were carried out within a stated threshold under the section; or
- (g) carrying out an activity to which section 55 or 58 applies.

(3) In the following table, the aggregate environmental score for the relevant activity is the score stated opposite the threshold within which the relevant activity is carried out.

Threshold	Aggregate environmental score	3
receiving and storing regulated waste	21	C

(4) In this section—

AS 4031 means ‘AS 4031:1992—Non-reusable containers for the collection of sharp medical items used in health care areas’.

AS/NZS 4261 means ‘AS/NZS 4261:1994—Reusable containers for the collection of sharp items used in human and animal medical applications’.

in-transit, in relation to storing regulated waste, means storing the waste for no more than 5 days, including, for example, while transporting the waste or because of an unavoidable delay in transporting the waste’ (page 199).

The ‘**aggregate environmental score**’ for each environmentally relevant activity is used in Qld to allocate a scale to the level of environmental risk/s. The higher the score, the higher licensing fees (for example).

Hazardous waste tracking

There is a hazardous waste tracking system in place in Qld for hazardous waste movements within the jurisdiction. Hazardous waste must be tracked when transported into, within or out of Qld. The waste consignor, transporter and receiving facility all have obligations to ensure that the waste is properly tracked. There are several tracking exemptions in place in Qld, that are detailed in Appendix A.

Enforcement against illegal dumping

Queensland’s DEHP established the Litter and Illegal Dumping Unit (LIDU) in 2012. There is also opportunity to publicly report littering and illegal dumping using the online littering and illegal dumping reporting system.

Given the program delivery link between illegal dumping and littering, Queensland’s approach appears to be less targeted at illegal corporate activity (representing the more hazardous end of the waste spectrum) and more targeted at domestic litter.

Landfill levy settings

No landfill levy is in place in the Qld.

7.2 Management

Stockpile restrictions

No specific stockpiling restrictions were identified.

Stockpile reporting

No specific reporting requirements were identified for hazardous waste stockpiles.

Stockpile controls

No specific controls were identified for hazardous waste stockpile controls.

Emergency planning

No specific emergency planning requirements were identified for hazardous waste stockpiles.

[Fire and Rescue Service Act 1990 \(Requisition 1\) 2011](#) requires any person who stores more than 500 tyres to take steps to minimise the risk of fire, including pile size and separation distances.

7.3 Clearance

Financial assurance

Qld sets out financial assurance requirements in the guideline [Financial assurance under the Environmental Protection Act 1994](#). The guideline states:

‘Prescribed Environmentally Relevant Activities FA may be required for any prescribed Environmentally Relevant Activities (ERA) where the activity will result in ‘significantly disturbed land’. However, if a prescribed ERA is an authorised ancillary activity under an EA for a resource activity the FA is taken to be calculated under the resource EA and it is not required again. The following prescribed ERAs are likely to require FA...

- ... Regulated waste recycling or reprocessing ERA 55(2)
- Regulated waste storage ERA 56
- Regulated waste treatment ERA 58
- Waste disposal ERA 60(1a to 1d) and ERA 60(2d to 2h)
- Clinical and regulated waste incineration and thermal treatment ERA 61(3a) and ERA 61(3b).’

Government trust or funds for abandoned stockpiles

No government trust or funds for abandoned stockpiles were identified.

8 SA framework for hazardous waste stockpiles

SA is currently looking to implement significant reforms that will result in significant change to the current framework for hazardous waste stockpiles prevention, management and clearance.

The [Explanatory paper: consultation draft Environment Protection \(Waste Reform\) Amendment Bill 2016](#) details the reforms. The current draft Waste Reform Amendment Bill would introduce significant changes to stockpiles governance in South Australia. The Act amendments will implement a range of changes for stockpiles management including:

- Mass balance reporting and upfront levy payment (similar to the NSW model).
- Improving licence controls including limits on tonnages and the use of audits.
- Requiring financial assurances from sites that stockpile.
- The 'recovery of illegally obtained economic benefit'.

The explanatory paper states:

'Through its reforms, the EPA seeks to material flows with no excessive stockpiling. The EPA recognises that this is not a 'one-size fits all' solution as different waste types will need to be considered on their own merits to ensure the most cost effective and appropriate management approach is established for industry participants.

The amendment Act will empower the EPA to achieve balanced material flows, most particularly through proposed amendments to the Objects of the EP Act to explicitly allow the EPA to promote material flow in the waste industry, revising the circumstances when financial assurances can be used (including insurance) and enhancing the its ability to readily act on licence condition breaches. The changes from the Bill will support the development of strengthened administrative policies and licence conditions, and also lead to enable further regulatory changes for the improved monitoring of material flows in the waste industry and to influence the financial drivers applying to waste material flows' (page 10).

The proposed reforms are discussed further in the subsections that follow.

8.1 Stockpile prevention

Waste reform bill: prevention

Amendment of section 10 Objects of Act. The amendment specifically refers to regulating the stockpiling of waste and includes:

'The objective of this amendment is to ensure the EPA is able to impose maximum stockpile limits as a licence condition on material stored at waste or recycling depots listed in clause 3(3) of Schedule 1 of the EP Act **and** implement controls on material flows to prevent excessive accumulation of material, irrespective of direct environmental harm risks and whether or not material meets the physical and chemical criteria of a product' (page 15).

The SA proposed framework of legislation to enforce mass balance reporting and material flows goes beyond the application of landfill levy liabilities and prevention of contamination of land and attempts to ensure that processed materials are moved through the economy without significant delay. Issues of stockpiling can arise post-processing of wastes where there are poor 'off-take' markets for the processed materials. The SA model of enforcing material flows of processed materials could ensure that reprocessors do not stockpile materials for extended periods due to poor product quality or unfavourable market conditions.

Hazardous waste minimisation reporting for generators

No reporting requirements were identified that specifically require waste generators to report on minimising hazardous waste generation.

Site permits to receive and store hazardous waste

[Environment Protection Act 1993](#) (EP Act) Schedule 1—Prescribed activities of environmental significance, Part A—Activities defines the sites requiring licensing in SA. The relevant inclusions requiring a licence are for the following activities:

Receival, storage, reuse, recycling, treatment of –

- any substances listed in Part B of the Schedule (which includes a broad range of hazardous wastes)
- more than 5,000 litres per year of waste oil
- more than 500 waste lead acid batteries per year
- more than 5 tonne of waste tyres or tyre pieces per year.

Hazardous waste tracking

There is a comprehensive hazardous waste tracking system in place in SA for hazardous waste movements within the jurisdiction. Hazardous waste must be tracked when transported into, within or out of SA. The waste consignor, transporter and receiving facility all have obligations to ensure that the waste is properly tracked. Organic and putrescible waste are exempt from tracking in SA, see Appendix A.

Enforcement against illegal dumping

Waste reform bill: recovery of illegally obtained economic benefits

The amendment also discusses the “effective recovery of illegally obtained economic benefits” and suggest that this will be a major deterrent for stockpiling.

SA EPA have detailed the intention of their proposed policy for recovery of illegally obtained economic benefits in [Reforming waste management – Creating certainty for an industry to grow](#) including the following extract.

‘5.11.2 Overview of the proposed policy

The EPA has commenced working with other jurisdictions to develop policy that will promote a nationally consistent approach in recovering illegally obtained economic

benefits. It is proposed that South Australia's policy will address the following matters:

1 Principles of recovering illegally obtained economic benefit

- Remove competitive advantage of non-compliance: the removal of economic benefit from offenders will appropriately penalise offenders, deter future non-compliance and assist compliant operators who are currently disadvantaged by investing in compliant operation while non-compliant competitors are gaining economic benefits.
- Promote compliance: currently, those businesses that avoid complying with environmental obligations gain an economic benefit from the use of the avoided costs of compliance. The policy will ensure that this benefit is measured during the enforcement process and recovered where possible. This in turn will act as a better general deterrent to contravene environmental laws.

2 Methods used to calculate illegally obtained economic benefit

The policy will outline the process used to quantify the economic benefit that may accrue to a business from delayed or avoided compliance with environmental laws. It will also outline the evidence that might be gathered and used to provide the basis of quantifying economic benefit.

3 Process of recovering illegally obtained economic benefit

The policy will provide an explanation of when the EPA will seek the recovery of economic benefit in conjunction with an offence under the Act and how this will be presented to a court or judicial body.

5.11.3 Key discussion points

Within the waste and resource recovery sector, significant economic benefits can accrue from contraventions of the EP Act. Within the waste sector, due to the costs associated with the safe handling and lawful disposal of waste, the benefits of illegal dumping, excessive stockpiling and promotion of waste as 'product' can significantly outweigh the likely penalties available upon successful prosecution for matters such as a contravention of a condition of licence or even causing environmental harm.

The policy will assist the EPA to create a level playing field for business between those who comply with environmental laws and those who do not by removing the benefits of offending and promoting greater compliance with environmental laws. The policy can be expected to also benefit licensees and the courts by providing a transparent and consistent basis for action' (page 67).

Legislation that allows the recovery of funds obtained by illegal activities is not unique and exists in many jurisdictions. However, SA was the only jurisdiction identified with policy that will outline the specific circumstances, method and process for the recovery of funds from illegal stockpiling. This should be a more effective deterrent than a general head of power to recover profits made from 'breaking the law'.

SA EPA has a dedicated Illegal Dumping Unit (IDU), which targets illegal waste activities such as illegal landfilling, dumping of hazardous wastes, commercial quantities of demolition and industrial waste, liquid waste, and waste businesses and transporters operating without an EPA licence.

SA also provides a hotline for members of the public to report suspicious activity.

Landfill levy settings

The [SA EPA](#) website publishes the current information regarding levy settings in SA as follows.

'Waste levy rates 2017–18

New levy rates apply from 1 July 2017–18 as foreshadowed in previous information about future levy rates.

The solid waste depot levy for waste produced in metropolitan Adelaide is:

- 1 July 2017–30 June 2018: \$87 per tonne

The solid waste depot levy for relevant waste produced in non-metropolitan Adelaide is:

- 1 July 2017–30 June 2018: \$43.50 per tonne

The liquid waste levy for 2017–18 is \$35.81 per kilolitre.

Reduced levy for asbestos

Building on the reduced rates introduced for asbestos waste in 2016–17, the State Government has announced that from 1 July 2017, no levy will apply for the disposal of packaged asbestos waste*, that is:

- Metropolitan Adelaide: \$0 per tonne
- Non-metropolitan Adelaide: \$0 per tonne

Under these requirements, asbestos waste needs to be presented appropriately packaged, secured and labelled to support its safe disposal at an appropriate facility.

* Meaning the disposal of asbestos waste that is packaged and disposed in accordance with:

- Chapter 8 of the Work, Health and Safety Regulations 2012, or the requirements for lawful unlicensed removalists as set out from time to time in the legislation and excluding asbestos-contaminated soil.

'Asbestos waste' is any asbestos or ACM removed and disposable items used during asbestos removal work including plastic sheeting and disposal tools where asbestos containing material (ACM) means any material or thing that, as part of its design, contains asbestos.

Future levy rates

In future years, the Government has announced that solid waste levy is intended to rise to the following rates per tonne.

	2018–19	2019–20
<u>Metro</u>	<u>\$100</u>	<u>\$103</u>
<u>Non-metro</u>	<u>\$50</u>	<u>\$51.50.'</u>

8.2 Management

Stockpile restrictions

EPA SA [Guideline for stockpile management](#): *Waste and waste derived products for recycling and reuse* publication focuses mainly on stockpile management issues such as location within a site, height, stability, end market opportunities and suggested stockpile life. The guideline states: "... the EPA does not generally support storage or stockpiling of materials awaiting recycling or reuse for longer than six months in order to reduce potential abandonments or speculative indefinite stockpiling."

Waste reform bill: management

As discussed above the SA reforms will bring into action a mass balance reporting and upfront levy payment systems that is similar to the NSW model. It will also improve licence controls including limits on tonnages and the use of audits. The explanatory paper states:

'Amendment of section 45 Conditions

The proposed new subsection 45(3)(c) of the EP Act allows the EPA to impose or vary a condition of an environmental authorisation (such as a licence condition) imposing a maximum allowable stockpile limit at any time if the EPA considers it necessary to promote the circulation of materials through the waste management process' (page 16).

Stockpile reporting

No specific reporting requirements were identified for hazardous waste stockpiles. However, this will change under the proposed reforms. It is not yet clear how reporting will work under the reforms, however, it may be similar to the NSW EPA reporting requirements for stockpile tonnages on site each year and the amount of stockpile drawdown or growth.

Stockpile controls

EPA SA [Guideline for stockpile management](#): *Waste and waste derived products for recycling and reuse* publication provides detailed guidance focuses mainly on stockpile management issues such as location within a site, height, stability, end market opportunities and suggested stockpile life.

Emergency planning

No specific emergency planning requirements were identified for hazardous waste stockpiles.

The [General Guidelines for Rubber Tyre Storage](#) developed by the SA Fire Authorities provide guidance for indoor and outdoor storage of waste tyres.

8.3 Clearance

Financial assurance

It is unclear if SA EPA currently require financial assurances for sites stockpiling hazardous wastes. It is clear, however, that the proposed reforms intend to put in place requirements for financial assurance for waste stockpiling in SA where there is risk of environmental harm. The [Explanatory paper: consultation draft Environment Protection \(Waste Reform\) Amendment Bill 2016](#) explains that:

‘the substitution of section 51 of the EP Act that sets out the provisions around financial assurances that may be required as a condition of an environmental authorisation. The proposed new section 51 sets out the kinds of financial assurances that may be required and clarifies the purposes for which a financial assurance may be sought to include any costs associated with making good any environmental damage as a result of a contravention. The proposed new subsection 51(1)(c) specifies that a financial assurance may take the form of a policy of insurance and subsection 51(6) outlines the provisions applying to a policy of insurance. Clause 18 also allows the EPA to amend a licence condition at any time to require a financial assurance. The clause also provides that the EPA may require a financial assurance as part of an application for an environmental authorisation and that the financial assurance can extend to when no clean up or remediation is required even following cessation of the activity’ (page 17).

Government trust or funds for abandoned stockpiles

No government trust or funds for abandoned stockpiles were identified.

9 Tasmania framework for hazardous waste stockpiles

9.1 Stockpile prevention

Hazardous waste minimisation reporting for generators

No reporting requirements were identified that specifically require waste generators to report on minimising hazardous waste generation.

Site permits to receive and store hazardous waste

The Tasmania EPA [Environmental Management and Pollution Control \(Waste Management\) Regulations 2010](#) includes general requirements related to hazardous waste (‘controlled waste’) storage including:

‘6. General responsibilities

(1) A person must not remove from a site, arrange for the removal from a site, receive, store, reuse, recycle, reprocess, salvage, incinerate, treat, dispose of, or use for energy recovery, a controlled waste except –

- (a) as approved; or
- (b) in accordance with –
 - (i) an environmental approval; or
 - (ii) an approved management method.

Section 7 also includes the following relevant content:

7. Production, storage and treatment of controlled waste

(1) A person must not cause or permit a controlled waste to be produced, received, stored, reused, recycled, reprocessed, salvaged, incinerated, treated, disposed of, or used for energy recovery, in such a manner that it is reasonably likely that the controlled waste will –

- (a) leak, spill or escape into the environment; or
- (b) cause serious environmental harm, material environmental harm or environmental nuisance.'

References in official Tasmanian EPA communications routinely refer to stockpiles but these are often referring to mining and quarrying references and are not often not related to hazardous wastes.

There are no tyre storage requirements for EOLT except for landfill operators who must not openly store more than 200 EPU's under the regulations.

Hazardous waste tracking

Under the [Environmental Management and Pollution Control \(Controlled Waste Tracking\) Regulations 2010](#) operators involved in the production, transportation and receipt of hazardous waste (or controlled wastes) must be registered.

However, there is no hazardous waste tracking system in place in Tasmania for hazardous waste movements within the jurisdiction.

Enforcement against illegal dumping

Tasmania does not have a waste levy, and consequently does not have dedicated compliance and enforcement teams. However, they encourage public reporting of illegal dumping activities (not specifically focused on hazardous waste) through their Pollution Incidents and Complaints Hotline.

Landfill levy settings

No landfill levy is in place in Tasmania.

9.2 Management

Stockpile restrictions

No specific stockpiling restrictions were identified.

Stockpile reporting

No specific reporting requirements were identified for hazardous waste stockpiles.

Stockpile controls

No specific controls were identified for hazardous waste stockpile controls.

Emergency planning

No specific emergency planning requirements were identified for hazardous waste stockpiles.

For EOLT, there are no specific requirements or guidance notes for fire safety, however the [General Fire Regulations 2010](#) provide provisions for general site requirements.

9.3 Clearance

Financial assurance

Tasmanian EPA may direct facilities to clean up or improve management of onsite stockpiles of waste.

The [Environmental management and pollution control act 1994 - sect 35](#) outlines EPA requirement on financial assurances and includes the following content.

‘Division 6 - Financial assurances 35. Financial assurance to secure compliance with Act

(1) Subject to this section, the Board may by notice in writing served on the person responsible for an environmentally relevant activity, or a site in respect of which a notice issued under Part 5A has been issued, require that person to lodge with the Board a financial assurance in the form of a bond (supported by a guarantee, insurance policy or other security approved by the Board), or a specified pecuniary sum, the discharge or repayment of which is conditional on that person—

- (a) not committing any contravention of this Act of a specified kind during a specified period; or
- (b) taking specified action within a specified period to achieve compliance with this Act; or
- (c) complying with any conditions or restrictions requiring the person to take action for the purposes of remediation, site clean-up, site decommissioning or infrastructure decommissioning and which –
 - (i) have been required by the Board under section 25 to be contained in a permit or under section 27 to be contained in an environment protection notice; or
 - (ii) are contained in an environment protection notice issued and served by the Director under section 44; or
- (d) in the case of a notice issued under Part 5A, complying with any requirements specified in the notice; or
- (e) complying with any conditions or restrictions required by the Board under section 60L(8) of the Land Use Planning and Approvals Act 1993 to be contained in a special permit granted under section 60T of that Act.’

Government trust or funds for abandoned stockpiles

No government trust or funds for abandoned stockpiles were identified.

10 Vic framework for hazardous waste stockpiles

The [Environment Protection Act 1970 \(EP Act\)](#), [Environment Protection \(Industrial Waste Resource\) Regulations 2009](#) (IWR Regs), and the [Environment Protection \(Scheduled Premises and Exemptions\) Regulations 2007](#) (Scheduled Premises Regs) set out the Victorian framework for stockpiles.

10.1 Stockpile prevention

Hazardous waste minimisation reporting for generators

No reporting requirements were identified that specifically require waste generators to report on minimising hazardous waste generation.

Site permits to receive and store hazardous waste

Management of emissions from or other impacts as a consequence of stockpiled waste are governed by EPA Victoria's system of licensing 'scheduled premises', those industrial facilities identified in the Scheduled Premises Regs to pose the most significant risk to the environment. EPA licences aim to control the operation of scheduled premises so that there is no adverse impact on the environment.

Recent changes to the Scheduled Premises Regs put in place management requirements for stockpiles of tyres.

Complementary to licensing is a range of statutory tools such as clean up notices, which can be served on licensed or unlicensed premises, and have been frequently used to direct actions such as the removal of stockpiled wastes that pose a threat to segments of the environment. Such notices have been repeatedly served in relation to EOLT stockpiles in recent years. Understandably, Vic EPA's current referencing of stockpiling in regulation and official communications is almost entirely in relation to stockpiling of EOLT.

Recent regulation of [EOLT](#) storage in Victoria via the *Environment Protection (Scheduled Premises and Exemptions) Regulations 2007*, requires EOLT storages >40 tonnes to be licensed. EPA has also developed a standard licence (LI_WM1.6) for sites receiving EOLT which reads "*the maximum size of a pile of tyres stored outdoors does not exceed 20m long, by 6m wide, by 3m high*"

Whilst these changes should help prevent some EOLT stockpiles in Vic, it is worth noting that the threshold for licensing, at 40 tonnes, is eight times higher than comparable jurisdictions (NSW and SA).

The Scheduled Premises Regs were under review at the time of writing, however, the proposed changes do not put in place additional requirements for stockpiles prevention, management or clearance.

The relevant extracts from Schedule 1 of the Scheduled Premises Regs are included below for reference.

Column 1 Type Number and Summary Description	Column 2 Description of Scheduled Premises*	Column 3 Does a category specific exemption from works approval under section 19A or licensing under section 20(1) apply?†	Column 4 Is a Financial Assurance Required?
A: Waste treatment, disposal and recycling			
A01 (PIW management)	Storage, treatment, reprocessing, containment or disposal facilities handling any prescribed industrial waste not generated at the premises.	No	Yes
A02 (Other waste treatment)	Waste treatment works engaged in the immobilisation, thermal degradation, incineration or other treatment of waste.	No	No
A06 (Land disposal)	Land disposal facilities for the disposal of nightsoil, septic tank sludge or sewage treatment plant sludge.	No	No
A09 (Waste tyre storage)	Premises with more than 40 tonnes or 5000 EPU of waste tyres at any time.	No	No
L02 (Contaminated sites—onsite soil containment)	On-site retention of contaminated soil on premises that are designed to or have a capacity to hold at least 1000m ³ in an engineered facility.	These premises are exempt from licensing under section 20(1) of the Act.	Yes
L04 (Contaminated sites—long term management)	Premises on which there is soil or groundwater contamination in respect of which a notice has been issued under the Act requiring long term management.	These premises are exempt from works approval under section 19A of the Act and licensing under section 20(1) of the Act.	Yes

*(Note—these premises require works approvals or licences)

†(Note that a general exemption may also apply under regulations 9 to 12)'

Hazardous waste tracking

There hazardous waste tracking system in place in Vic for hazardous waste movements within the jurisdiction. Hazardous waste must be tracked when transported into, within or out of Vic. The waste consignor, transporter and receiving facility all have obligations to ensure that the waste is properly tracked. There are several tracking exemptions in place in Vic, that are detailed in Appendix A.

A notable exclusion from the Vic tracking system is EOLTs, because they are not deemed to be 'prescribed industrial waste'. Vic does not report movements of EOLTs within the state but does report export of EOLTs other states, as they are a 'controlled waste' required to be managed under the Controlled Waste NEPM. With NSW implementing [WasteLocate](#), Vic is the only jurisdiction with a tracking system that does not track EOLTs.

Enforcement against illegal dumping

Through landfill levy funding, EPA Victoria has established a dedicated Illegal Dumping Strike Force team. The team is:

- supporting businesses to understand their legal requirements for managing waste and recyclable material
- working with its council partners and other government agencies to share intelligence about dumping offences and hotspots
- investigating and enforcing against incidents of large-scale industrial waste dumping.

Public reporting of illegal dumping activity in Victoria includes specifically targeting intelligence from the community of suspicious activity or sites, to help direct compliance activity.

More specifically, section 27(A) of the EPA Act makes it an indictable offence (with significant penalties attached) to dump, deposit, discard or abandon 'industrial waste' at a place not a licensed to accept that waste.

It is notable in Victoria that enforcement regarding littering specifically excludes industrial premises such as those engaging in manufacturing or mining. Consequentially, while relevant to illegal waste dumping, littering is not related to stockpiling of hazardous waste per se in Victoria.

Landfill levy settings

The current landfill levy rates are published on [EPA Vic website](#) and are detailed below.

- Metro & regional: MSW \$62/t; C&I and C&D \$62/t.
- Rural: MSW \$31.10/t; C&I and C&D \$53.35/t.
- Prescribed industrial waste: Cat B \$250/t; Cat C \$70/t; Asbestos \$30/t.

10.2 Management

Stockpile restrictions

No specific stockpiling restrictions were identified.

Stockpile reporting

No specific reporting requirements were identified for hazardous waste stockpiles.

Stockpile controls

No specific controls were identified for hazardous waste stockpile controls.

Emergency planning

No specific emergency planning requirements were identified for hazardous waste stockpiles.

Guidelines for the safe storage of tyres [indoor](#) and [outdoor](#) have been published by the Metropolitan Fire Brigade (MFB) and Country Fire Authority (CFA).

10.3 Clearance

Financial assurance

EPA's publication *Financial assurance for licences and works approvals* details how financial assurances are applied to licences and works approvals. Section 67B of the Environment Protection Act and associated regulations provide for financial assurances.

As detailed in the extracts from the Scheduled Premises Regs, financial assurances are required for any site storing hazardous wastes and also for contaminated sites, where the stockpile of soils remains onsite.

Government trust or funds for abandoned stockpiles

No government trust or funds for abandoned stockpiles were identified.

11 WA framework for hazardous waste stockpiles

The [Environmental Protection Act 1986](#) (EP Act), [Environmental Protection Regulations 1987](#), [Environmental Protection \(Controlled Waste\) Regulations 2004](#) set out WA's framework for stockpiles.

In addition, the Department and Environment Regulation (DER) published *Guidance statement: Regulatory Principles* clarifies how the Department carries out its regulatory functions, which is supported by a series of Guidance Statements and process improvements to provide for efficient, effective, transparent, consistent and accountable environmental regulation in Western Australia. Published documents to date include:

- *Guidance Statement: Regulatory Principles* (July 2015);
- *Guidance Statement: Decision Making* (February 2017);
- *Guidance Statement: Land Use Planning* (February 2017);
- *Guidance Statement: Risk Assessments* (February 2017);
- *Guidance Statement: Environmental Siting* (November 2016);
- *Guidance Statement: Setting Conditions* (October 2015);
- *Guidance Statement: Licence Duration* (August 2016);
- *Guidance Statement: Environmental Standards* (September 2016); and
- *Guidance Statement: Publication of Annual Audit Compliance Reports* (May 2016).

The definition of hazardous waste in WA is included within the *Landfill Waste Classification and Waste Definitions 1996* (as amended December 2009) (LWCWD) as:

'Component of the waste stream which by its characteristics poses a threat or risk to public health, safety or the environment (includes substances which are toxic, infectious, mutagenic, carcinogenic, teratogenic, explosive, flammable, corrosive, oxidising and radioactive)' (page 4).

A more detailed description of Hazardous Waste and examples thereof, are also provided in Table 2c of the LWCWD.

As an interesting aside, this review found no specific definitions of a waste stockpile within the environment legislation. However, the following definition was found in the WA Department of Mines and Petroleum *Mining Rehabilitation Fund – Guidance* defines **waste dump and overburden**

stockpiles as “waste dump and overburden stockpiles are defined as areas associated with the storage of unprocessed waste material resulting from a mining operation.”

11.1 Stockpile prevention

Hazardous waste minimisation reporting for generators

No reporting requirements were identified that specifically require waste generators to report on minimising hazardous waste generation.

Site permits to receive and store hazardous waste

Department of Environment Regulation (DER) is responsible for regulating industrial emissions and discharges to the environment through a works approval and licensing process.

DER define certain industrial premises with the potential to cause emissions and discharges to air, land or water as ‘prescribed premises’ which trigger regulation under the EP Act.

The EP Act requires a works approval to be obtained before constructing a prescribed industrial premises and makes it an offence to cause an emission or discharge unless a licence or registration is held for the premises.

Prescribed premises categories are outlined in Schedule 1 of the Environmental Protection Regulations 1987. The most relevant extracts are included below for reference.

‘Category number	Description of category	Production or design capacity
53	Flyash disposal: premises on which flyash is disposed of.	1 000 tonnes or more per year
56	Used tyre storage (tyre fitting business): premises on which used tyres are stored in connection with a tyre fitting business.	500 tyres or more
57	Used tyre storage (general): premises (other than premises within category 56) on which used tyres are stored.	100 tyres or more
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
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
62	Solid waste depot: premises on which waste is stored, or sorted, pending final disposal or re-use.	500 tonnes or more per year
65	Class IV secure landfill site: premises on which waste (as determined by reference to the waste type set out in the document entitled “Landfill Waste Classification and Waste Definitions 1996” published by the Chief Executive Officer and as amended from time to time) is accepted for burial.	Not applicable

'Category number	Description of category	Production or design capacity
66	Class V intractable landfill site: premises on which waste (as determined by reference to the waste type set out in the document entitled "Landfill Waste Classification and Waste Definitions 1996" published by the Chief Executive Officer and as amended from time to time) is accepted for burial.'	Not applicable

Hazardous waste tracking

There is a waste tracking system in place in WA for hazardous waste movements within the jurisdiction. Hazardous waste must be tracked when transported into, within or out of WA. The waste consignor, transporter and receiving facility all have obligations to ensure that the waste is properly tracked.

EOLT are a controlled waste under the Environmental Protection (Controlled Waste) Regulations 2004 and as such permitting and tracking is required when EOLTS are transported from commercial premises.

Asbestos is not tracked when transported within WA. Asbestos is excluded from the requirements relating to transport by a licensed controlled waste carrier and tracking via a controlled waste tracking form.

Enforcement against illegal dumping

In 2010, the Environmental Protection Act 1986 (EP Act) was amended to introduce a new offence for the illegal dumping of waste. DER is responsible for investigating and prosecuting illegal dumping under the EP Act. Upon conviction, this offence carries a maximum fine of \$125,000 for corporations and \$62,500 for individuals.

In 2015, a dedicated Illegal Dumping Program was established within DER. The Program includes a dedicated enforcement capacity of five officers comprising a Senior Manager and four Investigators to investigate reports of illegal dumping.

DER identifies illegal dumping incidents through public complaints, overt and covert surveillance, and sharing intelligence with partnership bodies such as Local Government Authorities and other land managers.

Landfill levy settings

The current landfill levy rates are published on the [DERs website](#) and are detailed below.

- Putrescible wastes: \$60/tonne.
- Inert wastes \$50/tonne.
- \$0 for asbestos products such as roofing or insulation. \$40 for asbestos contaminated soils/rubble that cannot be readily cleaned sent to inert landfill from Jan 2015, increasing to \$70 by 2018.¹¹

¹¹ For levy purposes, WA DER defines 'asbestos contaminated soils' as "not considered to be asbestos-containing materials."

WA's \$0 levy on asbestos products such as asbestos sheeting or insulation & \$40 (equivalent) levy on asbestos contaminated soils or rubble, should help to mitigate the risk of mixing asbestos into other loads to achieve a lower levy rate.

It is widely accepted that the best fate for waste asbestos is disposal to a licensed landfill. Government policy settings should be set to encourage the safe disposal of asbestos to a licensed landfill. WA and SA (since July 2017) have implemented a \$0 landfill levy for waste asbestos containing material (ACM) (e.g. roofing, cement sheeting) disposal. All other jurisdictions with a landfill levy (Vic, NSW) still levy waste asbestos disposal to landfill. ACT landfill fees also apply to waste asbestos loads.

11.2 Management

Stockpile restrictions

No specific stockpiling restrictions were identified.

Stockpile reporting

No specific reporting requirements were identified for hazardous waste stockpiles.

Stockpile controls

No specific controls were identified for hazardous waste stockpile controls.

Emergency planning

No specific emergency planning requirements were identified for hazardous waste stockpiles.

While WA does not have standalone requirements or guidance for stockpile management, regulatory controls (conditions) are imposed on licences where required to manage risks to the environment and public health associated with emissions and discharges from prescribed premises. There are a number of licences in the State that contain conditions that address stockpiles and stockpile management.

11.3 Clearance

Financial assurance

DER's [Environmental protection regulations 1987 - Reg 28](#) details financial assurance requirement in WA, including the following extract.

'28 . Financial assurance, licensees to pay

(1) In this regulation —

licensee does not include a licensee who is a local government.

(2) Each licensee is to pay to the Chief Executive Officer, in accordance with subsection (3), a financial assurance that —

(a) is in an approved form; and

(b) secures or guarantees payment of an amount determined by the Chief Executive Officer, being an amount that in the opinion of the Chief Executive Officer is equivalent to the average levy to be paid by the licensee in a return period.

(3) The financial assurance is to be paid to the Chief Executive Officer —

- (a) in the case of an existing licensee, not later than 2 weeks after commencement day; and
 - (b) in the case of a licensee who is granted a licence after commencement day, not later than 2 weeks after the licence is granted.
- (4) The licensee is to maintain the financial assurance in accordance with any requirements of the Chief Executive Officer of which the licensee has been given written notice.
- (5) The moneys from any financial assurance that is called on or used by the Chief Executive Officer are to be paid into the Fund.
- (6) The Chief Executive Officer is to review the amount of a financial assurance provided under this regulation not later than 2 years after it is provided and thereafter not later than 2 years after each review.
- (7) The Chief Executive Officer may at any time, by written direction, require a licensee to increase the amount of the financial assurance provided by the licensee if the Chief Executive Officer thinks it is appropriate to do so.
- (8) A licensee is to comply with a direction given to the licensee under sub regulation (7).'

Government trust or funds for abandoned stockpiles

No government trust or funds for abandoned stockpiles were identified.

12 Global regulatory frameworks and definitions for waste stockpiles

This section provides review of how the USA and Europe define waste stockpiles, as well as the broad regulatory frameworks for stockpile prevention, management and clearance.

12.1 USA

In the US the [Resource Conservation and Recovery Act](#) (RCRA) is the federal law that creates the framework for the management of hazardous wastes.

The [US Code of Federal Regulations \(CFR\)](#) has been formed under the RCRA. The CFR is a collection of all federal regulations codified and enforced by all federal agencies. Title 40 – Protection of the Environment – contains all of the regulations governing US EPA's programs. The regulations governing hazardous waste identification, classification, generation, management and disposal are found in title 40 CFR parts 260 through 273.

The CFR regulation §261.5 establishes hazardous waste management standards for waste generators. Under the regulations generators are categorised by waste generation thresholds as follows:

13. Conditionally exempt small quantity generators (CESQGs).
14. Small quantity generators (SQGs)
15. Large quantity generators (LQGs).

The table below provides a summary of requirements for each category of generator that are particularly relevant to stockpile prevention, management, and clearance. The table includes web links to the relevant section of the CFR regulations, as provided by US EPA.

Table 2 Summary of USA EPA regulatory requirements for stockpiling by hazardous waste generators

Requirement	Conditionally Exempt Small Quantity Generators	Small Quantity Generators	Large Quantity Generators
Quantity Limits The amount of hazardous waste generated per month determines how a generator is categorized and what regulations must be complied with.	≤100 kg/month, ≤1 kg/month of acute hazardous waste, ≤100 kg/month of acute spill residue or soil §§261.5(a) and (e)	>100 <1,000 kg/month §262.34(d)	≥1,000 kg/month >1 kg/month of acute hazardous waste >100 kg/month of acute spill residue or soil §262.34(a)
Waste Minimization Certify steps taken to reduce or eliminate the generation of hazardous waste	None	Good faith effort required §262.27	Program in place required §262.27
Accumulation requirements			
Accumulation Requirements Manage hazardous waste in compliance with certain technical standards.	None	Basic requirements with technical standards for tanks or containers §§262.34(d)(2) and (3)	Full compliance for management of tanks, containers, drip pads, or

Requirement	Conditionally Exempt Small Quantity Generators	Small Quantity Generators	Large Quantity Generators
			containment buildings §262.34(a)
Accumulation Time Limits Determine amount of time hazardous waste is allowed to accumulate on site.	None	≤180 days or ≤270 days (if transporting greater than 200 miles) §§262.34(d)(2) and (3)	≤90 days §262.34(b)
On-Site Accumulation Quantity Determine amount of hazardous waste generators are allowed to "accumulate" on site without a permit.	≤1,000 kg ≤1 kg acute ≤100 kg of acute spill residue or soil §§261.5(f)(2) and (g)(2)	≤6,000 kg §262.34(d)(1)	No limit
Reporting requirements			
Biennial Report Report data from off-site shipments of waste during the previous calendar year	Not required	Not required	Required §262.41
Manifest Tracking hazardous waste shipments using the multiple-copy manifest (required by DOT and EPA)	Not required	Required Part 262 subpart B	Required Part 262 subpart B
Exception and Additional Reporting Report if any required copies of signed manifests are not received back Provide information on quantities and disposition of wastes upon request	Not required	Required §§262.42(b) and 262.43	Required §§262.42 and 262.43
Recordkeeping Maintain records of manifests , biennial reports , exception reports and waste testing	Not required	Required §262.40(a), (c), and (d)	Required §262.40
Waste management requirements			
Facility Type Send off-site shipments to appropriate facilities for management	Facilities noted in §§261.5(f)(3) and (g)(3)	RCRA permitted/interim status facility Parts 264/265, 266/267 and 270	RCRA permitted/interim status facility Parts 264/265, 266/267 and 270
Land Disposal Restrictions Meet standards for placing on the land and associated requirements	Not required	Required Part 268 from §262.34(d)(4)	Required Part 268 from §262.34(a)(4)

Requirement	Conditionally Exempt Small Quantity Generators	Small Quantity Generators	Large Quantity Generators
for certifications, notifications, and waste analysis plans			
Emergency planning			
Preparedness and Prevention Develop procedures to follow in the event of an emergency.	Not required	Required Part 265 subpart C from §262.34(d)(4)	Full plan required Part 265 subpart C from §262.34(a)(4)
Contingency Plan and Emergency Procedures Develop procedures to follow during an unplanned major event.	Not required	Basic plan required §262.34(d)(5)(i-iv)	Full plan required Part 265 subpart D from §262.34(a)(4)
Site closure requirements			
Closure Close equipment, structures, soils and units by meeting specified performance standards and disposal and decontamination requirements	Not required	Required - tanks only §265.201(f)	Required - General §§265.111(a) and 265.114 from §262.34(a)(1)(iv) - Unit specific Part 265, subparts I, J, W, and DD

Source: US Environmental Protection Agency website Oct 2016, see:

<https://www.epa.gov/hwgenerators/hazardous-waste-generator-regulatory-summary>

From the above table, the following US EPA requirements are particularly relevant to stockpile **prevention**:

1. Waste minimisation plans are in place for large hazardous waste generators.
2. Restrictions on the accumulation of hazardous wastes onsite to <90 days for large quantity generators and <180 days for small quantity generators (<270 days for remote locations). Referred to as 'move-on requirements'.
3. Restrictions on the amount of hazardous waste that is allowed to be accumulated on-site for Conditionally Exempt Small Quantity Generators and Small Quantity Generators.

The US EPA [Land Disposal Restrictions \(LDR\)](#) are particularly relevant to stockpile **management and clean-up**. The LDR regulations set out three important prohibitions:

1. The indefinite storage of hazardous wastes in lieu of treatment.
2. The land disposal¹² of untreated hazardous waste.
3. The dilution of hazardous wastes instead of appropriate treatment.

Each of these prohibitions is discussed briefly below.

¹² US EPA define **land disposal** as: "Land disposal means the placement in or on the land, except in a corrective action management unit or staging pile. It includes, but is not limited to, placement in a landfill, surface impoundment, **waste pile**, injection well, land treatment facility, salt dome formation, salt bed formation, underground mine or cave, or placement in a concrete vault, or bunker intended for disposal purpose". Source: US EPA website Oct 2016 at <https://www.epa.gov/node/127431>.

The storage prohibition

Under the regulations, temporary storage of hazardous wastes is allowed. However, storage is only permitted if it is to accumulate a sufficient volume of waste to facilitate proper treatment, recovery, or disposal of that waste. Importantly this prohibition requires the following:

1. Hazardous waste storage **must be in either a tank, container, or containment building**.
2. If the storage period **exceeds one year** the ‘waste handler’¹³ must be able to prove that the storage is necessary to facilitate proper recovery, treatment, or disposal.

The land disposal prohibition

The disposal prohibition requires waste-specific treatment standards to be met before a waste can be land disposed.

The dilution prohibition

The dilution prohibition states that a waste handler cannot dilute a hazardous waste as a substitute for adequate treatment. Dilution is not permitted when it is used to avoid meeting an applicable treatment standard. This is referred to an “impermissible dilution.” Wastes that are aggregated or mixed as part of a legitimate treatment process, and are subsequently diluted as a result are not considered to be impermissibly diluted under LDR.

Source: US Environmental Protection Agency website Oct 2016, see: <https://www.epa.gov/node/127431>

12.1.1 USA Superfund

In 1980, the US Congress established the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA). The CERCLA was established in response a number of significant human health and environmental impacts from the dumping of hazardous wastes. CERCLA is informally called **Superfund**. The Superfund program is administered by US EPA in cooperation with each state government. The fund is designed to enable the clean up hazardous waste sites by either forcing a potentially responsible party (PRP) to perform clean-ups or reimburse the government for clean-ups led by US EPA.

An important part of the Superfund is **special accounts**. EPA establishes special accounts to provide ready access to PRP clean-up funds for sites where future response work remains. The use of funds secured in special accounts preserves the funding held in the Superfund Trust Fund for clean-up of sites without viable PRPs.

Special accounts are funded entirely with money received from PRPs, and not with funds provided by the US Government through the Superfund Trust Fund. US EPA retains money received through settlements with PRPs in special accounts to conduct planned future clean-up work at the site based on the terms of the settlement agreement.

“More than \$4 billion have been deposited in special accounts through PRP settlements. Over \$2 billion of those settlement dollars have been spent on Superfund site clean-ups and the balance is planned to be used for ongoing or future Superfund clean-up work.”

The US EPA reports the following status of special accounts for the fiscal year (FY) 2015 is as follows:

¹³ US EPA define ‘hazardous waste handlers’ as: waste generators and facilities that treat, store or dispose of hazardous waste.

- “created approximately 49 special accounts,
- deposited about \$1.778 billion into special accounts,
- earned over \$16.8 million in interest on its special accounts,
- for a total of \$1.795 billion,
- disbursed or obligated more than \$259 million for response work,
- reimbursed itself for over \$36 million worth of past clean-up related costs at sites,
- closed 29 special accounts, and
- transferred \$974,098 of special account receipts to the Superfund Trust Fund”.

Source: US EPA website 2016, see <https://www.epa.gov/enforcement/superfund-special-accounts#status>

USA regulatory framework summary

Through the RCRA legislation the US EPA has set up a comprehensive set of requirements that prevent stockpile generation through waste minimisation and tonnage and time restrictions for waste accumulation on-site. The legislation also drives hazardous waste stockpile management and clean-up by requiring that stockpiles not be stored for more than 12 months, and that any disposal to land can only occur post treatment (to a defined standard).

12.2 European Union (United Kingdom)

Our review of EU policy frameworks did not identify any specific approaches to waste stockpiles prevention, management and clearance.

The EU’s European Environment Agency [Prevention of hazardous waste in Europe — the status in 2015](#) provides a detailed account of all waste prevention programs in the EU, including for hazardous wastes.¹⁴ However, this reporting refers to waste prevention policies more broadly and addresses issues such as cleaner production for industry and community education campaigns to reduced waste generation, rather than the management of wastes and waste stockpiles.

The United Kingdom, for example, does provide more specific direction regarding hazardous waste stockpiles and their approach is discussed below.

12.2.1 United Kingdom

The [Gov UK website](#) provides direction for producers and holders of hazardous wastes in the England.

The requirements apply any businesses in England that:

- produces hazardous waste

¹⁴ The report responds to the Waste Framework Directive (EU, 1975, revised 2008) legal obligations for EU Member States to adopt waste prevention programmes by 12 December 2013. The Directive including its article related to waste prevention, is currently under revision and discussion.

- holds or stores hazardous waste
- has hazardous waste removed from its premises.

There are five steps required as follows:

16. Classify the waste to check if it's hazardous. Gov UK provides guidance on classifications of waste, which state that it is illegal to mix a hazardous waste with either non-hazardous or another hazardous waste.
17. Separate and store hazardous waste safely.
18. Use authorised businesses to collect, recycle or dispose of hazardous waste – check that waste carriers are registered and waste sites have environmental permits.
19. Fill in the producer parts of the consignment note and keep one copy and give 2 copies to the carrier collecting the waste.
20. Keep records (known as a 'register') for 3 years at the premises that produced or stored the waste.

The [Gov UK website](#) also provides generic advice about the storage of wastes that includes the following.

'You must store waste safely and securely. To do this:

- store waste in a secure place
- use suitable containers that will stop waste escaping
- label containers clearly with the type of waste they contain
- use covers to stop waste blowing away
- use waterproof covers if rain could cause contaminated run-off or prevent the waste from being reused

You have extra responsibilities if you're storing hazardous waste¹⁵

Store different types of waste separately, so that:

- they don't contaminate each other
- they can be reused more easily
- you can complete the waste transfer note correctly'.

Our review also identified more specific requirements for the storage of hazardous waste in the UK for Wales.

The [Gov UK website](#) provides direction for hazardous waste producers and holders (collections or removal) in Wales. Producers and holders must register their premises **unless** they meet the following exemptions:

- 'less than 500 kg of hazardous waste is produced, held or removed in any 12-month period
- it's a domestic premises and you're not producing asbestos
- it's a mobile service at a customer premises, e.g. a photocopier repair service where the mobile service has its own premises registration

¹⁵ These additional requirements refer back to those requirements listed in the five steps above from the UK Gov website.

- the premises is a ship’.

Hazardous wastes are wastes that:

‘can be harmful to human health or the environment, and includes:

- asbestos
- lead-acid batteries
- solvent-based inks and paints
- pesticides
- oils (except edible ones), e.g. car oil
- fluorescent light tubes
- equipment containing ozone-depleting substances, e.g. fridges
- hazardous packaging waste’.

Interestingly the registrations must be renewed every 12 months and there are fines of up to \$8,000AU for not have an up-to-date registration.

EU and UK regulatory framework summary

Unlike the USA the EU does not have an overarching policy framework to regulate hazardous waste stockpile prevention, management and clearance. However, there are examples of countries within the EU that have a framework in place. The UK has requirements for the managing of hazardous waste and in Wales there are specific requirements to register a site generating and/or storing >500kg of hazardous waste over a 12-month period. The registration of the site must be renewed each year.

13 Summary of framework key elements

Table 3 summarises each jurisdiction's inclusion of the framework key elements discussed in Section 3 to prevent, manage, and clear stockpiles.

Table 3 Analysis of key elements of hazardous waste stockpile prevention, management and clearance policy frameworks by jurisdiction

Key element	Australia							International			Discussion
	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	USA	UK	
PREVENTION											
1. Generator hazardous waste minimisation reporting required	✗	✗	✗	✗	✗	✗	✗	✗	✓ ¹⁶	✓	Hazardous waste minimisation plans are not required in Australia. However, the waste hierarchy is legislated in all jurisdictions, which prioritises waste minimisation. Note: US EPA have set up a sliding scale of requirements for waste minimisation, <u>and all other elements discussed below</u> , based on the amount and toxicity of the waste being stockpiled.
2. Licence/permit required to stockpile hazardous waste	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	In all Australian jurisdictions and in many developed countries sites that are generating and/or stockpiling hazardous wastes (such as liquid wastes and chemically intractable solid wastes) are required to have an environmental permit or licence in place.
2.1. EOLT licence required to stockpile	✓ ¹⁷	✓ ¹⁸	✓	✗	✓ ¹⁹	✗	✓ ²⁰	✓ ²¹	-	-	EOLT stockpiling is licensed in all Australian jurisdictions apart from Qld and Tas. However, the thresholds of storage that are regulated vary significantly from about 1 tonne in WA up to 40 tonnes in Vic. Both SA and NSW regulate storage of EOLT stockpiles of 5 tonnes.
2.2. ‘Mass balance’ reporting and upfront	✗	✓	✗	✗	✓	✗	✗	✗	-	-	NSW is the only Australian jurisdiction to have implemented ‘mass balance’ reporting and upfront levy payment for waste stockpiles. SA

¹⁶ Small quantity generators (>100 <1,000 kg/month): good faith effort required, Large generators (≥1,000 kg/month, or >1 kg/month of acute hazardous waste, or >100 kg/month of acute spill residue or soil): program in place required

¹⁷ Require a licence for more than 2 tonnes, about 200 EPUs at 10kg each, **and** storage is limited to 25 tonnes in some licences or about 2,500 equivalent passenger units (EPUs) and areas must be clearly marked and segregated.

¹⁸ Operators who store more than 5 tonnes at any time require a licence.

¹⁹ For quantities exceeding 5 tonnes per annum require a licence

²⁰ Tyre storages >40 tonnes (about 4,000 equivalent passenger units) require a licence.

²¹ Sites storing more than 100 tyres (about 1 tonne) require a licence.

Key element	Australia								International		Discussion
	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	USA	UK	
landfill levy liability to receive wastes											is likely to implement a similar system in 2017. The landfill levy is payable if: the stockpile of material remains unprocessed for 12-months; is stockpiled above lawful limits; waste is transported for unlawful disposal.
3. Hazardous waste tracking (transport and receipt)	x	✓	x	✓	✓	x	✓	✓	✓	✓	All Australian jurisdictions, apart from ACT, Tas, NT, and many developed countries track the collection, transport, and receipt of hazardous wastes (such as liquid wastes and chemically intractable solid wastes).
3.1. EOLT tracking (transport and receipt)	x	✓	x	✓	✓	x	x	✓	-	-	EOLTs collection, transport and receipt is tracked in NSW, Qld, SA and WA only. ACT, Tas, NT and Vic do not track EOLTs. Vic is the only large and populous state in Australia that do not track EOLT and this has likely contributed to the significant stockpiling issue for EOLT in Vic.
4. Enforcement against illegal dumping	x	✓	x	x	✓	x	✓	x	-	-	A dedicated resource to enforce against illegal dumping was only identified in NSW, SA and Vic. We note that all states have the ability to fine or prosecute offenders, however, this element refers to dedicated resources to actively find and prosecute offenders.
4.1. Specific policy to recover illegally obtained economic benefit from stockpiling	x	x	x	x	✓	x	x	x	-	-	South Australia is proposing to introduce specific policy that will outline the specific circumstances, method and process for the recovery of funds from illegal stockpiling. This should be a more effective deterrent than a general head of power to recover profits made from 'breaking the law'.
5. Landfill levy	✓ ²²	✓	x	x	✓	x	✓	✓	-	✓	Most jurisdictions have a landfill levy in place, Qld, Tas, and NT do not. The cost of landfilling in Qld, Tas, and NT is therefore cheaper than other states.
MANAGEMENT											
6. Stockpile quantity limits set for all sites	x	✓	x	x	✓	x	x	x	✓	x	US EPA set a limit of 6 tonnes for storage from small quantity generators and have no limit for large generators. NSW and SA (under proposed reforms) set the limits on a case by case basis, depending on the waste type.

²² ACT Government own all landfills in the ACT. A landfill levy is not actually charged, rather, a single gate fee price is set by the ACT Government. Gate fees are high and comparable to jurisdictions that have a landfill levy and operator gate fee system in place.

Key element	Australia								International		Discussion
	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	USA	UK	
6.1. EOLT stockpile quantity limit set for all sites	✓ ²³	✓	✗	✗	✓	✗	✓ ²⁴	✗	-	-	ACT set a tonnage limit of 25 for EOLT storage, Vic sets a limit on the volume of EOLT that can be stockpiled, NSW and SA set the limit within the site license.
7. Stockpiling time limits set for all sites	✗	✓	✗	✗	✓	✓	✓	✗	✓	-	US EPA sets explicit time limits on stockpiling of 90 days for large generators and for small generators 180 days or 270 days (if transporting greater than 200 miles). NSW and SA (under proposed reforms) require payment of landfill levy after 12 months. Whilst this is not a time limit per se, after this time the NSW and SA would be able to require removal of the material from the site, as it is effectively being treated as a waste disposed to landfill.
8. Reporting required on stockpile status and change	✗	✓	✗	✗	✓	✗	✗	✗	✓	✓	NSW and SA (under proposed reforms) require annual report of stockpile status under the mass balance and upfront levy liability framework. US EPA require biannual reporting from large generators and Wales in the UK require sites to apply for a new permit to stockpile wastes every 12 months, effectively requiring annual reporting.
9. Stockpile site controls required	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	All jurisdictions in Australia and most developed countries have stockpile site control requirements in place. Controls including bunding for liquid waste, dust control, and prohibition on mixing or diluting hazardous wastes. Whilst these requirements are common, how effectively they are enforced varies significantly.
10. Emergency plan required for stockpiles	✗	✗	✗	✗	✗	✗	✗	✗	✓	-	US EPA is the only jurisdiction that has published required emergency planning for hazardous waste generators for stockpiles. SA provide some guidance for emergency planning and NSW EPA commented that it is required in licences for higher risk sites. However, no Australian jurisdiction has published requirements for emergency planning for stockpiles, including specification of minimum equipment onsite, maintenance, and planning with local emergency departments.

²³ Limit in Act for EOLT is 25 tonnes.

²⁴ The maximum size of a pile of tyres stored outdoors does not exceed 20m long, by 6m wide, by 3m high.

Key element	Australia							International			Discussion
	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	USA	UK	
10.1. EOLT fire plan required	✗	✓	✗	✓	✓	✗	✓	✗	-	-	Vic, Qld, SA and NSW all have guidelines and or requirements in place to prevent and manage fire at EOLT stockpiling sites. No guidance or requirement was identified in ACT, NT, Tas, or WA to specifically manage the risk of fire at EOLT sites.
CLEARANCE											
11. Financial assurance for site clean-up	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	The US EPA, under US Code of Federal Regulations (CFR) section Subpart H—Financial Requirements requires a financial assurance to cover both site clean-up and site aftercare. All Australia jurisdictions have a legislative framework in place to require financial assurances. There is however, significant variability in the application of this legislation it should not be assumed that all hazardous waste stockpiles in Australia have a financial assurance in places to cover the cost of clean-up.
12. Government trust or funds set up to deal with abandoned stockpiles/contaminated site	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	The US Superfund is a trust funds established to clean-up contaminated sites (stockpiles). No Australian jurisdictions have set up central trusts to specifically fund clean-up of abandoned sites, preferring the site-specific financial assurance approach. NSW EPA commented that the NSW Environmental Trust has provided site clear-up funds in the past. However, this funding appears to be incidental as opposed to a permanent and dedicated contaminated site fund.

Legend:

✗ = key element not identified. Noting that there may be specific site licenses that have implemented something similar, the jurisdiction does not have a clear policy position, program, or regulation that would drive industry wide compliance.

✓ = key element identified and the jurisdiction has a clear policy position that includes the element listed.

- = literature review did not identify if the element was in place or not (unknown).

14 Defining a 'waste stockpile'

This section discusses the definition of a hazardous waste stockpile, considering the current Australian, USA and EU frameworks analysed in the sections above.

14.1 Definition of a hazardous waste stockpile

Figure 1 provides an illustration of the definition for hazardous waste stockpiles that is discussed below and applied in this report.

For the purposes of this project, a solid or liquid hazardous waste is defined as a stockpile where all of the following apply:

- it has not been treated or processed
- a significant proportion (i.e. 75%) has been stored for more than one year
- it requires ongoing management or monitoring to prevent impacts to human health or the environment
- it is subject to 'clearance' requirements set out by relevant environmental legislation.

A hazardous waste stockpile may be stored above ground or below ground and be located on the site it was generated or elsewhere.

For clarity, the following are not a hazardous waste stockpile:

- Hazardous materials, such as asbestos, that are still in use (they are yet to enter the 'waste' stream).
- A product derived from hazardous waste that meets a defined specification after processing.
- Hazardous waste this is stored in an 'approved long-term on-site storage' (discussed below).
- Hazardous waste that is landfilled or contained in long-term storage facilities off-site under approval from a state or territory regulator.
- Hazardous waste that does not require ongoing management or monitoring to prevent impacts to human health or the environment because permanent controls are in place or the current form of the waste presents insignificant risk to human health or the environment. Examples would include in-situ low level contaminated soils, or small stockpiles of waste tyres.

14.2 Definition of an approved hazardous waste long-term on-site storage

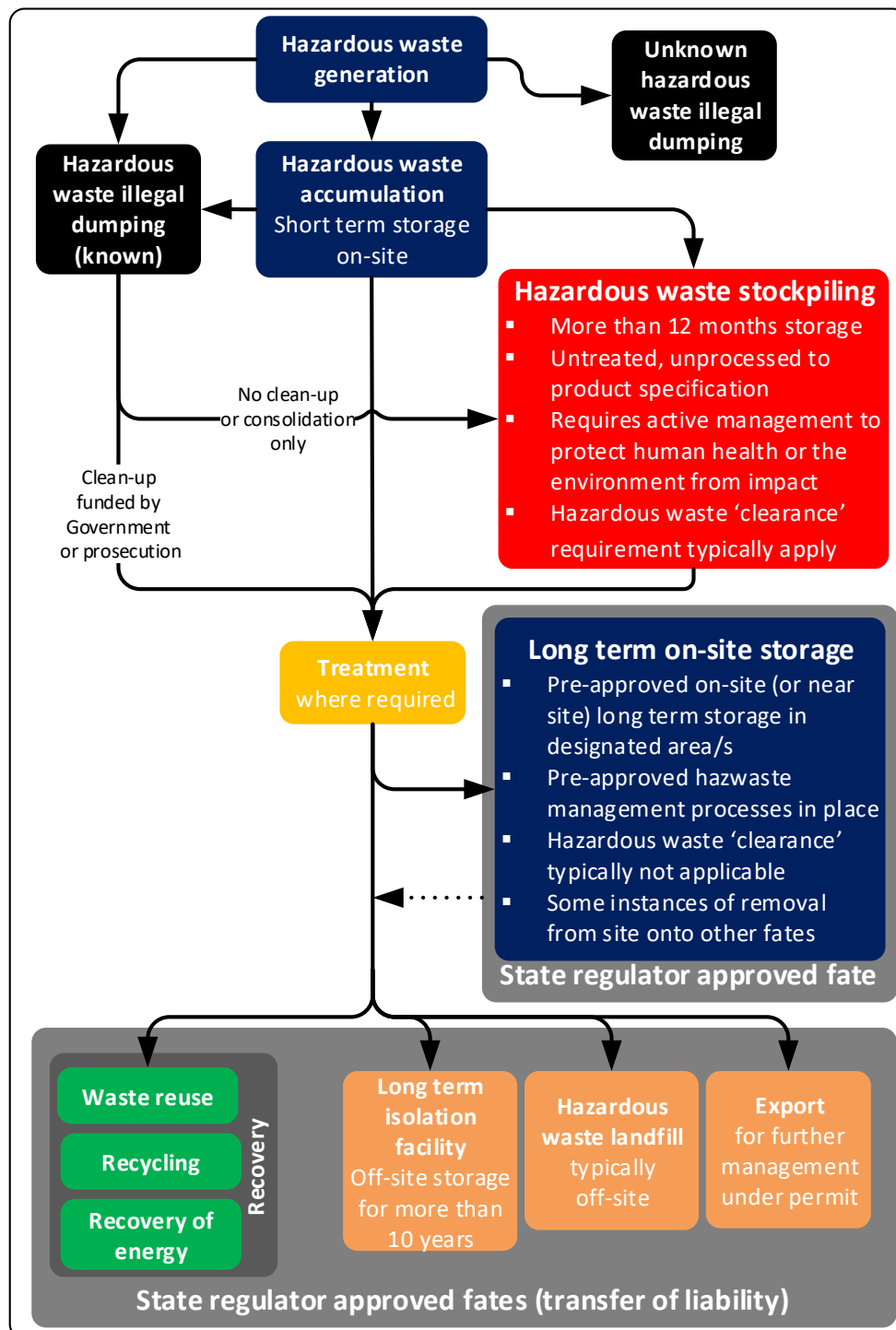
There needs to be a clear distinction between a 'stockpile' and an 'approved long-term on-site storage'.

For the purposes of this project, approved long-term on-site storage refers to waste storage that is:

- on-site (or near site)
- in designated area/s

- pre-approved²⁵ for long-term storage (i.e. greater than 10 years) by state or territory regulator and has pre-approved management processes in place
- typically, not required to meet stockpiled waste 'clearance' requirements
- still under management by waste generator (i.e. liability has not been transferred to a third party/facility such as a hazardous waste landfill or isolation facility).

Figure 1 Defining hazardous waste stockpiling versus other fates of hazardous wastes



²⁵ The storage of the waste was planned and approved by environment regulators prior to placement including management requirements to protect human health and the environment.

15 National hazardous waste stockpiles dataset

This section provides the baseline dataset for hazardous waste stockpiles in Australia. The dataset focuses on listing the known major hazardous waste stockpiles in Australia (standing and recurrent) and describes their age, location, amount and composition. For completeness, this section also provides a baseline dataset for approved long-term on-site storages that this project has identified and analysed during project delivery.

Why include 'approved long-term on-site storages' in the dataset?

Following discussions with DoEE it was agreed to include these storages in the dataset, reported separately as a sub-total, for the following reasons:

1. Because these wastes do not leave the site, typically the wastes are not tracked via state waste tracking systems, and there may be no reporting of generation and disposal rates to state environment departments
2. These wastes typically differ from those sent off-site to a licensed landfill (for example) where there is a transfer of the waste 'ownership' and liability for the long-term management.

The section includes:

- important notes regarding the database publication
- an explanation of the dataset reporting (i.e. what is reported in each column for each stockpile or approved long-term on-site storages)
- the baseline dataset for both hazardous waste stockpiles and for approved long-term on-site storages
- a concise description of each material type stockpile and approved long-term on-site storage in alphabetical order.

Appendix B includes the dataset for each Australian state and territory.

The national dataset was derived from:

- a literature review and research completed by the authors
- consultation with state regulators
- consultation with the waste management industry
- consultation and validation of stockpile or storage data with stockpile/storages 'owners', where the owner could be clearly identified (i.e. where there is a small number of stockpiles/storages).

Appendix C details provides details of the stockpile or approved long-term on-site storage estimation methods (only as where required) to explain the assumptions and calculations that the authors have completed in providing the estimations.

15.1 Important notes regarding database publication

1. The dataset presented in this section is a summary presentation has been compiled for publication.
2. The dataset is sourced from a more detailed confidential database that has been developed for the project that includes information about each site. The detailed database information is not intended for publication by DoEE as it contains site specific information may be commercial-in-confidence.
3. The stockpile data is redacted (see red blocks) where the supporting data is commercial-in-confidence as there are few sites and/or stockpile 'owner' companies.
4. Note the 'data quality' assessment columns (see definitions below).

15.2 Explanation of dataset reporting

Table 4 provides details of each of the reporting columns that are included in the dataset.

Table 4 Explanation of dataset reporting

Reporting	Explanation
Est. tonnes	This is the estimate of the <u>total</u> tonnage of stockpiled or approved long-term on-site stored wastes in Australia or in each state and territory (Appendix B)
Est. average age (years)	This is the average age in years of all of the stockpiled or stored wastes by waste type.
Primary contam. or risk (NEPM)	This is the authors' understanding of the primary contaminant or risk of concern for each stockpile or storage waste type based on the <i>National Environment Protection (Movement of Controlled Waste between States and Territories) Measure, Schedule A List 1: Waste categories</i> .
Second. contam. or risk (NEPM)	This is the authors' understanding of the secondary contaminant or risk of concern for each stockpile or storage waste type based on the <i>National Environment Protection (Movement of Controlled Waste between States and Territories) Measure (Controlled Waste NEPM) Schedule A List 1: Waste categories</i> . For reference a list of the NEPM codes is included in Appendix D.
Hazwaste each state territory? (Y/N)	This is a simple 'yes' or 'no' analysis of the classification as a hazardous waste for each stockpile or storage type. If the waste is a classified as a hazardous waste (or the jurisdictional equivalent) in each state, then it is listed as yes. If any state or territory does not classify the waste as a hazardous waste then it is listed as no.
Primary reason for stockpiling or storage (suggested)	<p>This is a subjective assessment based on research and consultation of the most likely reason for the hazardous waste stockpiling or approved long-term on-site storage. The main reasons that the project has identified are included in full text below.</p> <ol style="list-style-type: none"> 1. Financial costs of processing 2. Lack of (or unstable) off-take markets 3. Limited technical ability to treat 4. Insufficient installed capacity for treatment 5. Insufficient regulatory controls 6. Market behaviour of processing companies to secure hazardous wastes and the associated gate fee, with insufficient or capacity to process the hazardous wastes 7. Historical industrial practices contaminating sites or building a stockpile that require clean up, with limited/no capital set aside to manage the legacy 8. Commodity linked strongly to global market and commodity prices

Reporting	Explanation
	9. Transport distances to processing facilities.
Secondary reason for stockpiling or storage (suggested)	This is a subjective assessment based on research and consultation of the secondary likely reason for the hazardous waste stockpiling or approved long-term on-site storage, based on the same list of reasons as identified above.
ANZISC code/s gen. sector	This refers to the Australian and New Zealand Standard Industrial Classification (ANZSIC) for the <u>generating</u> sector of the stockpile or storage.
Data quality ass.	Refers to the quality of the data and information gathered within the scope of this project. The quality is assessed as high, medium or low according to the groupings explained below. Data quality is presented as the percentage of stockpile or storage sites that are high, med or low (totalling 100% for each waste).
High	Most data supplied directly or from credible published sources with no additional estimates or assumptions required.
Med	Some data provided directly or from published sources and some additional data estimates or assumptions required.
Low	Most data estimated based on credible references but still requiring significant estimations and assumptions and therefore is of lower quality. Low quality data estimates need to be used with caution.

Table 5 National hazardous waste stockpiles and approved long-term on-site storage dataset

Hazardous waste stockpile waste type	Est. tonnes	Est. average age (years)	Primary contam. or risk (NEMP)	Second. contam. or risk (NEMP)	Hazardous waste in all States?	Primary reason for stockpiling or storage (suggested)	Secondary reason for stockpiling or storage (suggested)	ANZISC code/s gen. sector	Comments	Data quality ass.		
										High	Med	Low
Aluminium dross recycling salt cake		55	D300	D110	Y	4. Insuff. installed capacity to treat.	2. Lack of/unstable off-take market	21		100%		
Arsenic wastes (speiss)	17,000		D130		Y	2. Lack of/unstable off-take market	1. Financial costs of processing	21		100%		
Asbestos	3,020,000	54	N220		Y	7. Historical industrial practices	5. Insufficient regulatory controls	09			38%	63%
Contaminated biosolids	1,378,000	70	D150	D220	N	3. Limited technical ability to treat	7. Historical industrial practices	28		100%		
CRT glass		3	D220		Y	6. Processor market behaviour	1. Financial costs of processing	29	Stockpiles identified cleared		100%	
Dieldrin-impregnated timber	60,000	30	H100		Y	1. Financial costs of processing	3. Limited technical ability to treat	08		100%		
End-of-life tyres	696,250	3	T140		N	6. Processor market behaviour	2. Lack of/unstable off-take market	39				100%
E-waste		3	D220	M160	N	1. Financial costs of processing	6. Processor market behaviour	29	Stockpiles identified cleared		100%	
HCB	14,500	50	M160		Y	4. Insuff. installed capacity to treat.	7. Historical industrial practices	18	No tonnage data	100%		
Sig. Cont. Soils PFAS			N120		Y	3. Limited technical ability to treat	5. Insufficient regulatory controls	77	No tonnage data			100%
Mercury waste			D120		Y	6. Processor market behaviour	5. Insufficient regulatory controls	29	No tonnage data	83%		17%
PCB			M100		Y	3. Limited technical ability to treat		21	Stockpiles identified cleared			100%
PFOS			M160		Y	3. Limited technical ability to treat		76			57%	43%
Spent dry-cleaning solvents (PERC)					Y				None identified			
Spent pot liner	533,553	31	D110	A130	Y	1. Financial costs of processing	3. Limited technical ability to treat	21		100%		
Used lead acid batteries (auto & ind.)	25,983	3	D220	B100	Y	9. Transport distances to process	6. Processor market behaviour	29			100%	
Approved long-term storage waste type												
CSG salt brine wastes	9,543,000	8	D300		N	3. Limited technical ability to treat	1. Financial costs of processing	07		100%		
SiMn slag		20	D290		Y			21		100%		
Stockpiles only total:	6,204,366											
All total:												

Important: blank 'tonnage estimate' column does not mean zero tonnage stockpile

The list of stockpile waste types is based on research and consultation that found that there are likely stockpiles of each of these waste types in Australia. However, for some wastes there was insufficient information to provide an estimate. For example, there are significant PFAS contaminated soils sites around Australia that are likely to require clean-up, requiring treatment infrastructure capacity to clear the stocks. There was insufficient data available to provide an estimate for this significant stockpile of contaminated soils. See discussion below for further information about each waste type.

15.3 Waste types description

Below a concise description of each material type stockpile and approved long-term on-site storage is provide, in alphabetical order

Aluminium dross recovery salt cake wastes

US EPA 2015²⁶ provides the following description of salt cake wastes: “solid residues generated by the aluminium melting processes are often referred to as aluminium dross, which forms on the surface of molten aluminium through contact with oxygen during melting, holding, refining, and transfer processes. Dross obtained from primary melting operations (also known as “white dross”) consists primarily of aluminium oxide (with some oxides of other alloying elements, such as magnesium and silicon) and may contain from 15 to 70% recoverable metallic aluminium. Dross from secondary smelting operations (also known as “black dross”) typically contains a mixture of aluminium/alloy oxides and slag (a partially amorphous solid by-product of the smelting process) and contains approximately 12 to 18% recoverable aluminium. Commercial smelting of both white and black dross is often completed in a rotary salt furnace. The non-metallic by-product residue that results from such furnace slag is frequently termed “salt cake”, and contains only 3 to 10% residual metallic aluminium. The formation of salt cake and the amount of salt cake formed depend on several factors such as type and quality of input material (e.g., aluminium scraps), operating conditions, and technology applied” (page iv).

Arsenic waste (including speiss) from mineral processing

Arsenic occurs naturally in mineral form, usually with sulphur and valuable metals such as copper, lead and gold. Arsenic is an unwanted by-product of the mining and extraction of metals such as copper, lead, nickel and uranium, due to its presence in significant quantities in the ore. Flue dust from the roasting and smelting of these ores, called “bearing dust”, contains arsenic.

Elemental arsenic is unlikely to occur in pure form in Australia as most of its applications are either in its trivalent (As III, called arsenites) or pentavalent (As V, called arsenates) oxidation states, both typically present as solids. The former is its most hazardous form and the simplest trivalent arsenic compound, arsine gas, is extremely toxic.

Arsenic wastes would typically undergo chemical/ physical treatment to immobilise their hazard, then the stabilised material is usually disposed of in hazardous waste landfill.

‘Speiss’ is a mixture of impure metal arsenides and antimonides resulting from the smelting of ores such as cobalt and lead.

The US Department of Energy²⁷ explains the how speiss is formed. “The rough lead bullion may be separated into as many as four distinct liquid layers, depending on the sinter composition. The lead bullion (94 to 98 percent lead by weight) will collect at the bottom of the forehearth, with speiss (a mixture of the arsenides and antimonides of copper) above the bullion. Matte (primarily copper sulfide) collects above the speiss, and the slag (consisting of the oxides which were not reduced to the metallic state in the blast furnace) floats above the matte. Matte and speiss are sold to the operators of copper smelters for metal recovery” (page 6-5).

²⁶ US EPA *Secondary Aluminium Processing wastes: Salt cake characterization and reactivity* (US EPA 2015), available at: https://cfpub.epa.gov/si/si_public_record_report.cfm?dirEntryId=311174

²⁷ US Department of Energy, *Energy and Environmental Profile of the U.S. Mining Industry*, available at: https://energy.gov/sites/prod/files/2013/11/f4/lead_zinc.pdf

Asbestos

Asbestos includes products that contain asbestos and wastes contaminated with them. Asbestos is the name given to a group of naturally occurring minerals found in rock formations. Inhalation of asbestos fibres can cause respiratory problems that can be fatal. Asbestos-containing building products are classified as either 'friable' (soft, crumbly) or 'bonded' (solid, rigid, non-friable). Friable asbestos products may be as much as 100% asbestos fibres and can become airborne and inhalable very easily. Bonded products such as asbestos cement sheet (otherwise known as 'fibro') contain approximately 15% asbestos fibres, bonded with cement and do not normally release fibres into the air when in good condition.

Houses built before the mid-1980s are highly likely to have asbestos- containing products, between mid- 1980s and 1990 likely, and after 1990 unlikely.

Asbestos is one of the largest flows of hazardous waste in Australia and poses significant health risks. Asbestos waste includes both end-of-life asbestos-containing building materials as well as soil that has been tested to demonstrate asbestos contamination. Since the latter may involve very low asbestos fibre concentrations and very high soil volumes, this can greatly contribute to reported asbestos waste volumes.

Contaminated biosolids

Biosolids are a product of sewage sludge (the sludge collected from wastewater treatment) once it has undergone further treatment to reduce disease causing pathogens and volatile organic matter, producing a stabilised product.

Biosolids may be contaminated above guideline levels, which relate to both microbiological (treatment, T) hazard or chemical (contaminant, C) hazard. If levels of contamination are below acceptable limits (specified by each State and Territory in respective biosolids guidelines), biosolids can be recovered as a resource for various beneficial uses, such as agriculture (application to land), landscaping (of composted biosolids) and plantation forestry application.

Wastewater treatment is downstream of domestic sewer and greywater inputs and, in some cases, a number of industrial trade waste inputs, including landfill leachate discharge. Biosolids act as a collector and concentrator of those chemical species resident in the various input streams that partition to the solid phase and are not destroyed through the treatment process. This includes trace metals, nutrients and other substances of potential benefit (particularly to agricultural uses) but it can also include chemicals that have harmful or potentially harmful impacts on human health and the environment, such as heavy metals and various organic chemicals.

While not typically considered as hazardous waste, or even waste at all by some, it is widely accepted that some biosolids – particularly those generated in treatment plants servicing industrial areas – are contaminated with heavy metals at levels exceeding criteria set to protect environmental and human health values, that would (if they were soils for example) would classify them as a hazardous waste.

While the majority of biosolids in Australia are managed through application to land for beneficial reuse, there are stockpiled biosolids that have been graded as not suitable for this fate. The most significant of these is Victoria's Western Treatment Plant stockpile of biosolids contaminated in heavy metals.

CRT glass

CRT glass is glass from e-waste recycling of Cathode ray tube (CRT) screens, either from old model televisions or computer monitors (typically manufactured pre-2004), that contain high concentrations of lead. It comes from e-waste dismantlers/ recyclers, and may arise through intermediate storage facilities. CRT glass has the potential to be stockpiled because it contains a hazard (lead) with a management/disposal cost attached. Copper, plastics and non-lead containing glass, along with precious metal-rich circuitry, are examples of recoverable e-waste components that drive the economics of its recycling.

CRT glass can be managed as an input feed into base metal smelting, although the weight of the lead-containing waste carries a transport cost that can impact the feasibility of management options.

CSG salt brine wastes

Coal seam gas (CSG) mining currently occurs predominantly in Queensland and to a lesser extent in NSW. Consequently, the majority of CSG-based waste is generated in Queensland, in the Bowen and Surat Basins.

The CSG extraction process produces a range of wastes, but salty/ brine wastes are the most significant.

Water is extracted as part of the CSG mining process because the gas – methane – is in the coal seam and held there at great pressure by water and other sediment layers. To release the gas, the water needs to be pumped out of this coal seam and up to the surface in a process known as 'dewatering'. The water that is pumped out as part of the CSG mining process is very salty and may contain a range of petroleum and mineral based chemical compounds, such as heavy metals and hydrocarbons.

CSG extraction waters appear to be managed mainly in large scale evaporation ponds or dams (called aggregation dams or brine storage dams), typically located onsite. **CSG salt brine wastes** are the residue of the desalination of extraction waters that were deposited in much higher volumes in ponds. An estimated 9.5 Mt of salt brine waste has been deposited in Australia over the last 10 years.

Dieldrin-impregnated timber

Dieldrin is an organochlorine pesticide, or more specifically an insecticide, typically used in agricultural and related settings from the 1950s up until the 1970s. However, it is also an extremely persistent organic pollutant, which tends to biomagnify as it is passed along the food chain. Long-term exposure has proven toxic to a very wide range of animals including humans, far greater than to the original insect targets.

In the past dieldrin has been used to prevent termite and related insect damage to wooden fence posts, railway sleepers and other wooden infrastructure on a large scale. There are likely to be several examples around Australia of stores of old railway sleeper timbers in large quantities, with no clear market to deal with the problem.

End-of-life-tyres

Waste tyres, or end of life tyres (EOLTs), are used, discarded or rejected tyres that have reached the end of their useful life, i.e., when they can no longer be used for their original purpose, and are subsequently removed from a vehicle.

Regulatory data suggests that EOLTs are typically recycled, landfilled or stored. It is noted that tyres have gained the more recent attention of regulators due to the number of illegal stockpiles, which

undoubtedly grew through arisings that occurred outside the regulatory system. Vic data²⁸ confirms an illegal management problem, quoting a rate of tyre recycling in Australia around 20%, with another 26% exported and 54% unaccounted for and presumed to be either stockpiled or illegally dumped.

E-waste

Waste electronic or electrical equipment, known in Europe as WEEE and in Australia as e-waste, is made up of a large array of end of life e-goods that have reached the end of their functional life. These range from mobile phones to televisions, photocopiers to toasters and even potential future waste streams such as end of life solar panels (photovoltaic cells).

In Australia, The National Television and Computer Recycling Scheme (NTCRS) exists as a co-regulatory product stewardship program to fund and foster greater recycling of televisions and computers and their peripheral components. While the program has been successful in increasing the rate of recycling of these end of life goods, there have been inevitable fluctuations in market supply and demand, overshoot (or under delivery) of recycling targets and other market/ program imperfections that have affected equipment value in the marketplace from time to time. These have had the potential to result in accumulated e-waste stockpiles.

E-waste, in the form of whole items of equipment, are not typically considered hazardous waste. However, individual components are known to contain hazardous substances such as heavy metals and brominated flame retardants which, once dismantled could be regarded as hazardous waste in certain (inadequate) management circumstances if substances are present at concentrations that could cause them to exhibit hazardous characteristics.

HCB

Chemical manufacturing company Orica have historically stockpiled hexachlorobenzene (HCB) at their Botany Industrial Park site in Sydney. HCB was generated as a waste by-product in solvent and plastic manufacturing plants at the site between 1963 and 1991.

Orica worked on applications to export the waste for destruction in high-temperature incinerators in Europe between 2006 and 2010. However, in December 2010, the Danish Government made a decision to cancel its approval for the environmentally sound destruction of Orica's HCB waste at a treatment facility in Denmark. No acceptable management solution – whether destruction or more appropriate storage – has been implemented many decades since this material began accumulating, including a third bid for export and destruction- this time in France – in 2014. As of 2016, Orica has begun a fourth process to seek approval for shipment of a portion of the stockpile to a facility in Finland.

It is one of the world's largest remaining HCB stockpiles that continues to grow due not to a continuation in manufacturing but because of periodic re-containerisation requirements to ensure safe storage, which results in the old, used packaging becoming a new toxic component of the stockpile.

²⁸ EPA Victoria *Storage of waste tyres – Regulatory impact statement (RIS)* (2014). Publication number 1576.

Mercury waste

Mercury is used in its pure form in thermometers and barometers, some batteries, fluorescent lighting, as a catalyst in the chemical manufacturing industry, in thermostats and dental amalgams. It has also been used in the mining industry to extract gold and silver ores.

Mercuric chloride is used in the manufacture of disinfectants, as a catalyst, in photography and embalming. Mercury salts are sometimes used in skin lightening creams and as antiseptic creams and ointments.

Wastes of mercury compounds in Australia include end of life fluorescent light tubes and healthcare sources, as well as spent catalysts from chemical, petrochemical and mining industries. While volumes generated in Australia are very small, this waste has been singled out due to its inherent hazard, as evidenced by the *Minamata Convention on Mercury*.

PCB

Polychlorinated biphenyls (PCBs) are a group of halogenated compounds similar to other persistent organic pollutants listed on the Stockholm Convention for Persistent Organic Pollutants (POPs), such as organochloride pesticides, dioxins and furans and, more recently, brominated flame retardants and PFOS (see below).

PCB wastes consist of any materials contaminated with PCBs and are dominated by waste oils.

The waste was historically generated in the electricity industry where PCBs were used as insulating and heat-conducting fluids in transformers and other electrical installations. Starting in the late 1980s the equipment was drained and refilled with paraffin oil. Because PCBs were not completely removed, the result was residual PCBs in paraffin oil. PCBs were also used in small items such as capacitors and fluorescent-lighting ballasts, meaning that PCBs can also be an issue in e-waste.

PCBs were removed from service in the 1980s and 1990s, but there still remains paraffin oil contaminated with commercial PCB mixtures, albeit at lower volumes in the present day, as older electricity and related infrastructure are replaced or remediated. PCBs in oils are managed in Australia through separation and destruction technologies, the latter to destroy the chlorinated nature of the hazard. Both Victoria and NSW closely control movements of these wastes through PCB-specific notification legislative instruments, that derive from the national PCB Management Plan introduced in 1996.

The waste treatment industry noted that the bulk of the PCB stockpile has been processed in Australia. However, stockpiling was still identified by some and there are still some PCB stocks to be destroyed. Insufficient information was identified during by this project's consultation and research scope to provide an estimate of the PCB stockpile in Australia.

PFOS (part of PFAS group of chemicals)

Australia is a party to the Stockholm Convention on Persistent Organic Pollutants (POPs), which aims to protect human health and the environment from the effects of these chemicals. Australia is currently in the process of deciding whether to ratify new chemicals added to the Convention since 2009. Should it decide to do so, new wastes contaminated with elevated levels of POPs might need to be managed as hazardous, some of which are not currently managed in this way. Perfluorooctane sulfonate (PFOS) is one such newly added POP chemical, which has been used in various mist dispersal and surface coating applications, including (significantly) firefighting foams, since mid-last century.

POPs are hazardous and environmentally persistent substances which can be transported between countries by the earth's oceans and atmosphere. POPs accumulate in living organisms and have been traced in the fatty tissues of humans and other animals.

PFOS has gained more attention than the other newly listed POPs in the last couple of years in particular, due to a number of incidents involving fish kills and other environmental and human health concerns emanating from spills of fire-fighting foams that contain PFOS – known as AFFF (aqueous film forming foam). PFOS is particularly toxic to aquatic environments - the recently released *draft Commonwealth Environmental Management Guidance on Perfluorooctane Sulfonic Acid (PFOS) and Perfluorooctanoic Acid (PFOA)* (DoEE 2016) quotes particularly stringent environmental water guideline values for PFOS, on account of its high water-species ecotoxicity compared to other POPs – near the limit of laboratory protection for 99% species protection.

Australian jurisdictional governments have recently joined forces to establish a National Management Plan for PFASs (poly and per fluorinated alkyl substances, a family of chemicals similar to and including PFOS), such is the urgency for clearer guidance on its better management.

The PFOS line item in the national database refers to the stockpile of the chemical in its concentrated or product form, as opposed to soils or groundwater that is contaminated with PFOS (refer to significant contaminated soil waste stockpiles (PFAS contamination) description below).

Reference materials used to estimate the PFOS stockpile are confidential and therefore the PFOS tonnage data has been redacted.

Significant contaminated soil waste stockpiles (PFAS contamination)

Contaminated soils typically are the result of poorly controlled historical industrial practices. The highly-varied types and levels of contamination make contaminated soils difficult to describe through a common set of attributes or characteristics. The waste stream is generated predominantly from construction and demolition activities, often involving property development, but they also come from industrial sites, petrol stations, as well as utilities such as the electricity supply industry.

Contaminated soils are the largest hazardous waste generated in Australia (around 1.5M tonnes arising in 2014-15).

There have been many instances of historical soil contamination with major consequences, and clean-up costs. These soils could be contaminated with any waste or contaminant on the NEPM list, but key contaminants include hydrocarbons, organic solvents, heavy metals, pesticides, halogenated organic chemicals, asbestos and cyanide.

Where contaminated soil is removed from the site, it is usually managed by landfilling although this depends on the level and nature of their contamination. Those containing volatile organic compounds such as from petroleum contamination may be remediated through techniques such as thermal desorption, while those shown to exhibit high levels of contaminants may be required by State-based legislation to be treated in some form to encapsulate or otherwise immobilise the waste's hazards, to mitigate the risk of subsequent leaching of contaminants in a landfill environment.

The remaining 'stocks' of Australia's contaminated soils mostly resulted from historical industrial practices and remain in-situ and are difficult to define and estimate (tonnages). Unpublished studies completed by the authors found that there is a large 'stock' of contaminated soils in and around metropolitan areas in particular. However, depending on proposed land use of the site being

developed, contaminated soils are not always required to be removed and hence contribute to the 'stockpile' of contaminated soils requiring treatment.

As agreed with DoEE, this project will not provide an estimation of the total remaining stocks of contaminated soils, rather, it focuses on 'significant' contaminated soils stockpiles that are known to exist and where it is likely that the soils will have to be treated in the near to medium term.

There is value in reporting on significant contaminated soils waste stockpiles that have a known volume of soils that will require treatment. Significant contaminated soils stockpiles requiring treatment have the potential to impact on treatment infrastructure capacity and capability needs and where the information is readily available from EPA's they are included in the database.

During consultation with EPA's and the waste treatment industry, the significant stock of **PFAS (poly and per fluorinated alkyl substances)**²⁹ contaminated soils that requires treatment was consistently raised (by all states) as a concern and an active area of site assessment and current and future site clean-up.

The PFAS contaminated sites range from airports, industry, emergency services and defence. The contamination of the sites is typically a result of using (both during actual and simulated fire events) or spilling aqueous film forming foams (AFFF) with a high concentration of PFOS.

Whilst it is clear that there are numerous PFAS contaminated sites around Australia, and a stockpile of PFAS impacted soils and groundwater that will likely required treatment, insufficient information was identified during this project's consultation and research to provide an estimate of this stockpile in Australia.

Silicomanganese (SiMn) alloy slag

SiMn is mostly used in steelmaking as an alloying element, which improves properties like strength and toughness. SiMn is also used in steelmaking for its properties as a deoxidant³⁰ and for preventing the formation of iron sulphides which can cause surface cracking in the steel.

SiMn alloy slag, is the main waste product from the smelting processes used to generate SiMn. **CIC**.

Spent dry-cleaning solvents (PERC)

Perchloroethylene, otherwise known as tetrachloroethylene or 'perc', is the principle synthetic solvent used in commercial dry-cleaning. While it is non-flammable, it can be dangerous in a fire situation because it decomposes upon heating and exposure to UV light to give phosgene and hydrochloric acid, and can react violently with finely dispersed metals such as aluminium.

Because perc is the primary raw material in dry cleaning, there is potential for its storage on a reasonable scale in the industry, which may involve fire risk, particularly if co-located with heating infrastructure such as commercial scale driers and laundries.

Some stockpiling of PERC in Australia is likely, however, insufficient information was identified during by this project's consultation and research scope to provide an estimate of this stockpile in Australia. It should be noted that both environmental regulators and waste industry consultees did not identify any stockpiles of PERC.

²⁹ PFASs are a family of chemicals similar to and **including PFOS**, see the PFOS description.

³⁰ To remove the oxygen content during steel manufacturing. Deoxidation is important in the steelmaking process as oxygen is often detrimental to the quality of steel produced.

Spent pot liner

Spent pot lining (SPL) is a waste material generated from aluminium smelters, of which there are four in current operation (in Vic, NSW, Qld and Tas) and two recently closed (in Vic and NSW). Aluminium smelting is the extraction of aluminium metal from aluminium oxide (also known as alumina). This process takes place in electrolytic cells that are known as pots. During the operation of the cell, substances, including aluminium and fluorides, are absorbed into the cell lining. After some years of operation, the pot lining fails and is removed. The removed material is SPL, a hazardous waste due to:

- toxicity – leachable fluoride and cyanide compounds, with fluoride levels often around 10%
- corrosiveness – high pH due to the presence of alkali metals and oxides
- reactivity with water – producing toxic, explosive, and inflammable gases

The toxic, corrosive and reactive nature of SPL means that particular care must be taken in its handling, transportation and storage. SPL has been recognised as a major environmental concern for the industry for decades, but has recovery potential because of its fluoride, energy and, to a lesser extent, aluminium content.

SPL is sometimes heat-treated prior to transport to recycling/ re-processing fates to remove cyanides and flammability risk, but not fluorides, hence the convention to record it in hazardous waste tracking systems as *D110 Inorganic fluorine compounds excluding calcium fluoride*.

Poor management practices such as landfilling of SPL date back to the decades prior to the early 1990's, but SPL has been stored onsite in covered shedding since then. While this may be appropriate for safe (short-term) storage, onsite stockpiling in sheds is not a long-term solution for SPL management, where the SPL remains exposed to risks such as extreme weather events.

Used lead acid batteries (auto and industrial)

The stockpiles data provided is for automotive batteries (used for vehicle starting, lighting and ignition) and for large industrial batteries (used as backup power supplies in many situations, including storing the energy captured from solar panels).

Lead acid batteries were invented in 1859 and are the oldest type of rechargeable battery. They involve the use of lead sheet plates as electrodes and dilute sulfuric acid as the electrolyte. Once a lead acid battery reaches end of life (spent or used lead acid battery, ULAB) the electrolyte is very dilute but the lead hazard remains.

Despite having a very low energy-to-weight ratio and a low energy-to-volume ratio, its ability to supply high surge currents means that the cells have a relatively large power-to-weight ratio. These features, along with their low cost, makes it attractive for use in motor vehicles to provide the high current required by automobile starter motors. Lead acid batteries are also used to a lesser extent in smaller applications such as tools and lighting as well as in large industrial batteries as backup power supplies.

Where economics enables it, ULABs are typically bound for recycling/ recovery in fit for purpose smelting operations. They originate from a broad range of industries, including vehicle intensive ones such as mining and transport-related businesses, but usually via collection programs facilitated by metal and other resource recovery companies.

16 Conclusions

Overall

Part of the project scope was to develop a better definition of a hazardous waste 'stockpile'. In defining a stockpile, it became clear that distinction is required between a 'stockpile' and an 'approved long-term on-site storage'.

There are an estimated 6.2 million tonnes of 'hazardous waste'³¹ in stockpiles around Australia. It should be noted that the stockpile number would likely be significantly higher if data were available for PFAS contaminated soils and groundwater in Australia. When approved long-term on-site storages are included, more than double the tonnages (CIC) of hazardous waste are estimated to be either stockpiled or in approved long-term on-site storages in Australia.

CIC

Reporting and discussion of both stockpiles and approved long-term on-site storages has merit, but they need to be reported as separate line items and it needs to be recognised that in most instances 'clearance' requirements are not applied to approved long-term on-site storages.

The main reasons for reporting approved long-term on-site storages in the dataset, reported separately as a sub-total, include:

1. As these wastes do not leave the site, typically the wastes are not tracked via state waste tracking systems, and there may be little or no reporting of generation and disposal rates to state environment departments
2. These wastes typically differ from those sent off-site to a licensed landfill (for example) where there is a transfer of the waste 'ownership' and liability for the long-term management.

Of the estimated 6.2 million tonnes of stockpiled wastes in Australia some 72% of the wastes are asbestos waste and contaminated biosolids. Spent pot lining from aluminium smelting and end-of-life tyres both make up about 10% each and the remaining waste types combine to make up 5% of the 6.2 million tonnes.

It is important not to focus too much on the total tonnages of different hazardous wastes. For example, the HCB stockpile at 15,000 tonnes, or just 0.2% of the 6.2 million tonne stockpile, is not a significant proportion. However, this is reportedly the largest stockpile of HCB in the world and it is highly hazardous and has been extremely difficult to manage and is likely to be exported for treatment due to a lack of local treatment infrastructure capabilities and development.

Average age

The average age for both stockpiles and approved long-term on-site storages is around 28 years. Stockpiles and storages resulting from older industrial development in Australia include contaminated biosolids (70 years), asbestos, and HCB (50 years), followed by waste from alumina and aluminium production at around 40 years. Waste from oil and gas production have been stockpiled or stored over the past decade or more.

³¹ Refer to definition included in Section 2

More recently stockpiling of e-waste has become an issue with the changeover of products such as CRT TVs.

The analysis has assumed a limited stockpiling period for some wastes, such as end-of-life tyres and used lead acid batteries. After three years these wastes are assumed to be either recovered or permanently 'lost' to an unknown fate (tyres).

Contaminant types

Looking at the Controlled Waste NEPM codes by number of listings, the D codes (inorganics chemicals /metals) dominate making up 50%, followed by M codes (organic chemicals) and N codes (soils and sludges) at 14 % each.

Reasons for stockpiling and long-term on-site storage

The most frequent primary reason identified for both stockpiling and long-term on-site storage was limited technical ability to treat the waste type at around 30%. This was listed almost twice as many times as financial costs of processing, lack of/unstable off-take market, or processor market behaviour which were all listed for about 15% of the waste types.

Interestingly, a lack of regulation was listed as the most common secondary reason at almost 30%, followed by financial costs of processing at around 20% and limited technical ability to treat, and processor market behaviour both at around 10%.

These results suggest that Australia's waste management industry is well established enough to treat hazardous waste stockpiles, but is often limited by capabilities. More elaborate treatment capabilities typically require significant capital and have high gate fees. The results suggest a lack of regulatory drivers and controls for some waste could be impacting on the waste industries' investment in additional capabilities.

Generating industry sectors

Around 30% of stockpiles and approved long-term on-site storages listed were generated by ANZSIC code 21 *Primary Metal and Metal Product Manufacturing* reflecting the high rate of NEPM 'D' waste type contamination. ANZSIC code 29 *Waste Collection, Treatment and Disposal Services* accounted for around 20% of listing and code 7 *Oil and Gas Extraction* accounted for around 15% of listing.

Missing stockpiles data

This project aimed to build a baseline dataset and analysis and it was not expected that all stockpiles listed would have full account. The stockpile number would likely be significantly higher if data were available for:

- PFAS contaminated soils and groundwater in Australia
- Other mining and minerals waste that are not reported here.

Stockpile prevention, management and clearance policy in Australia

Analysing the policy frameworks in Australia, the US and EU for stockpile prevention, management and clearance resulted in identifying a set of 'key elements' which allowed for a targeted literature review and collation of comparable information across jurisdictions. This collation enabled the identification of issues, innovations and opportunities for improvement in how Australia prevents, manages and clears hazardous waste stockpiles and

Table 6 provides a summary.

Table 6 Summary of policy key elements and implementation

Key element	Discussion/findings
1. Generator hazardous waste minimisation reporting required	Hazardous waste minimisation plans are not required in Australia. However, the waste hierarchy is legislated in all jurisdictions, which prioritises waste minimisation. Note: US EPA have set up a sliding scale of requirements for waste minimisation, <u>and all other elements discussed below</u> , based on the amount and toxicity of the waste being stockpiled.
2. Licence/permit required to stockpile hazardous waste	In all Australian jurisdictions and in many developed countries sites that are generating and/or stockpiling hazardous wastes (such as liquid wastes and chemically intractable solid wastes) are required to have an environmental permit or licence in place.
2.1. EOLT licence required to stockpile	EOLT stockpiling is licensed in all Australian jurisdictions apart from Qld and Tas. However, the thresholds of storage that are regulated vary significantly from about 1 tonne in WA up to 40 tonnes in Vic. Both SA and NSW regulate storage of EOLT stockpiles of 5 tonnes.
2.2. 'Mass balance' reporting and upfront landfill levy liability to receive wastes	NSW is the only Australian jurisdiction to have implemented 'mass balance' reporting and upfront levy payment for waste stockpiles. SA is likely to implement a similar system in 2017. The landfill levy is payable if: the stockpile of material remains unprocessed for 12-months; is stockpiled above lawful limits; waste is transported for unlawful disposal.
3. Hazardous waste tracking (transport and receipt)	All Australian jurisdictions, apart from ACT, Tas, NT, and many developed countries track the collection, transport, and receipt of hazardous wastes (such as liquid wastes and chemically intractable solid wastes).
3.1. EOLT tracking (transport and receipt)	EOLTs collection, transport and receipt is tracked in NSW, Qld, SA and WA only. ACT, Tas, NT and Vic do not track EOLTs. Vic is the only large and populous state in Australia that do not track EOLT and this has likely contributed to the significant stockpiling issue for EOLT in Vic.
4. Enforcement against illegal dumping	A dedicated resource to enforce against illegal dumping was only identified in NSW, SA and Vic. We note that all states have the ability to fine or prosecute offenders, however, this element refers to dedicated resources to actively find and prosecute offenders.
4.1. Specific policy to recover illegally obtained economic benefit from stockpiling	South Australia is proposing to introduce specific policy that will outline the specific circumstances, method and process for the recovery of funds from illegal stockpiling. This should be a more effective deterrent than a general head of power to recover profits made from 'breaking the law'.
5. Landfill levy	Most jurisdictions have a landfill levy in place, Qld, Tas, and NT do not. The cost of landfilling in Qld, Tas, and NT is therefore generally cheaper than other states. Asbestos levy: it is widely accepted that the best fate for waste asbestos is disposal to a licensed landfill. Government policy settings should to be set to encourage the safe disposal of asbestos to a licensed landfill. WA and SA (since July 2017) have implemented a \$0 landfill levy for waste asbestos containing material (ACM) (e.g. roofing, cement sheeting) disposal. All other jurisdictions with a landfill levy (Vic, NSW) still levy waste asbestos disposal to landfill. ACT landfill fees also apply to waste asbestos loads.
6. Stockpile quantity limits set for all sites	US EPA set a limit of 6 tonnes for storage from small quantity generators and have no limit for large generators. NSW and SA (under proposed reforms) set the limits on a case by case basis, depending on the waste type.

Key element	Discussion/findings
6.1. EOLT stockpile quantity limit set for all sites	ACT set a tonnage limit of 25 for EOLT storage, Vic sets a limit on the volume of EOLT that can be stockpiled, NSW and SA set the limit within the site license.
7. Stockpiling time limits set for all sites	US EPA sets explicit time limits on stockpiling of 90 days for large generators and for small generators 180 days or 270 days (if transporting greater than 200 miles). NSW and SA (under proposed reforms) require payment of landfill levy after 12 months. Whilst this is not a time limit per se, after this time the NSW and SA would be able to require removal of the material from the site, as it is effectively being treated as a waste disposed to landfill.
8. Reporting required on stockpile status and change	NSW and SA (under proposed reforms) require annual report of stockpile status under the mass balance and upfront levy liability framework. US EPA require biannual reporting from large generators and Wales in the UK require sites to apply for a new permit to stockpile wastes every 12 months, effectively requiring annual reporting.
9. Stockpile site controls required	All jurisdictions in Australia and most developed countries have stockpile site control requirements in place. Controls including bunding for liquid waste, dust control, and prohibition on mixing or diluting hazardous wastes. Whilst these requirements are common, how effectively they are enforced varies significantly.
10. Emergency plan required for stockpiles	US EPA is the only jurisdiction that has published required emergency planning for hazardous waste generators for stockpiles. SA provide some guidance for emergency planning and NSW EPA commented that it is required in licences for higher risk sites. However, no Australian jurisdiction has published requirements for emergency planning for stockpiles, including specification of minimum equipment onsite, maintenance, and planning with local emergency departments.
10.1. EOLT fire plan required	Vic, Qld, SA and NSW all have guidelines and or requirements in place to prevent and manage fire at EOLT stockpiling sites. No guidance or requirement was identified in ACT, NT, Tas, or WA to specifically manage the risk of fire at EOLT sites.
11. Financial assurance for site clean-up	The US EPA, under US Code of Federal Regulations (CFR) section Subpart H—Financial Requirements requires a financial assurance to cover both site clean-up and site aftercare. All Australia jurisdictions have a legislative framework in place to require financial assurances. There is however, significant variability in the application of this legislation it should not be assumed that all hazardous waste stockpiles in Australia have a financial assurance in places to cover the cost of clean-up.
12. Government trust or funds set up to deal with abandoned stockpiles/contaminated site	The US Superfund is a trust funds established to clean-up contaminated sites (stockpiles). No Australian jurisdictions have set up central trusts to specifically fund clean-up of abandoned sites, preferring the site-specific financial assurance approach. NSW EPA commented that the NSW Environmental Trust has provided site clear-up funds in the past. However, this funding appears to be incidental as opposed to a permanent and dedicated contaminated site fund.

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Appendix A Gaps in jurisdictional waste tracking systems

Jurisdictional tracking by NEPM 75 analysis

		Status of waste tracking by jurisdiction tracking system					Tracked	Not tracked	Not fully tracked
15 code & description	75 code and description (NEPM Schedule A, List 1)	NSW	Qld	SA	Vic	WA			
A Plating and heat treatment	A100 Waste resulting from surface treatment of metals & plastics								
	A110 Waste from heat treatment & tempering operations containing cyanides								
	A130 Cyanides (inorganic)								
B Acids	B100 Acidic solutions or acids in solid form								
C Alkalis	C100 Basic solutions or bases in solid form								
D Inorganic chemicals	D100 Metal carbonyls								
	D110 Inorganic fluorine compounds excluding calcium fluoride								
	D120 Mercury; mercury compounds								
	D130 Arsenic; arsenic compounds								
	D140 Chromium compounds (hexavalent & trivalent)								
	D150 Cadmium; cadmium compounds								
	D160 Beryllium; beryllium compounds								
	D170 Antimony; antimony compounds								
	D180 Thallium; thallium compounds								
	D190 Copper compounds								
	D200 Cobalt compounds								
	D210 Nickel compounds								
	D220 Lead; lead compounds								
	D230 Zinc compounds								
	D240 Selenium; selenium compounds								
	D250 Tellurium; tellurium compounds								
	D270 Vanadium compounds								
	D290 Barium compounds (excluding barium sulphate)								
	D300 Non-toxic salts								
	D310 Boron compounds								
	D330 Inorganic sulfides								
	D340 Perchlorates								
	D350 Chlorates								
	D360 Phosphorus compounds excluding mineral phosphates								
E Reactive chemicals	E100 Waste containing peroxides other than hydrogen peroxide								
F Paints, resins, inks, organic sludges	F100 Waste from production, formulation & use of inks, dyes, pigments, paints, lacquers & varnish								
	F110 Waste from the production, formulation & use of resins, latex, plasticisers, glues & adhesives								
G Organic solvents	G100 Ethers								
	G110 Organic solvents excluding halogenated solvents								
	G150 Halogenated organic solvents								
	G160 Waste from the production, formulation & use of organic solvents								
H Pesticides	H100 Waste from the production, formulation & use of biocides & phytopharmaceuticals								
	H110 Organic phosphorous compounds								
	H170 Waste from manufacture, formulation & use of wood-preserving chemicals								
J Oils	J100 Waste mineral oils unfit for their original intended use								
	J120 Waste oil/water, hydrocarbons/water mixtures or emulsions								
	J160 Waste tarry residues arising from refining, distillation, & any pyrolytic treatment								
K Putrescible/ organic waste	K100 Animal effluent & residues (abattoir effluent, poultry & fish processing wastes)								
	K110 Grease trap waste								
	K140 Tannery wastes (incl. leather dust, ash, sludges & flours)								
	K190 Wool scouring wastes								
M Organic chemicals	M100 Waste substances & articles containing or contaminated with polychlorinated biphenyls, polychlorinated biphenyls, polychlorinated dibenzodioxins, polychlorinated dibenzofurans, polychlorinated dibenzodioxins, polychlorinated dibenzofurans, polychlorinated dibenzodioxins, polychlorinated dibenzofurans								
	M150 Phenols, phenol compounds including chlorophenols								
	M160 Organo halogen compounds—other than substances referred to in this Table or Table 2								
	M170 Polychlorinated dibenzo-furan (any congener)								
	M180 Polychlorinated dibenzo-p-dioxin (any congener)								
	M210 Cyanides (organic)								
	M220 Isocyanate compounds								
	M230 Triethylamine catalysts for setting foundry sands								
	M250 Surface active agents (surfactants), containing principally organic constituents & which may contain inorganic constituents								
	M260 Highly odorous organic chemicals (including mercaptans & acrylates)								
N Soil/ sludge	N100 Containers & drums that are contaminated with residues of substances referred to in this list								
	N120 Soils contaminated with a controlled waste								
	N140 Fire debris & fire wash waters								
	N150 Fly ash, excluding fly ash generated from Australian coal fired power stations								
	N160 Encapsulated, chemically-fixed, solidified or polymerised wastes referred to in this list								
	N190 Filter cake contaminated with residues of substances referred to in this list								
	N205 Residues from industrial waste treatment/disposal operations								
	N220 Asbestos								
	N230 Ceramic-based fibres with physico-chemical characteristics similar to those of asbestos								
	N240 Waste from the production & preparation of pharmaceutical products								
R Clinical and pharmaceutical	R100 Clinical & related wastes								
	R120 Waste pharmaceuticals, drugs & medicines								
T Miscellaneous	T100 Waste chemical substances arising from research & development or teaching activities, including teaching materials								
	T120 Waste from the production, formulation & use of photographic chemicals & processing materials								
	T140 Tyres								
	T200 Waste of an explosive nature not subject to other legislation								

Appendix B Jurisdictional hazardous waste stockpiles and approved long-term on-site storage dataset

CIC

Appendix C Stockpile/ approved long-term on-site storages estimations

For some waste types, no publicly available estimates of tonnages were available. In these cases, an estimation of tonnage has been derived based on a number of assumptions. These are described below.

End-of-life tyres

As discussed in Appendix A, the EPA Vic 2014 data confirms an illegal management problem, quoting a rate of tyre recycling in Australia around 20%, with another 26% exported and 54% unaccounted for and presumed to be either stockpiled or illegally dumped.

EPA Vic 2014 also provides an estimate of the actual existing EOLT stockpile and includes the following on page 17.

“2.3.6 Owners of stockpiles as an end point or for long-term storage

Stockpiles as an end point or for long-term storage may occur in order to avoid the costs of appropriate disposal. While there are reports estimating the annual number of tyres entering stockpiles in Australia and one recent report for Victoria, there is sparse evidence on the ‘stock’ of tyres in stockpiles or the flow of tyres in and out.

In 2013, an initial estimate of the number and size of tyre stockpiles across the state, was developed through a survey with Victorian councils and catchment management authorities (CMAs). EPA and the Victoria Fire Services (MFB / CFA) also undertook joint inspections to better understand the different cases and patterns of stockpiling of waste tyres in Victoria.

A sample of the results of this research is shown in Table 2. The table also highlights which stockpiles appear to be stored for the long-term or an end point. **This shows in 2013, an estimated 14 million tyres stockpiled in Victoria**, with the majority of these being in one site and numbering up to 9 million. The true number could be much higher than this as not all councils and CMAs responded (66 per cent response rate of the 79 councils and 11 CMAs surveyed). Also, these numbers are based on general visual estimates of the number of tyres in a stockpile rather than a direct count, which could result in a higher or lower estimate....

It is estimated that 11 million EPU of end-of-life tyres were generated in Victoria in 2013. With 54 per cent of these tyres believed to be either stockpiled or illegally dumped, the best estimate of the number of tyres that were added to Victorian stockpiles in 2013 is about 6 million EPU. Each year a proportion of these waste tyres added to Victorian stockpiles will be cleaned up, disposed of, reused, recycled or exported, although reliable estimates of these volumes are not currently available.

Even so, we estimate that there are approximately 14.0 million waste tyres currently in Victorian stockpiles and there is anecdotal evidence that tyre stockpiles have been increasing over time...”

Vic 2014 estimated the EOLT stockpile at approximately 2.5 times the annual arisings, suggesting that a reasonable benchmark for the existing stockpile of EOLTs in each state and territory is 2.5

times the annual arisings. EOLT have been stockpiled for longer than 2.5 years, however, with time the stockpiled EOLT should reach a final fate, which may include illegal landfills onsite.

For each jurisdiction, the existing stockpile of EOLTs that are likely to be still be readily accessible for clean-up is assumed to be 2.5 times the most recent data for unaccounted EOLT. REC 2017 provides the most recent set of EOLT arising and fate data. Importantly REC 2017 also estimated that nationally around 63% of EOLT were unaccounted for (i.e. sent to unknown fates which includes stockpiling). REC 2017 estimated that 55% of EOLT in Vic were unaccounted for (consistent with the Vic 2014 findings).

PFOS – stocks of PFOS-containing AFFF concentrates

CIC

Used lead acid batteries (ULAB) (auto and industrial)

- ABRI 2010 provided the estimate for tonnages of automotive and industrial ULAB stockpiling in 2010 (both informal and formal).
- Stockpiling is assumed to have remained at the same rate since 2010.
- Assumed three years of ULAB stockpile accumulation before clearing, i.e. the total stockpile is assumed to be three times the estimated annual stockpiling amount.
- No state and territory splits are provided in the public ABRI 2010 report and population was not used to estimate each jurisdiction's proportion of the national stockpile. It is understood that stockpiling of ULABs is more of an issue in WA and NT and less of an issue in the eastern states (stockpiling is due mainly to transport distances to processing facilities).

Appendix D Movement of Controlled Waste between States and Territories

NEPM, Schedule A List 1: Waste categories

NEPM "15" Waste Type		NEPM "75" Code	Waste Description
A	Plating and heat treatment	A100	Waste resulting from surface treatment of metals and plastics
		A110	Waste from heat treatment and tempering operations containing cyanides
		A130	Cyanides (inorganic)
B	Acids	B100	Acidic solutions or acids in solid form
C	Alkalis	C100	Basic solutions or bases in solid form
D	Inorganic chemicals	D100	Metal carbonyls
		D110	Inorganic fluorine compounds excluding calcium fluoride
		D120	Mercury; mercury compounds
		D130	Arsenic; arsenic compounds
		D140	Chromium compounds (hexavalent and trivalent)
		D150	Cadmium; cadmium compounds
		D160	Beryllium; beryllium compounds
		D170	Antimony; antimony compounds
		D180	Thallium; thallium compounds
		D190	Copper compounds
		D200	Cobalt compounds
		D210	Nickel compounds
		D220	Lead; lead compounds
		D230	Zinc compounds
		D240	Selenium; selenium compounds
		D250	Tellurium; tellurium compounds
		D270	Vanadium compounds
		D290	Barium compounds (excluding barium sulphate)
		D300	Non-toxic salts
		D310	Boron compounds
		D330	Inorganic sulfides
		D340	Perchlorates
		D350	Chlorates
		D360	Phosphorus compounds excluding mineral phosphates
E	Reactive chemicals	E100	Waste containing peroxides other than hydrogen peroxide
F	Paints, resins, inks, organic sludges	F100	Waste from the production, formulation and use of inks, dyes, pigments, paints, lacquers and varnish
		F110	Waste from the production, formulation and use of resins, latex, plasticisers, glues and adhesives
G	Organic solvents	G100	Ethers
		G110	Organic solvents excluding halogenated solvents
		G150	Halogenated organic solvents
		G160	Waste from the production, formulation and use of organic solvents
H	Pesticides	H100	Waste from the production, formulation and use of biocides and phytopharmaceuticals

J	Oils	H110	Organic phosphorous compounds
		H170	Waste from manufacture, formulation and use of wood-preserving chemicals
		J100	Waste mineral oils unfit for their original intended use
K	Putrescible/ organic waste	J120	Waste oil/water, hydrocarbons/water mixtures or emulsions
		J160	Waste tarry residues arising from refining, distillation, and any pyrolytic treatment
		K100	Animal effluent and residues (abattoir effluent, poultry and fish processing wastes)
		K110	Grease trap waste
L	Industrial washwater	K140	Tannery wastes (including leather dust, ash, sludges and flours)
		K190	Wool scouring wastes
		-	Not listed in Schedule A List 1 of NEPM. Heading reported as part of "15" in NEPM annual reporting
M	Organic chemicals	M100	Waste substances and articles containing or contaminated with polychlorinated biphenyls, polychlorinated naphthalenes, polychlorinated terphenyls and/or polybrominated biphenyls
		M150	Phenols, phenol compounds including chlorophenols
		M160	Organo halogen compounds—other than substances referred to in this Table or Table 2
		M170	Polychlorinated dibenzo-furan (any congener)
		M180	Polychlorinated dibenzo-p-dioxin (any congener)
		M210	Cyanides (organic)
		M220	Isocyanate compounds
		M230	Triethylamine catalysts for setting foundry sands
		M250	Surface active agents (surfactants), containing principally organic constituents and which may contain metals and inorganic materials
		M260	Highly odorous organic chemicals (including mercaptans and acrylates)
N	Soil/ sludge	N100	Containers and drums that are contaminated with residues of substances referred to in this list
		N120	Soils contaminated with a controlled waste
		N140	Fire debris and fire wash waters
		N150	Fly ash, excluding fly ash generated from Australian coal fired power stations
		N160	Encapsulated, chemically-fixed, solidified or polymerised wastes referred to in this list
		N190	Filter cake contaminated with residues of substances referred to in this list
		N205	Residues from industrial waste treatment/disposal operations
		N220	Asbestos
R	Clinical and pharmaceutical	N230	Ceramic-based fibres with physico-chemical characteristics similar to those of asbestos
		R100	Clinical and related wastes
		R120	Waste pharmaceuticals, drugs and medicines
T	Miscellaneous	R140	Waste from the production and preparation of pharmaceutical products
		T100	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
		T120	Waste from the production, formulation and use of photographic chemicals and processing materials
		T140	Tyres
		T200	Waste of an explosive nature not subject to other legislation