

CONTAMINATED SOIL WASTES IN AUSTRALIA

FOR DEPARTMENT OF THE ENVIRONMENT

INSTITUTE FOR SUSTAINABLE FUTURES

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CITATION

Cite this report as:

Plant, R., Wilmot, K. and Ege, C. (2014) *Contaminated Soil Wastes in Australia*. [Prepared for the Australian Department of the Environment]. Institute for Sustainable Futures, University of Technology, Sydney.

Document history	
V0.0 first outline	5 th June 2014 by RP
V1.0 Draft	13 th June 2014
V2.0 Draft	17 th June 2014
Final report	24th June 2014

ACKNOWLEDGEMENT

The authors would like to acknowledge and thank the staff in the various authorities and departments, and the subject matter experts, for giving up their time to participate in interviews and compile data.

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EXECUTIVE SUMMARY

The purpose of this report is to provide a baseline data set and knowledge compilation about contaminated soil wastes in Australia. Using this baseline, the report identifies aspects of soil waste management that may need further investigation and/or represent opportunities for coordinated effort that is most likely to improve environmental, health and safety, as well as economic outcomes.

Contaminated soil wastes are relevant in the context of hazardous waste management. Hazardous waste is waste that poses substantial or potential threats to public health and/or the environment. Contaminated soil wastes reflect a special case in hazardous waste management as site contamination is largely a historical legacy issue and soil waste generally arises a result of construction and development activities.

The approach taken in this study is framed from both the contaminated soil and waste management perspectives. A mixed-methods approach was used, employing quantitative data compilation and qualitative analysis of literature and interview data. The multi-tiered analysis covered key legislative instruments, waste registration and tracking systems, and on-the-ground-practice. Consultation with key stakeholders (both in the soil and waste sectors) in policy and industry, in Australia and internationally, was undertaken to inform and enrich the knowledge compilation.

The primary entry point for this study was framed to be remediation involving some form of exsitu storage or treatment, where a quantity of contaminated soil enters the waste stream. A secondary entry point of contaminated soil into the waste stream exists where contaminated soil is moved off-site for treatment, storage or reuse elsewhere.

Three existing data inventories covering soil wastes were reviewed for data sources, quality and consistency. From these inventories a total of 1,418,000 tonnes of soil waste could be estimated for the financial year 2008-09. For 2010-11 the total quantity of soil waste, based on best available data, was 727,710 tonnes, whereas the total quantity for 2011-12 was 1,343,744 tonnes.

Based on interviews with jurisdiction and newly sourced jurisdictional data, the current soil and waste policy context, the state of tracking and the overall state of play were systematically assessed. This provided a newly sourced data baseline (Table 1) data set with revised estimates for the financial years 2011-12, 2012, 2013. Comparing the two year overlap with existing data compilations, a substantially higher total quantity of 646,694 tonnes was found for 2010-11. For the financial year 2011-12 the difference was 353,975 tonnes. This suggests that jurisdictions are able to collate more comprehensive data on soil wastes than typically required under the annual NEPC reporting requirements.

Even though all *ex-situ* soil waste was within scope of our study, estimation of quantities of exsitu on-site soil waste proved difficult. Ex-situ, on-site contaminated soil is generally measured in the course of handling it, and reported in approval applications and audit reports, but rarely is this data systematically racked or collated in the waste domain. On-site storage (as opposed to on-site treatment) will be counted if and when it is eventually moved off-site. Definitional boundaries also present a major challenge. Different jurisdictional terminology makes it different to consistently compare (and calculate) soil waste streams. The assessment of contaminated land gives rise to contaminated soil but not necessarily to contaminated soil *waste*. Other definitional challenges exists where soil waste is degraded and/or when soil waste crosses jurisdictional boundaries. Another challenge exists where contaminated soil is moved off-site for 'fit for purpose' reuse elsewhere.

State totals [t] for Financial Years							
State	2010-11	2011-12	2012-13				
ACT	n/a	30,728	29,489				
NSW	505,989	620,116	555,299				
NT	70	8	407				
QLD	228,188	238,301	352,425				
SA	229,494	434,229	240,453				
TAS ^{*)}	4,921	1,600	7,748				
VIC	398,577	366,949	362,948				
WA	6,765	5,859	3,439				
National total	1,374,004	1,697,790	1,552,208				

*)2010-11 and 2011-12 is partial data; only includes quantity disposed to otherwise unapproved recipients or treatments, but not to approved landfills

Table 1 Newly sourced data contaminated soil waste baseline data set

A synthesis of the alignment of contaminated soil wastes tracking across jurisdictions suggests that this alignment is currently poor. This is especially so for the 'early' and 'later' life stages of contaminated soil: where interstate movement (in particular imports) is comprehensively tracked – due to national and international reporting requirements - the arisings (on-site quantities of contaminated soil) as well as soil waste streams to treatment and landfill are only partially tracked, based on different classifications. Reuse of soil waste exhibits similar tracking characteristics.

The waste management hierarchy is referenced by most jurisdictions in their policies for managing wastes as a clear path for decision making for industry. This is leading to greater emphasis on on-site treatment and management.

Interstate flows are substantial and thereby arguably not adhering to the proximity principle. However, if a specialist treatment facility is available in one location, environmental outcomes may be better when transporting the soil waste some distance to take advantage of that facility. This brings up a cost-risk trade-off. Landfill levies, which are generally on the rise in most jurisdictions, set an incentive to adhere to the proximity principle, for example my making on-site treatment economically more attractive.

The adequacy of technology and waste infrastructure was seen as generally adequate, or at least moving towards an improved state. However, the large inter-annual variation in contaminated soil quantities can give rise to capacity problems as point of treatment.

Comparison of Australia's soil waste handling to world best practice could not systematically be undertaken. Other federations are likely to grapple with similar definitional boundary problems.

The physical boundary limitations (counting on-site soil waste in) may be addressed by adopting approaches from elsewhere.

This study concludes that:

- Clearly and statically defining contaminated soil waste is difficult, whereas the term "hazardous" adds another level of definitional complexity
- Setting boundaries for where quantities should be tracked is complicated by current definitional diversity.
- Current data on contaminated soil waste is very patchy and of poor quality. Even where there is a robust tracking or reporting system, data is not necessarily collected or collated at stages that could furnish useful baseline information.
- The newly sourced baseline dataset is based on currently available data, with its current inconsistencies and inadequacies. This limits the use of such a baseline.
- Jurisdictional comparisons are not helpful due to the varying tracking practices, but also due to economic and geographic diversity.
- Tracking, reporting, and auditing processes vary between jurisdictions. They are generally emerging. Many jurisdictions are improving their systems against a backdrop of broader regulatory review.



1 INTRODUCTION

The purpose of this report is to provide a baseline data set and knowledge compilation about **contaminated soil wastes in Australia**. Using this baseline, the report identifies aspects of soil waste management that may need further investigation and/or represent opportunities for coordinated effort that is most likely to improve environmental, health and safety, as well as economic outcomes.

Contaminated soil wastes are relevant in the context of **hazardous waste** management (KMH Environmental 2013). Hazardous waste is waste that poses substantial or potential threats to public health and/or the environment. Hazardous materials exhibit traits such as ignitability, reactivity, corrosivity and toxicity. Examples of common hazardous wastes include spent auto batteries, spent solvents, sludges from industrial wastewater treatment units, and contaminated soil waste. The international movement of hazardous waste is managed by the **Basel Convention**, an international treaty designed to reduce and regulate the movements of hazardous waste between nations. Australia has been a signatory to the Basel Convention since its inception in 1992 (ABS 2013).

Contaminated soil wastes reflect a **special case** in hazardous waste data management and assessment. Site contamination is largely a historical legacy issue (KMH Environmental 2013). It is generally a result of construction and development activities that require the excavation of contaminated soil material. The quantity of soil waste produced in any given year fluctuates with the level of development activity in contaminant prone geographical area, such as former industrial areas that are being redeveloped for residential purposes. These drivers of the annual volumes of contaminated soil wastes are rather different from those for other hazardous waste categories. The annual quantities of other hazardous wastes are more directly related to consumption patterns, reflecting current rather than historical activity.

Contaminated soil wastes are a key component of hazardous waste in Australia and yet **little national data is available** on these wastes. The root cause of the problem of lacking consistent national data on contaminated soil wastes lies in the diverse ways in which jurisdictions define, classify and regulate their waste. Historically this has led to hazardous waste tracking that has been irreconcilable at the national level, making systematic and coherent national assessment and tracking impossible. Moreover, the diverse jurisdictional tracking systems are unlikely to capture the full extent of contaminated soil waste. As a result, even if jurisdictional tracking systems are reconciled at the national level, such compilations only partially represent the problem. Of particular potential significance are the volumes of contaminated soil waste that have been stored on-site, either for ex-situ treatment or merely for long-term storage. Depending on the relevant jurisdiction's definitions, classifications and regulations, such soil wastes often go unnoticed in current waste tracking systems.

The lack of consistent national data on contaminated soil wastes presents **several challenges**. First, as a signatory to the Basel Convention, Australia undertakes annual reporting on hazardous waste movements, including contaminated soil wastes. It is required to undertake its reporting based on best available data. Furthermore, consistent national data on the arisings, movements and fates of contaminated soil wastes allow better understanding and management of the efficacy of Australia's waste infrastructure. The different ways in which jurisdictions currently define, classify ad regulate their soil wastes may inadvertently incentivise the handling of contaminated soil waste in ways that that are economically and environmentally suboptimal and are inconsistent with waste management principles such as the waste hierarchy and the proximity

principle. The **waste management hierarchy** is a nationally and internationally accepted guide for prioritising waste management practices with the objective of achieving optimal environmental outcomes. It sets out the preferred order of waste management practices, from most to least preferred. The **proximity principle** advocates that waste should be disposed of (or otherwise managed) close to the point at which it is generated, thus aiming to achieve responsible self-sufficiency at a regional or subregional level. Where this is not possible, priority should be given to transportation by rail or water.

This report is structured as follows. Chapter 2 outlines the methodology followed to compile a baseline data set on contaminated soil wastes. Chapter 3 elaborates key definitions and concepts to set the scope for the study. Chapter 4 presents qualitative and quantitative findings at the national level and by jurisdiction. Chapter 5 provides a synthesis of jurisdictional information and evaluates aspects of contaminated soil wastes management in Australia that offer opportunities for further improvement of the baseline data set. Chapter 6 summarises conclusions and suggests next steps.



2 METHODOLOGY

The approach taken in this study has four characteristics:

- i) Scoping based on the **double entry point** of both soil and waste;
- ii) A **mixed-methods** approach covering quantitative data compilation, reconciliation and analysis as well as qualitative analysis of literature and interview data;
- iii) **Multi-tiered analysis** covering key legislative instruments, waste registration and tracking systems, and on-the-ground-practice.
- iv) Consultation with **key stakeholders** (both soil and waste) in policy and industry, in Australia and internationally;

The project methodology comprised the following tasks:

First, a targeted literature review was conducted to assess definitions and classifications of hazardous waste at the international level (Basel Convention), the national level (National Waste Policy 2009; Controlled Waste NEPM (Commonwealth of Australia Legislation 2010)) and the state/territory jurisdictional level. We also examined previous hazardous waste data compilations and the key legislative instruments that are currently governing site contamination and remediation at national and state/territory levels. This identified the definitional boundaries of the baseline assessment. In parallel, four semi-structured telephone interviews were conducted to canvas how Australian management and knowledge of contaminated soil wastes currently operates. High-level interviews were conducted with: 1) a biochemical engineer and environmental auditor working for an environmental consultancy; 2) a principal environmental scientist who consults on property development that generates contaminated soil as well as audits the clean-up of contaminated sites; 3) two experts (hazardous waste and contaminated sites; interviewed simultaneously) representing a state-based environmental regulator; and 4) a research program leader for the cooperative research centre for contaminated sites. In addition, detailed expert information was provided by the Hazardous Waste Section within the Environment Protection Branch of the Australian Government Department of the Environment. All interviews were recorded and transcribed for further analysis. A meta-level overview of definitions, classifications and regulations in each jurisdiction was established to capture the initial information, obtained from literature, data review, and interviews.

The next project task involved the compilation of a baseline data set of contaminated soil wastes. The **data collection process** was guided by the meta-level overview prepared under project task one and involved semi-structured interviews with jurisdictions. A total of 10 interviews were conducted with staff from state and territory jurisdictions, working in contaminated sites, waste tracking, illegal dumping and hazardous waste disposal sections. Contaminated soil wastes data sets were obtained from all eight jurisdictions (NSW, VIC, TAS, SA, WA, QLD, NT, ACT). In some cases multiple interviews per jurisdiction were required, per referral by the initial representative contacted if that person was unable to respond to all the interview questions. All interviews were recorded and transcribed for further analysis. An additional four informal interviews were undertaken to supplement understanding of the jurisdictions or its data. Another interview was

undertaken with a waste treatment operator for his perspective on policy and practices as a waste handler, and the effectiveness and any deficiencies in the system.

Where possible, contaminated soil wastes were quantified in three main categories: arisings; movements (intrastate and interstate); and fate. This provided initial answers to the key questions of how much contaminated soil waste is generated; where and how it arises; where and how it is moved; and where it is moved.

Finally, based on the baseline data set prepared, a synthesis and evaluation were conducted with respect to consistency of the approaches used across jurisdictions; consistency with other data compilations; and consistency with world's best practice. The synthesis and evaluation were guided by the principles of the waste hierarchy and the proximity principle.



3 FRAMING THE ASSESSMENT

The starting point for scoping the CSWA is a systemic representation of the arisings, movements and fates of contaminated soil (Section 3.1). Using insights from high-level stakeholder interviews, Section 3.2 juxtaposes this systemic representation against the current policy and regulation context (Section 3.3.) Section 3.4 presents a summary of existing data.

3.1 THE "LIFE" OF CONTAMINATED SOIL

The objective of the current assessment is to establish a baseline data set and knowledge compilation about **contaminated soil wastes** in Australia. As outlined in the Introduction, to date a lack of definitional consistency around such key concepts as "contaminated soil", "soil waste" or "hazardous waste" has prevented the establishment of such a baseline set. Therefore, rather than starting with accepting or rejecting a-priori definitions the scope of the current assessment can be set by a systemic representation of the arisings, movements and fates of contaminated soil. Such a systemic understanding considers the "life", or "life cycle" of a given unit of soil, say a cubic metre (m3).

Soil, in the context of the current assessment, refers to fragmentary or unconsolidated *material* occurring naturally at or near the earth's surface, regardless of its suitability for plant life . **Contaminated soil** refers to in-situ soil material that has previously received one or more potentially hazardous xenobiotic chemical substances, with the contamination persisting over time. Soil contamination is typically caused by past industrial activity, use of agricultural chemicals, or disposal of waste, but can include naturally occurring contamination such as acid sulfate or arsenic. **Soil waste** refers to contaminated soil that has arisen as waste. Usually, this means that a certain volume of contaminated soil has been excavated or otherwise exposed at a contaminated site and is excess, surplus, unwanted or rejected.

The arising of soil waste can be understood as a step by step "filtering" process, starting from a site towards an entity of soil material that is being moved off-site (Figure 1). A **site** can refer to any parcel of land with a given history and (planned) future use(s), for example residential, industrial, or recreational. The notion of a **contaminated** site arises when there is reason to suspect that a site has been contaminated. Such suspicion can emerge when a site is being developed or redeveloped, or when historic evidence reveals past uses and practices that would have been polluting. It has been estimated that Australia has more than 160,000 sites across the country that are polluted with as many as 75,000 different contaminants (CRC CARE 2014).

Contaminants include an array of chemicals, but also include municipal waste, and asbestos. Asbestos is vexatious because it cannot be treated. Asbestos contamination presents a difficulty to clean up because the contaminant usually manifests itself in fragments. Vast quantities of asbestos-contaminated soil may be involved, making remediation expensive and logistically challenging.

Once a site has been marked as potentially contaminated a responsible jurisdictional agency may require scientific assessment of the contamination. Contaminated site assessments are to be guided by the National Environment Protection (Assessment of Site Contamination) Measure 1999, hereafter referred to as the ASC NEPM. The purpose of the ASC NEPM is to establish a nationally consistent approach to the assessment of site contamination to ensure sound environmental management practices by the community which includes regulators, site assessors, environmental auditors, land owners, developers and industry. The ASC NEPM defines

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contamination as "the condition of land or water where any chemical substance or waste has been added as a direct or indirect result of human activity at above background level and represents, or potentially represents, an adverse health or environmental impact" (Commonwealth of Australia Legislation 1999). If a site assessment yields an affirmative result a volume of **contaminated soil** has arisen. Further details of the ASC NEPM are provided in Section3.3.2.





Once the nature and extent of the contaminated soil have been assessed, a remediation solution can be designed, consisting of one or more remediation technologies. A large suite of remediation technologies currently exists. For the purpose of this study they can broadly be subdivided into *insitu* and *ex-situ* technologies. *In-situ* technologies allow the volume of contaminated soil to be left in place whereas *ex-situ* technologies require excavation. Examples of in-situ remediation technologies include chemical reduction, flushing, oxidation and thermal treatment. Examples of ex-situ technologies include ex-situ soil washing, solidification, thermal treatment and "dig and dump" to landfill.

If site remediation involves some form of *ex-situ* storage or treatment, a volume of contaminated soil can be considered to enter the waste stream. We term this the **primary entry point** of contaminated soil into the waste stream. *Ex-situ* remediation may involve on-site treatment or storage, both of which require the volume of contaminated soil to be moved from its original *in-situ* location. A **secondary entry point** of contaminated soil into the waste stream exists where contaminated soil is moved off-site for treatment, storage or reuse elsewhere.

As off-site movements of contaminated soil are governed by a variety of policy instruments (Chapter4) the second entry point marks the *de facto* arising of soil waste. However, the primary entry point – the excavation of contaminated soil – marks the arising of soil waste from a *systemic* perspective. For the purpose of the current benchmark assessment we consider both entry points to be within scope of our study, with the ability to quantify volumes to be tested.

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Unless the need to identify and manage contaminated soils has arisen due to risk to environmental or human health that warrants a formal clean-up notice, management of contaminated soils is due to development activity on a site. A step by step filtering analysis can also be used to understand the derivation of contaminated soil in the C&D waste stream Figure 2. Because contaminated soil is assessed in the context of the use of the site, it will often arise on a development site in response to a change of use, whether from a different functional occupation, or from dormant brownfield to proposed use. Waste arising from construction activities is part of the construction and demolition (C&D) waste stream, and this includes soil waste. Soil waste as a consequence of industrial site rehabilitation may be tracked under the commercial and industrial (C&I) waste stream, and some jurisdictions are reporting contaminated soil waste from the municipal solid waste stream also. Not all soil waste is contaminated.



Figure 2 The arising of contaminated soil in the waste stream

Having conceptualised the arising of contaminated soil as waste we can consider the next stage in the "life" of a volume of contaminated soil – that of off-site movement. Soil waste is moved for a variety of **purposes**: for direct reuse; for treatment in a dedicated facility and subsequent recycling; for disposal to landfill; or for illegal dumping. A broad distinction can be made between intra-state, inter-state and off-shore **destinations** of soil waste. Figure 3 summarises the different possible **pathways** (orange arrows) that a certain volume of soil waste can follow. For the purpose of the current benchmark study (CSWA), these purposes, destinations and pathways are all with the scope of our study. The systems representation provided in Figure 3, combined with high-level findings from five expert interviews (Section3.2) provided the frame of analysis for the current benchmark study.

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Figure 3 Pathways of soil waste movement.



3.2 CONTAMINATED SOIL IN PRACTICE

This section briefly introduces some key issues to contextualise the systemic representation developed above. A systematic treatment of issues by jurisdiction is provided in the Results section of this report (Chapter4). The issues were identified based on analysis of semi-structured interviews with five senior experts representing industry, policy and research.

3.2.1 Past, current and emerging practices

There is an over-arching requirement for materials, including soil material, to be classified appropriately and disposed of lawfully.

When looking at potentially contaminated land there are stringent guidelines. Most states of Australia, particularly Victoria and New South Wales, Western Australia and South Australia, have contaminated land audit systems in place, but site audits are not always regulated and there is not necessarily a qualified site auditor involved at every site. The environmental audit system is often triggered when a site is subject to redevelopment, possibly as a condition of planning consent. Alternatively, it may be a regulatory site audit as a condition of a notice that the regulator has issued. Audits are also undertaken for a range of other due diligence exercises, particularly where parties are purchasing or leasing land.

The environmental overlay reliability is questionable in some areas where the reliance is on the history of that area to identify those sites that could be contaminated. Geotechnical reports, for an ordinary residential house, are typically much cheaper than contaminated site assessments so are not a path to a regular testing process.

Environmental and geotechnical consultants encounter the issue of soil contamination on 85 - 90 per cent of sites they are dealing with. There is often some form of contamination in the shallow

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filled soils that have been imported to site historically. If a site is under an audit process, or if a consultant is involved it is pretty straightforward. Environmental consultants are usually the ones that flag the issue of contaminated soil. However, many earth works get done on sites that won't have records. The issue is often is that people do earth works without recognising that they need to follow a procedure; people often just think contaminated soil looks like ordinary soil.

Intended to pre-empt unexpected finds, the ASC NEPM (see Section 3.1) offers general guidelines for the assessment of site contamination. That is, they do not offer guidance for the actual clean up, remediation and management of the contaminated sites. Often material is retained on-site, left in-situ or indeed dealt with through some process onsite. The more material from contaminated sites can be treated to a level where the soil material is regarded as clean fill the more soil waste can then be diverted from landfill. The ASC NEPM is to ensure that contaminated soil material is not harmful as it is being dealt with.

Protected beneficial uses are defined within the relevant acts. In order to see what beneficial uses contaminated land might be suited for a lot of information is required.

Soil is only considered a waste once it leaves a site. Transportation and disposal of contaminate soils off-site is required to be in accordance with the relevant regulations. If contaminated soil is not considered general solid waste it is tracked in some form or other in each jurisdiction. The MCW NEPM waste codes specify the categories in which waste needs to be tracked, and this includes soil waste. Owners of soil waste have to apply to the treatment facility that they want to take it to, and have to use a licensed waste transporter.

A lot of site development occurs outside the audit process where there is strong reliance on the honesty of the people involved in it to follow the proper procedures. To categorically quantify the size of the problem would involve referencing the existing records that are mainly with the landfills that have accepted the material and issued the paperwork, and the regulators who receive that paperwork.

Waste levies have been rising in most jurisdictions in recent years, although they were abolished in Queensland in 2012. Substantial amounts of waste are being moved interstate to jurisdictions with lower costs or where a lower-level waste levy regime currently exists. There is concern that illegal dumping is connected to the regulation on landfills, exacerbated by landfills prices. It would make sense to have some level of national uniformity or harmonisation in levies and regulations. Currently the different criteria in different states provide different incentives. The management issues are quite different depending on the nature (what contaminants) and extent (how much) of the soil waste.

It depends on a jurisdiction's definitions of what is hazardous waste versus what is just a lowergrade waste. Higher-grade soil wastes, encountered on only a minority of contaminated sites, can be handled by only a few facilities nationally, at significantly higher cost than lower-grade soil wastes. For example, in Victoria there is a trend away from landfilling higher grade wastes towards licensing recycling facilities that treat the soil waste to a lower-grade waste, and dispose of it as a lower category waste, or even to recycle the soil material and treat it effectively so that it can be can be used as fill material.

Landfill space is a very valuable commodity and is being compromised by the so-called "dig and dump" remediation approach during the clean-up of contamination. Much of the soil waste that gets landfilled could technically be remediated on-site and reused. This is often not done due to a lack of time. That is, time constraints imposed by the development and construction process is one of the large drivers for the volumes of soil waste that currently go to landfill. This is at odds with the waste hierarchy or the waste management procedures in most jurisdictions. If

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alternative processes are not easy, the landfilling option, irrespective how expensive it is, is preferred. There is a need for innovation in remedial approaches.

On-site storage may require environmental impact assessment of long-term storage itself. Even if there is a mechanism in place for storing or treating soil on-site, the process involved in doing so is so lengthy that it becomes an unviable option. This reflects a mismatch between current regulation and commercial realities.

Appropriately constructed landfills minimises the risk to the environment and human health but there is still a residual risk from moving high risk material from one place to another.

3.2.2 Measurement

To quantify the amount of contaminated soil in Australia , one could estimate the square meterage of properties that are affected in each jurisdiction by considering every site that had an audit overlay, and then estimate the geological thickness or the range of thickness. It would require historical records of what percentage of soils feed each sub-category of contamination. The certainty of the numbers or the uncertainty associated with the estimate would be quite large. The quantity of contaminated soil that exists couldn't be established accurately, short of actually doing an assessment of regions.

There are many sites where contaminated soil material is contained on-site. It remains on the site, making it a future legacy for the next round of development. This makes estimation of the total volume of soil waste difficult.

It comes down to definitions and the definition will determine to some degree the quantity. As soon as the soil is moved on-site it is regarded as a waste and must be managed in the waste stream. Moving the definition of soil waste to the site boundary would be very wise. On site movement may often go undetected – many site owners may see no need to contact the regulator, hence under current policy and regulation it would be challenging to quantify the total volume of contaminated soil stored on-site.

3.2.3 Responsibilities

Difficulties regarding contaminated soil waste pertain to the expense, the difficulty, the difference in terms of regional as opposed to metropolitan waste management due to the value of land. The higher value of land in metropolitan areas warrants to cost and effort to clean the site.

If soil is heavily contaminated and is thus classified as hazardous waste, it can't go to landfill and may have to travel some distance to a facility licenced to accept hazardous waste soils.

A site auditor system and a strong regulator are required to have intelligence and awareness of where soil waste issues arise and to identify and track and deal with them. In some jurisdictions, the industry tracks its own movements and these are audited. The receiving facilities issue a consignment authorisation and each individual load is entered into an online tracking system. If a site is under audit, the auditor is responsible for noticing any breaches of the waste regulations. If it is outside the audit process, the responsibility is on a sewage contractor or the consultant to advise the site personnel to follow the regulations. The policing function is with the landfills.

Simple audits are not possible because there is no mechanism. The levels of investigative requirements are now becoming significant.

3.3 NATIONAL POLICY CONTEXT

3.3.1 Hazardous waste

The Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal was adopted on 22 March 1989 by the Conference of Plenipotentiaries in Basel, Switzerland, in response to a public outcry following the discovery, in the 1980s, in Africa and other parts of the developing world of deposits of toxic wastes imported from abroad. The objective of the Basel Convention is to protect human health and the environment against the adverse effects of hazardous wastes. The Convention covers a wide range of hazardous wastes, with their classification as 'hazardous' being based on their origin and/or composition and their characteristics. Parties to the Basel Convention are required to transmit their national reports on an annual basis. The reporting is based on a questionnaire on 'transmission of information' and a manual and is to provide the total quantity of waste generated in a country. Quantities are to be reported using waste stream categories (Article 1, § 1(a) wastes, Y1-Y18) and categories of waste constituents (Article 1, § 1 (b) wastes; Y19-Y45). Furthermore, reporting is required for two categories of wastes requiring special consideration (Annex II): Y46 (Wastes collected from households) and Y47 (Residues arising from the incineration of household wastes). There are eight additional waste categories not included in the Y-coding system for which reporting is required. Of these, the sixth, "Soils contaminated with residues of substances in Basel Y-codes 19-45", is relevant in the context of the current report.

In Australia, hazardous waste is governed under the **Hazardous Waste (Regulation of Exports and Imports) Act 1989**. The main purpose of the Act is to regulate the export and import of hazardous waste to ensure that hazardous waste is disposed of safely so that human beings and the environment, both within and outside Australia, are protected from the harmful effects of the waste. The original Act of 1989 only controlled movements of wastes that lacked financial value, usually destined for final disposal operations (for example, by incineration or landfill). In 1996, the Act was amended to include wastes that possess financial value, usually destined for recycling and recovery operations. These amendments enabled Australia to meet all of its obligations under the Basel Convention.

The transport of controlled wastes in Australia is covered by the National Environment Protection (Movement of Controlled Waste between States and Territories) Measure,

introduced in 1998 (hereafter referred to as MCW NEPM). The MCW NEPM establishes a national protocol for tracking controlled waste and aims to ensure that controlled wastes that are to be moved between states and territories are properly identified, transported, and handled in ways that are consistent with environmentally sound practices. The **National Environment Protection Council (NEPC)** produces an annual report on the MCW NEPM containing a summary of the quantities of hazardous waste transported between each of the states and territories. The NEPM categorises hazardous wastes into 75 different waste types (NEPM-75) which are summarised under 15 broader categories (NEPM-15). By convention, states report on the NEPM-15 summary. International reporting under the Basel Convention requires data on the NEPM-75 categories. Contaminated soil waste resides in the NEPM-15 category Soil/ sludge, which in the NEPM-75 classification specifies *"Soils contaminated with a substance or waste referred to in this Table"* (NEPM-75 category N120). The principle of managing waste according to the waste hierarchy is written into legislation or regulation in every jurisdiction in Australia and many waste policy targets and data collations are based on the various levels of the hierarchy (Blue Environment Pty Ltd 2014).

3.3.2 Contaminated soil

No transnational legislation currently exists for the assessment and remediation of contaminated land. In Australia, the Australian and New Zealand Environment and Conservation Council (ANZECC) and the National Health and Medical Research Council jointly developed technical guidelines to inform and educate government, industry, unions and the general community about the issues and factors to be considered in the assessment and management of contaminated land. The guidelines were published in 1992 and have since been rescinded, to be replaced by the National Environment Protection (Assessment of Site Contamination) Measure in 1999 (hereafter referred to ASC NEPM) as guidelines under the National Environment Protection Council Act 1994. Both the ANZECC guidelines and the ASC NEPM state that the preferred order of options for site clean-up and management are: (i) on-site treatment of the soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level; (ii) off-site treatment of excavated soil after which, depending on the residual levels of contamination, the treated material is then returned to the site, removed to an approved waste disposal site or facility or used as fill for landfill. The ANZECC guidelines and the NEPM further state that if it is not possible for either of these options to be implemented, other options should be considered:

- removal of contaminated soil to an approved site or facility, followed where necessary by replacement with clean fill;
- isolation of the soil by covering with a properly designed barrier;
- choosing a less sensitive land use to minimise the need for remedial works which may include partial remediation;
- leaving contaminated material in-situ providing there is no immediate danger to the environment or community and the site has appropriate controls in place;

Where the assessment indicates remediation would have no net environmental benefit or would have a net adverse environmental effect, implementation of an appropriate site management strategy is required. All jurisdictions either adopt the ANZECC guidelines and/or include the waste hierarchy as a guide to remediation options. The States and Territories have ultimate jurisdictional responsibility.

3.3.3 Interviews

In New South Wales the policy and legal framework is seen as very effective. As far as the tracking system goes compliance in NSW is very high. South Australia has picked up the online tracking and other states are looking at using it, too.

The requirement for licensing trucks is effective. Waste transport certificates track what happens to the material and where it goes. The landfills must have records of the material being accepted.

In Victoria there is a lot of material that, once excavated, may actually be suitable for residential use. The thresholds for waste assessment haven't matched changes to those for health risks so there is material that is subject to regulation as a waste, not as a resource and does not get used.

Regulators can be under-funded, under-resourced and may have limited in-house technical expertise to review audits. Several jurisdictions commented on insufficient resources to effectively police or enforce the regulations.

Consultants were said to be problematic. An accreditation system for consultants in the field of contaminated sites would be useful.

Outcomes could be improved by creating a tradeable market in treated soil - where materials go into a treatment facility, are reused, demonstrated to be able to be recycled back into land

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developments. The waste hierarchy has been quite rigidly enforced and there exists a big barrier to innovative thinking.

3.4 EXISTING INVENTORIES OF CONTAMINATED SOIL WASTE

This section provides a summary and brief discussion of recent past efforts to quantify contaminated soils in Australia.

3.4.1 Waste and Recycling in Australia 2011, Hyder 2011

The report Waste and Recycling in Australia 2011 by Hyder Consulting targeted the annual arising of solid waste and its partial recycling. Reported data exhibit data gaps and other discrepancies for contaminated soil. This is due to the nature of data reported by jurisdictions, rendering it difficult to separate material categories. The reported hazardous waste types are: quarantine; contaminated soil (both chemical and biological); hazardous industrial waste; and asbestos. This results in coverage of "contaminated soil" that differs from the category in the Controlled Waste NEPM (N120). The report is cited in the tables as *Hyder 2011*.

3.4.2 Waste generation and resource recovery in Australia 2010/11, Blue Environment and Randell Environmental Consulting 2014

The report Waste generation and resource recovery in Australia - Reporting period 2010/11 by Blue Environment Pty Ltd focused on recycling, recovery and waste generation across Australia during the financial year 2010/2011. The study was undertaken by collating data provided by jurisdictions. The data collection process was not specifically focussed on contaminated soil. Hence, Table 4 has several gaps regarding the tonnage of soil waste in the financial year. The report is cited in the tables as *Blue Environment 2014*.

3.4.3 Hazardous Waste Data Assessment, KMH Environmental 2013

The report Hazardous Waste Data Assessment by KMH Environmental outlines hazardous waste generation in Australia. It covers the generation *within* as well as the movement *across* jurisdictional borders. Data gaps were filled based on population figures or by using data from similar categories to provide a dataset that allows comparison between jurisdictions. Key data gaps were identified for contaminated soil in NSW and QLD. Contaminated soils are not required to be tracked for intrastate movements in New South Wales and Queensland (See Section 4 of this report). The very low figures in Table 4 for these states may represent either mistakes in classification or use of transport certification in that particular state beyond legal requirements. (KMH Environmental 2013).

The KMH report is presented in three parts: a Summary Report, an Assessment Report, and a data worksheet. This CSWA report sought unadjusted figures as close as possible to those reported by jurisdictions so, when any KMH figures were used, they were taken from the Assessment Report. The data in the Summary Report has been updated by Blue Environment, June 2014, commissioned by the Department of the Environment. The final draft report was provided to the project team by the Department. The revised numbers have not affected the data used in this CSWA report.

The report is cited in the tables as *KMH 2013*.

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3.4.4 Basel reporting Blue Environment (2014)

A worksheet draft was provided to the project team by the Department during the course of the study. As yet unpublished, it categorises jurisdictionally reported data for waste generation in 2012 into Basel reporting categories. Contaminated soil volumes are reasonably comprehensive for all but NSW and Queensland, which have been supplemented with data from *Waste generation and resource recovery in Australia*.

The tables are headed as containing "tonnes generated". It is not clear at what point in the contaminated soil life this is measured, and therefore whether it captures all the possible contaminated soil in the jurisdiction.

The report is cited in the tables as Basel reporting Blue Environment 2014.

3.5 CURRENT DATA

These tables draw together data from the published and current sources outlined above, for the three years for which the most comprehensive data is available, to arrive at national totals.

There is notable variation in the materials measured – where a choice was available, the closest category to N120 was referenced for these tables.

Year 0	Year 08/09						
State	Waste category	Quantity [t]	Source/Note				
ACT	Contaminated Soil	4,700	Hyder 2011				
NSW	Contaminated Soil	371,600	Hyder 2011				
NT	Contaminated Soil	20,700	Hyder 2011				
QLD	Contaminated Soil	712,700	Hyder 2011				
SA	Contaminated Soil	53,900	Hyder 2011				
TAS	Contaminated Soil	5,000	Hyder 2011				
VIC	Contaminated Soil	246,400	Hyder 2011				
WA	Contaminated Soil	3,000	Hyder 2011				
	National total	1,418,000	Hyder 2011				

Table 2 Existing data set - compilation of best available current data for financial year 2008-09

Notes for Table 2, Table 3 and Table 4

- * Number for imported into Tasmania only
- ** Calculation value is zero
- *** Number taken from Basel reporting Blue Environment 2014 "Adjusted jurisdiction data" which uses a 2010-11 figure

Year 10/11						
State	Waste category	Quantity [t]	Source/Note			
ACT	Entire "N" Category	0	Calculated from KMH 2013 data (total = within + imported - exported) **			
NSW	Entire "N" Category	86,499	Calculated from KMH 2013 data (total = within + imported - exported)			
NT	Entire "N" Category	-286	Calculated from KMH 2013 data (total = within + imported - exported)			
QLD	Contaminated Soil with not all movements captured	14,351	Blue Environment 2014 (prov. by jurisdiction)			
SA	Entire "N" Category	246,323	Calculated from KMH 2013 data (total = within + imported - exported)			
TAS	Entire "N" Category	-8,741	Calculated from KMH 2013 data (total = within + imported - exported)			
VIC	Soil Cat. B & C	374,360	Blue Environment 2014 (prov. by jurisdiction)			
WA	Entire "N" Category	15,204	Calculated from KMH 2013 data (total = within + imported - exported)			
	National total	727,710	Project team calculation			

Table 3 Existing data set - compilation of best available current data for financial year 2010-11

Year 1	1/12		
State	Waste category	Quantity [t]	Source/Note
ACT	Category N120	269	Basel reporting Blue Environment 2014
NSW	Category N120	504,500	Basel reporting Blue Environment 2014 ***
NT	Category N120	17	Basel reporting Blue Environment 2014
QLD	Contaminated Soil with not all movements captured	2,930	Blue Environment 2014 (prov. by jurisdiction)
SA	Category N120	460,308	Basel reporting Blue Environment 2014
TAS	Category N120	71	NEPC 11/12 *
VIC	Categories N119, N120, N121	369,284	Basel reporting Blue Environment 2014
WA	Category 2.02	6,437	Basel reporting Blue Environment 2014
	National total	1,343,815	Project team calculation

Table 4 Existing data set - compilation of best available current data for financial year 2011-12

4 RESULTS

The findings for jurisdictions are presented with a section for each. The section starts with setting the context. It provides a list of the key instruments and documents referenced in that jurisdiction for soil and waste, information about the definitions used, followed by useful background material. A description is provided of the tacking system for that jurisdiction, and the section concludes with details of the original data provided by the jurisdiction.

4.1 NEW SOUTH WALES

4.1.1 Context

Soil

In NSW, contaminated land is governed by two main policy documents:

- Contaminated Land Management Act 1997 (NSW)
- Guidelines for the NSW Site Auditor Scheme (NSW)

Excavated soil material must be classified appropriately and disposed of lawfully. Remediation of a site requires EPA approval or auditing by an accredited third party (accredited site auditor). The need for a site audit can arise from regulatory requirements, i.e. as a condition of consent or a condition of a notice that the EPA has issued, so that consent could come from the planning authority. Furthermore, the audit process can be triggered by a range of other due diligence exercises or where parties are purchasing or leasing land.

Waste

In NSW, soil waste is governed by the policies:

- Protection of the Environment Operations Act 1997 (NSW)
- Regulation Protection of the Environment Operations (Waste) Regulation 2005 (NSW)

Terminology

In NSW, contaminated soil material only becomes waste once it leaves the site. It then triggers the waste tracking process that is also used for other controlled wastes. Waste Classification Guidelines Part 1: Classifying Waste (NSW) specifies the categories of "Hazardous waste", "Restricted solid waste", "General solid waste (putrescible)" and "General solid waste (non-putrescible)". In addition, the categories of "Special waste" and "Liquid waste" are distinguished. Contaminated soil wastes can classify as general solid waste (lowest contamination), followed by restricted solid waste and hazardous waste. The 1997 Act sets out which transported wastes require tracking.

State of Play

NSW waste regulation is currently under review. Amongst other changes the review proposes a power within the NSW EPA to require waste transporters to install devices in their vehicles to track the movement of those vehicles and the waste in them to give a better idea about where the waste goes, whether legitimately or outside the system. A centralised illegal dumping is expected within six months for illegal dumping in the state, profile of what is being dumped.

Treatment options in NSW: may be specific large-scale on-site treatment. Others may be taken to a landfill for treatment prior to being disposed of at the landfill. If it's hazardous the only places it

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can go are interstate (currently Queensland) because NSW doesn't have a facility licensed to accept hazardous waste soils.

NSW is piloting land farming for treatment by bio-remediation for hydrocarbon impacted soils. Caltex is running it on their Kurnell refinery site for soil removed from service station sites. This innovative approach is acceptable because it is contained within one company and therefore able to be controlled.

Key issues with remediating contaminated soil wastes in NSW pertain to the expense, the difficulty, and a dichotomy between regional and metropolitan land values. In metropolitan areas, soil waste is not much of an issue because increased land values after clean-up are typically much higher. Clean-up in metropolitan areas is primarily driven by redevelopment. In regional areas, sites can "just sit there and stagnate". The NSW EPA has implemented strategies and policies for funding, assistance, education and training. The levels and mobility of chemical compounds in contaminated soil can render it hazardous waste, preventing it to go to landfill. This triggers a requirement for the soil waste to a facility that can lawfully receive it. Contaminated soil classified as hazardous waste needs to be treated to lower levels of contamination, or contaminants to be immobilised to prevent leaching. In NSW, the notion of 'remediation' covers everything from putting a fence around a contaminated site to full treatment in a dedicated facility.

NSW EPA reports that it has good systems in place to address illegal dumping. There compliance and strategy model is seen as robust and includes Regional Illegal Dumping (RID) Squads. Soil and excavated material is a very small proportion of the total of all waste that is dumped. Soil contaminated with asbestos is the most common type of illegally dumped soil dealt with by NSW EPA. This is thought to be because chemical contamination can be treated whereas asbestos cannot, so no profit or offset can be made. Asbestos contamination presents a difficulty to clean up because the contaminant usually manifests itself in fragments. Vast quantities of asbestoscontaminated soil may be involved, making remediation expensive and logistically challenging. An example would be a large area of land that has been filled or contoured with soil that turns out to be contaminated; there's not enough room in the local landfills to remediate by removing all that soil, which is also costly and difficult. The preferred solution may be capping it and limiting the uses of the site.

4.1.2 Tracking

What is tracked?

Soils contaminated with *a substance or waste that requires tracking* (as defined in Schedule 1 of Protection of the Environment Operations (Waste) Regulation 2005 (NSW)). Part 1 of Schedule 1 of the Regulations (tracking intrastate and interstate) contains 66 waste codes. Part 2 of Schedule 1 (tracking interstate) covers further eight waste codes. This reflects an inconsistency in types of waste tracked intrastate than interstate. This inconsistency can propagate to contaminated soil wastes because soil wastes are included in both Schedules as *"Soils contaminated with a substance or waste referred to in this Part"*.

When is soil waste tracked?

The NSW tracking system covers interstate, intrastate and cross-state movements. When moving soil waste interstate, each destination jurisdiction provides waste trading certificates that are required to be used.

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Site	Movements	Fate	Measurement
Trigger: regulated site or redevelopment of site (planning approval process). Assessment of historical activity determines if contamination is likely. Contamination classified based on concentrations of contaminants and exposure pathways. Accredited auditor approves remediation plan or site suitability for use.	Soil becomes waste on leaving site. Tracked from site to destination – online tracking system, information entered as they go. Movement by licenced waste transporter. Consignment authorisation required from receivers before moving.	High level waste must be treated before landfilling; treatment onsite or interstate. Receiving facility must be licensed for appropriate classification of contamination. Automatic exception reporting flags inconsistencies through online tracking. Waste levies apply to landfill.	Quantities reported for movements and arrival at receivers. Quantities of soil treated or stored on site available through approvals and auditing. Process; not reported or tracked so not currently available.

Table 5 Tracking and approval process summary for New South Wales

4.1.3 Data

The Waste Data Unit of the NSW EPA provided data for the quantities of contaminated soil handled by landfill facilities . Data on Contaminated soil is as categorised in the Section 88 monthly or annual returns required by landfills to submit to the EPA. Separate figures are given for each of tonnes received at the gate, tonnes transported from the facility for further recycling or disposal, and tonnes disposed at the facility. The figures used for the baseline summary is the total disposed, thereby discounting the quantity transported.

The NSW EPA noted that sometimes asbestos contaminated soil is disposed under the material classification of "Asbestos" waste, a category which is not addressed in this report.

FY	Total received	Total transported	Total disposed
2008-2009	641,115	17	641,098
2009-2010	442,008	-	442,008
2010-2011	506,005	16	505,989
2011-2012	620,116	-	620,116
2012-2013	555,299	-	555,299

Table 6 Annual reporting by landfill facilities of contaminated soil in NSW. (Source: (New South Wales EPA))

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Figure 4 Annual reporting by landfill facilities of contaminated soil in NSW (Source:(New South Wales EPA))

Additionally, NSW EPA presented details of the waste streams from where the disposal is sourced . The over-riding source is C&D waste, but very small quantities are generated from municipal waste and a small proportion from the C&I (commercial and industrial) waste stream.

NSW EPA also provided a full break up of the figures according to the region from where it was sourced. This is more detail than need for this report so has not been referenced here.

FY	Municipal received	Municipal trans- ported	Municipal disposed	C&I received	C&I trans- ported	C&I disposed	C&D received	C&D trans- ported	C&D disposed	Total disposed
2008- 2009	597	-	597	32 <i>,</i> 864	-	32,864	607 <i>,</i> 654	17	607,637	641,098
2009- 2010	19	-	19	24,354	-	24,354	417,635	-	417,635	442,008
2010- 2011	20	-	20	298	16	282	505,687	-	505,687	505,989
2011- 2012	702	-	702	14,137	-	14,137	605,277	-	605,277	620,116
2012- 2013	325	-	325	1,436	-	1,436	553,539	-	553,539	555,299

Table 7 Annual reporting of contaminated soils by landfill facilities, categorised by waste stream source for NSW. (Source: (New South Wales EPA))

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Figure 5 Annual reporting of contaminated soils by landfill facilities, categorised by waste stream source for NSW. (Source: (New South Wales EPA))

4.2 VICTORIA

4.2.1 Context

Soil

Relevant Victorian policy documents include:

- State Environment Protection Policy (Prevention and Management of Contamination of Land) (Vic)
- State Environment Protection Policy (Groundwaters of Victoria) (Vic)
- Planning and Environment Act 1987 (Vic)
- Industrial Waste Resource Guidelines Soil Soil Hazard Categorisation And Management (Vic) (IWRG621)
- The Environmental Audit System (Contaminated Land) (Vic) (provides the administrative framework for assessing site contamination)

Waste

Relevant policy documents include:

- Environment Protection Act 1970 (Vic)
- Environment Protection (Industrial Waste Resource) Regulations 2009 (Vic)
- Industrial Waste Management Policy (Movement of Controlled Waste Between States and Territories) (Vic)
- Industrial Waste Resource Guidelines (IWRG)
 - Waste Categorisation (Vic) (IWRG600.2)
 - o Soil sampling guidelines (Vic) (IWRG702)



Terminology

In Victoria, hazardous waste is termed Prescribed Industrial Waste (PIW). The definition of waste is triggered if the material is excess, surplus, rejected or unwanted. Contaminated soil wastes are classified as Category A; Category B; or Category C for the purposes of determining a suitable destination. These categories are determined by compound loadings and leachability:

- Category A landfills are not licensed to accept. It must be treated or immobilised. It
 must only be transported for destruction to achieve "better environmental performance
 standards";
- Category B only one licensed destination;
- Category C multiple destinations available.

Fill Material has the lowest concentration, for which only an upper threshold applies. Above this threshold the waste has to be classified as Category C. VIC EPA does not regulate fill material (see Environment Protection (Industrial Waste Resource) Regulations 2009 (Vic) Victoria has adopted the ASC NEPM for waste generators to determine if material is fit for use.

State of Play

Even though Category A waste must not be transported in Victoria, if contaminated soil waste displays any characteristics listed in Industrial Waste Resource Guidelines (similar to the UN Codes for dangerous goods) it is automatically categorised as Category A waste. VIC EPA can limit unnecessary cross-border movements that might occur to avoid waste levies or higher dumping or treatment prices. They have an approval mechanism through the NEPM for Controlled Movements and through IWRG 832 "Movement Of Prescribed Industrial Waste From Victoria (Vic)" which both require that it be proved the movement is to achieve a better environmental outcome.

EPA has indicated an intention to amend legislation, once suitable treatment facilities are available, to prohibit dumping of organic contaminants to landfill. There is no indication that this is currently being planned, although a treatment facility will be operational October 2014, and approvals have been given for construction of others.

Victoria has a "Top 6" environmental program with contaminated environments one as of the priority areas.

There is some awareness of inadequacies in the system by those who are working with it, but no active review is underway.

Only one landfill site is licenced to receive Category B waste, run by SITA at Lyndhurst. Renex will shortly (October 2014) open a pyrolytic treatment facility for PIW, including soils, to treat organic pollutants and volatile metals. This facility will have capability to handle all waste categories. A number of sites can accept Category C waste. They include industrial C&I and C&D tips as well as municipal facilities. Permanent treatment facilities are the only ones in Australia so will expect to receive waste from interstate.

In Victoria the primary source of contaminated soils is redevelopment of former industrial sites for urban renewal, both property and infrastructure development. There is some rehabilitation of industrial land.

Victoria has an Illegal Dumping Strikeforce. Some illegal dumping incidents are discovered through expectations of soil quantities not matched by tracked quantities. Because waste is not tracked through from generator to receiver there is no way of systematically tracking what leaves the system. Further, the tracking system does not provide information about soil not in the system. Licensed clean fill sites will ask for clean fill certificates. Illegal dumping to farmland is only known if an incident is investigated.

4.2.2 Tracking

What is tracked?

Prescribed Industrial Waste (PIW) that is moved off site is tracked. Movements must be undertaken by licensed handlers and sent to licensed receivers. Certificates are exchanged. Receivers report annually, including quantities. Imports to Victoria are tracked in accordance with the MWC NEPM, as covered by the Victorian Waste Management Policy. Exports of PIW from Victoria must be approved by VIC EPA, and only if they result in a better environmental outcome as required in the MWC NEPM. The receiving jurisdiction must consult the generating jurisdiction but it has not occurred consistently. Hence Victoria is implementing the requirement for approval to export.

When is soil waste tracked?

The Victorian tracking system includes all movements of PIW. The current tracking and management is primarily undertaken for the purpose of generating receipts.

Site	Movements	Fate	Measurement
Contaminated sites register exists but does not pick up all contaminated soil. Trigger is redevelopment of site, change of zoning. No link with Dept of Planning to be notified of developments. Contamination classified based on concentrations of contaminants, leaching VIC EPA appoints an auditor under NEPM	Only moved off-site if no preferred opportunities available. Tracked from site to destination using certificates. Movement by licenced waste transporter. Consignment authorisation required from receivers before moving.	High level waste (Category A) must be treated before landfilling. Receiving facility must be licensed for appropriate classification of contamination. Waste levies apply to landfill.	Quantities reported for movements and arrival at receivers. Quantities of soil treated or stored on site available through approvals and auditing process; not reported or tracked so not currently available.

Table 8 Tracking and approval process summary for Victoria

4.2.3 Data

The Victorian EPA has provided the figures for contaminated soil volumes being transported, by categories . Category A is considered hazardous and only permitted to be transported for desctruction, hence the very low quantities shown which may or may not reflect the arisings of this category.

Waste Code	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
N119 - Cat A Soil	3,504	5,992	6,036	5,760	5,072	3,032	1,955
N120 – Cat B Soil	28,797	19,881	16,931	12,875	20,888	34,954	9,414
N121 – Cat C Soil	381,259	268,622	254,999	379,942	340,989	324,961	203,344
Totals	413,560	294,495	277,966	398,577	366,949	362,948	214,713

Table 9 Annual movements of contaminated soil in Victoria (Source: Contaminated Soil Data Victoria (Vic))

Figure 6 Annual movement of contaminated soil in Victoria, by category (Source: Contaminated Soil Data Victoria (Vic))



Variations in contaminated soil quantities in Victoria between different years can be explained by several factors. Urban redevelopments saw huge spikes in quantities 4-5 years ago. Then a downturn in the economy saw a decline. The new ACS NEPM increased the level of contamination that could be left on site, so more material was left on site further decreasing the amounts. The new Renex treatment facility has recently been approved to start receiving contaminated soil, so some generators may be stockpiling in anticipation of the treatment plant commencing, although they may need to move to holding site and such a movement would be captured in the tracking system.



4.3 TASMANIA

4.3.1 Context

Soil

- State Policies and Projects Act 1993 (Tas)
- Environmental Management and Pollution Control Act 1994 (Tas)
- Environmental Management and Pollution Control (Waste Management) Regulations 2010 (Tas)
 - Associated guidelines for implementation of the CSA NEPM.
 - Information Bulletin No. 105 Classification and Management of Contraminated Soil For Disposal (Tas)
- The Tasmanian Acid Sulfate Soil Management Guidelines (Tas) published by Department of Primary Industries, Parks, Water and Environment

In Tasmania, the Environmental Management and Pollution Control Act 1994 is the principal vehicle for identifying and managing contaminated sites; however, the Act does not specify remediation requirements, hence remediation options under the NEPM reflect Tasmania's *de facto* state policy.

Waste

- State Policies and Projects Act 1993 (Tas)
- Environmental Management and Pollution Control Act 1994 (Tas)
 Environmental Management and Pollution Control (Controlled Waste Tracking)
 Regulations 2010 (Tas)
- Environmental Management and Pollution Control (Waste Management) Regulations 2010 (Tas)

The Environmental Management and Pollution Control (Controlled Waste Tracking) Regulations 2010 (Tas) cover intrastate movements. Contaminated soil was exempt from these regulations when they were first issued in 2010. It had been expected that a database would be released at the same time, but it wasn't ready so an exemption was gazetted for the tracking of soils. The intention had been to register producers, transporter and receivers. Certificated would be issued for waste movements and these would be recorded in the database. The intervention of the GFC caused a re-think of the process and the exemption was not lifted.

Terminology

Controlled waste means a substance within the meaning of the MCW NEPM (list of waste category codes and characteristics of dangerous goods) and prescribed by the regulations (Environmental Management and Pollution Control Act 1994 (Tas) (EMPCA) Part 1, 3(1)).

Controlled waste is a substance with environmentally significant characteristics such as dangerous goods (UN-Codes), chemicals, poison or a scheduled waste from the National Management Plan Environmental Management and Pollution Control (Waste Management) Regulations 2010 (Tas). Furthermore controlled waste can come under the Quarantine Regulations 2000 (Part 2, regulation 5).

Contaminated soil may or may not be defined as a controlled waste. TAS EPA uses four classes of contaminated soil: Level 1 -"Fill Material"; Level 2 -"Low Level Contaminated Soil"; Level 3 -"Contaminated Soil"; and Level 4 -"Contaminated Soil for Remediation". Level 1 reflects low-

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grade soil waste that can be used as fill material, whereas Level 4 reflects high-grade soil wastes that are not to be disposed without prior treatment. Level 1 is not declared as controlled waste, Level 2 to 4 are contaminated with a controlled waste or display characteristics of a dangerous good (per the UN-Codes).

State of Play

EPA Tasmania has a single investigation officer. Landfill fees have been increasing steeply over the last five or so years.

Waste tracking alternatives are being considered at high level. Tasmania plans to implement a "Controlled Waste Tracking System (CWTS)" on the legal basis of Environmental Management and Pollution Control (Controlled Waste Tracking) Regulations 2010 (Tas). Although there is no tracking system yet, an approval by the Environment Protection Authority is required. As reported in Classification and Management of Contraminated Soil For Disposal (Tas) no formal notification or approval is required for fill material unless it is likely to cause environmental harm. This implies that only Level 2 to Level 4 contamination is recorded.

There are four Tasmanian landfills at which Level 2 "Low Level" contaminated soils may be accepted. At the time of writing, no Tasmanian landfill is receiving Level 3 waste for disposal (Classification and Management of Contraminated Soil For Disposal (Tas)). Total Petroleum Hydrocarbons (TPH) contaminated soil can be land farmed. One such facility is available, and some on-site handling of TPH is approved. The suitable technologies for waste treatment of Level 4 contaminated soil are not available in Tasmania and these soil wastes must be sent to an interstate facility. Historically, Queensland has been the destination for remediation of soils with high mercury content.

TPH contaminated soils and soils from mines with metal contamination comprise major sources of contaminated soil. Tasmanian mines mostly self-manage soil contamination on-site using tailings ponds. Industrial wastes include mercury contaminated soil from paper mills, as well as metal contaminated soils from various other industries. A lot of recent industry closure has seen an increase in soils for remediation because sites must be rehabilitated, particularly service stations. Old railway yards on the docks currently being rehabilitated are likely to be a source of a large quantity of contaminated soil in the near future.

4.3.2 Tracking

What is tracked?

In Tasmania, only controlled wastes need to be tracked. Prior to the Controlled Waste Tracking Regulations, Tasmania had Environmental Protection Notices for controlled waste transport, with a quarterly reporting process that summarised movements. The onus was on the transporter to retain records and report quarterly. Policing completion of these may have been patchy. Tasmania sees a tracking system as valuable for policing loads to ensure they arrive at the intended destination, but the advantage of Tasmania being a small place is that inappropriate activities are noticed and reported. Certificates are issued to track interstate movements.

When is it tracked?

According to the "Classification and Management of Contraminated Soil For Disposal (Tas)", the approval process is started by the producer (or acting consultant), when disposal, re-use or remediation of soil is required. If contaminated soil is intended to go to landfill, the landfill facility should be contacted first. After that, an application is sent to EPA. Approved classification is sent to the producer, as well as the landfill authority. This results in a tracking before the waste is moved.

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Site	Movements	Fate	Measurement
Owner or occupier must notify TAS EPA if contamination suspected. EPA maintains database of known contaminated sites. Testing required before application to move soil. Contamination classified based on maximum total and maximum leachable concentration for specific pollutants.	EPA monitors that quantities moved match approval.	Level 4 wastes must be treated before landfilling – treatment on site or interstate. Receiving facility must be licensed for appropriate classification of contamination	EPA keeps records of all Regulation 12 approvals issued and approval letters. These contain information about quantities and types of contaminants.
TAS EPA issues an approval under Regulation 12 of the Waste Management Regulations to remove or treat controlled waste at other than an approved disposal. To take material to an approved disposal requires an approval letter from TAS EPA.			

Table 10 Tracking and approval process summary for Tasmania

4.3.3 Data

Data from EPA Tasmania for disposals, , was provided with detail of landfill or treatment facility destination, and the quantities in the measurement units reported. There is opportunity for distortion of the volumes during conversion from kg, m3 or litres to tonnes because a generic density was assumed for the calculation.

Disposal of material to approved receivers						
FY	Treatment [t]	Landfill [t]	Annual Total (t)			
12-13	378	5,520	5,898			
13-14	144	2,455	2,599			

Table 11 Annual disposal of contaminated soil to approved receivers (Source: (Tasmania EPA2014)); data has been collated by project team.

Additionally, Tas EPA provided a detailed listing of activities that received approvals under Regulation 12 which is for disposals to otherwise unapproved recipients or treatments. This included on-site treatment, and landfill destinations for reuse. The project team has only provided collated figures to protect commercial confidences. These figures have been kept separate, and reported separately in the summary tables, because most jurisdictions do not collect or cannot provide matching data.

The level of detail in the data suggests a high level of reliability. Within the regulation 12 figures are two particularly disproportionate quantities, both related to once-off approvals. In 2010-11, 4000 tonnes was approved for treatment and storage; in 2013-14 30,000 tonnes was disposed on site .

Disposals to otherwise unapproved recipients or treatments				
FY	tonnes			
10/11	4,921			
11/12	1,600			
12/13	1,850			
13/14 (to May)	30,800			

Table 12 Annual disposal of contaminated soil to otherwise unapproved recipients or treatments, Collated by project team from extract of records of specific activities for which Regulation 12 approvals were issued (Source: (Tasmania EPA 2014)).

Figure 7 Annual disposal of contaminated soil to approved receivers showing both landfill and otherwise unapproved handling (Source: (Tasmania EPA 2014)))



As can be seen from Figure 7, the once-off approval for an on-site disposal in Year 2013-14 overshadows all other quantities. It demonstrates the importance of knowing the detail behind the figures to understand their reliability or likelihood of re-occurrence.

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4.4 SOUTH AUSTRALIA

4.4.1 Context

Soil

In South Australia, the following documents cover land contamination:

- Environment Protection Act 1993 (SA)
- Specific site contamination provisions of the Environment Protection Act 1993 commenced in full on 1 July 2009 (NEPC 2012/2013).

SA EPA has developed specific guidelines for environmental management of on-site remediation.

Waste

The following documents set the policy context for waste:

- Environment Protection Act 1993 (SA)
- Standard for the production and use of Waste Derived Fill (SA)

The National Environment Protection (Movement of Controlled Wastes between States and Territories) Measure (Cth) is implemented through conditions of licences.

Terminology

Four soil waste categories are used in South Australia:

- Waste fill (formerly clean fill);
- Intermediate waste soil can be used for landfill cover, or reused subject to auditor involvement.
- Low-level contaminated soil;
- High-level contaminated soil.

Reuse of contaminated soil is not regulated because materials are not deemed to be a waste once it is fill. All movements of contaminated soil – intermediate, low-level and high-level are classified as NEPM-75 class N120. Material is not deemed waste if it has not left the site, but this does not reflect the application of a formal definition.

State of Play

South Australia uses a Waste transport certificate (SA)(WTC) and a Waste tracking form (SA) (WTF) while the majority of listed wastes are tracked with a WTC. When transporting "intermediate landfill cover (contaminated soil)", a WTF is used to track the listed waste. When transporting interstate, a WTC must be used. In cases of large infrastructure works, SA EPA uses different programs in place to avoid having to handle large numbers of waste transport certificates. The streamlined process allows faster data gathering than the normal system and is considered successful.

Commencing 1 July 2014, SA will be implementing an online waste tracking system based on the NSW system and adapted to SA legislation.

There are six licensed facilities receiving contaminated soil waste - Southern Waste ResourceCo Pty Ltd, Acquista Investments Pty Ltd, Veolia Environmental Services (Australia) Pty Ltd, Waste Management Pacific (S.A.) Pty Ltd, ResourceCo Pty Ltd, Adelaide Resource Recovery Pty Ltd, and Corporation of the City of Whyalla. Recently three treatment facilities have become established in Adelaide, leading to more low-level contaminated and high-level contaminated material being treated for potential reuse purposes. Soil rehabilitation occurs within boundaries of a landfill. PCB contamination needing removal is sent interstate.

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The SA EPA advises that a significant volume of contaminated soil is generated annually and that this volume has been relatively consistent over the last 10-15 years. Consistency is not borne out by the data provided for the last few years. The Royal Adelaide Hospital development was a major infrastructure project, which generated 260,000 tonnes of waste soil during @YEAR.

Illegal dumping is expected to be minor in SA. All soil waste quantities are defined and are part of the contractual arrangements. This process is too well-defined for diversion to be straightforward. SA EPA can ensure that unlicensed waste transporters are removed from the site or that all the vehicles are registered If the process makes it easier and more economically viable for the generators, it is well accepted. Auditors are appointed by SA EPA, with stiff penalties for inappropriate behaviour. All auditor reports are reviewed by SA EPA. This reduces a possible avenue for illegal activity. SA EPA can cross-reference classifications against suspected or known contaminated areas. The benefit of a smaller jurisdiction is arguably that commercial competitors will report dishonest activity.

4.4.2 Tracking

What is tracked?

In South Australia, all NEPM-75 class N120 soil movements are tracked using waste transport certificates, both intrastate and interstate imports. Soil waste is not tracked if excavated, rehabilitated and replaced on-site. Generally, tracked quantities do not differentiate between categories of waste soil unless this is required to keep track of movements for large infrastructure works.

When is soil waste tracked?

Soil waste is tracked from site to treatment or rehabilitation, then to landfill, except when it becomes waste fill.





Site	Movements	Fate	Measurement
Public register of potentially contaminated sites. Change of use development triggers audit system, driven by planning system requiring site history to assess contamination potential. Formal audit required. Site contamination auditor deems the material fit for purpose and receiving sites being fit for purpose, fit for receipt.	Soil becomes waste upon leaving site. Consultant or auditor approves off-site movements in the first instance. Incoming interstate movements are notified in advance by generating jurisdiction to ensure receiving facility is suitably licensed and can accept material before SA EPA issues approval and consignment authorisation number. Quantity is validated by receiving facility. Waste transport certificates track movements from generating facility, to transporter to receiving facility, including interstate imports.	High-level waste must be treated before landfilling. Receiving facility must be licensed for appropriate classification of contamination. Waste levies apply to waste received for the purpose of disposal.	Volume can be gauged during in-situ assessment, before excavation. All movements, including those internal to a landfill, tracked for volumetric survey of disposal (mass balance). Movements are tracked, raising possibility of some double counting if there is an intermediate stop for treatment. Measurement also possible at point of disposal; does not include any treated for reuse. Waste leaving SA is not tracked; responsibility of jurisdiction receiving material. Compliance work between states to balance quantities.

Table 13 Tracking and approval process summary for South Australia

4.4.3 Data

South Australia's tracking system is continuous between generator, transporter and receiver and allows for quantities to be validated, suggesting reliability of the figures reported. The total figures may be inflated by the inclusion of waste derived fill quantities disposed to the three unlicensed facilities because they can be characterised as "reuse" which is outside the defined scope for this baseline. Additionally, equivalent figures for reuse are not necessarily available for other jurisdictions.
FY	tonnes
2008-09	41,507
2009-10	56,486
2010-11	229,494
2011-12	434,229
2012-13	240,453
2013-14	109,983

Table 14 Combined total annual quantities received by all facilities (licensed and treatment).The figures include interstate movements into South Australia. (South Australia EPA 2014)

FY	tonnes
2008-09	371
2009-10	251
2010-11	6,017
2011-12	5,483
2012-13	491

Table 15 Total annual interstate movements into South Australia. (South Australia EPA 2014)These figures confirm those reported by NEPC.



Figure 8 Total annual quantities received by all facilities (licensed and treatment), showing contribution of imports from interstate (Source: (South Australia EPA 2014))

EPA South Australia provided information about major infrastructure works that distort the figures, (see Table 16). Exact dates were not provided which would allow allocation to financial

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years but by viewing the data in graphical form, , the impact of these works can be clearly identified. The figures provide an interesting insight into the impact of major works, discussed further in Section 5.6. The very large volumes reported in years 2010-2014 compared to the earlier years can be explained by these projects. It shows that high variability in data cannot be discounted without a deeper look into the possible reasons.

Site	Year(s)	tonnes
New Royal Adelaide Hospital	2011–13	328,560
Adelaide Oval	2012	167,409
Mulherns Liquid Waste Depot Fire	2012	14,307
Whyalla Hospital	2012	267
Tonsley Park (old Mitsubishi site)	2013	800
Victoria Square, Adelaide	2013	17,870

Table 16 Large infrastructure works that distort annual figures (South Australia EPA 2014)

4.5 WESTERN AUSTRALIA

4.5.1 Context

Soil

Relevant policy documents include:

- Contaminated Sites Act 2003 (WA)
- Contaminated Sites Regulations 2006 (WA)
- Associated guidelines, including the revised Contaminated Sites Management Series Assessment levels for Soil, Sediment and Water (WA)'.

Waste

Relevant policy documents include:

- Environmental Protection Act 1986 (WA)
- Environmental Protection (Controlled Waste) Regulations 2004 (WA)
- Landfill Waste Classification and Waste Definitions 1996 (WA)
- User Guide: Controlled Waste Tracking System Guideline No. 4 (WA)

Terminology

Contaminated soils are classified in terms of their suitability for disposal at a class of landfill. Landfill Waste Classification and Waste Definitions 1996 (WA) sets out the thresholds for going to Class I, II, III, IV, or V landfill. If the contaminant threshold meets the requirement without a leach test, it can go straight into that relevant landfill. If any particular contaminant exceeds the relevant threshold, then the generator may choose at a higher cost to do a leachate concentration test, because if it falls under leachate concentration test the material can still go to

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that lower class landfill. Treatment can reduce material by no more than one class of landfill. The WA system covers the highest risk materials, tracking from waste generators to disposal sites.

Western Australia categorises five landfill types: Class I – Class V (lowest to highest contamination) (see Landfill Waste Classification and Waste Definitions 1996 (WA)). Contaminated soil is defined to have contaminations above background level and/or provide a risk of harm. Additionally, the Environmental Protection (Controlled Waste) Regulations 2004 (WA) identifies *"Soils contaminated with a controlled waste"* as a controlled waste for which the regulations apply.

State of Play

The WA Department of Environment and Regulation (DER) deals with tracking contaminated soil to make sure it is at a proper disposal site and does not represent a risk to human health or the environment. The controlled waste regulations are for the transportation of contaminated soil waste on a road, by a licensed operator that knows how to handle it. Activities prescribed under the Environment Protection regulations give rise to prescribed premises. Categories are assessed on environmental impact, based on activities and waste quantities.

There is a contaminated sites database based on the address and the certificate of title information. There are seven different classifications for sites: a report not substantiated, possibly contaminated, investigation required, remediated restricted use, contaminated restricted use, contaminated remediation required, decontaminated, and not contaminated unrestricted use. There are nearly 3,000 sites classified.

Discrepancies in the jurisdictional data between quantities picked up and quantities disposed may be due to one of a number of causes which indicate a degree of inaccuracy in any figures generated: the data is not audited, there are no verification checks; each assessment is undertaken independently with pick-up done by the driver and disposal by the receiving facility; typos may be entered for quantities or using wrong units (kg, t, l); most inert landfills don't have weighbridges; load quantities may be estimated or rounded off; conversions to tonnes from other units are standardised and not based on mass of specific load.

There are a large number of movements every year and limited resources to vet every movement. The enhancements planned for the tracking system are to enable a big picture overview to identify risks.

WA is currently going through a regulatory amendment process to address enforcement issues and enhance the system to make it a more useful tool for analysing the data and identifying discrepancies. NEPM codes will be adopted. Landfill levies are increasing so that infrastructure for landfills, treatment options and remediation techniques can be improved. A recent review of the Contaminated Sites Act is unlikely to result in changes to the legislation. It may lead, however, to some changes to procedures and practice to improve timeframes and providing useful information.

The Redhill facility is the only Class IV landfill in WA.

In WA, the biggest single contributors to contaminated soil wastes are landfills and service stations. Landfills present uncertainty as to the types of waste that have previously been disposed to landfill. There is also some urban renewal of old industrial sites. Part of Perth's issue is that residential areas are expanding into former industrial areas. This triggers a lot of infill development. The move to more sensitive land uses means that a lot more sites need to be addressed. Mine sites are classified, with regulatory responsibility crossing over with the WA Department of Mines and Petroleum. Waste regulators work with this Department on mine

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closure plans to be developed at mine approval stage, including consideration of contaminated site requirements.

The main contaminants encountered in WA are hydrocarbons from fuel storage; a number of metals from the mine sites and from landfills; nutrients and ammonia from the landfills. A few sites have volatile organic compounds, mainly from solvents. Asbestos is a major issue in WA - "it tends to be everywhere". DER defers to Department of Health in the investigations of those sites but classifies the sites because of asbestos contamination.

Acid sulphate soils are extensive in WA, even in sands. The result of this naturally occurring contamination - the lowering of the PH of groundwater – mobilises metals from contamination or naturally occurring in the soil. This can in turn result in groundwater contamination with heavy metals.

Groundwater is a valuable resource in WA, and anybody can put in a bore without need to get a licence. Therefore, extra care is needed to ensure landfills are not a potential source of groundwater contamination. If they are, affected properties may need to be classified to prevent bores being drilled without being aware of the groundwater contamination issue, and possibly creating a pathway to the contamination that is a health or environmental risk.

The reality is the costs to dispose of contaminated waste is a fraction of the real cost of dealing with the materials. It is primarily a dig and dump mentality, as the most commercially viable. DER is hoping increasing landfill levies will change that a little. The hierarchy of remedial techniques that used to be in the EPA document is promoted – preference for material to be handled on site and managed on site rather than dug out and taken off site.

There is the potential for illegal activity but it could be observed and reported by anyone, which acts to limit it.

4.5.2 Tracking

What is tracked?

Contaminated soils that are disposed at a Class IV or Class V landfill are required to be tracked, Regulation 3 Part 1 of Environmental Protection (Controlled Waste) Regulations 2004 (WA). Tracking is from source through to the waste facility. It is not involved in any on-site wastes. Class V (intractable) is rarely used and no disposal was reported in the 6 years of data provided to the project team by DER.

Some loads disposed to Class I, II and III landfills have been reported. This may be because the carrier did not understand tracking was not required, or the generator may have required reporting to demonstrate good corporate practice. This partial data is included in the annual totals together with the Class IV disposals provided by WA, making the figures very incomplete.

When is soil waste tracked?

(Western Australia DEC 2010)(Western Australia DEC 2010),

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When a site is reviewed and assessed, a mass balance is undertaken to ensure that what they're claiming was removed from the site was disposed to a landfill. That information isn't tracked separately.

Site	Movements	Fate	Measurement
Record kept of contaminated sites; site classification memorials kept on land titles. Trigger is site classification or redevelopment of site (planning approval process) for a more sensitive land use. Accredited auditor reviews investigations. For complex sites, DER recommends a contamination sites auditor be involved in remediation, as a sort of a peer review process. Quantification is only reviewed by DER for off-site movements. No attempt made for on site management. The site works would know the volume of material needing to be remediated, and this would be included in the reporting for that site, but the quantity is not captured. Remediation leads to a	Tracked from site to destination – online tracking system, information entered as they go Movement by a licensed carrier, with a licensed vehicle driver.	Receiving facility must be approved for appropriate classification of controlled waste.	Quantities are reported for movements and arrival at receivers; see discussion above regarding accuracy of data.
change in site classification.			

Table 17 Tracking and approval process summary in Western Australia

4.5.3 Data

Only soils disposed to Class IV or V destinations are required to be tracked, but soils of lower classes are sometimes reported to the tracking system. Because Western Australia has only one facility licensed to Class IV, WA EPA was not able to provide annualised data for that class of soil so as not to breach commercial confidence. No soil was disposed to Class V during the years for which data was provided. The data was provided for all contaminated soil reported to the tracking system therefore it contains all Class IV quantities and partial Classes I, II and III quantities, making it incomplete and not transparent.

Data was provided for quantities at both ends of the movement – that recorded by the truck operator at pick up, and then reported by the receiver at disposal, with notable inconsistencies between the two. The reports are conducted independently. The method of measurement varies – sometimes an estimation of proportion of truck load, or estimation based on experience, or

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actual measurement on a weighbridge. The unit of measurement varies – the data was provided grouped under the units used for each of pick up and receipt. There is opportunity for distortion of the volumes during conversion from kg, m³ or litres to tonnes because a generic density was assumed for the calculation. The EPA reports that errors can occur in reporting, with "typos" regarding a zero added or lost, or the wrong unit of measurement recorded.

For these reasons, the Western Australian data is very poor for the purposes of establishing a baseline. Notwithstanding this, the data reported at disposal has been included in the baseline summary. This group was selected over the pick up group because it was estimated or measured at the receiving facility, which, in some cases, would have a weighbridge and with the experience of conducting more estimates than the truck drivers, may be more accurate. Additionally, the baseline may rely on disposal data from other jurisdictions, so there is better data consistency.

FY	Picked Up tonnes	Disposed tonnes
08/09	8,170	8,688
09/10	12,224	13,498
10/11	7,077	6,765
11/12	5,787	5,859
12/13	3,168	3,439
13/14	2,289	2,489

Table 18 Annual movements of contaminated soil, tracked by licensed transporters at pick up and by licensed receivers at disposal destination. Data has been collated by project team from data reported in a variety of measurement units (Source: (Western Australia DER 2014))



Figure 9 Annual movements of contaminated soil, tracked by licensed transporters at pick up and by licensed receivers at disposal destination. (Western Australia DER 2014)

Both pick up and disposed quantities are shown in , for ease of comparison. It demonstrates a general alignment, but lack of accuracy in reporting.

4.6 QUEENSLAND

4.6.1 Context

Soil

Relevant soil policy documents:

- Sustainable Planning Act 2009 (Qld)
- Environmental Protection Act 1994 (Qld)
- Guidelines for the Assessment and Management of Contaminated Land in Queensland, May 1998.

Waste

Relevant waste policy documents:

- Environmental Protection Act 1994 (Qld)
- Environmental Protection (Waste Management) Regulation 2000 (Qld) includes tracking definitions
- Environmental Protection Regulation 2008 (Qld)- requirements for the licensing of controlled waste transporters
- Waste Reduction and Recycling Act 2011 (Qld)
- Waste Tracking Guideline Managing waste tracking in Queensland (Qld)

Terminology

Queensland uses the term 'regulated waste' for waste underlying a legal regulation, listed in Schedule 7 of Environmental Protection Regulation 2008 (Qld). The term 'trackable waste' is used to describe regulated waste for which movement must be tracked (Queensland Legislation 2000). Contaminated soil is not listed as a regulated waste, but becomes so by means of its contaminating chemical compounds. The ACS NEPM guidelines are used by auditors to classify contamination, using HILS.

State of Play

The QLD legislation is currently under review. Regulatory change is expected by December 2014. An online waste tracking system (Ecotrack) will be implemented. Contaminated soil is expected to be captured in the changes. A system of auditors is commencing as of 1 July 2014. Change to the legislation will allow the Department to require suitable solutions without directing how it is to be achieved.

There are five facilities in QLD that specialise in contaminated soils and a further 6 listed as handling (NEPM) "N" code wastes (Rawtec 2014)@RAWTEC ref.

Sources of contaminated soil waste in QLD include sheep dips (representing a good example of example of notifiable activity); gasworks; and landfills near airport used for C&D waste.

There is the potential for illegal receiving and transporting, but this is often picked up by the Department when matching certificates are not received for the generating and receiving ends of the movement. They can identify and follow up unlicensed operators, and chase discrepancies for an explanation.

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4.6.2 Tracking

What is tracked?

All waste falling into one or more categories of Environmental Protection (Waste Management) Regulation 2000 (Qld) Schedule 1 Trackable Waste must be tracked. Contaminated soil is not included in the requirement. Contaminated soil is explicitly excluded in Waste Tracking Guidelines: "However, regulated waste does not include acid sulfate soil or contaminated soil" (Queensland EHP 2013). Any soil containing contaminants would be logged in the tracking system under a code for the contaminant, and is therefore not identifiable as a soil volume.

There is a Soil Disposal Permit System separate to the tracking system, but soil quantity information is not collated. The number of permits issued in the first 5 months of 2014 is approximately 60; there are approximately 100 each year.

A third system captures quantities disposed to or leaving licensed facilities, those considered "in the waste market". A left over from the system that reported for waste levies, it has been kept as a data collection mechanism now that levies have been abolished. Facilities are asked to report on what they received, what was landfilled and what was recovered. Any quantities that go through a treatment facility may not be recorded as soil. Recyclers can report soil, but none have. The system collects information about waste recovered on aluminium refinery and power station sites, but none have reported soil. It does not include soils managed on mining sites. The system tracks contaminated soil imported from interstate.

The various tracking and approval systems operate independently of each other and are not coordinated or reconciled.

Although electronic records are kept, the system is very old. The tracking system relies on 5 carbon copy certificates that are variously held by the operator, or submitted to the Department. The Department scans each certificate then manually enters or verifies the data. Contaminated soil is logged under the code for the contaminant so the database can't be interrogated for soil quantities.

An incentive for the land owner to have contamination addressed properly is that the Department can relist a site if a problem is found at a later date.

Until two years ago, the reporting system consolidated contaminated and acid sulphate soil figures. These are now disaggregated.

When is soil waste tracked?

A waste generator must use a licensed waste transporter. Waste transport certificates are used by QLD EHP to ensure that the waste that left the generator arrived at the receiver. Soil Disposal Permits are for material from registered sites, or sites that should be registered. The QLD tracking system covers movements of waste soil from generators that are not on contaminated sites register. There may be some quantities that are tracked unnecessarily, and will therefore be double counted with Soil Disposal Permits, although the manual checking system means staff will often identify quantities that appear to be in the wrong category, and will confer with colleagues in the other area to reconcile accounts. The quantities disposed to landfill are counted at point of arrival at the facility. Although landfill facilities are asked to report quantities that are recovered, generally soil is not reused because it is not a product the facility can make money from. Councils do use some quantities for parks or roads.

Site	Movements	Fate	Measurement
Environmental Management Register – sites, disposal permits Environmental Land Register – contaminated but under control, no threat to the environment	Waste transport certificates track waste leaving a generator and arriving at a receiver. Transporters must have a regulated waste transporting licence		
Contaminated Land Register – leaching contamination and nearby sensitive receptors; 12-13 listed blocks across the whole state.			
Environmental Authority (EA) – requires remediation to be undertaken for the activity/use proposed and lists site on register. Development proposal can trigger an EA.			

Table 19Tracking and approval process summary for Queensland

4.6.3 Data

The data was provided by the Queensland Department of Environment and Heritage Protection. It was compiled from data they hold for contaminated and acid sulfate soils reported by local governments and private landfills, measured at arrival or departure from the receiving facility.

Contaminated and acid sulfate were combined for all years in the local government surveys and for the period 2007-08 to 2010-11 in the private landfill surveys. Partly disaggregated data is available for 2011-12 and 2012-13.

Contaminated soils are defined as any soils contaminated with a regulated waste.

The quantity reported as tonnes landfilled is the net amount disposed, and does not included the amount recovered. Where disaggregated amounts are available, they are included within the landfill quantity. The landfill quantity has been used to compile the baseline figure.

At the request of the project team, figures were provided separately for soils received from interstate sources for 2012-13, which will allow checking of NEPC data series.

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tonnes	Contaminated & Acid Sulfate Soils		Disaggregated waste r		received	Waste receive interstate so	ed from ources
FY	Tonnes Landfilled (net)	Tonnes Recovered	Contaminated Soil	Acid Sulfate Soil	Contaminated & Acid Sulfate Soils	Contaminated Soil	Acid Sulfate Soil
2007-08	1,355,000	153,000					
2008-09	536,338	176,391					
2009-10	501,026	42,777					
2010-11	228,188	199,888					
2011-12	238,301	263	139,056	64,702	34,806		
2012-13	352,425	654	61,573	280,084	11,423	1,910	23,584

Table 20 Annual receipts at and recovery from landfill facilities in Queensland, with detail of soil type and source, where known. (Source: (Queensland EHP 2014))

Figure 10 Annual receipts at landfill facilities in Queensland, with detail of soil type and source, where known. Recovered quantities indicated dashed, as additional to the net total. (Source: (Queensland EHP 2014))



4.7 NORTHERN TERRITORY

4.7.1 Context

Soil

- Waste Management and Pollution Control Act (NT)
 - Section 30 Licences
 - Part 6 Environmental Audits
 - o Part 10 Div II PANs
- Waste Management and Pollution Control (Administration) Regulations (NT)
 - o Audits of contaminated sites (Northern Territory EPA 2014)
 - o Contaminated Land Framework (Northern Territory EPA 2014)

Waste

- Waste Management and Pollution Control Act (NT)
- Transport of Dangerous Goods by Road and Rail (National Uniform Legislation) Regulation (NT)

Terminology

In the NT, the terminology for waste that is legally regulated is 'listed waste'. While this term is defined in the Waste Management and Pollution Control Act (NT) it is specified in Waste Management and Pollution Control (Administration) Regulations (NT) Schedule 2. Contaminated soil is described in this Schedule as "Soils contaminated with a listed waste". There are no substance threshold concentrations relevant to the definition. Acceptable levels depend on end use. NT uses auditors accredited in Victoria or NSW, using full process from those states.

State of Play

The Act is undergoing a full review currently. Contaminated soil is included in the review; looking at definitions in other states and may include threshold concentrations but at a lower level to capture more sites. Also considering widening the net on which industries would be captured by the legislation. An online reporting and data system will be operational by the end of the year. Add-ons are expected to quickly follow – matching origin and destination reporting, interstate movements, intrastate movements. Until recently data was only used for the purpose of billing waste levies.

Only one facility is licensed to take contaminated soil (Shoal Bay in Darwin). A lot of waste is exported but exported volumes or soil wastes are low. On-site remediation is the preferred approach. Some on-site remediation is undertaken but such remediation is not controlled by licensing.

In the NT, there has been a rapid increase in contaminated soil quantities in the last three years due to the development boom. Darwin had fuel farms on old industrial sites in the town centre which are now being redeveloped for residential use. Ongoing improvements in NT EPA regulation and better control of reporting requirements may be adding to the increase.

4.7.2 Tracking

What is tracked?

When dealing with listed wastes (collecting, transporting, storing, re-cycling, treating or disposing) on a commercial or fee for service basis, a licence is needed (Waste Management and Pollution Control Act (NT) (Schedule 2 Part 2 Clause 2)). According to the "Guide for Completing Waste

Transport Certificate (WTC) (NT)", persons holding a licence must record the undertaken activity including the activity itself, the amount and the type of listed waste.

When is soil waste tracked?

As there is no tracking system or approval process, listed waste contaminated soil is tracked as soon as an "authorised officer" (Guide for Completing Waste Transport Certificate (WTC) (NT)) requests an inspection of the record.

Waste Management and Pollution Control Act Part 12 Division 4 Regulation, 117 (2)(b): "provide for the implementation of a system to track the movement of waste, or a class of waste, from the place at which it is generated to the place at which it is disposed of;" (Waste Management and Pollution Control Act (NT)).

Site	Movements	Fate	Measurement
Database of contaminated sites Integrated land information system database has confirmed and suspected contaminated sites. Trigger: planning applications for work on site, or Pollution Abatement Notices (PANS).	Movement by licenced handler, to a designated facility. Handlers report annually but it is not tracked or thoroughly audited.	Receiving facility must be licensed and must report activity.	Quantification possible through waste levy billing data.
Accredited auditor approves remediation plan or site suitability for use.			

Table 21 Tracking and approval process summary

4.7.3 Data

The data represents the amount measured at disposal at the only licensed disposal facility, Shoal Bay. It was collected for the purposes of applying the waste levy.

The data does not capture on site treatment or reuse. Given that the quantities were collected for financial purposes it can be expected that they are a reasonably reliable account of the material that reaches the facility.

As mentioned in Section 4.7.1, a rapid increase in redevelopment of old industrial sites for residential purposes, together with improvements in reporting and control, explain the large increase in the recent years, which is clearly evident in Table 22.

Year	Volume reported to NT EPA (tonnes)
2008-2009	Only reported by population serviced
2009-2010	Only reported by population serviced
2010-2011	70 *
2011-2012	8
2012-2013	407
2013-2014	1,242

* has been reported in kilolitres

Table 22 Total annual quantities received at the licensed contaminated soil disposal facility(Source: (Northern Territory EPA 2014))

Figure 11 Total annual quantities received at the licensed contaminated soil disposal facility Quantities not reported in years 2008-09 and 2009-10 (Source: (Northern Territory EPA 2014)).



4.8 AUSTRALIAN CAPITAL TERRITORY

4.8.1 Context

Soil

- Environment Protection Act 1997 (ACT)
- Contaminated Sites Environment Protection Policy (ACT) (reviewed 2009)
- ACT's Environmental Standards: Assessment & Classification of Liquid & Non-liquid Wastes (ACT) for assessment of all potentially contaminated material for disposal.
- Information sheet 4 Requirements for the reuse and disposal of contaminated soil in the ACT (ACT)
- Criteria used by the ACT EPA for the classification of contaminated soil for reuse and disposal in the ACT.

Waste

- Environment Protection Act 1997 (ACT)
- Environment Protection Regulation 2005 (ACT)
- Waste Minimisation Act 2001 (ACT)
- ACT Waste Management Strategy (ACT)

In accordance with the No Waste Strategy there is an established hierarchy for waste management which is - from most preferred to least preferred: avoidance; reduction; re-use; recycling; recovery; disposal (ACT Department for Environment and Sustainable Development 2011, Information sheet 4).

Terminology

The ACT uses the term, controlled waste when transporting between states, in accordance with Movement of Controlled Wastes (MCW) NEPM. Regulated waste is the term for waste transported within the ACT (Environment Protection Act 1997 (ACT))

The classification of non-liquid wastes has the following types:

- Inert—this waste type is the least likely to undergo environmentally significant transformations; therefore, it should not release significant quantities of greenhouse gases or leachates contaminated with nutrients and/or chemicals;
- **Solid**—this waste type can include putrescible waste and is considered to pose a higher environmental risk than inert waste, and consequently needs to be managed with greater care;
- Industrial—this waste type can contain somewhat higher (four times) levels of the contaminants than solid waste, and needs to be managed with more stringent environmental controls than solid waste.
- **Hazardous**—this waste type contains contaminants at levels high enough to require treatment to render them safe before disposal.

Table 6 of the Standards summarises the test values for chemical contaminants in these waste classifications (ACT's Environmental Standards: Assessment & Classification of Liquid & Non-liquid Wastes .

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An Environmental Authorisation (EA) is a form of licence granted under s. 49 of the Act. An EA sets out the conditions under which activities with a significant potential to cause environmental harm may be conducted. The transportation within the ACT of regulated waste, commercial landfills, placement of soil on land, and treatment of contaminated soil are all Class A activities, for which an environmental authorisation is necessary (Environment Protection Regulation 2005 (ACT)).

State of Play

The Act is currently under review for currency. It is expected that there will be greater emphasis on resource recovery and that it will address any emerging technologies. There is no plan to introduce a tracking system because the jurisdiction is said to be too small to justify the cost and effort.

The ACT has one active landfill facility, the Mugga Lane Resource Management Centre (MLRMC), which is classed as a "Solid" waste facility (per terminology above) requiring ACT EPA approval for disposal. At West Belconnen there is a "borrow pit" being remediated with fill, a beneficial reuse. It has been approved to accept contaminated soil but cannot accept putrescibles because it is unlined. It accepts asbestos but not hydrocarbon contaminated soil. A borrow pit exists where soil has been excavated for use in another location, in this case for cover in a landfill site.

Any material exceeding the "Solid" waste classification may require further treatment or disposal interstate (mainly NSW) at a suitably licensed facility.

Limited bio-remediation treatment is available within the ACT.

Development of brownfield sites has caused an increase in contaminated soil quantities in the last couple of years because an old landfill was uncovered. Furthermore, there has been remediation of old service station sites, as well as sheep dips.

Common contaminants found in ACT are asbestos, hydrocarbons from old service station sites and arsenic from the sheep dips.

Being a small jurisdiction, activities are self-regulating; that is, operators are aware of each other's activities. There doesn't appear to be much illegal dumping.

4.8.2 Tracking

What is tracked?

Movements within the Territory are not tracked. Exports from the Territory are tracked, but only collated for reporting to NEPC; current year figures were not available to the project team at time of reporting. All Beneficial Reuse (BRU) approvals are tracked.

When is soil waste tracked?

Under the MCW NEPM, movements into NSW are tracked using the NSW online system. Under the ACT No Waste Strategy, all quantities entering Mugga Lane and West Belconnen cross a weighbridge, so quantities have a reasonable level of accuracy. Some material is imported from the NSW region immediately surrounding ACT because the ACT receivers are closest.



Site	Movements	Fate	Measurement
Database of contaminated sites that includes GIS information and is audited. Development Applications are referred to EPA; the site history is used to determine if treatment may be required. ACT uses NSW and Victorian accredited auditors to report on proposed management, for approval. Contamination classified based on total concentration of contaminants, and the leachable concentration of contaminants- using Toxicity Characteristics Leaching Procedure (TCLP).	The generator or owner is responsible for producing documentation that conveys the correct classification of the waste to the waste transporter and the waste management facility receiving the waste. (Australian Capital Territory 2000)	For beneficial re-use requests and waste disposal applications the results of the sampling and analysis must be provided to the EPA in the form of a brief report, for approval.	Quantification possible through reporting by receiving facility.

Table 23 Tracking and approval process summary

4.8.3 Data

ACT EPA has provided data for quantities of contaminated soil received at the weighbridge of Mugga Lane for disposal to landfill and at West Belconnen Resource Management Centre for approved reuse for one full year, and most of a second year. West Belconnen also operates as a landfarm remediation centre and figures have been provided for movements in and out for the financial year 2011-12. The net loss due to remediation has been incorporated in the total for the year.

The material landfilled at West Belconnen is soil that has been approved for acceptance by EPA and that is contaminated with small amounts of bonded asbestos sheeting and cam rom 3 project sources.

The quantities do not include Beneficial ReUse Material at West Belconnen: material such as clay, gravel, sand, soil, and rock that has been approved for acceptance by the EPA and that has been extracted from areas that are contaminated or have been previously contaminated.

It is notable that the quantities reported here are significantly higher than any of the published data, albeit that there is very little previous data available. The Mugga Lane landfill volumes alone are within the range of quantities for reports of "all N categories", not just N120. Adding the reuse at West Belconnen makes it a different scale altogether.

FY	Mugga Lane Landfill Tonnes Received	West Belconnen Reuse Tonnes Received	West Belconnen Landfarm (Remediation) Net Tonnes	Total Tonnes
2011-12	12,107	26,067	-7,445	30,728
2012-13 (to May)	5,605	23,883		29,489

Table 24 Annual figures for movements in and out from 2 receival facilities in ACT (Source ACT EPA)





5 SYNTHESIS AND DISCUSSION

This Chapter provides a synthesis of newly sourced data and discusses boundary issues arising from definitions. Furthermore, the adequacy of regulatory and market settings, and that of technology and infrastructure are briefly discussed.

5.1 NEWLY SOURCED DATA

Data sourced directly from jurisdictions was consolidated to establish a national total for the year. The periods used are the financial years for which the most comprehensive data is available. Despite the high variability of reported volumes from one year to the next, the national total for these three years varies much less, approximately 10% either side of the 2012-13 year total of 1,552,208 tonnes, with an average total of 1,514,334 tonnes.

State totals [t] for Financial Years					
State	2010-11	2011-12	2012-13	Notes	
ACT	n/a	30,728	29,489		
NSW	505,989	620,116	555,299		
NT	70	8	407		
QLD	228,188	238,301	352,425		
SA	229,494	434,229	240,453		
TAS	4,921	1,600	7,748	2010-11 and 2011-12 is partial data; only includes quantity disposed to otherwise unapproved recipients or treatments, but not to approved landfills	
VIC	398,577	366,949	362,948		
WA	6,765	5,859	3,439		
National total	1,374,004	1,697,790	1,552,208		

Table 25 Newly sourced data reported directly by jurisdictions – financial years 2010-11, 011-12and 2012-13.

With the provisos that Tasmanian and Western Australian data is only partial (refer discussions in Section 4), Figure 13 clearly shows the dominance of quantities from Victoria, South Australia, Queensland and New South Wales.

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Figure 13 Consolidated newly sourced data, best available years.

Table 26 on the following pages summarises the basis of the newly collected data, by jurisdiction. It provides a tool for comparison of what each state was able to quantify, what was excluded, and the reliability of the figures for the purposes of establishing a baseline.

Jurisdiction	Category	Sub category	Where is the data measured	What is excluded	Data reliability H/M/L
NSW	Contaminated soil	general solid (non-putrescible) general solid (putrescible) restricted solid hazardous	Movement to or from a landfill facility	Some asbestos contaminated soils; Soil handled by facilities used solely for the purposes of re-using, recovering, recycling or processing waste (Section 88 of the Act)	M Not comprehensive but tracking system good for what it covers
Vic	N119 N120 N121	Category A Category B Category C	Transported volumes		M Opportunity for double counting
Qld	Regulated wastes - Contaminated Soil	-	Reports from landfill facilities for receipts and recovery; includes acid sulfate soils	Treatment and reuse other than through a landfill facility; Recovered volume discounted.	M Not comprehensive but reporting system good for what it covers and clear;
WA	Controlled waste – contaminated soil	Class I Class II Class III Class IV Class V	At gate of receiver	Only a proportion of Classes I, II and II were reported	L – only partial for some classes and data for all classes aggregated; quantification methods variable; mass balance undertaken of site assessments but not tracked
SA	NEPM N120	Waste fill (formerly clean fill) – reuse is not regulated Intermediate waste soil - can be used for landfill cover, or reused Low-level contaminated soil High-level contaminated soil			H - Mass balance undertaken to verify movement data, continuous tracking of movements

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Jurisdiction	Category	Sub category	Where is the data measured	What is excluded	Data reliability H/M/L
Tas	Controlled waste or display characteristics of a dangerous good (UN-Codes)	Level 1 - Fill Material (not a controlled waste) Level 2 - Low Level Contaminated Soil Level 3 - Contaminated Soil Level 4 - Contaminated Soil for Remediation	Approvals for management (treatment, reuse, landfill)	Data for approvals to landfill for years other than 2012-13 & 2013- 14	H – detail included, but landfill data only provided for 2 years and reuse & treatment for 4 years; inaccuracies possible through conversion of measurement units to tonnes
ACT	Controlled waste (for MCW NEPM) Regulated waste for internal movements	inert solid industrial hazardous –must be treated or exported	On arrival at receivers; movements from receivers	Beneficial re-use (BRU);	H – weighbridge; 2 receivers; Includes remediation and reuse details
NT	Listed waste – contaminated soil	-	Derived from waste levy data from landfill facility report	On site treatment or reuse	M - single receiver; limited years, collected for financial accounting.

 Table 26 comparison of basis of data reported in Table 25

5.2 PHYSICAL AND DEFINITIONAL BOUNDARIES

This study was framed (Chapter 3) in terms of both physical location boundaries and definitional or categorisation boundaries. Our findings reflect this broad scope and therefore allow some discussion of what could and should be measured in order to establish a meaningful baseline data set of contaminated soil waste.

As framed in Chapter 3, of particular significance to any baseline data set are the quantities of contaminated soil that have been stored on-site, either for *ex-situ* treatment or merely for long-term storage. From a systemic perspective all *ex-situ* soil waste was within the scope of our study, as discussed in Section 3.1. In practice, however, the measurement of *ex-situ* on-site soil waste proved difficult as expected. Ex-situ, on-site contaminated soil is generally measured in the course of handling it, and reported in approval applications and audit reports, but rarely is this data systematically racked or collated in the waste domain. On-site storage (as opposed to on-site treatment) is not a problem because the soil will be counted if and when it is eventually moved off site.

Figure 14 Framing of benchmark measure. The grey area represents the extent of current tracking that was feasible to include in the baseline assessment for this report. The grey area with dashed border represents the scope that is currently measured but not tracked and could be considered for future inclusion.



Definitional boundaries also present a major challenge. Different jurisdictional terminology makes it different to consistently compare (and calculate) soil waste streams. Clearly the assessment of contaminated land under the ASC NEPM gives rise to contaminated soil, but - from a definitional perspective - not necessarily to contaminated soil *waste*. Regardless of the operational difficulty of tracking total quantities of on-site contaminated soil (per the above), there exists an

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incompatibility between the processes, classifications and definitions used in site assessment on the one hand and waste classification on the other. Other definitional challenges exists where soil waste is degraded (chemical compound levels reduced) and/or when soil waste crosses jurisdictional boundaries where different waste classifications exist. As regards post-treatment lower grade waste questions arise as to whether the net volume (pre-treatment minus posttreatment) should be counted, or the pre-treatment volume only. The NEPC reporting on intrastate controlled wastes movements reconciles definitional boundaries between states (i.e. waste in state X exported to state Y is still waste). Another challenge exists where contaminated soil is moved off-site for 'fit for purpose' reuse elsewhere. The mere movement of soil from site A to site B can change its character from contaminated soil to non-contaminated soil (without having entered the waste stream).

5.3 ALIGNMENT OF JURISDICTIONS

Table 27 below provides a synthesis of the alignment of contaminated soil wastes tracking across jurisdictions. As regards arisings, the handling of site auditing varies across jurisdictions. Several jurisdictions keep track of the state of contaminated land audits, but this is not done systematically. Information on how audits are tracked in WA and ACT could not be provided. Arguably the most challenging category is that of intrastate movements/transports from generator. It here is that the definitional boundaries play up, effectively preventing any meaningful calculation across jurisdictions. Interstate movements (soil waste exports) are tracked in five out of eight jurisdictions whereas imports are consistently tracked under the NEPC reporting requirements (for reporting to the Basel convention). Treatment, reuse and disposal (receipt at landfill) also displaying a variety of approaches and practices when it comes to tracking and recording of soil waste quantities. In summary, the approach taken across Australian jurisdictions is hardly consistent.

As a first pass improvement jurisdictions could move towards the practice of at least systematically collating the information they gather. For example, VIC EPA records and approves audits but does not collate. For a more consistent baseline data set on contaminated soils the CSA NEPM may be levered: site audits involving certified auditors might be able to provide rapid expert estimates of ex-situ, on-site quantities of contaminated (and perhaps even in-situ volumes).

Australian data and reporting on contaminated soil wastes (including references to 'reuse') could be made consistent with the national data collection and collation methods used in the Waste *Generation and Resource Recovery in Australia* (previously *Waste and Recycling in Australia*) and sequence of national data compilations. This would require more comprehensive reporting against the required categories (including reuse) based on consistent definitions of contaminated soil waste.





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Juris- diction	Category	Sub category	Arisings	Intrastate movements / transport from generator	Interstate movements (export)	Interstate movements (import) Required under CWM NEPM	Treatment	Reuse	Disposal / receipt at landfill
NSW	Soils contaminated with a substance or waste referred to in [the regulations]	general solid (non- putrescible) general solid (putrescible) restricted solid hazardous	N Not waste until it leaves site	Y (most NEPM 75 types)	Ŷ	Y	N (should be captured by movement tracking)	part (movements from a landfill)	Y
Vic	Prescribed Industrial Waste (PIW) NEPM 75	Category A Category B Category C	Approvals and audits but not collated	Cat A, Cat B, Cat C tracked	Y approved	Y tracked	Y (captured by movement tracking)		Y issues consignment authorisation; waste levies
Qld	Regulated waste; trackable waste	-	Registered sites: Soil Disposal Permit – quantities not collated	Trackable waste – waste transport certificates (logged by contaminant, not soil)		У	Can be reported	Y (recovery from landfill)	Y
WA	Controlled waste – contaminated soil	Class I Class II Class III Class IV Class V (intractable)		Classes IV & V required Classes I, II, & III part, but not required		У			Classes IV & V Classes I, II, & III part, but not required

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Juris- diction	Category	Sub category	Arisings	Intrastate movements / transport from generator	Interstate movements (export)	Interstate movements (import)	Treatment	Reuse	Disposal / receipt at landfill
SA	NEPM N120	Waste fill Intermediate waste soil Low-level contaminated soil High-level contaminated soil	N Not deemed waste until it leaves site; quantity could be derived from required site audit	N120 waste transport certificates		N120 waste transport certificates	Y waste transport certificates	No, except transporting intermediate landfill cover – waste tracking form	y waste transport certificates
Tas	Controlled waste - MCW NEPM Contaminated soil	Level 1 - Fill Material (not a controlled waste) Level 2 - Low Level Contaminated Soil Level 3 - Contaminated Soil Level 4 - Contaminated Soil for Remediation	Controlled waste Y - through approvals	n	Controlled waste Y - certificates	Controlled waste Y - certificates	Inferred from approvals	Inferred from approvals	Inferred from approvals
ACT	Controlled waste (for MCW NEPM) Regulated waste	inert solid industrial hazardous		Environmental Authorisation (EA) for regulated waste	Tracked for NEPC	Y	EA for regulated waste	Y EA for regulated waste; BRU approvals are tracked	Y EA for regulated waste
NT	Listed waste – contaminated soil	-	Not licensed, but audited	licensed, reporting	licensed, reporting	у	licensed, reporting	licensed, reporting	Y – licensed, reporting

Table 27 Comparison of tracking and authorisation processes and potential for quantification of contaminated soils, by jurisdiction.

5.4 ADEQUACY OF REGULATORY AND MARKET SETTINGS

The **waste management hierarchy** (see Chapter 1 for definition), or a closely related version, is referenced by most jurisdictions in their policies for managing wastes. It provides a clear path for decision making for industry participants and is leading to greater emphasis on on-site treatment and management in preference to "dig and dump".

Interstate flows are substantial and thereby seemingly not adhering to the **proximity principle** (see Chapter 1 for definition). During the study interviews, a counter view was offered as a point of discussion. If there is a specialist treatment facility available in one location, it may be a better environmental outcome to transport the waste some distance to take advantage of that facility. An assessment needs to be made as to whether the transport costs, impact and risks outweigh the improved outcome from treatment. Although a mechanism exists under the MCW NEPM to limit cross-border movements to only those that result in an improved environmental outcome, only Victoria reported actively monitoring exports (as opposed to imports) by requiring VIC EPA approval for the movement. There is a risk that many of the cross-jurisdictional movements are to take advantage of lower costs in the receiving jurisdiction. Accordingly, many additional movements may be as a consequence of differential pricing, levies and regulations. Either the jurisdictions should take greater responsibility for limiting unnecessary movements, or it is a further argument for harmonisation between jurisdictions that would then better address the proximity principle.

5.5 ADEQUACY OF TECHNOLOGY AND INFRASTRUCTURE IN AUSTRALIA

As regards the adequacy of technology and waste infrastructure, some observations were made in the course of this study. For example, the remediation of the New Royal Adelaide Hospital site in SA system made it clear that SA's waste is adequate for normal purposes but is unable to handle such exceptionally large remediation cases. Furthermore, not all states can handle all types of states which generates cross-border transports, over land as well as by sea (e.g. a large quantity of contaminated soil from TAS was shipped to QLD for treatment).

Due to the general lack of publically information it is difficult to compare Australian management and knowledge of contaminated soil wastes to world's best practice. Other Federations that are Signatories to the Basil Convention, such as the US, Canada, or Germany are likely to face similar challenges regarding different jurisdictional definitions of contaminated soil and soil waste. The physical boundary issue is generic and likely to be faced by any country, regardless of whether it has a federative system or not. This study has briefly canvassed contaminated soil waste tracking and monitoring practices applied in the Netherlands. The Netherlands, with the US is, due to its high population density and long industrial history, generally seen as having exemplary soil and waste management policy and practice. Soil waste streams are tracked under the European Waste Framework Directive. A national regulation (Besluit Bodemkwaliteit) sets out how lowgrade contaminated soil is to be handled, including treatment of soil arising from remediation; reuse of contaminated soil, and disposal of contaminated soil to landfill. As a matter of principle, contaminated soil is not considered a waste in the Netherlands – disposal is not allowed unless the soil is untreatable. Transporters are required to register their loads with a centralised 'soil bank', allowing both quantity and quality of any moved load of soil to be registered. Sampling and analysis is to be undertaken based on detailed guidelines.

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5.6 SYNERGIES WITH ECONOMIC CONDITIONS

As identified in various preceding reports, the quantity of contaminated soil waste is alone in the various waste streams (perhaps with the exception of asbestos) in not being related to consumption trends. Its variability makes it difficult to predict, difficult to estimate quantities to fill gaps in the data, and casts doubt on the usefulness of a single year as a baseline for future measures.

An expectation of the project team was confirmed in interviews with jurisdictions, that variability in the data from one year to another could be substantially explained by the level of construction activity. An inspection of ABS data for the value of building approvals by year and state showed this variability, with an increasing trend reflecting increasing building costs and activities over time, but fluctuations between consecutive years, Figure 15. Of particular note, an industry downturn is clearly identifiable during the year of the GFC in 2008-09.





The study tested how well the value of the construction sector reflected fluctuations in contaminated soil quantities. If a relationship could be demonstrated, it could be used to verify unusual quantities. Potentially, a method could be developed to estimate quantities for gaps in the data.

The following series of figures graphs annual contaminated soil quantities obtained from jurisdictions against the value of building approvals (ABS data), for each state. Although the data is not complete or consistent, the exercise demonstrates that in some jurisdictions there is a general similarity of pattern, but not a sufficiently clear correlation to be used to fill data gaps or predict quantities. In particular, New South Wales indicates a contrary relationship, which confirms this data cannot be used for estimating quantities.

The comparison for Western Australia, Figure 20, highlights the partial data available from that state, with only a small proportion of lower grade contaminated soils being tracked. Given the size of the state and the value of construction activity, the quantity contributed by Classes I, II and III is likely to be much higher.

The final figure is a summary graph showing the same data for the national setting. It also indicates no useful correlation.



Figure 16 NSW value of building approvals against contaminated soil quantities, annual

Figure 17 Victorian value of building approvals against contaminated soil quantities, annual



Figure 18 Queensland value of building approvals against contaminated soil quantities, annual





Figure 19 South Australian value of building approvals against contaminated soil quantities, annual

Figure 20 Western Australian value of building approvals against contaminated soil quantities, annual



Figure 21 Northern Territory value of building approvals against contaminated soil quantities, annual





Figure 22 Tasmanian value of building approvals against contaminated soil quantities, annual

Figure 23 National value of building approvals against contaminated soil quantities, annual



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6 CONCLUSIONS

6.1 CONCLUSIONS

- Clearly and statically defining contaminated soil waste is difficult. Although there are concentration levels for sub-grade thresholds in most jurisdictions, the characteristics of "contaminated" or not are not inherent in the material but dependent on, and defined in terms of, it being fit for purpose at the origin, and compatible with licence conditions at destination. Additionally, each jurisdiction sets its own definitions.
- The term "hazardous" adds another level of definitional complexity. As a first pass, comprehensive and systematic tracking of contaminated soil waste could suffice in order to establish a usable baseline. This may not be satisfactory for Basel reporting, though.
- Setting **boundaries** for where quantities should be tracked is complicated by this definitional imprecision. Although systemically arising, recycling and reuse should be included in the scope of consideration, it is impractical with the current tracking and measuring arrangements.
- Data on contaminated soil waste is very patchy and poor quality. Even where there is a robust tracking or reporting system, data is not necessarily collected or collated at stages that could furnish useful information. Data from each jurisdiction contains different parts of the contaminated soil spectrum, and/or is measured at a different stage in the tracking process, or contains mixed or partial data that the project team was not in a position to untangle. The data sets need to be used with caution.
- The **baseline dataset** is based on currently available data, with its inconsistencies and inadequacies. Such a baseline is not very useful as there is **high variability between years** depending on economic conditions and construction industry activity. A single major development or site rehabilitation can cause a disproportionate spike in the volumes from that jurisdiction for a reporting period. (examples being TAS, and the SA Hospital). A sound understanding of quantities in Australia needs to be based on several years of consistent data.
- **State comparisons** are not helpful. The causes of contaminated sites, and hence the sources of contaminated soil, are bedded in manufacturing and mining history and natural soil conditions. These vary widely between states.
- **Tracking, reporting, and auditing processes** vary between jurisdictions. They are generally emerging. Many jurisdictions are in throes of improvements and the systems and definitions are starting to align a little. States are also beginning to seek synergies, for example by using each other's online tracking systems or site auditor accreditation systems.

6.2 BASELINE DATA

A key requirement of this project was to develop a baseline data set. The best available data is considered to be that collected for the project directly from the jurisdictions, in a year for which most jurisdictions supplied data. Any deficiencies were to have been supplemented from the published data, but this was found to not be necessary. Financial year 2012-13 has been selected because data was received from all jurisdictions, including a complete data set from Tasmania. Coincidentally, the total is also close the average for the three years of original data reported in Table 25.

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The total is a composite of sources and tracking systems. Refer to Table 26 for an understanding of the basis for individual figures.

2012-13						
State	State totals [t]	Notes				
ACT	29,489	reported by jurisdiction				
NSW	555,299	reported by jurisdiction				
NT	407	reported by jurisdiction				
QLD	352,425	reported by jurisdiction				
SA	240,453	reported by jurisdiction				
TAS	7,748	reported by jurisdiction				
VIC	362,948	reported by jurisdiction				
WA	3,439	reported by jurisdiction				
National total	1,552,208					

Table 28 Baseline data. Consolidated best available data from all sources.

The graphical presentation of the data illustrates well the dominance of NSW, and significant contributions of Victoria, Queensland and South Australia. The very small contribution indicated for Western Australia reflects the partial data.

Figure 24 Graphical representation of baseline data



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