

**Recycled Embedment and Backfill  
Materials Technical Standard  
AM3021**

## Document Control

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# 1. Introduction

## 1.1 Background

South East Water typically has over 190km of water and recycled water mains and 100km of gravity sewers constructed each year. These are predominantly constructed through the land development industry as gifted and reimbursable assets with the remaining assets constructed directly by South East Water as capital or maintenance works. These assets are constructed and maintained to South East Water's technical standards which are predominantly based on the WSAA Codes of Practice and accompanying MRWA standards. The standards include a list of approved products on the MRWA Web-portal ([www.mrwa.com.au](http://www.mrwa.com.au)) that are required to be used on the construction of South East Water assets.

Traditional standards used at South East Water are based on the use of virgin quarry materials for pipe embedment and trench backfill. For pipe embedment these materials are typically sand or aggregates. Trench backfill materials are typically aggregates in locations under roadways/footpaths and select on-site excavated material in non-trafficable areas. The current standards do not currently make provision or address the use of recycled materials for pipe embedment or trench backfill.

There is a growing trend for recycled materials to be used on civil works in other industries and South East Water receives requests from time to time for the use of recycled products. Without approved products or a documented standard on which to assess any request or application to use recycled materials, this has been difficult to implement.

This standard is intended to assist design consultants and contractors in the requirements for the use of recycled materials for the construction of South East Water assets, and product suppliers in the requirements for seeking product approval.

## 1.2 Scope

This standard applies to any recycled material used for pipe embedment and/or trench backfill in the construction of new South East Water pipe assets for water supply or gravity/pressure sewer. Subject to project specific acceptance by South East Water, this standard may also be applied to maintenance works undertaken on existing assets.

Recycled materials typically covered by this standard are recycled concrete aggregate, recycled brick aggregate and recycled crushed glass. Other recycled materials are not necessarily covered by the requirements of this standard, however the principles of these requirements may act as a starting point for considering alternative materials should these be proposed.

This standard is not applicable to other recycled materials used in pipeline products themselves or in other applications such as construction of structures.

### 1.3 Limitations & Exclusions

This standard is not intended to cover every conceivable project circumstance. The principles of good design are expected to be applied to ensure provisions are fit for purpose, including but not limited to, durability, buildability, safety, sufficient access for maintenance, etc.

This standard does not address:

- The use of recycled materials that may form part of pavement profiles overlying trench backfill.
- Stabilised recycled materials and controlled low strength materials (CLSM).
- Cohesive materials (recycled materials within the current scope of this document are anticipated to be granular).
- Rigid pipes (only flexible pipes as covered by AS2566 are addressed).

### 1.4 Reference documents

Further to this standard, the design and construction of all works shall comply with South East Water standards and bulletins as listed at: <https://southeastwater.com.au/building-and-development/developers/technical-standards/>

**Table 1: Reference Documents**

Document Number	Document Name
MRWA 04-03.1	MRWA Backfill Specification
MRWA-W-201	MRWA Water Supply Standard - Trenchfill
MRWA-W-203	MRWA Water Supply Standard - Embedment
MRWA-S-201	MRWA Sewerage Standard – Trenching and Trenchfill
MRWA-S-202	MRWA Sewerage Standard - Embedment
WSA PS-364	WSAA Product Specification - Graded Recycled Materials for Pipe Embedment
WSA PS-366	WSAA Product Specification - Grade and Single Sized Recycled Materials for Pipe Embedment
WSA PS-368	WSAA Product Specification - Recycled Glass Sand for Pipe Embedment
Specification 820	Vicroads Specification - Crushed Concrete for Pavement Subbase and Light Duty Base
IPWEA	IPWEA Specification for Supply of Recycled Material for Pavements, Earthworks and Drainage

## 1.5 Abbreviations and Key Terminology

Key terms and abbreviations

**Table 2: Abbreviations/Terms and Interpretation**

Abbreviations/Terms	Interpretation
SEW	South East Water
Acceptance	No objection
Backfill	Fill from the ground surface (or the underside of any pavement, if present) to the top of the pipe embedment material. Backfill is independent of the embedment (pipe support) material with a primary purpose to fill the trench and support the ground surface (or pavement, if present).
Cohesionless / cohesive materials	Soils are generally divided into two groups (cohesive and cohesionless) based on the ability of the soil mass to hold together. Cohesive soils when wet and remoulded can hold together whereas cohesionless soils crumble under light pressure. Cohesive soils can be generally thought of as fine-grained (e.g. clay) where cohesionless soils can be generally thought of as granular (e.g. sand).
Embedment	Material placed around a pipe between the trench foundation and side walls to provide suitable and consistent structural support to the pipe.
Supplier	The person or company responsible for the certified stockpiles who delivers or arranges for delivery of material directly to the site of use.
Lawful Place	A lawful place is a facility or site that holds the appropriate EPA Victoria permission (licence, permit or registration), to accept, receive, store, treat or process specified categories of industrial waste. A facility with such a permission is legally authorised to receive industrial waste streams such as concrete, brick, glass or asphalt for recycling.
Classification Report	A Classification Report is a document provided by the supplier for each batch of recycled material, demonstrating compliance with EPA Victoria waste classification requirements.
MRWA	Melbourne Retail Water Agencies comprising South East Water, Yarra Valley Water and Greater Western Water
NATA	National Association of Testing Authorities
RAP	Recycled Asphalt Pavement
RCA	Recycled Concrete Aggregate

Abbreviations/Terms	Interpretation
RCG	Recycled Crushed Glass
TDA	Tyre Derived Aggregate
WSAA	Water Services Association of Australia.

## 1.6 Disclaimer

This document is **not** intended to be used a prescriptive standard as defined by the Professional Engineers Registration Act 2019 (Vic).

This Standard is published by South East Water on the understanding that:

- South East Water is not responsible for the results of any action taken on the basis of information in this document, nor any errors or omissions.
- South East Water disclaims all and any liability to any person in respect of anything, and the consequences of anything, done or omitted to be done by a person in reliance upon the whole or any part of this standard.

Please note that this standard may be periodically updated.

## 1.7 Environmental Protection Act

The Victorian *Environment Protection Act 2017*, which commenced on 1 July 2021, establishes a general environmental duty requiring duty holders to eliminate or, where elimination is not reasonably practicable, minimise risks of harm to human health and the environment through the implementation of appropriate systems and controls. The Act also imposes specific duties relating to contaminated land, addressing risks associated with land and groundwater contamination, as well as duties in relation to pollution and waste management. These obligations are applicable to the use of recycled materials.

## **2. Recycled Materials**

### **2.1 Benefits of Recycled Materials**

The use of recycled materials in construction is emerging as common practice to supplement traditional quarry products such as sand and aggregates. These materials can provide significant benefits including:

- Protecting natural resources
- Limiting further degradation of the environment
- Working towards modern best practice
- Sustainable development of water industry projects
- Potential cost savings
- Potential carbon savings

Traditional quarry products often have a large embodied carbon cost when considering the production and construction activities. Recycled material alternatives have the potential to reduce whole of life carbon cost however this is highly dependent on the recycling activities such as collection, cleaning and processing.

### **2.2 Nature of Recycled Materials**

It is important to understand that recycled materials can behave differently to traditional quarry products, with differences potentially including:

- Generally supplied with an increased moisture content
- Generally additional moisture is required to increase workability
- They have a lower unit weight which results in lower supply and transport costs
- Can be capable of being worked in wetter conditions
- Can bind together better
- They may require a different level of effort to achieve the same compaction density

### **2.3 Supply of Recycled Materials**

The proposed use of recycled materials needs to consider:

- Material availability with consistent and reliable supply to meet the project quantities
- Location of supply so transportation does not become unviable.

Victoria's supply of traditional quarry products is experiencing increased constraints due to a high demand and depletion of natural deposits. The increasing demand for residential land and additional environmental constraints has meant that the establishment of new quarries or extension to existing quarries in the vicinity of South East Water's service area is limited.

Local sources of materials for pipe embedment and trench backfill is preferred to minimise transportation costs and the associated carbon cost.

## 2.4 Common Types of Recycled Materials

**Recycled concrete aggregate (RCA)** is typically sourced from demolition works and other construction activities. Steel and other contaminants are removed during processing followed by crushing and screening which produces a graded material similar to crushed rock.

**Crushed brick** is typically sourced from demolition works and can be considered for use as a supplementary material to some crushed rock or crushed concrete mixes. Crushed brick is a softer material compared to crushed rock and crushed concrete.

**Recycled crushed glass (RCG)** is typically sourced from household recycling collection and other glass collection. The glass is processed by removal of contaminants and crushing of the glass to the required grading, which is typically similar to that of a naturally occurring sand.

**Reclaimed asphalt pavement (RAP)** is sourced from an existing road pavement and processed by crushing and screening. RAP is not typically accepted as a stand-alone embedment or backfill material but may be considered as a component within a crushed rock mix.

**Crumb rubber** is sourced from recycled tyres and is typically used as a recycled product in road pavements. Crumb rubber is not typically accepted as a stand-alone embedment or backfill material but may be considered as a component within a crushed rock mix.

## 3. Risks and Impacts

### 3.1 Water Supply Risks and Impacts

Risks and issues associated with use of recycled materials with drinking water systems include:

- Impacts on drinking water quality and public health from contaminants via:
  - Contaminant dispersal through the surrounding area by water in the event of a water main burst or leak
  - Contamination entering water main whilst the main is de-pressurised
  - Contamination entering plastic water mains via osmosis whilst under pressure
  - Contamination entering water main during a repair or burst
- Impacts of poor water quality on South East Water's reputation

Some pipe materials such as plastic pipes are known to be at risk of some chemicals such as hydrocarbons permeating through the wall of the pipe and contaminating the water being transported inside. Even though a continuous flow of water within the pipe will lead to significant dilution of the contaminant that has permeated inside the pipe, public health concerns involving contamination would still exist even at extremely low concentrations. Aside from public health contamination within the water supply can lead to taste and odour complaints which impact on South East Water's reputation.

The risk of contaminants in embedment materials used directly around the water main are considered higher than that of backfill above (as backfill contaminants would have to migrate further), however conservatively these should be viewed as posing the same risk.

Non-drinking water systems (i.e. recycled water) are much less likely to be consumed by the customer compared to drinking water which results in a lower level of potential public health issues. However, for the purposes of risk and materials selection non-drinking water systems should be treated the same as drinking water. Recycled water can be used in applications such as watering of vegetable gardens and clothes washing which can still be sensitive to contamination or odour.

### 3.2 Sewerage Risks and Impacts

The purpose of a sewerage system is to remove human exposure to untreated waste and as such do not have the same level of risk associated with water quality for public health. Sewerage systems also are predominantly gravity systems at a greater depth which may be located in either road reserve or private land.

Risks and issues associated with use of recycled materials with sewerage systems include:

- Deep sewer trenches or those on steep sites can be prone to act as a preferential drain for the movement of groundwater. This increases the risk of transportation of contaminants within the trench material.
- Deep sewer trenches typically require a higher standard of embedment and backfill material to provide stronger support for the pipe and minimise settlement of backfill.
- Water quality is still an issue for sewerage systems with any contaminants and chemicals having the potential to impact on the process used at the downstream treatment plant. Treatment plants are predominantly biological and do not necessarily remove all contamination prior to returning treated water to the environment or reuse.

### **3.3 Asset Risks**

The long-term integrity of the sewer or water pipeline asset and its associated support and backfill over its entire design life is a key objective.

The integrity of a pipeline asset can be affected by chemicals in the ground which can deteriorate the mechanical properties (i.e. environmental stress cracking, swelling). This can potentially lead to premature failure of the pipe far earlier than the required design life. Metal pipes are specifically vulnerable to corrosion which can be impacted by surrounding ground contaminants. However other asset materials such as concrete and plastic can also be impacted by corrosion or deterioration where exposed to particular chemicals of contamination.

Engineering risks to assets associated with recycled embedment and backfill materials can include:

- Settlement
- Adequate embedment support
- Long term structural deterioration of the asset
- Buoyancy (i.e. lightweight backfill provides less buoyancy mitigation)
- Consistency of product
- Road owner or reserve owner acceptance and requirements for backfill which typically take precedence over South East Water's standards

### 3.4 Installation Risks

Safety risks associated with the construction with recycled embedment and backfill materials can include:

- Product handling
- Silicosis from glass products primarily from inhalation during installation (noting this may be a lower risk with recycled glass than naturally occurring sand – refer below)
- Trench safety
- Physical handling (risk of physical cuts, etc.)
- Dust and inhalation

Crystalline silica is a cause of silicosis and a known carcinogen in the manufacture of glass containers. Crushed glass has consistently been shown to have significantly less crystalline silica content than normal sand. This is due to the manufacturing of glass containers converting crystalline silica into the more stable amorphous state. The amorphous silica is then not altered during the production of crushed glass from recycled glass inputs.

## **4. Approvals and Supplier Quality Control**

### **4.1 EPA Permissions Required for Facilities Supplying Recycled Materials**

Recycled materials are derived from industrial waste streams. Those waste streams must have been sent to and processed at a facility with lawful authority to accept and treat those wastes. Under the Environment Protection Act 2017, EPA Victoria issues licences, permits and registrations authorising facilities to receive specified categories of industrial waste and to undertake waste-processing activities. A facility that holds the appropriate EPA permission to lawfully accept and process waste is defined as a lawful place.

The classification of waste received and the nature of the processing activities undertaken determine the type of EPA permission required. Only recycled materials produced at such lawful places are suitable for supply, sale and use in pipe embedment and trench backfill applications. Current facility permissions can be verified via the EPA Permissions Register.

Recycled aggregates are specifically recognised by EPA Victoria as industrial waste streams that include concrete (Y100), brick (Y110), glass (Z100), asphalt (Y140), natural rock and ceramics.

When sourcing recycled materials, the contractor shall verify that the supplier's facility holds the relevant EPA permission(s) for the acceptance and processing of the waste streams used to produce recycled aggregates or sand. Current facility permissions can be confirmed using the EPA Permissions Register (<https://www.epa.vic.gov.au/public-registers>).

This verification step is necessary to ensure that materials are sourced from a lawful place and comply with environmental and regulatory requirements.

The table below summarises permission categories commonly applicable to facilities producing recycled aggregates and glass-derived sand. This table is indicative and depends on the scale, processes and waste types received by the facility.

Permission Category	Description / Applicability	Permission Type
A13a – Waste and Resource Recovery (large)	For large-scale facilities receiving and processing industrial waste, such as construction and demolition waste streams (concrete, brick, glass). Applicable to major recycling depots or reprocessing plants.	Licence
A13b – Waste and Resource Recovery (medium)	Facilities undertaking medium-scale acceptance and processing of waste materials, including crushing, screening and reprocessing of concrete, brick or glass.	Permit
A13c – Waste and Resource Recovery (small)	Smaller operators processing limited volumes of industrial waste material for recycled aggregates or glass sand production.	Registration
H05c – Glass Works (small reprocessing)	Specifically applicable to small-scale processing or reprocessing of glass into products such as glass sand.	Registration or Permit (depending on scale)

## 4.2 Raw Material Quality Control

Prior to recycled material being approved for use, the source(s) from which the material will be obtained and the producer shall be identified by those proposing its use. Where possible, the supply of recycled material from a single source is preferred and encouraged by South East Water.

If proposed to change the source(s) or supplier of a recycled material, South East Water shall be notified in sufficient time, so that necessary reviews can be carried out.

Crushed concrete product from recycled, reuse or waste products where their sources cannot be traced shall not be used for water supply applications.

Only material from a Department of Transport (VicRoads) accredited source can be considered for use as 'crushed concrete' as trench fill in water supply applications.

## **4.3 Recycled Material Quality Control**

### **4.3.1 Processing of Recycled Materials**

The product supplier shall have in place suitable screens and storage facilities to keep foreign matter in the product to an absolute minimum. Only small amounts of contaminant material such as timber, steel and plastic will be permitted where allowed by the relevant standard (for example IPWEA allows maximum 5% by mass metal/glass/ceramics, 0.5% plaster, clay and other friable materials and 0.5% rubber, plastic, bitumen, paper, cloth, paint, wood and other vegetable matter). Asbestos must not be contained at all in any product supplied to South East Water projects.

All recycled material shall be free from noxious weeds and dangerous chemicals.

Recycled materials shall be stored in identified stockpiles of suitable volume to adequately manage quality control and supply demands. No further material may be added to an identified stockpile once the final test samples for that stockpile have been collected.

### **4.3.2 Sampling and Testing**

The material property tests for recycled material shall be linked to identified stockpiles, to provide assurance as to consistency and quality of product. Testing shall be representative of the material in the stockpile. Sampling from stockpiles shall be in accordance with AS1141.3.1. The frequency and locations of samples (within a stockpile) shall be sufficient to ensure that all the material in the stockpile complies with the required properties as defined in Section 6. The frequency of testing shall not be less than one test per property per 1000 tonnes unless a greater frequency is required by the relevant standard or road owner requirements (where used for trench backfill).

Testing methodologies and acceptance criteria shall verify that the requirements outlined in Section 6 have been achieved.

## **4.4 Supplier Quality Control**

### **4.4.1 Quality Assurance Requirements**

Recycled products shall be collected, processed and supplied under a certified AS/NZS ISO 9001:2016 Quality Management System. The scope of the certification shall include the collecting, processing, cleaning and grading of the relevant recycled material.

A recycled material shall conform to the properties given in Section 6, however this does not relieve those proposing its use from undertaking whatever further tests are required to assess its suitability for the intended purpose. The supplier of the product (which may be different from the material source) shall provide a report documenting the testing undertaken by NATA accredited laboratories and classification of the material.

Non-compliant product shall be quarantined and disposed of or reprocessed. Records shall be maintained for all batches on the sampling, testing and end recipient of all produced material.

### 4.4.2 Contamination Classification Report

Each batch of recycled material must be accompanied by a Contamination Classification Report that states the recycled material is classified as Fill Material in accordance with EPA Publication 1828 Water disposal categories – characteristics and thresholds.

Each batch must be tested for contaminants in accordance with EPA Publication 1828 – Waste disposal categories – characteristics and thresholds, as updated from time to time. Publication 1828 sets out contaminant threshold criteria for classifying industrial waste and determining its suitability for use or disposal.

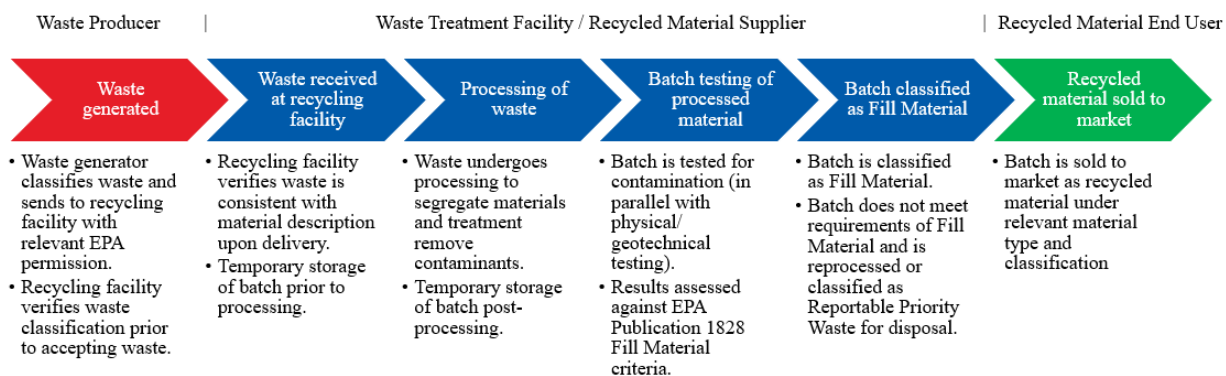
Testing must characterise contaminants relevant to the waste source, including (but not limited to) chemical contamination, leachable contaminants, asbestos, and any other substances that may present a risk to human health or the environment.

Suppliers must provide clear information on the source of the recycled material, demonstrating that they have considered contaminants known or reasonably expected to be present based on the origin and type of waste processed.

The Contamination Classification Report must include:

- Information on the source of industrial waste used to produce the recycled material and potential contaminants associated with that source/s
- Sampling methodology and frequency
- Laboratory test results for contaminants and comparison with thresholds within EPA Publication 1828
- Assessment of chemical contamination, leachability, and asbestos (where applicable)
- Confirmation that the material meets is classified as Fill Material in accordance with EPA Publication 1828

An overview of the process from waste generation to recycled materials with batch testing, is provided in the flow chart below.



## 4.5 South East Water Product Approval

### 4.5.1 Application For Product Approval

All products used on South East Water works shall be listed as an approved product on the MRWA web-portal ([www.mrwa.com.au](http://www.mrwa.com.au)). Application for a recycled embedment or backfill product shall be made by the supplier through the standard South East Water process for 'Application for Product Authorisation for Use in South East Water's Water and Sewer Network', details of which are available on the South East Water website.

It is expected that an application for product authorisation will differ from most other products in that a WSAA appraisal is not likely to have been undertaken. Any product submitted for authorisation must comply with the requirements of this standard.

South East Water will require independent 3<sup>rd</sup> party testing and analysis of the product to support the application and demonstrate compliance with this standard. The independent 3<sup>rd</sup> party testing shall be undertaken by a JASANZ accredited body and undertaken at the applicant's cost.

Applications must be accompanied by all relevant supporting information including type and batch sampling and testing data and product certifications from a JASANZ accredited body.

### 4.5.2 Product Approval and Limitations

Following application by the supplier to South East Water for acceptance of a recycled embedment and backfill product, South East Water will review the application. South East Water will then advise of any additional information required to complete the assessment.

South East Water may request field trialing of the proposed product prior to formal acceptance. The field trial would be undertaken on the construction of a new pipeline asset and be undertaken in conjunction with the supplier, designer and contractor in accordance with South East Water's standard requirements for field trials. It should be noted that a field trial could take considerable time to finalise.

At the completion of South East Water's product assessment process, an accepted product may be subject to limitations of use which will be published on the MRWA web-portal. These limitations are subject to change at any time at the sole discretion of South East Water.

### 4.5.3 Post-Approval Monitoring

The supplier shall conduct regular monitoring and testing of their product. As a minimum this must include an annual minor audit and a tri-annual major audit by an JASANZ accredited body. Evidence of these audits shall be provided to South East Water at any time upon request.

#### **4.5.4 Project Specific Product Approval**

Where appropriate, South East Water may consider granting project specific approval or field trial for the use of a product in lieu of full approval. The proponent for a project specific approval shall contact South East Water to discuss the application and specific information to be submitted. It is expected that most of the requirements of this standard will also apply to project specific approvals, however South East Water at its discretion may opt not to apply a particular aspect of the standard based on the single use or trial nature of the use, applicability and risk to South East Water.

#### **4.6 Reuse of Onsite Material**

Reuse of onsite material for backfill of water and sewer trenches in non-trafficable areas is covered by MRWA Backfill Specification 04-03 and the relevant MRWA standards either MRWA-S-201 or MRWA-W-201.

Where the existing onsite material proposed to be used does not fit the definition of Selected Fill or Ordinary Fill, the location is a trafficable area or there is a reasonable likelihood of contamination then the requirements of this standard also apply to the re-use or re-purpose of onsite material except in instances where these are considered by South East Water to not apply (e.g. product approvals).

#### **4.7 Reuse of Offsite Surplus Material**

Recycled material that is discarded or is surplus to the needs of another site is industrial waste and the waste duties under the Environment Protection Act 2017 apply. Such material may only be imported if the site meets the lawful place requirements, such as under an EPA determination, designation, or another form of EPA permission that authorises that specific waste type and use.

Refer to Section 5 for further details on the general requirements for importation and use of recycled materials.

## 5. Contamination

### 5.1 General Requirements for Use of Recycled Materials

#### 5.1.1 General environmental duty

The *Environment Protection Act 2017* (EP Act) is the overarching environmental legislation within Victoria. The EP Act requires Victorians to understand the risks of harm to human health and the environment, from pollution and waste that is associated with their activities, and taking reasonable, proactive steps towards eliminating or minimising those risks.

The EP Act is underpinned by the general environmental duty (GED), which requires a person/s engaging in an activity to understand and assess the risks of harm to human health and the environment associated with that activity, and to take reasonably practicable measures to eliminate or otherwise minimise those risks.

When using recycled materials, the product producer/supplier has a legal obligation under the EP Act to understand and assess the risks of harm to human health and the environment from contamination and waste and must take reasonably practicable steps to minimise those risks. Under the EP Act, the Environment Protection Authority Victoria (EPA) has enhanced powers and tools, and the ability to pursue stronger sanctions and penalties to hold environmental polluters to account.

#### 5.1.2 Free from hazardous substances and asbestos

Recycled materials must be free from hazardous substances as defined in the Occupational Health and Safety Regulations 2017.

Recycled materials must be free from asbestos and asbestos containing materials as defined in the Occupational Health and Safety Regulations 2017.

Note: Under the Victorian Occupational Health and Safety Regulations 2017, asbestos means any material or object, whether natural or manufactured, that contains one or more of the mineral silicates: actinolite asbestos; anthophyllite asbestos; chrysotile ("white asbestos"); crocidolite ("blue asbestos"); grunerite asbestos (or amosite) ("brown asbestos"); and tremolite asbestos. Asbestos-containing material means any manufactured material or object that, as part of its design, contains one or more of the mineral silicates referred to in the definition of asbestos.

#### 5.1.3 Free from industrial waste

Recycled materials must be free from industrial waste including plastics, metal, wood and any other foreign materials that are not the intended product. The person/s importing recycled materials are responsible for inspecting each delivery of recycled materials.

Where small quantities of foreign materials can be removed such that they are no longer visible, the recycled material may be accepted. If foreign materials are present and cannot be removed until they are no longer visible, the recycled material shall be rejected or quarantined for return to the supplier.

Note: Industrial waste is defined in the *Environment Protection Act 2017* and means (a) waste arising from commercial, industrial or trade activities or from laboratories; or (b) waste prescribed to be industrial waste for the purposes of this definition.

#### **5.1.4 Free from chemical contamination**

Recycled materials must be free from chemical contamination and accompanied by a Classification Report that states the material meets the requirements for 'Fill Material', in accordance with EPA Publication 1960 Guide to classifying industrial waste and EPA Publication 1828 Waste disposal categories – characteristics and thresholds.

Recycled materials must be sampled and tested for all chemical substances known and reasonably expected to be present in the waste material. This requires knowledge of the source of the recycled materials. It is a requirement that testing be undertaken by a NATA accredited laboratory.

Contaminant total concentrations and leachable concentrations shall not exceed the thresholds in Table 2 or Table 3 in EPA Publication 1828. For contaminants not listed in EPA Publication 1828, further guidance on classification must be obtained from EPA.

The Classification Report must be prepared by an experienced and competent environmental consultant. Refer to EPA Victoria for guidance on finding the right environmental consultant for the job ([Work with a consultant | epa.vic.gov.au](http://epa.vic.gov.au))

#### **5.1.5 Must be compatible with pipe materials**

Recycled materials must be free from chemical contaminants that can impact pipe integrity, leading to pipe failure or leaching of contaminants into the pipe.

Organic chemicals such as petroleum hydrocarbons (e.g. benzene, toluene, xylenes, phenols, etc.), can interact with polyethylene and polyvinylchloride pipes. Corrosive chemicals that change soil and groundwater pH (e.g. acidic or alkaline chemicals), or increased reduction/oxidation potential can interact with steel or copper pipes.

The threshold concentrations where these chemical contaminants may impact pipe integrity may be below the Fill Material thresholds in EPA Publication 1828 Waste disposal categories – characteristics and thresholds. A comparison of recycled material contaminant concentrations with pipe manufacturer technical and resistance data should be undertaken by an experienced and competent person.

## **5.2 Recycled aggregate material**

Recycled aggregates that meet the specifications and conditions outlined in EPA Determination – Specifications Acceptable to the Authority for Receiving Recycled Aggregates, may be used for pipe embedment and trench backfill, subject to meeting other requirements outlined within this standard. The person/s importing recycled materials must follow all these requirements to meet its legal obligations and to prevent risk of harm to human health and the environment.

Note: Recycled aggregates means industrial waste or a mix of industrial wastes that comprise of concrete (waste code Y100), brick (waste code Y110), glass (waste code Z100), asphalt (waste code Y140), natural rock or ceramics.

## 5.3 Recycled soil material

Soil that is 'fill material' as defined in the *Environment Protection Regulations 2021*, may be used for pipe embedment and trench backfill, subject to meeting the specifications and conditions outlined in EPA Determination – Specifications Acceptable to the Authority for Receiving Fill Material, in addition to other requirements outlined within this standard. The person/s importing fill material must follow all these requirements to meet its legal obligations and to prevent risk of harm to human health and the environment.

Fill material is defined in the *Environment Protection Regulations 2021* as industrial waste that is soil (a) with contaminant concentrations not exceeding the upper limits for fill material contaminant concentrations specified in the Waste Disposal Categories - Characteristics and Thresholds (EPA Publication 1828); and (b) that does not contain asbestos.

EPA Publication 1828 Waste disposal categories – characteristics and thresholds, as updated from time to time, provides criteria for various chemical contaminants in soil.

## 5.4 Emerging Contaminants

### 5.4.1 General

Emerging contaminants include a broad range of natural and synthetic substances, for example, pharmaceuticals, pesticides, industrial chemicals, and personal care products. As the scientific and toxicological knowledge evolves on the potential risks of harm to human health and the environment, these emerging contaminants will become regulated and potentially phased out of manufacturing or importation to Australia, for example some of the most toxic PFAS (PFOS, PFOA and PFHxS) were banned from importation to Australia from 1 July 2025.

This standard shall be reviewed and updated from time to time, to ensure new regulations relating to emerging contaminants are included.

### 5.4.2 Per- and poly-fluoroalkyl substances

Per and polyfluoroalkyl substances (PFAS) are a large group of manufactured chemicals that have been used in firefighting foams and other industrial and consumer products for many decades. The most well understood and regulated are perfluorooctane sulphonate (PFOS), perfluorooctanoic acid (PFOA) or perfluorohexane sulphonate (PFHxS).

EPA regulates the disposal, reuse and management of PFAS affected materials. Thresholds for PFOS, PFOA and PFHxS in Fill Material are provided in EPA Publication 1828.

## **5.5 Other recycled materials**

Recycled materials that are not aggregates or soils and therefore cannot be used in accordance with the EPA determinations described above, will require a separate EPA determination or designation to enable the reuse of the material.

## 6. Physical Requirements

### 6.1 Material Requirements

#### 6.1.1 Common Requirements

The maximum particle size of the recycled material shall be as per the relevant MRWA Standard for the application (e.g. MRWA-W-201 and 203, MRWA-S-201 and 202 and the MRWA Backfill Specification).

Where it is possible for fines to migrate from the trench fill or native soil into the embedment zone, then either a geotextile filter fabric shall be used or the embedment particle size distribution shall be appropriately graded to restrict migration.

Where the road owner or reserve owner has requirements that exceed those contained in this standard, then these additional requirements shall apply.

Crushed concrete, brick, asphalt and glass sand shall have a wet strength not less than 80kN when tested in accordance with AS1141.22.

Crushed concrete, brick and asphalt shall have a wet/dry strength variation of not more than 35% and weak particles no more than 0.5% when tested in accordance with AS1141.22 and AS1141.32. Crushed glass shall have a wet/dry strength variation of not more than 20% and weak particles not more than 0.1%.

#### 6.1.2 Crushed Concrete

Crushed concrete for trench backfill shall meet the requirements of Vicroads Specification 820 for 20mm nominal sized crushed concrete for either Class 2, 3 or 4 as per the required application as defined by the road owner requirements or MRWA standards.

Crushed concrete for pipe embedment shall meet the requirements of WSAA Product Specification WSA PS-364 for use in place of graded crushed rock or WSA PS-366 for use in place of single size aggregate. At this stage there is limited evidence whether crushed concrete meets the requirements for pipe embedment and whilst it appears likely that it may meet the requirements of AS2566 no specific testing has to date been carried out to investigate this.

#### 6.1.3 Crushed Brick

Crushed brick for trench backfill shall meet the requirements of Vicroads Specification 812 or 820 for 20mm nominal sized aggregate as an addition to either Class 3 or 4. As per the requirements of Specification 812, the addition of crushed brick shall not exceed 15% of Class 3 backfill by dry mass or 50% in the case of Class 4 backfill material unless otherwise accepted by South East Water and the road authority.

Crushed brick for pipe embedment shall meet the requirements of WSAA Product Specification WSA PS-364 for use in place of graded crushed rock or WSA PS-366 for use in place of single size aggregate.

At this stage there is limited evidence whether crushed brick meets the requirements for pipe embedment and whilst it appears likely that it may meet the requirements of AS2566 no specific testing has to date been carried out to investigate this. The supplier shall undertake the necessary testing to demonstrate compliance of the crushed brick material with AS2566 and WSA PS-364/WSA PS-366 as applicable.

### **6.1.4 Crushed Glass**

Crushed glass shall comply with WSAA Product Specification WSA PS-368.. For any aspect not covered by WSA PS-368, then the requirements of Austroads Technical Specification ATS 3050 shall apply.

## **6.2 Trench backfill In Non-Trafficable Areas**

It is not anticipated that there would be a significant need for recycled materials to be used as trench backfill in non-trafficable areas, given the normal practice of using select excavated material from site as backfill.

In the event that recycled backfill material was proposed for use in non-trafficable areas, the requirements of this standard in relation to the material and requirements of the MRWA Backfill Specification shall apply.

## **6.3 Chemical Composition**

Recycled material shall be free of materials that would be harmful to a pipe or its protective coating.

Recycled material shall have a pH between 5 and 9 when determined in accordance with AS 1289.4.4.1.

Recycled material shall have a resistivity greater than 1500  $\Omega$ .cm when tested in accordance with AS 1289.4.4.1.

## **6.4 Moisture content**

Correct moisture content is important to achieving adequate compaction for some materials and particle size distributions. The required compaction level is specified by the corresponding MRWA standards based on the location and application. Where relevant to achieving adequate compaction, an optimum moisture content range shall be determined for the recycled material being proposed.

## **6.5 Sharp Edges**

Due to the risk of damage to plastic pipes or pipe coatings from sharp edges of surrounding material, recycled material shall be:

- Free of hard, sharp objects and organic material.
- Crushed glass shall be free of sharp edges and elongated particles.

## **7. Quality Control Processes For Use**

### **7.1 Quality Assurance**

This standard and the WSAA Product Specification nominates default quality assurance requirements for the product. At the time of placing an order, the purchaser (e.g. Contractor) shall require the product supplier to declare that products delivered conform to this standard and the nominated WSAA Product Specification. The declaration should be additional to the default quality assurance requirement for the product.

### **7.2 Transportation and Delivery**

This standard or the WSAA Product Specifications do not specify transportation and delivery requirements. The supplier is responsible for ensuring that products are not damaged in any way by transport and unloading at the purchaser's nominated reception location. The purchasers' procurement processes shall fully address this requirement.

Handling of recycled material, including the loading of trucks and stockpiling, shall be undertaken in such a manner as to minimise segregation.

### **7.3 Record Keeping**

The Contractor shall obtain a copy of each delivery docket from the supplier for each delivery of the recycled material. The Contractor shall retain these dockets and retain details of all recycled materials use in the works and supply these records to South East Water upon request.

The type and location of recycled materials used for embedment or backfill shall be recorded on the as-constructed drawings. This is an important aspect of the use of recycled materials as it allows South East Water to monitor any issues and manage its risk.

In addition to the as-constructed drawings, the use and type of recycled material used shall be recorded in the electronic as-constructed information to be included in the GIS field for 'bedding material' and or 'ground conditions'. Available record categories relating to the material shall be:

- Recycled Sand
- Recycled Brick
- Recycled Concrete
- Recycled Glass
- Recycled Other

## **7.4 Safety and Handling**

Users of recycled materials should ensure that appropriate compaction/placing techniques are employed that avoid breakdown of weaker constituents during construction. Some guidance covering these issues is included in Annexure 2 of IPWEA Specification for Supply of Recycled Material for Pavements, Earthworks and Drainage 2010.

## 8. Specification and Procurement

Where recycled materials are to be considered by the designer for embedment and/or backfill material on a project, the following process is the suggested:

1. Identify suitable recycled material options for pipe embedment and trench backfill. This should consider proximity and availability of products and current South East Water approved product status.
2. Undertake a cost comparison between recycled product alternatives and traditional virgin quarry materials. Where suitable recycled materials are identified and the cost increase is modest (less than 20% extra), the design should specify the use of these within the design drawings and specifications as the default position.
3. Tenders or price submissions for construction should provide for separate prices for both virgin and recycled materials. As part of the tender assessment for South East Water funded works, South East Water will have the opportunity to consider whether the cost and risk associated with the recycled material option will be accepted.
4. Tenders shall include an assessment of embodied carbon associated with the supply and installation of both the virgin and recycled material options so that South East Water may consider both the cost and embodied carbon difference associated with different material options.

## **Appendix A – EPA Waste Disposal Characteristics and Thresholds Publication 1828.3**

The EPA Waste Disposal Characteristics Publication 1828.3 is included in this appendix for information only. It must be noted that the version included was the latest version available at the time of the original publication of this South East Water standard and users shall note that the EPA may have subsequently updated this document. Prior to relying on this document, users shall confirm the latest version of EPA Publication 1828.3 by visiting the EPA website:

<https://www.epa.vic.gov.au/waste-disposal-categories-characteristics-and-thresholds>

# Waste disposal categories: characteristics and thresholds

Publication 1828.3

September 2024

Policy and Regulation Branch



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## Introduction

In Victoria, waste must be classified to meet waste duties under Part 6.4 (Duties relating to industrial waste) and 6.5 (Duties and controls relating to priority waste) of the Environment Protection Act 2017.

The Environment Protection Regulations (the Regulations), Part 4.2 (Industrial Waste and priority waste) specifies the process for classifying waste.

This Waste disposal categories: characteristics and thresholds publication, as published by Environment Protection Authority Victoria (EPA) from time to time, is incorporated into the Regulations without modification.

This publication establishes the characteristics and thresholds necessary for complying with the Regulations, specifically, classification of wastes to determine the relevant waste disposal category in accordance with Schedule 6 of the Regulations.

A holder of waste must use the criteria and thresholds in this publication to determine a waste disposal category unless the category is determined by the Regulations.

A classification of priority waste must be consistent with any designation issued by the Authority for that type of priority waste.

### How to use this publication

The tables in the following sections list criteria against which certain priority wastes must be assessed to determine which waste disposal category applies.

Table 1 provides hazard characteristics for the assessment of priority waste that are identified as Category A waste in the Regulations. These characteristics must be assessed to determine which category applies to the waste.

Priority waste that is not assigned as Category A waste in the Regulations, and, does not have any of the characteristics in Table 1 must be assessed against the contaminant thresholds in Table 2.

Any reference in this document to soil that contains asbestos does not include soil from which visible asbestos-containing material has been removed, so far as reasonably practicable, from the soil by the person proposing to supply, store, transport, sell, use or re-use the soil. See regulation 217 of the Occupational Health and Safety Regulations 2017 for further information.

### Testing requirement

Wherever this publication requires testing to be completed, such as for leachable concentration or total concentration, it is a requirement that testing be undertaken by a National Association of Testing Authorities, Australia (NATA) accredited laboratory.

## Definitions

Term	Description of terms
<b>ADG Code</b>	The Australian Code for the Transport of Dangerous Goods by Road & Rail (ADG Code)
<b>Fill material</b>	As defined in the Environment Protection Regulations fill material is industrial waste that is soil— <ul style="list-style-type: none"> <li>(a) with contaminant concentrations not exceeding the upper limits for fill material waste contaminant specified in the document Waste Disposal Categories — Characteristics and Thresholds; and</li> <li>(b) does not contain asbestos.<sup>1</sup></li> </ul>
<b>Leachable concentration</b>	The leachable concentration of a contaminant as determined in accordance with Australian Standards AS 4439.2-1997 and AS 4439.3—1997 and expressed as an ASLP value in the Australian Standard Leaching Procedure.
<b>Priority waste</b>	As defined in the <i>Environment Protection Act 2017</i> priority waste is any waste, including municipal waste and industrial waste, that is prescribed to be priority waste for the purposes of— <ul style="list-style-type: none"> <li>(a) eliminating or reducing risks of harm to human health or the environment posed by the waste; or</li> <li>(b) ensuring the priority waste is managed in accordance with Part 6.5 of the Act; or</li> <li>(c) facilitating waste reduction, resource recovery and resource efficiency.</li> </ul>
<b>Schedule 5 of the Regulations</b>	List of waste codes and classifications under the Regulations.
<b>Schedule 6 of the Regulations</b>	Provides a definition, or criteria-based assessment, for each category of priority waste
<b>TC</b>	Total concentration. This is the total concentration of contaminants.

<sup>1</sup> Note that, in accordance with the Occupational Health and Safety Act 2004, industrial waste that is soil does not contain asbestos if all visible asbestos-containing material (that is, any manufactured material or object that, as part of its design, contains asbestos) has been removed, so far as reasonably practicable, from the soil by the person proposing to supply, store, transport, sell, use or re-use the soil.

## Table 1: Specific characteristics

The following table lists and describes the characteristics for the assessment of priority wastes to determine the relevant category.

Characteristic	Definition	Category
<b>Explosive wastes</b>	An explosive waste is a solid waste (or a mixture of wastes), which is in itself capable, by chemical reaction, of producing gas at such a temperature, pressure and speed, as to cause damage to the surroundings.  Note: these are wastes classified as 'Class 1' under the ADG Code.	Category A
<b>Flammable solid wastes</b>	Waste solids, other than those classified as explosives, which, under conditions encountered in transport or containment, are readily combustible, or may cause or contribute to fire through friction.  Note: these are wastes classified as 'Class 4.1' under the ADG Code.	Category A
<b>Wastes liable to spontaneous combustion</b>	Wastes which are liable to spontaneous heating under normal conditions encountered in transport, or to heating up in contact with air, and liable to catch fire.  Note: these are wastes classified as 'Class 4.2' under the ADG Code.	Category A
<b>Wastes which, in contact with water, emit flammable gases</b>	Wastes which, by interaction with water, are liable to become spontaneously flammable or to give off flammable gases in dangerous quantities.  Note: these are wastes classified as 'Class 4.3' under the ADG Code.	Category A
<b>Oxidising wastes</b>	Wastes which, while in themselves not necessarily combustible, may, generally by yielding oxygen, cause or contribute to the combustion of other materials.  Note: these are wastes classified as 'Class 5.1' under the ADG Code.	Category A
<b>Organic peroxide wastes</b>	Organic wastes which contain the bivalent-O-O-structure and which are thermally unstable and may undergo exothermic self-accelerating decomposition.  Note: these are wastes classified as 'Class 5.2' under the ADG Code.	Category A
<b>Infectious wastes</b>	Wastes containing viable microorganisms or their toxins which are known or suspected to cause disease in animals or humans.  Note: these include clinical and related wastes as prescribed in the Environment Protection Regulations. These are classified as 'Class 6.2' waste under the ADG Code.	Category A

## Waste disposal categories: characteristics and thresholds

Characteristic	Definition	Category
<b>Corrosive wastes</b>	<p>Wastes which, by chemical action, will cause severe damage when in contact with living tissue, or in the case of leakage, will materially damage, or even destroy, other goods or the means of transport or containment. They may also cause other hazards. Where corrosivity testing data is not available, pH may be used to determine if the material is Category A.</p> <ul style="list-style-type: none"> <li>• pH value of 2 or less</li> <li>• pH value of 12.5 or more</li> </ul> <p>Note: this includes wastes classified as 'Class 8' under the ADG Code.</p>	Category A
<b>Wastes that liberate toxic gases in contact with air or water</b>	<p>Wastes which, by liberation with air or water, are liable to give off toxic gases in dangerous quantities.</p> <p>Note: these are wastes liable to give off toxic gases that are classified as 'Class 2.3' under the under the ADG Code.</p>	Category A
<b>Wastes capable of yielding another material which possesses any of the characteristics above</b>	<p>Wastes capable, by any means, after containment, of yielding another material, for example, leachate, which possesses any of the characteristics listed above and/or is a flammable liquid.</p>	Category A
<b>Non-corrosive acids and alkaline wastes</b>	<p>Waste that:</p> <p>(a) have a:</p> <ol style="list-style-type: none"> <li>i. pH value of less than 4 and more than 2; or</li> <li>ii. pH value of greater than 10 and less than 12.5.</li> </ol> <p>(b) but do not have:</p> <ol style="list-style-type: none"> <li>i. any of the other characteristics listed in this table; or</li> <li>ii. any contaminant concentration that exceed the upper limits for Category C in Table 2; or</li> <li>iii. any leachability concentrations that exceed the upper limits for Category C in Table 2.</li> </ol>	Category C
<b>Soil containing asbestos only</b>	<p>Soil that –</p> <ol style="list-style-type: none"> <li>(a) contains asbestos<sup>2</sup>; and</li> <li>(b) does not contain any contaminant concentration exceeding the upper limits for fill material contaminant concentrations specified in Table 3.</li> </ol>	Soil containing asbestos only

<sup>2</sup> Note that, in accordance with the *Occupational Health and Safety Act 2004*, industrial waste that is soil does not contain asbestos if all visible asbestos-containing material (that is, any manufactured material or object that, as part of

<p><b>Packaged waste asbestos</b></p>	<p>Waste asbestos (other than soil containing asbestos) contained in a manner so as to eliminate the release of airborne asbestos fibres</p>	<p>Packaged waste asbestos</p>
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Any priority waste that is not Category A may be acceptable for disposal to landfill subject to assessment against contaminant thresholds in Table 2.

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its design, contains asbestos) has been removed, so far as reasonably practicable, from the soil by the person proposing to supply, store, transport, sell, use or re-use the soil.

## Table 2: Waste disposal contamination concentrations and leachable concentrations

Parts 6.4 and 6.5 of the *Environment Protection Act 2017* provide duties for persons managing industrial and priority waste. To adequately understand the risk of waste, appropriate sampling and analysis is required. To determine an appropriate sampling and assessment regime please refer to relevant EPA guidance. Assessment must be for all chemical substances known and reasonably expected to be present in the waste, this may mean that not all contaminants listed in Table 2 are analysed in every waste. For contaminants not listed in Table 2, please contact EPA for further guidance or a designation.

Category <sup>1</sup>	Category D <sup>2</sup> / industrial waste upper limit		Category C upper limit		Category B upper limit	
	Leachable Concentration (mg/L)	TC (mg/kg)	Leachable Concentration <sup>3</sup> (mg/L)	TC <sup>4</sup> (mg/kg)	Leachable Concentration (mg/L)	TC (mg/kg)
<b>Inorganic species</b>						
Antimony	0.15	75	0.3	75	1.2	300
Arsenic <sup>5</sup>	0.5	500	1	500	4	2000
Barium	100	6250	200	6250	800	25000
Beryllium	3	100	N/A	100	N/A	400
Boron	200	15000	400	15000	1600	60000
Cadmium	0.1	100	0.2	100	0.8	400
Chromium (VI)	2.5	500	5	500	20	2000
Copper	100	5000	200	5000	800	20000
Lead	0.5	1500	1	1500	4	6000
Mercury	0.05	75	0.1	75	0.4	300
Molybdenum <sup>5</sup>	2.5	1000	5	1000	20	4000
Nickel	1	3000	2	3000	8	12000
Selenium	0.5	10000	1	10000	4	40000

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Category <sup>1</sup>	Category D <sup>2</sup> / industrial waste upper limit		Category C upper limit		Category B upper limit	
	Contaminant concentration thresholds as dry weight (Units)	Leachable Concentration (mg/L)	TC (mg/kg)	Leachable Concentration <sup>3</sup> (mg/L)	TC <sup>4</sup> (mg/kg)	Leachable Concentration (mg/L)
Silver	5	180	N/A	180	N/A	720
Tributyltin oxide	0.05	2.5	0.1	2.5	0.4	10
Zinc	150	35000	300	35000	1200	140000
<b>Anions</b>						
Chloride	12500	N/A	25000	N/A	N/A	N/A
Cyanide (amenable)	1.75	300	3.5	300	14	1200
Cyanide (total)	4	2500	8	2500	32	10000
Fluoride <sup>5</sup>	75	10000	150	10000	600	40000
Iodide	25	N/A	50	N/A	200	N/A
Nitrate	2500	N/A	5000	N/A	20000	N/A
Nitrite	150	N/A	300	N/A	1200	N/A
<b>Organic species</b>						
C6-C9 petroleum hydrocarbons <sup>5</sup>	N/A	325	N/A	650	N/A	2600
C10-C36 petroleum hydrocarbons <sup>5</sup>	N/A	5000	N/A	10000	N/A	40000
Di (2 ethylhexyl) phthalate	0.5	40	1	40	4	160
2,4-Dinitrotoluene <sup>6</sup>	0.065	5.2	0.13	5.2	0.52	21
Ethylene diamine tetra acetic acid (EDTA)	12.5	1000	25	1000	100	4000
Formaldehyde	25	2000	50	2000	200	8000

Waste disposal categories: characteristics and thresholds

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Category <sup>1</sup>	Category D <sup>2</sup> / industrial waste upper limit		Category C upper limit		Category B upper limit	
	Contaminant concentration thresholds as dry weight (Units)	Leachable Concentration (mg/L)	TC (mg/kg)	Leachable Concentration <sup>3</sup> (mg/L)	TC <sup>4</sup> (mg/kg)	Leachable Concentration (mg/L)
Methyl ethyl ketone <sup>6</sup>	100	8000	200	8000	800	32000
Benzene	0.05	4	0.1	4	0.4	16
Toluene	40	3200	80	3200	320	12800
Ethylbenzene	15	1200	30	1200	120	4800
Xylenes (total)	30	2400	60	2400	240	9600
Styrene	1.5	120	3	120	12	480
Nitrobenzene <sup>6</sup>	1	80	2	80	8	320
Polycyclic aromatic hydrocarbons (PAH total)	N/A	50	N/A	100	N/A	400
PAH total sum of naphthalene, acenaphthylene, acenaphthene, anthracene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluorene, fluoranthene, indeno(1,2,3-c,d)pyrene, phenanthrene and pyrene.						
Benzo(a)pyrene <sup>7</sup>	0.0005	20	0.001	40	0.004	160
2 Chlorophenol	15	1200	30	1200	120	4800
2,4-Dichlorophenol	10	800	20	800	80	3200
2,4,5-Trichlorophenol <sup>6</sup>	200	16000	400	16000	1600	64000
2,4,6-Trichlorophenol	1	80	2	80	8	320
Phenols (total, non-halogenated)	7	<b>560</b>	14	<b>560</b>	56	<b>2200</b>
Total sum of phenol, 2,4-dimethylphenol, 2,4-dinitrophenol, 2-methyl-4,6-dinitrophenol, 2-nitrophenol, 4-nitrophenol, 2-cyclohexyl-4,6-dinitrophenol and dinoseb.						

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Category <sup>1</sup>	Category D <sup>2</sup> / industrial waste upper limit		Category C upper limit		Category B upper limit	
	Contaminant concentration thresholds as dry weight (Units)	Leachable Concentration (mg/L)	TC (mg/kg)	Leachable Concentration <sup>3</sup> (mg/L)	TC <sup>4</sup> (mg/kg)	Leachable Concentration (mg/L)
Cresol (total) <sup>6</sup>	100	8000	200	8000	800	32000
Polychlorinated biphenyls <sup>8</sup>	N/A	2	N/A	50	N/A	Note 6
Hexachlorobutadiene	0.035	2.8	0.07	2.8	0.28	11
Vinyl Chloride	0.015	1.2	0.03	1.2	0.12	4.8
Carbon tetrachloride	0.15	12	0.3	12	1.2	48
Chlorobenzene	15	1200	30	1200	120	4800
Chloroform <sup>9</sup>	4	240	8	240	32	960
1,2-Dichlorobenzene	75	6000	150	6000	600	24000
1,4-Dichlorobenzene	2	160	4	160	16	640
1,2-Dichloroethane	0.15	12	0.3	12	1.2	48
1,1-Dichloroethene	1.5	120	3	120	12	480
1-2-Dichloroethene	3	240	6	240	24	960
Dichloromethane (methylene chloride)	0.2	16	0.4	16	1.6	64
1,1,1,2-Tetrachloroethane	5	400	10	400	40	1600
1,1,2,2-Tetrachloroethane	0.65	52	1.3	52	5.2	210
1,1,1-Trichloroethane <sup>9</sup>	10	1200	20	1200	80	4800
1,1,2-Trichloroethane <sup>9</sup>	0.25	48	0.5	48	2	190
Trichloroethene <sup>9</sup>	0.25	20	0.5	20	2	80

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Category <sup>1</sup>	Category D <sup>2</sup> / industrial waste upper limit		Category C upper limit		Category B upper limit	
	Leachable Concentration (mg/L)	TC (mg/kg)	Leachable Concentration <sup>3</sup> (mg/L)	TC <sup>4</sup> (mg/kg)	Leachable Concentration (mg/L)	TC (mg/kg)
Tetrachloroethene	2.5	200	5	200	20	800
Trichlorobenzene (total)	1.5	120	3	120	12	480
PFOS + PFHxS (Perfluorooctanesulfonic acid + Perfluorohexanesulfonic acid)	0.00007	1	0.0007	20	0.007	50
Perfluorooctanoic acid (PFOA)	0.00056	10	0.0056	50	0.056	50
<b>Pesticides<sup>10</sup></b>						
Aldrin + dieldrin	0.015	1.2	0.03	1.2	0.12	4.8
DDT + DDD + DDE	0.45	50	0.9	50	N/A	50
2,4 -D	1.5	120	3	120	12	480
Chlordane	0.1	4	0.2	4	0.8	16
Heptachlor	0.015	1.2	0.03	1.2	0.12	4.8
Other organochlorine pesticides	N/A	<b>10</b>	N/A	<b>10</b>	N/A	<b>50</b>
Total sum of hexachlorobenzene(HCB), alpha BHC, beta BHC, gamma BHC (lindane), delta BHC, endrin, endrin aldehyde, heptachlor epoxide, methoxychlor and endosulfan (includes endosulfan I, endosulfan II and endosulfan sulphate).						

**Notes for Table 2**

1. In Table 2, N/A means there is no applicable compliance value for this contaminant and the category will be determined by the available values for the contaminant.

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2. Category D upper limits are only applicable to contaminated soils. Waste other than contaminated soils which have contaminant leachable concentration and TC concentrations less than the 'Category D / industrial waste upper limit' are industrial waste.
3. Unless otherwise specified, leachable concentration values are derived from the National Health and Medical Research Council (2011) Australian Drinking Water Guidelines (Version 3.5 updated August 2018).
4. Unless otherwise specified, TC for inorganic species and anions are derived from National Environment Protection Measure on the Assessment of Site Contamination 1999, Health Investigation Level for Commercial/Industrial land.
5. TC based on NSW EPA Waste Classification Guidelines – Part 1: Classifying waste, 2014. Maximum values for specific contaminant concentration when used together with leachable concentration (Table 2).
6. Leachable Concentration based on NSW - Waste Classification Guidelines Part 1: Classifying waste, 2014. Maximum values for leachable concentration when used together with specific contaminant concentration.
7. TC are based on the National Environment Protection (Assessment of Site Contamination) Measure 1999, Sch. B7, health investigation levels at Commercial sites (HIL D) for BaP and carcinogenic PAHs (assessed as BaP TEF). Includes amendments up to National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1).
8. Management of PCBs is based on the Polychlorinated biphenyls management plan (2003, Australian and New Zealand Environment and Conservation Council (ANZECC).
9. Leachable Concentration based on USEPA - 2018 Edition of the Drinking Water Standards and Health Advisories Tables - Maximum Contaminant Level.
10. Organochlorine Pesticides (OCP) Waste Management Plan (1999, ANZECC).

## Table 3: Fill material contamination total concentration upper limit

For the purposes of the definition of fill material in the Regulations, the total concentration thresholds in Table 3 below are the upper limit for industrial waste that is soil.

Soil that exceeds the total concentration threshold of any contaminant in Table 3 is a priority waste unless designated otherwise by EPA. In circumstances that you are aware of known or likely contaminants not included in this table please contact EPA for further guidance or a designation.

Contaminant	Fill material upper limit TC as dry weight (mg/kg)
<b>Inorganic species</b>	
Arsenic	20
Cadmium	3
Chromium (VI)	1
Copper	100
Lead	300
Mercury	1
Molybdenum	40
Nickel	60
Tin	50
Selenium	10
Silver	10
Zinc	200
<b>Anions</b>	
Cyanide	50
Fluoride	450
<b>Organic species</b>	
Phenols (halogenated) <sup>1</sup>	1
Phenols (non-halogenated) <sup>2</sup>	60
Monocyclic aromatic hydrocarbons <sup>3</sup>	7
Benzene	1
Polycyclic aromatic hydrocarbons <sup>4</sup>	20
Benzo(a)pyrene	1
C6-C9 petroleum hydrocarbons	100
C10-C36 petroleum hydrocarbons	1000
Polychlorinated biphenyls	2
Chlorinated hydrocarbons <sup>5</sup>	1
Perfluorooctanesulfonic acid (PFOS)	0.002
Perfluorohexanesulfonic acid (PFHxS)	0.001
Perfluorooctanoic acid (PFOA)	0.001

Pesticides	
Organochlorine pesticides <sup>6</sup>	1

**Notes for Table 3**

1. Total sum of 4-chloro-3-methylphenol, 2-chlorophenol, 2,4-dichlorophenol, 2,6-dichlorophenol, pentachlorophenol, 2,3,4,5-tetrachlorophenol, 2,3,4,6-tetrachlorophenol, 2,3,5,6-tetrachlorophenol, 2,4,5-trichlorophenol, and 2,4,6-trichlorophenol.
2. Total sum of phenol, 2-methylphenol (o-cresol), 3-methylphenol (m-cresol), 4-methylphenol (p-cresol), 2,4-dimethylphenol, 2,4-dinitrophenol, 2-methyl-4,6-dinitrophenol, 2-nitrophenol, 4-nitrophenol, 2cyclohexyl-4,6-dinitrophenol and dinoseb.
3. Total sum of benzene, toluene, ethyl benzene, xylenes (includes ortho, para and meta xylenes) and styrene.
4. Total sum of naphthalene, acenaphthylene, acenaphthene, anthracene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluorene, fluoranthene, indeno(1,2,3-c,d)pyrene, phenanthrene and pyrene.
5. Total sum of carbon tetrachloride, chlorobenzene, chloroform, 1,2-dichlorobenzene, 1,4-dichlorobenzene, 1,2-dichloroethane, 1,1-dichloroethene, 1,2-dichloroethene, dichloromethane (methylene chloride), 1,1,1,2-tetrachloroethane, 1,1,2,2-tetrachloroethane, 1,2,4-trichlorobenzene, 1,1,1-trichloroethane, 1,1,2-trichloroethane, trichloroethene, tetrachloroethene, vinyl chloride and hexachlorobutadiene.
6. Total sum of aldrin, hexachlorobenzene, alpha BHC, beta BHC, gamma BHC (lindane), delta BHC, chlordane, DDT, DDD, DDE, dieldrin, endrin, endrin aldehyde, heptachlor, heptachlor epoxide, methoxychlor and endosulfan (includes endosulfan I, endosulfan II and endosulfan sulphate).

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