

# WASTE ACCEPTANCE CRITERIA AND DEVELOPMENT OF SOIL TRIGGER VALUES FOR EPA-LICENSED SOIL RECOVERY FACILITIES

## 1. Introduction

This guidance document applies to soil recovery facilities which exceed the operational thresholds for waste facility permits as set out in the Third Schedule of the Waste Management (Facility Permit and Registration) Regulations 2007 (S.I. No. 821 of 2007) as amended. Facilities that exceed these thresholds are required to operate under a Waste Licence granted by the Environmental Protection Agency (the Agency).

Licensed soil recovery facilities are typically worked-out quarries that are in the process of being restored. They may also be sites where relatively large volumes of soil are being imported to raise natural ground levels. In both cases the soil recovery facilities are licensed to accept only uncontaminated natural soil and stone.

Unlike landfills, soil recovery facilities are not required to have an engineered basal liner, nor are they required to install an engineered cap following completion of restoration or land raising. As such there are no engineering controls to protect groundwater from contamination that may be present in soil used as backfill at these facilities. Because of this, it is important that precautions are taken by operators of these facilities, both prior to accepting soil from individual source sites and while soil is being received, to ensure that only uncontaminated soil and stone is accepted.

It is best practice to monitor incoming materials so that the Licensee can determine if this material is uncontaminated and suitable for acceptance at their site. Licences granted by the Agency for soil recovery facilities may include a condition requiring the licensee to propose maximum concentrations and/or trigger levels for relevant contaminants in soil and stone proposed for acceptance at the facility from non-greenfield sources. This document provides guidance on developing soil trigger levels that will be acceptable to the Agency, to comply with these conditions.

## 2. Waste Acceptance Criteria for Soil Recovery Facilities

With a view to ensuring that only uncontaminated soil and stone is accepted at licensed soil recovery facilities, only soil and stone from the following types of source site should be considered:

|   |  |
|---|--|
| Greenfield sites:   | Acceptable, subject to meeting agreed Waste Acceptance Criteria.   |
| Non-greenfield sites where the risk of contamination from chemical or solid materials is low: | Acceptable, subject to meeting agreed Waste Acceptance Criteria.   |
| Non-greenfield sites where there is an increased risk of contamination                        | Not acceptable – such materials should not be accepted at soil recovery facilities. Waste soil and stone from such sites |

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from chemicals or solid materials: should be transferred to an appropriately licensed landfill or recovery facility.

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The minimum criteria under which soil and stone may be accepted at a soil recovery facility from source sites are outlined in Table 2.1. There are different criteria for material originating from greenfield sites and for material originating from non-greenfield sites. This reflects the increased risk of contamination being present in soil and stone originating from non-greenfield sites.

**Table 2.1: Waste Acceptance Criteria for Backfill Material\***

| <b>Material Type</b>            | <b>Minimum Criteria</b>   |
|---------------------------------|---|
| Greenfield soil and stone:-     | <p>Letter of suitability for the first 5,000 tonnes of material received, and a further letter of suitability for each subsequent 5,000 tonnes of material received.</p> <p>Each letter of suitability shall be signed by a suitably qualified person and shall state the following:</p> <ul style="list-style-type: none"> <li>• The waste is greenfield soil and stone</li> <li>• A description of the source and nature of the soil and stone</li> <li>• The location of the source of the soil and stone (including a map showing the source site boundary)</li> <li>• The material is suitable for use as backfill within the facility</li> <li>• The material will not cause environmental pollution at the facility</li> </ul> <p>There is no requirement for testing greenfield soil and stone, unless directed by the Agency. However, it is advisable that the suitably qualified person relies on soil test results to confirm the greenfield status of the source site before signing the letter of suitability.</p> <p>When the material arrives at the soil recovery facility, a visual check is required to verify that the material is greenfield soil and stone.</p> |
| Non-greenfield soil and stone:- | <p>Prior to accepting material from each individual source site, the licensee shall obtain information on the past use of the site and shall reject non-greenfield sites where soil or groundwater contamination has been identified or where there is an increased risk of contamination being present. Soil and stone should not be accepted from sites where activities in the past have involved the manufacture or storage of hazardous substances e.g. chemical manufacturing facilities, oil storage facilities, retail filling stations.</p> <p>Up to 2% contamination with non-natural materials is acceptable within the soil and stone, i.e. anthropogenic or man-made substances such as rubble, concrete, bricks, metal and bitumen that are non-natural to the environment from which the material was extracted. There is no allowance for chemical contamination.</p> <p>Basic characterisation, compliance testing and on-site verification shall be undertaken, as outlined in Table 2.2 below. Contaminant concentrations within the soil and stone must comply with soil trigger levels agreed with the Agency.</p>   |

\* In the case where there is conflict between Table 2.1 and a licence requirement, the licence requirement shall prevail.

**Table 2.2: Waste Characterisation for Non-Greenfield Soil and Stone\***

| Amount of Material                             | Testing Requirement                      | Frequency of Testing/Location of Sampling   |
|--|--|---|
| Greater than 2,000 tonnes from a single source | Basic characterisation <sup>Note 1</sup> | To be carried out off-site prior to agreeing acceptance of the waste at the facility.   |
|  | Compliance testing <sup>Note 1</sup>     | One representative sample shall be analysed for every 2,000 tonnes of material received at the facility.<br><br>A portion of each sample shall be retained on site for three years and shall be available for inspection/analysis by the Agency.  |
|  | On-site verification <sup>Note 2</sup>   | Every load received at the facility   |
| Less than 2,000 tonnes from a single source    | Basic characterisation <sup>Note 1</sup> | Sampling shall be undertaken at the facility prior to the use of material as backfill. At least one representative sample shall be collected from every 2,000 tonnes of material from the collective of single sources, each of which is less than 2,000 tonnes <sup>Note 3</sup> .<br><br>A portion of each sample shall be retained on site for three years and shall be available for inspection/analysis by the Agency. |
|  | On-site verification <sup>Note 2</sup>   | Every load received at the facility   |

\* In the case where there is conflict between Table 2.2 and the licence requirements, the licence requirements shall prevail.

Note 1: This constitutes a thorough determination, according to standardised analysis and behaviour testing methods, of the short and long-term leaching behaviour and/or characteristic properties of the waste. Parameters and trigger levels are to be agreed with the Agency.

Note 2: Rapid check methods (e.g. visual inspection) to confirm that a waste is the same as that which has been subjected to compliance testing and that which is described in any accompanying documents.

Note 3: It is recommended that waste in this category is placed in the quarantine area until sampling is completed and the results are available to determine suitability for acceptance.

### 3. Development of Soil Trigger Levels

The soil trigger levels for licensed soil recovery facilities must focus on the requirement for material accepted at the facility to be uncontaminated. Generic soil trigger levels, or a methodology for developing generic soil trigger levels, to be used for basic characterisation and compliance testing are presented in this Section for the following parameters.

- Heavy metals and metalloids in soil (to include As, Cd, Cr, Cu, Hg, Ni, Pb, Zn);
- Total organic carbon in soil;
- Total BTEX (benzene, toluene, ethylbenzene, xylenes) in soil;

- Extractable Petroleum Hydrocarbons (EPH) in soil;
- Polycyclic aromatic hydrocarbons (PAHs) in soil;
- Polychlorinated Biphenyls (PCBs) in soil;
- Asbestos fibres in soil.

### Heavy Metals

Many heavy metals are present at milligram per kilogram concentrations in soils in Ireland, and these elements will be present at detectable concentrations in uncontaminated soil and stone. The table on the following page contains summary data from a Teagasc report entitled "National Soils Database" dated July 2007 (report reference RMIS 5192) for a number of heavy metals including those listed above<sup>1</sup>. The data presented in this table is a summary of actual soil quality data collected by Teagasc from soil samples collected across Ireland, and it gives an indication of the range of concentrations of these elements found in Irish soils.

**Table 3.1: Concentrations of Metals in Soil in Ireland  
(From Teagasc National Soils Database)**

| Element        | Irish Soil Geochemistry (mg/kg) |       |        |
|----------------|---------------------------------|-------|--------|
|                | Median                          | Min   | Max    |
| Arsenic        | 7.25                            | 0.35  | 122.7  |
| Cadmium        | 0.326                           | 0.028 | 15.148 |
| Total Chromium | 43.7                            | 2.1   | 221.7  |
| Copper         | 16.2                            | 1.1   | 272.4  |
| Mercury        | 0.087                           | 0.02  | 3.45   |
| Nickel         | 17.5                            | 0.8   | 176    |
| Lead           | 24.8                            | 1.1   | 2634.7 |
| Zinc           | 62.55                           | 3.6   | 1384.4 |

More detailed information on the National Soils Database is available on Teagasc's website, including an on-line mapping tool that provides a break-down of the soil quality data by area across Ireland.

The soil trigger levels for heavy metals for any particular soil recovery facility shall be the 90<sup>th</sup> percentile concentrations quoted in the National Soils Database for each metal listed above. These values are presented in Table 3.2 below.

<sup>1</sup> The report can be accessed by following this [link](#)

**Table 3.2: Soil Trigger Levels for Metals in Soil**

| Element        | Soil Trigger Level<br>mg/kg |
|----------------|-----------------------------|
| Arsenic        | 16                          |
| Cadmium        | 1.3                         |
| Total Chromium | 75                          |
| Copper         | 35                          |
| Mercury        | 0.2                         |
| Nickel         | 42                          |
| Lead           | 48                          |
| Zinc           | 126                         |

It should be noted that the soil trigger levels in Table 3.2 are total concentrations of the listed metals in soil. They are not comparable with the Waste Acceptance Criteria for metals in inert waste landfills (and other landfills), which are based on the leachable component of metals in soil.

#### Total Organic Carbon (TOC)

The primary concern in relation to soils with elevated TOC is the potential for generation of landfill gas. This risk must be maintained at a very low level at soil recovery sites and as such, materials including topsoil and peat should not be accepted at soil recovery facilities (in any case these materials are generally prohibited in waste licences for soil recovery facilities).

This is also the case at licensed inert waste landfills; i.e. inert waste landfills are not licensed to accept materials that could potentially generate landfill gas. In the case of inert waste landfills, the Waste Acceptance Criterion (WAC) for TOC is 3% by weight or 30,000 mg/kg<sup>2</sup>.

This criterion for inert waste landfills of 3% has been adopted as the soil trigger level for TOC at licensed soil recovery facilities.

#### Organic Compounds (BTEX, EPH, PAH, PCBs)

Organic compounds such as BTEX, EPH, PAHs and PCBs should not be present in uncontaminated soils. As such, the concentrations of these groups of compounds in samples of uncontaminated soil submitted for laboratory analysis will be below the laboratory's limits of detection. The detection limits commonly reported by reputable environmental testing laboratories for these groups of compounds have been used as the basis for soil trigger levels for these groups of compounds.

With regard to TPH and EPH, the detection limit commonly reported by laboratories is between 30 and 40 mg/kg. For total PAHs, the detection limit is typically less than 1 mg/kg. For total

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<sup>2</sup> Council Decision 2003/33/EC of 19<sup>th</sup> December 2002 establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC

BTEX, the detection limit is typically less than 0.05 mg/kg. For PCBs (total of 7 common congeners) the detection limit is also typically less than 0.05 mg/kg. By setting soil trigger levels for these compounds at the level of readily achievable detection limits, they will be consistent with the requirement for soil accepted at licensed soil recovery facilities to be uncontaminated and at these levels the risk of environmental pollution can be expected to be minimal.

With the above in mind, the following soil trigger levels have been adopted for organic compounds:

- Total BTEX - 0.05 mg/kg
- TPH/EPH - 50 mg/kg
- Total PAHs<sup>3</sup> - 1 mg/kg
- Total PCBs<sup>4</sup> - 0.05 mg/kg

### Asbestos

Asbestos fibres should not be present in soil used as backfill at soil recovery sites. As such, the soil trigger level for asbestos shall be “No Asbestos Detected”.

### Other Substances

The list of soil trigger levels included in this guidance note shall be considered *de minimus* for the basic characterisation and compliance testing of soil at licensed soil recovery facilities.

It may be necessary to develop soil trigger levels for other parameters or substances on a case-by-case basis, depending on the historical use of sites from which soil is to be received, and on the particular sensitivities of the receiving site e.g. taking into consideration groundwater or surface water sensitivities. Concentrations of such substances (for example volatile organic compounds) should be below detection in soil proposed for acceptance at soil recovery facilities, unless they have been demonstrated to the Agency to be present at detectable concentrations in natural soil and stone, including at the receiving site.

As a general rule, soil trigger levels for all other substances shall be set at levels that are consistent with detection limits reported by accredited environmental testing laboratories, unless they are present at detectable concentrations in natural soil and stone.

### Summary

The following is a summary of the soil trigger levels that shall be adopted for licensed soil recovery facilities. Additional parameters shall be included on a case-by-case basis, depending on the historical activities at non-greenfield source sites, and on the sensitivity of the receiving environment (as appropriate).

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<sup>3</sup> Total of 16 USEPA priority compounds plus coronene

<sup>4</sup> Total of 7 priority congeners

**Table 3.3: Summary of Soil Trigger Levels for Soil Recovery Facilities**

| Parameter in Soil                    | Soil Trigger Level   |
|--------------------------------------|----------------------|
| Arsenic                              | 16 mg/kg             |
| Cadmium                              | 1.3 mg/kg            |
| Total Chromium                       | 75 mg/kg             |
| Copper                               | 35 mg/kg             |
| Mercury                              | 0.2 mg/kg            |
| Nickel                               | 42 mg/kg             |
| Lead                                 | 48 mg/kg             |
| Zinc                                 | 126 mg/kg            |
| TOC                                  | 3 %                  |
| Total BTEX <sup>Note 1</sup>         | 0.05 mg/kg           |
| TPH or EPH <sup>Note 1</sup>         | 50 mg/kg             |
| Total PAHs <sup>Note 1 &amp; 2</sup> | 1 mg/kg              |
| Total PCBs <sup>Note 1 &amp; 3</sup> | 0.05 mg/kg           |
| Asbestos fibres                      | No asbestos detected |

Note 1: The soil trigger levels for these parameters are consistent with detection limits reported by accredited environmental testing laboratories

Note 2: Total concentration of the following 17 compounds: Naphthalene, Acenaphthylene, Acenaphthene, Anthracene, Benzo[a]anthracene, Benzo[b]fluoranthene, Benzo[k]fluoranthene, Benzo[g,h,i]perylene, Benzo[a]pyrene, Chrysene, Coronene, Dibenzo[a,h]anthracene, Fluorene, Fluoranthene, Indeno[1,2,3-c,d]pyrene, Phenanthrene and Pyrene.

Note 3: Total concentration of the following seven PCB congeners: PCB-28, PCB-52, PCB-101, PCB-118, PCB-138, PCB-153 and PCB-180.

#### 4. Groundwater Monitoring

Waste Licences for soil recovery facilities typically require the licensee to install groundwater monitoring wells at or near the facility at a minimum three locations prior to accepting waste. A minimum of one well shall be located up-hydraulic gradient of the facility and a minimum of two wells shall be located down-hydraulic gradient of the facility. For large sites a larger number of groundwater wells may be advisable to ensure there are up-gradient and down gradient wells available for monitoring, particularly if separate aquifers exist within the site. The wells shall be located and designed so they can be used to assess groundwater flow direction under the facility, as well as collecting representative samples of groundwater.

The depth of the well screens shall be agreed in advance with the Agency. The well screens shall be located within the first geological unit encountered during drilling that is a potential migration pathway for groundwater flowing under the site. The well screens should be no more than three metres long and shall be installed in the upper few metres of the aquifer. Each monitoring well shall be designed and installed to ensure there is no preferential pathway for surface water run-off or perched groundwater to enter the well.

Prior to accepting waste at a newly licensed facility, a groundwater monitoring round shall be completed to provide baseline data on groundwater quality up-gradient and down-gradient of the facility. Thereafter, licensees should be required to complete groundwater monitoring on a minimum annual basis (occurring around the same time of year to remove seasonal influences) and to use the groundwater monitoring to assess the facility's compliance with the European Communities Environmental Objectives (Groundwater) Regulations (S. I. No. 9 of 2010) as amended.

Groundwater samples collected during the baseline and subsequent groundwater monitoring rounds shall be analysed for the following analytes, unless agreed otherwise with the Agency:

- pH and electrical conductivity - measured in the field at the time of sampling;
- Chloride, sulphate, nitrate;
- Ammoniacal nitrogen;
- Dissolved metals (to include As, Cd, Cr, Cu, Hg, Ni, Pb, Zn) - samples shall be filtered in the field and preserved;
- Polycyclic aromatic hydrocarbons (PAHs – 16 priority USEA compounds);
- Standard suite of Volatile Organic Compounds (VOCs) and a scan for Tentatively Identified Compounds<sup>5</sup>;
- Total Petroleum Hydrocarbons (TPH) or Extractable Petroleum Hydrocarbons (EPH).

The report on each groundwater monitoring round shall be included in the AER unless otherwise required by the Agency.

## **5. Existing Soil Recovery Facilities**

There are a number of licensed soil recovery facilities operating in Ireland that have received backfill material in the absence of soil trigger levels having been agreed with the Agency. In these cases, it is necessary that licensees demonstrate to the Agency either that the backfill received at the facility to date is compliant with soil trigger levels developed in accordance with this guidance, or that the existing facility is not causing environmental pollution.

In such cases, and in the absence of relevant parametric monitoring to demonstrate compliance with the trigger levels specified in Table 3.3, the licensee shall submit a proposal to the Agency to

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<sup>5</sup> Tentatively Identified Compounds or TICs are those VOCs which can be detected by using a gas chromatograph/mass spectrometer instrument and their identity can be confirmed with a search of the spectral library of compounds, but the concentration cannot be confirmed accurately without running a known standard of the TIC.



undertake a programme of soil sampling (assuming soil samples have not been retained or are unsuitable for testing) and laboratory analysis for approval. This proposal should specify how and where soil sampling is to be undertaken, as samples should be taken from a sufficient number of locations and range of depths to be fully representative of materials placed at the site.

The collected samples shall be analysed for the suite of parameters specified in Table 3.3 of this document.

If the results of this testing programme indicate that material has been used as backfill that exceeds the soil trigger levels for the facility then the licensee shall complete a hydrogeological assessment that considers whether the facility is compliant with the European Communities Environmental Objectives (Groundwater) Regulations, (S. I. No. 9 of 2010) as amended. Guidance on the scope of the hydrogeological assessment and the content of the report can be accessed by clicking this [link](#) to the EPA's website.

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