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JRC.B.5/EU-BRITE

**KICK-OFF MEETING**

**FOR THE DRAWING UP OF THE**

**BEST AVAILABLE TECHNIQUES (BAT) REFERENCE DOCUMENT**

**FOR LANDFILLS**

**(LAN BREF)**

**SEVILLE**

**6 – 9 October 2025 (tentative)**

**BACKGROUND PAPER**



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## INTRODUCTION

Directive 2010/75/EU, as amended by Directive (EU) 2024/1785 (24 April 2024), on Industrial and Livestock Rearing Emissions (integrated pollution prevention and control) (hereafter the IED)<sup>1</sup>, through its Chapters I and II, lays down a framework requiring Member States to issue operating permits for installations carrying out industrial activities specified in its Annex I, including the activity under point 5.4:

- *Landfills, as defined in Article 2(g) of Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste<sup>2</sup>, receiving more than 10 tonnes of waste per day or with a total capacity exceeding 25 000 tonnes, excluding landfills of inert waste.*

The IED stipulates that permits must contain conditions based on Best Available Techniques (BAT) as defined in Article 3(10) of the IED, to achieve a high level of protection of human health and the environment taken as a whole.

The BAT conclusions, the key parts of the BAT reference documents (BREFs), serve as the reference for the competent authorities when setting permit conditions for installations under the scope of the IED. BREFs are also used by the industry concerned in preparing applications for operating permits. Additionally, BREFs are a source of information for other parties (including outside the EU) interested in ways to minimise the negative environmental impacts of industry.

The amending Directive (EU) 2024/1785 provides for the deletion of Article 1, Paragraph 2, of Directive 1999/31/EC (hereafter the LWD). This amendment allows the adoption of BAT conclusions for landfills, as defined in Article 2(g) of the LWD, receiving more than 10 tonnes of waste per day or with a total capacity exceeding 25 000 tonnes, excluding landfills of inert waste (IED Annex I, point 5.4). This would also allow a thorough investigation of the technical innovation that has taken place so far, and identification of today's most widely applied techniques, such as methane capture.

The technical working group (TWG) set up for the drawing up of the LAN BREF will hold its Kick-off Meeting (KoM) from 6 to 9 October 2025 (tentative).

The purpose of this background paper (BP) is to provide members of the TWG with an outline of the matters that are proposed for discussion at the KoM, including draft proposals to carry forward the LAN BREF work. This BP also includes a section referring to those items not proposed for discussion at the KoM. For those items that in the end are not discussed at the KoM, the EU-BRITE proposals will be carried forward in the LAN BREF work.

**The KoM will determine/clarify the process for the drawing up of the LAN BREF, so that TWG members are aware of the specific tasks needed to deliver a high-quality BREF according to a timetable that will be agreed on by the TWG.**

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<sup>1</sup> [Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial and livestock rearing emissions](#)

<sup>2</sup> [Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste](#)

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# ACRONYMS AND TERMS USED IN THIS BACKGROUND PAPER

## General acronyms and terms

Acronym/term	Meaning
BAT	Best Available Technique(s) (as defined in Article 3(10) of the IED)
BAT-AEL	Emission level associated with the BAT (as defined in Article 3(13) of the IED)
BAT-AEPL	BAT-associated environmental performance level (as defined in Article 3(13a) of the IED)
BATc	Best Available Techniques conclusion(s)
BATIS	BAT information system
BP	Background paper (i.e. this document)
BREF	BAT reference document (as defined in Article 3(11) of the IED)
BREF Guidance	Commission Implementing Decision 2012/119/EU laying down rules concerning guidance on the collection of data and on the drawing up of BAT reference documents and on their quality assurance
CBI	Confidential Business Information
D1	First draft
EIEP	<a href="#">European Industrial Emissions Portal</a>
ELV	Emission limit value
EMS	Environmental Management System
EN	European Standard adopted by CEN (European Committee for Standardisation, from its French name Comité Européen de Normalisation)
EU	European Union
EU-BRITE	European Bureau for Research on Industrial Transformation and Emissions
FDM BREF	Best Available Techniques (BAT) Reference Document for the Food, Drink and Milk Industries (2019)
FMP BREF	Best Available Techniques (BAT) Reference Document for the Ferrous Metals Processing Industry (2022)
IED	Directive 2010/75/EU, as amended by Directive (EU) 2024/1785 of the European Parliament and the European Council of 24 April 2024, on industrial and livestock rearing emissions (integrated pollution prevention and control)
ISO	International Organisation for Standardisation. Also international standard adopted by this organisation.
KEI	Key environmental issue (for the drawing up of this BREF)
KoM	Kick-off Meeting
LCP BREF	Best Available Techniques (BAT) Reference Document for Large Combustion Plants (2017)
LWD	Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste
MCPD	Directive (EU) 2015/2193 of the European Parliament and of the Council of 25 November 2015 on the limitation of emissions of certain pollutants into the air from medium combustion plants
MS	Member State (of the European Union)
NGO	Environmental non-governmental organisation
PM	Particulate matter
REACH	Regulation (EC) No 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals, administered by ECHA
TWG	Technical Working Group
WAC	Council Decision of 19 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
WFD	Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy
WWTP	Waste water treatment plant

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## Chemical symbols

Symbol	Chemical element/metal
As	Arsenic
Cd	Cadmium
Cr	Chromium
Cu	Copper
Fe	Iron
Hg	Mercury
Li	Lithium
Mn	Manganese
Ni	Nickel
Pb	Lead
Sn	Tin
U	Uranium
Zn	Zinc

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## Substances, group of substances and parameters

Symbol	Chemical element/metal
CN <sup>-</sup>	Free cyanide
CO	Carbon monoxide
CO <sub>2</sub>	Carbon dioxide
COD	Chemical oxygen demand
HOI	Hydrocarbon oil index
H <sub>2</sub> SO <sub>4</sub>	Sulphuric acid
K <sub>2</sub> SO <sub>4</sub>	Potassium sulphate
Na <sub>2</sub> SO <sub>4</sub>	Sodium sulphate
NH <sub>3</sub>	Ammonia
NH <sub>4</sub> <sup>+</sup>	Ammonium
NMVOC	Non-methane volatile organic compounds
NO <sub>2</sub> <sup>-</sup>	Nitrite
NO <sub>3</sub> <sup>-</sup>	Nitrate
NO <sub>x</sub>	Nitrogen oxide
PFAS	Per- and poly-fluoroalkyl substances
PO <sub>4</sub> <sup>3-</sup>	Phosphate
SO <sub>2</sub>	Sulphur dioxide
SO <sub>x</sub>	Sulphur oxide
SO <sub>4</sub> <sup>2-</sup>	Sulphate
TN	Total nitrogen
TOC	Total organic carbon
TSS	Total suspended solids
VOC	Volatile organic compound (as defined in Article 3(45) of the IED)

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## EU Member States and EFTA countries

Acronym	Meaning
AT	Austria
BE	Belgium
CZ	Czechia
DE	Germany
DK	Denmark
EE	Estonia
ES	Spain
FI	Finland
FR	France
HR	Croatia
HU	Hungary
IT	Italy
MT	Malta
NL	Netherlands
NO	Norway
PL	Poland
PT	Portugal
SE	Sweden
SK	Slovakia

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## Other stakeholders

<b>Acronym/Name</b>	<b>Meaning</b>
Cefic	European Chemical Industry Council
CEWEP	Confederation of European Waste-to-Energy Plants
ECHA	European Chemicals Agency
EEB	European Environmental Bureau
ELA	European Landfill Association
ESWET	European Suppliers of Waste to Energy Technology
Eurits	European Union for Responsible Incineration and Treatment of Special Waste
EUROFER	The European Steel Association
Euroheat & Power	The international network for district energy, promoting sustainable heating and cooling in Europe and beyond
Eurometaux	European non-ferrous metals association
Euromines	European Association of Mining Industries, Metal Ores & Industrial Minerals
FEAD	European Federation of Waste Management and Environmental Services
FuelsEurope	European petroleum refining industry
HWE	Hazardous Waste Europe
MWE	Municipal Waste Europe
ZWE	Zero Waste Europe

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# 1 GENERAL INFORMATION

## 1.1 Call for frontloading

The drawing up of the LAN BREF started with the activation of the Technical Working Group (TWG) on 22 November 2024, which resulted in a TWG with currently 223 members from EU Member States and EFTA countries, industry, NGOs, ECHA and services of the Commission. The list is available in the BAT Information System (BATIS).

At that time, TWG members were invited, once nominated, to proactively engage in the frontloading process for gathering all relevant information that will contribute to the preparatory stage and facilitate decisions that will be taken by the TWG at the KoM.

On 14 February 2025 the TWG members were invited to frontload the information exchange in order to gather information and views on the main issues for the drawing up of the LAN BREF.

The drawing up of the LAN BREF requires frontloading work, especially to decide at the KoM on the scope of the BREF and the key environmental issues (KEIs) to be addressed.

To facilitate the frontloading work and data management, EU-BRITE prepared a survey using the European Commission's EU Survey tool. In this LAN frontloading survey, the TWG could find initial proposals by EU-BRITE and requests for information related to these proposals, as well as an invitation to send bulk information on landfills covered by the delegations.

These initial proposals were based on an extensive review of the landfill sector carried out by EU-BRITE, with a particular focus on the existing environmental acquis, information available through the European Industrial Emissions Portal (EIEP)<sup>3</sup> and through several Member States' emission portals. In addition, several landfill permits were examined.

EU-BRITE's initial proposals mainly referred to the scope of the LAN BREF and to potential key environmental issues for landfill activities and operations that may be covered by the LAN BREF. These key issues referred, for example, to emissions to air and water, channelled and diffuse emissions, noise emissions, water and energy consumption, consumption of chemicals and raw and auxiliary materials and waste generation.

Through this LAN frontloading survey, TWG members could express their initial positions about the potential KEIs to be considered for the drawing up of the LAN BREF.

With the aim of ensuring transparency, one of the cornerstones of the Sevilla process, TWG members were invited, once they completed the survey, to upload the information provided (filled-in survey and any other supporting documents) to BATIS.

The deadline for this frontloading process was 16 April 2025.

EU-BRITE received a total of 33 filled-in surveys and five contributions from Malta (1) and ECHA (4). The surveys and documents submitted by the TWG members were uploaded to BATIS and are available to all TWG members. Here is a summary of the documents received:

- 18 surveys and a number of supporting documents from Member States (BE, DE, NL, PL, PT, AT, HR, HU, FR, SE, SK, CZ, EE, IT, ES, FI, DK) and NO;
- one representative non-hazardous waste landfill permit from MT;
- two surveys and supporting documents from environmental NGOs (EEB and ZWE);
- four documents from ECHA;

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<sup>3</sup> [European Industrial Emission Portal](#).

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- 13 surveys and supporting documents from industry associations (Euromines, Eurits, FEAD, ESWET, CEWEP, ELA, Eurometaux, MWE, EUROFER, Euroheat & Power, HWE, FuelsEurope, Cefic).

All surveys and related supporting documentation are available in the following BATIS folder: [BATIS > Forum > LAN BREF > 02 Frontloading > 02 LAN BREF frontloading survey](#).

The compiled information, feedback and views submitted by the LAN TWG members is the basis of this background paper.

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## 1.2 Objectives of the kick-off meeting (KoM)

A description of the purpose of the KoM is given in Section 4.6.2.2 of the BREF Guidance<sup>45</sup>.

At the KoM, the members of the TWG will decide in particular on the **scope** (see Section 2.1) and the **key environmental issues (KEIs)** (see Section 2.2) based on the views and information collected through the frontloading process.

Furthermore, the KoM will address and reach conclusions on the items listed below:

- the nature and extent of the data collection, including via questionnaire and addressing confidentiality issues, if any – see Section 3.5;
- the tentative timeline for the work on the data and information collection – see Section 3.1.2;
- the structure (and content) of the LAN BREF – see Section 3.2.

It should be noted that, during the KoM, the discussions will be kept generic and will not include in-depth technical debates. For example, deciding whether a particular technique is BAT will not be discussed at this stage, as answers to questions of this nature need to be informed by the subsequent data and information collection exercise.

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<sup>4</sup> [Commission Implementing Decision 2012/119/EU](#)

<sup>5</sup> The Guidance document is currently being revised according to IED Article 13, point 1a.

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## 1.3 Purpose and content of this background paper

The aim of this background paper (BP) is to assist TWG members in their preparation for the KoM and to create a common basis for the discussion during the meeting.

The views and information provided by the TWG as part of the frontloading process have been analysed and the summaries are presented in subject groups, or issues, described in Section 2 and Section 3. Issues where the initial feedback from the TWG showed differing views and any new issues requiring discussion within the TWG are presented in Section 2. These are the items considered the most important in terms of obtaining clarification before starting the LAN BREF drawing up process and EU-BRITE proposes to discuss these at the KoM.

For issues that appear to not need discussions at the KoM, the submitted frontloading information, its analysis and the EU-BRITE proposals are presented in Section 3.

Individual items in this BP are presented where possible as follows:

<b>Initial EU-BRITE proposal</b>
This cell contains EU-BRITE's initial proposal(s), as outlined in the 'LAN BREF frontloading survey', for the TWG to consider and agree on the topic of concern. The proposals are numbered consistently with the original LAN BREF frontloading survey. Please note that, following an assessment of the information received, some sections and proposals may have been reorganised, merged, or split, and new proposals may have been added.
<b>Summary of initial information, feedback and views collected through the frontloading process</b>
This cell contains a summary of TWG members' information, feedback and views provided through the LAN BREF frontloading survey and/or other documents uploaded to BATIS. If multiple proposals have been assessed jointly, a separate summary is provided for each one.
<b>EU-BRITE assessment</b>
This cell contains EU-BRITE's assessment of the information, feedback and views provided and, where relevant, new information and forms the basis for EU-BRITE's proposal(s).
<b>EU-BRITE proposal</b>
This cell contains EU-BRITE's proposal(s) for the TWG to consider and agree on the topic of concern. A note is included to indicate the status of the initial proposal, specifically whether it has been confirmed, amended, merged or split and whether a new proposal has been added.

The order of the discussion items in this BP will not necessarily be the order of the discussions at the KoM.

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## 1.4 Before attending the meeting

To enable meaningful discussions at the KoM, it is important that TWG members have read this BP in advance of the meeting.

If you believe that issues other than those included in Section 2 of this background paper or issues other than those included in this BP need to be discussed at the kick-off meeting, please post your request directly in the following BATIS folder **before 15 September 2025**: [BATIS > Forum > LAN BREF > 03 Kick-off meeting > 03 TWG reactions](#).

Such a request must also include a justification/rationale for each new item proposed to be discussed.

Before participating in the kick-off meeting, EU-BRITE recommends that TWG members read and familiarise themselves with the contents of the following documents:

- The frontloading views and information of the TWG members posted in the BATIS Forum for the LAN BREF ([BATIS > Forum > LAN BREF > 02 Frontloading](#)).
- The [BREF Guidance](#) (Commission Implementing Decision 2012/119/EU)
- The [Industrial and Livestock Rearing Emissions Directive \(IED\)](#) (Directive 2010/75/EU as amended by Directive (EU) 2024/1785 of the European Parliament and of the Council)
- The [Landfill Directive](#) (LWD) (Council Directive 1999/31/EC on the landfill of waste amended by Directive (EU) 2024/1785 of the European Parliament and of the Council)
- [2003/33/EC](#): Council Decision of 19 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 (WAC)<sup>6</sup>.

Every LAN TWG member has received a username and a password enabling access to the BATIS Forum where all the relevant documents can be found ([BATIS > Forum > LAN BREF](#)). Additional information about how to work with BATIS will be provided during the KoM.

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<sup>6</sup> [2003/33/EC: Council Decision of 19 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](#)

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## 2 ITEMS FOR DISCUSSION AT THE KICK-OFF MEETING

### 2.1 Scope of the LAN BREF

#### 2.1.1 Activities and classes of landfills

<b>Initial EU-BRITE proposals</b>
<p>11. EU-BRITE proposes to cover in the LAN BREF activity 5.4 of Annex I to Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial and livestock rearing emissions:</p> <ul style="list-style-type: none"><li>○ 5.4 Landfills, as defined in Article 2(g) of Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste, receiving more than 10 tonnes of waste per day or with a total capacity exceeding 25 000 tonnes, excluding landfills of inert waste.</li></ul>
<p>12. EU-BRITE proposes to cover in the LAN BREF activity 5.6 of Annex I to Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial and livestock rearing emissions:</p> <ul style="list-style-type: none"><li>○ 5.6 Underground storage of hazardous waste with a total capacity exceeding 50 tonnes.</li></ul>
<p>13. EU-BRITE proposes to cover in the LAN BREF hazardous waste and non-hazardous waste landfills.</p>
<b>Summary of initial information, feedback and views collected through the frontloading process</b>
<ul style="list-style-type: none"><li>• The main comments on proposal 11 are the following:<ul style="list-style-type: none"><li>○ It is considered appropriate to define the activity of the LAN BREF as that of point 5.4 of Annex I to the IED, using the definition in Article 2(g) LWD [EEB, ELA, FR, HR].</li><li>○ Permanent storage facilities in salt mines (potassium or rock salt mines) are under point 5.4 of Annex I to the IED and thus fall within the scope of the LAN BREF [DE, Euromines].</li><li>○ One stakeholder recommends excluding permanent storage facilities in salt mines from the scope of the LAN BREF, on the grounds that they are unique [Euromines] however this exclusion may only apply if BATs for the permanent storage in salt mines are conclusively defined in the LWD [DE].</li><li>○ One stakeholder considers landfills receiving sludge from dredging operations as part of the scope [BE].</li><li>○ Inert waste landfills may exclusively accept inert waste [FEAD] and some concerns regarding the exclusion of inert waste landfills [EEB, ES, FI, HWE, ZWE] and LWD Article 3.4 exclusions [EEB] have been raised.</li><li>○ The deposit of non-hazardous waste described in Article 3.3 of the LWD may be excluded from the scope of this BREF [ELA, FEAD, NL, PL].</li><li>○ Concerns about recovery activities have been raised [EEB, ZWE].</li><li>○ The concept of ‘total capacity’ may be clarified for the purposes of this BREF [MWE].</li><li>○ Some stakeholders [AT, BE, FR, PT, ZWE] express interest in including landfill mining in the scope of the LAN BREF.</li></ul></li><li>• The main comments on proposal 12 are the following:<ul style="list-style-type: none"><li>○ Permanent storage facilities in salt mines in Germany are listed under point 5.4 of Annex I to the IED [DE, Euromines].</li><li>○ The scope may include the activity 5.6 of the Annex I to the IED [NL].</li><li>○ Several MS and stakeholders disagree with the proposal, arguing that they have no installations of this kind on their territory, or that their limited number would result in a lack of data or that the emissions are low due to their technical characteristics [Cefic, EUROFER, FR, MWE, SK].</li></ul></li></ul>

- Some MS raise doubts about the type of hazardous waste that is included in point 5.6 [BE] and which facilities are covered by it. [DE, BE].
- Installations covered by point 5.6 of Annex I to the IED may have unique conditions [Cefic, ES, Eurometaux, NO, PL]. It is thus important to have a clear understanding of the differences between underground storage and underground landfill and its impact in terms of BAT and ELV [FEAD].
- The main comments on proposal 13 are the following:
  - The drafting of the LAN BREF may not differentiate waste by its origin but by the intrinsic characteristics of the waste [ELA, PL].
  - Landfills for non-hazardous and hazardous waste may be addressed separately [AT, BE, Cefic, CZ, DE, EE, EEB, ELA, ES, ESWET, Eurometaux, Euromines, FEAD, FI, FR, HR, HU, HWE, IT, MWE, NO, PT, SK, ZWE].
  - A number of stakeholders raise objections, making a distinction between municipal and non-municipal waste landfills in the LAN BREF [EEB, ELA, ES, FEAD, MWE, PL, SE, ZWE].

#### **EU-BRITE assessment**

- Regarding EU-BRITE's proposal 11:
  - The description of the activity would be aligned with the IED and LWD.
  - When drawing up the LAN BREF, the TWG should refrain from interpreting directives or addressing related implementation issues.
  - The capacity of the landfill should be defined in the permit, according to the LWD.
  - Landfill mining is increasingly being recognised as an important issue. This is highlighted by European Commission initiatives such as 'Closing the loop - An EU action plan for the Circular Economy' which included measures to share practices such as recovering Critical Raw Materials from mining waste and landfills. Also, the report ['Recovery of critical and other raw materials from mining waste and landfills'](#) analyses Action 39 of the Circular Economy Action Plan, which focuses on sharing best practices for the recovery of critical raw materials from landfills. These actions and research initiatives may provide useful insights and information for the development of the LAN BREF.
- Regarding EU-BRITE's proposal 12:
  - The underground storage of hazardous waste with a total capacity exceeding 50 tonnes, not covered by the definition in Article 2(g) of the Landfill Directive, is an activity that is not widespread among the MS. It seems that there are only a few installations (see Annex 4.2) in the EU that fall under activity 5.6 of Annex I to the IED.
  - Existing underground installations do not currently report emissions to air, ground or water in the EIEP. Furthermore, there is a significant lack of data and limited comparability, making it challenging to assess techniques, as no specific installations or relevant data have been identified or shared by stakeholders to date.
  - Considering the small number of installations, there is limited added value to address underground storage under activity 5.6 at EU level.
  - The technical development that justifies the adoption of BATc for landfills may not be relevant for facilities under point 5.6 of Annex I to the IED due to different technical characteristics.
- Regarding EU-BRITE's proposal 13:
  - There seems to be broad agreement among TWG members on covering in the LAN BREF hazardous waste and non-hazardous waste landfills.
  - The differentiation between municipal and non-municipal waste landfills in the LAN BREF frontloading survey was intended to reflect the varying levels of organic matter typically present in these landfills. This aspect will be explicitly discussed in the document, specifying that the differentiation will focus on 'landfills with a

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substantial content of organic matter’, in order to provide clarity and context in the LAN BREF (see Section 3.2).

**EU-BRITE proposal**

To amend the original EU-BRITE proposal as follows:

- To cover in the LAN BREF activity 5.4 of Annex I to Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial and livestock rearing emissions:
  - 5.4 Landfills, as defined in Article 2(g) of Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste, receiving more than 10 tonnes of waste per day or with a total capacity exceeding 25 000 tonnes, excluding landfills of inert waste.
- Not to cover in the LAN BREF activity 5.6 of Annex I to Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial and livestock rearing emissions:
  - 5.6 Underground storage of hazardous waste with a total capacity exceeding 50 tonnes.
- To cover in the LAN BREF hazardous waste and non-hazardous waste landfills.
- To collect information, data and techniques about landfill mining.

## 2.1.2 Landfill operations

**Initial EU-BRITE proposal**

14. EU-BRITE proposes to cover the following landfill operations/phases in the LAN BREF:

- Waste characterisation and acceptance procedure
- On-site transport and handling of waste for disposal
- On-site transport and handling of materials
- Disposal and uniform distribution of waste
- Leachate management
- Landfill gas management
- Surface water management
- End-of-life cell capping
- Closure phase
- After-care phase
- Other(s)

**Summary of initial information, feedback and views collected through the frontloading process**

- During the early frontloading process some stakeholders [BE, DE, ELA, NL] suggested considering both the waste characterisation and acceptance procedure and the after-care phase in the LAN BREF.
- Some stakeholders gave their views about the waste characterisation and acceptance procedure:
  - Council decision on WAC shall not be revised [FEAD].
  - Avoiding landfilling of waste containing organic matter may prevent methane emissions [DE].
  - Waste should not be mixed to meet the WAC [Eurits].
  - Could be a criterion for qualifying restored sites for new uses [FEAD].
- The disposal and distribution of waste, and aspects such as compaction and stabilisation are key to ensuring the stability of the landfill [FEAD].
- Distribution of waste may not be uniform in certain cases, e.g. creation of specific landfill cells, specific location in order to anticipate landfill mining, use of certain types of waste to create certain facilities [AT].

- On-site transport and handling of materials may not be covered by the LAN BREF because of its low impact [FEAD].
- Landfill gas management may not be included in the scope for all kind of landfills, such as permanent storage facilities in salt mines or industrial landfills associated with steel production [Cefic, CZ, EUROFER, Eurometaux, Euromines, FEAD].
- Different views were offered during the frontloading period about including the after-care operations in the scope of the LAN BREF. They mostly concern the following:
  - Landfills in the after-closure phase may still emit pollutants to the environment. It must be clarified whether these landfills still fall under the scope of the IED and whether legal/technical requirements could be applied to them retrospectively [AT].
  - Differentiating between existing and new landfills is also proposed, especially for those in the closure or after-care phases, which may fall outside the scope [FuelsEurope, FEAD].
  - BAT-AELs may not be applicable to the after-care phase [MWE].
- Including landfill closure and post-closure phases may differentiate between hazardous and non-hazardous waste and biodiversity [FEAD].
- Some of the operations may not apply to permanent storage of waste in salt mines, e.g. leachate management, landfill gas management, surface water management, end-of-life capping [Euromines].

#### **EU-BRITE assessment**

- The WAC establishes the criteria and procedures for the acceptance of waste at landfills in accordance with the principles set out in the LWD and in particular Annex II.
- The IED allows the adoption of BAT Conclusions for landfills, including the ‘after-care’ phase as integral part of life cycle of landfills.
- This should however take into account that certain aspects of landfilling operations are governed by LWD, and those aspects should not be regulated by BAT conclusions and BREFS to avoid conflict of norms. The BAT conclusions should be additional or complementary to LWD.
- All landfills in the scope of the IED, including those already in ‘after-care’ phase, will need to apply the BAT Conclusions. The data collection and subsequent analysis will provide information on technical considerations related to the applicability of techniques that may be relevant for landfills already in ‘after-care’ phase, as laid down in the BREF Guidance.
- Landfilling of waste containing organic matter has a direct consequence on emissions from landfills, in particular on emissions of methane to air. This aspect needs therefore to be addressed in the BREF, as part of the landfilling operation ‘Waste characterisation and acceptance procedure’ and relevant information on existing waste acceptance procedure and criteria needs to be collected. See also Section 2.2 for the LAN BREF. Landfill management may include intentional variation in waste distribution in a landfill, such as designing specific landfill cells or strategically locating waste to enable future landfill mining or construction of landfilling facilities.
- Certain environmental management operations, such as leachate management, landfill gas management, surface water management, and end-of-life capping, may not be relevant or necessary for permanent underground disposal of waste due to their technical characteristics, including low permeability, minimal leachate generation, and anaerobic conditions.
- The dispersion of light fractions from landfill waste by the action of the wind may cause environmental pollution and harm local ecosystems. This could result in habitat degradation, species entanglement and ingestion of debris.
- Landfills may also lead to an increase in the number of invasive or non-invasive insects, rodents and birds, which could affect local or regional wildlife.
- Birds may act as vectors for litter dispersal, ingesting and regurgitating debris in new locations or using it as nesting material. This behaviour could facilitate the spread of pollutants and invasive species across different ecosystems and habitats, potentially altering ecosystem dynamics and community composition.
- The drifting and dispersion of waste (e.g. lightweight waste fraction drifting, birds as vectors for litter dispersal) and control of insects and rodents could be part of the scope of the LAN

BREF as well as other general management operations.

### **EU-BRITE proposal**

To slightly amend the original EU-BRITE proposal as follows:

- To cover the following landfill operations/phases in the LAN BREF, with a view to identify BATs additional or complementary to LWD and WAC:
  - Waste characterisation and acceptance procedure, in particular for waste containing organic matter
  - On-site transport and handling of waste
  - On-site transport and handling of auxiliary materials
  - General management operations
  - Strategies for waste disposal
  - Leachate management
  - Landfill gas management
  - Surface and ground water management
  - End-of-life landfill cell capping
  - Closure phase
  - After-care phase
- To develop a separate section in the LAN BREF (see Section 3.2) for underground disposal of waste under point 5.4 of Annex I to the IED.

## **2.1.3 Independently operated WWTP and combined treatment of waste water**

### **Initial EU-BRITE proposals**

15. EU-BRITE proposes to cover in the scope of the LAN BREF the activity in point 6.11 of Annex I to the IED (independently operated treatment of waste water not covered by Directive (EU) 2024 /3019) if the main pollutant load originates from the activity covered in points 5.4 and 5.6 of Annex I to the IED, as addressed in recent BREFs.
16. EU-BRITE proposes to cover in the scope of the LAN BREF the combined treatment of waste water from different origins if the main pollutant load originates from the activity covered in points 5.4 and 5.6 of Annex I to the IED, as addressed in recent BREFs.

### **Summary of initial information, feedback and views collected through the frontloading process**

- A significant number of stakeholders [BE, DE, FEAD, PT, AT, HR, HU, FR, MWE, CZ, Euroheat & Power, NO, EE, HWE, IT, ES, FI] have expressed their agreement on the inclusion of leachate treatment in the LAN BREF.
- No waste water would be produced in permanent storage of waste in salt mines [Euromines, DE] or activities covered by point 5.6 of Annex I to the IED [EUROFER].
- One stakeholder proposes to gather information on the composition of the leachate upstream prior to mixing in the WWT [BE].

### **EU-BRITE assessment**

- It may be the case that waste water generated in the landfill is treated downstream at an independently operated WWTP (activity in point 6.11 of Annex I to the IED). This has also been addressed in recently adopted BAT conclusions where a reference to the main pollutant load has been introduced in the scope section of the BAT conclusions. The relevance of such a case could be assessed in a similar way during the data collection for the LAN BREF. To do so, it would be useful to collect data for independently operated waste water treatment plants not covered by Directive (EU) 2024 /3019 that treat waste water from landfills and whose main pollutant load originates from the activity in points 5.4 and 5.6 of Annex I to the IED.
- Combined treatment of waste water from various activities has been addressed in recently adopted BAT conclusions (e.g. WT, FMP, SF), where a reference to the main pollutant load

has been introduced in the scope section of the BAT conclusions chapter. The relevance of such a case could be assessed in a similar way during the data collection for the LAN BREF as well. Therefore, it would be useful to collect information on the type of treatment (i.e. whether it is a dedicated or combined treatment) and on the contribution of the landfill to the total flow or total load directed to the combined treatment.

- See Section 2.2.3.2 Contextual information: waste water characteristics.

#### **EU-BRITE proposal**

To amend the EU-BRITE proposal as follows:

- To cover in the scope of the LAN BREF the activity in point 6.11 of Annex I to the IED (independently operated treatment of waste water not covered by Directive (EU) 2024/3019) if the main pollutant load originates from the activity covered in point 5.4 of Annex I to the IED, as addressed in recent BREFs.

To confirm the EU-BRITE proposal as follows:

- To cover in the scope of the LAN BREF the combined treatment of waste water from different origins if the main pollutant load originates from the activity covered in point 5.4 of Annex I to the IED, as addressed in recent BREFs.

### **2.1.4 Interface with other BREFs, the LWD, MCPD and WAC**

#### **Initial EU-BRITE proposals**

17. EU-BRITE proposes not to cover the waste treatment activity carried out on site, to avoid overlaps with the scope of other IED BREFs.
18. EU-BRITE proposes not to cover the waste incineration activity carried out on site, to avoid overlaps with the scope of other IED BREFs.
19. EU-BRITE proposes not to duplicate in the LAN BREF information already covered in the LCP BREF and in the MCPD, but to instead cross-reference these documents where applicable.

#### **Summary of initial information, feedback and views collected through the frontloading process**

- It is important to establish clear boundaries related to landfilling operations [Eurometaux].
- Overlaps with other BREFs may be avoided [Eurometaux].
- Explain how coherence in the relationship between the LWD, WAC and LAN BREF will be guaranteed and how potential contradictions will be avoided [MWE].
- Treatments such as solidification, stabilisation, moisturisation and compacting may be carried out at the landfill site [BE].
- The ‘directly associated activities’ may include the pretreatment of waste on site [Eurits].
- Waste treatment activities that are closely associated with the environmental performance of the landfill itself may be considered within the scope of the LAN BREF [ESWET]

#### **EU-BRITE assessment**

- The LAN BREF should not include BATs that could conflict with the LWD and WAC.
- However, the LAN BREF could include BAT which complement the WAC or the LWD.
- No techniques related to landfills or taking place in landfill installations are included in the scope of the WT BREF but the treatment of waste to make it more suitable for landfilling and pretreatment of waste to adapt the waste to the type of disposal are included.
- The management and treatment of waste taking place directly in or on the landfill may be considered within the scope of the LAN BREF, if it is not covered by another BREF, as it affects the landfill's environmental performance.
- The WT BREF covers waste treatment processes and identify BAT to carry out these processes. These processes may however be identified as BAT for landfilling.

#### **EU-BRITE proposal**

To slightly amend the EU-BRITE proposal as follows:

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- Not to cover waste treatment activities carried out on site that are already covered by other BREFs to avoid duplication, instead cross-referencing to these documents where applicable.
  - Not to cover the waste incineration activities carried out on site, to avoid overlaps with the scope of other IED BREFs.
  - Not to duplicate in the LAN BREF information already covered in the LCP BREF and in the MCPD, instead cross-referencing to these documents where applicable.

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## 2.2 Key Environmental Issues (KEIs) for the LAN BREF

### 2.2.1 Overview

The TWG views and information on the issues which may be considered KEIs have been assessed by EU-BRITE. This assessment and the subsequent EU-BRITE proposals for the drawing up of the LAN BREF are presented in the following sections:

- Emissions to water: Section 2.2.3;
- Emissions to air: Section 2.2.4;
- Odour emissions: Section 2.2.5
- Water and leachate management: Section 2.2.6;
- Chemical consumption: Section 2.2.7;
- Auxiliary materials consumption, residues generation and management and circular economy: Section 2.2.8
- Energy consumption: Section 2.2.9;
- Decarbonisation and greenhouse gas emission: Section 2.2.10.

#### **Important:**

In this BP, a KEI is understood as an environmental issue that is considered so important for the landfilling activities and operations covered by the LAN BREF that information should be collected through questionnaires and/or as bulk information. The aim of collecting such information may then differ from one KEI to another (e.g. deriving BAT, BAT-AELs, BAT-AEPLs and/or benchmarks).

### 2.2.2 Approach for emissions to air and water

At the Forum meeting in 2015 <sup>(7)</sup>, the Commission presented the following criteria for defining KEIs at the earliest possible stage of the information exchange for drafting/reviewing a BREF:

- Criterion 1: environmental relevance of pollution caused by the activity or process, i.e. whether it may cause an environmental problem;
- Criterion 2: significance of activity (number of installations, geographical spread, contribution to total (industrial) emissions in the EU);
- Criterion 3: potential of the BREF review/drawing up for identifying new or additional techniques that would further significantly reduce pollution;
- Criterion 4: potential of the BREF review/drawing up to set BAT-AELs that would significantly improve the level of environmental protection compared to current emission levels.

Based on the information currently available and on the views and information received as a result of the call for frontloading, EU-BRITE has used the four criteria mentioned above to assess the proposed KEIs for emissions to air and water in this background paper.

#### Criterion 1

A number of available sources/documents allowed the assessment of Criterion 1 regarding the environmental relevance of pollutants emitted to air and to water.

This BP aims to provide a preliminary assessment of the environmental relevance of the pollutants proposed as KEIs, i.e. whether they are relevant to the activities and operations to be covered in the LAN BREF, as well as whether these pollutants have intrinsic characteristics which may lead to environmental problems.

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<sup>(7)</sup> [IED Article 13 Forum meeting of 19 October 2015](#)

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## Criterion 2

According to the EIEP, there are more than 2 500 landfills in operation, under point 5.4 of Annex I to the IED, in the EU and NO (see Section 4.1).

The distribution of landfills varies significantly, with some countries having a large number of landfills while others have relatively few. DE has the highest number of landfills, with 406, followed by IT with 234, and PL with 227 while NO has 64 landfills. In contrast, some countries have a relatively small number of landfills, such as LU with only 1, and CY with 3.

The relevance of landfills in the EU's waste management industry is significant, as they still account for a substantial proportion of waste disposal operations. However, the EU has set ambitious targets to reduce landfilling and increase recycling rates. As the EU continues to transition towards a more circular economy, the role of landfills is expected to decrease.

The EIEP provides information and data on emissions to air and to water for the following activity:

- 5(d) Landfills (excluding landfills of inert waste and landfills, which were definitely closed before 16.7.2001 or for which the after-care phase required by the competent authorities according to Article 13 of Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste has expired).

It should be noted that the EIEP does not distinguish between hazardous and non-hazardous waste landfills.

## Criteria 3 and 4

Among the four criteria to identify KEIs, Criteria 3 and 4 are the most difficult to assess, as they rely on projections for the future. Nevertheless, some information is available regarding new/existing techniques and current legislation.

In particular, when pollutants are covered by national regulations, they are included in a monitoring plan so there is potential to collect data and then to set BAT-AELs.

EU-BRITE screened a number of national environmental assessments, guidance documents, reports and permits. This initial screening, together with the views and information provided through the call for frontloading, allowed insights into the potential availability of data on emissions to air and water for the relevant activities and operations that could be covered by the LAN BREF.

## **2.2.3 Emissions to air**

### **2.2.3.1 General**

<b>Initial EU-BRITE proposal</b>
There was no initial proposal from EU-BRITE.
<b>Summary of initial information, feedback and views collected through the frontloading process</b>
<ul style="list-style-type: none"><li>• There was no initial information, feedback and views from the TWG, as there was no initial proposal from EU-BRITE.</li></ul>
<b>EU-BRITE assessment</b>
<ul style="list-style-type: none"><li>• Information on treatment techniques and associated data on emissions to air seem to be available.</li></ul>
<b>EU-BRITE proposal</b>
To add the following EU-BRITE proposal: <ul style="list-style-type: none"><li>• To collect information on the techniques (including emerging techniques) used to remove/abate the pollutants proposed as KEIs from both channelled and diffuse emissions</li></ul>

to air, as well as associated emissions data.

- To collect information on the techniques (including emerging techniques) used to measure the diffuse emissions of pollutants proposed as KEIs.

### 2.2.3.2 Contextual information: landfill gas characteristics

<b>Initial EU-BRITE proposal</b>
There was no initial proposal from EU-BRITE regarding landfill gas characteristics.
<b>Summary of initial information, feedback and views collected through the frontloading process</b>
There was no initial information, feedback and views from TWG, as there was no initial proposal from EU-BRITE regarding landfill gas characteristics.
<b>EU-BRITE assessment</b>
<ul style="list-style-type: none"><li>• The characteristics of landfill gas play a crucial role in determining the most suitable treatment and utilisation strategies, such as thermal processes for energy recovery, or biological processes for emission reduction.</li><li>• Collecting data on landfill gas characteristics before and after treatment is crucial for assessing treatment effectiveness and ensuring compliance with environmental standards.</li></ul>
<b>EU-BRITE proposal</b>
To add the following EU-BRITE proposal: <ul style="list-style-type: none"><li>• To collect contextual information on landfill gas characteristics (e.g. flow, composition, temperature, moisture content) and how these vary over time.</li></ul>

### 2.2.3.3 Methane (CH<sub>4</sub>)

<b>Initial EU-BRITE proposal</b>
31. EU-BRITE proposes to consider methane (CH <sub>4</sub> ) as a KEI for emissions to air.
<b>Summary of initial information, feedback and views collected through the frontloading process</b>
<ul style="list-style-type: none"><li>• 24 out of 30 stakeholders agree with the proposal, 2 partly agree and 4 disagree.</li><li>• Stakeholders suggested during the frontloading process that this KEI may be relevant to both hazardous and non-hazardous waste landfills.</li><li>• Measuring methane emissions maybe challenging [DE, ELA, FEAD].</li><li>• Methane plays a crucial role as a greenhouse gas [DE].</li><li>• No rationale was provided by stakeholders who disagreed with the proposal.</li></ul>
<b>EU-BRITE assessment</b>
<ul style="list-style-type: none"><li>• According to the information received, data seems to be available [BE, CZ, EE, ELA, ES, FEAD, FI, FR, HU, IT, PL, PT, HU, SE, SK].</li><li>• The environmental relevance of methane is high, particularly as a greenhouse gas.</li><li>• This KEI might only be relevant when the amount of organic matter contained in the waste is high enough to produce a significant amount of methane.</li><li>• Although measuring diffuse methane emissions could be challenging, various techniques could be employed to estimate and quantify these emissions, such as satellite-based tools combined with ground-based data.</li><li>• Ideally, landfills may use the landfill gas they produce until the energy content drops below a useful value. Once it is no longer viable to utilise landfill gas, it may be recommended to use bio-oxidation technology in ‘hotspots’ identified across the site to neutralise the</li></ul>

<p>remaining methane<sup>8</sup>.</p> <ul style="list-style-type: none"> <li>• According to the EIEP data (for the reporting year 2022), the landfills covered by the EIEP emitted 484 304 t of methane to air.</li> <li>• Throughout the frontloading process, stakeholders considered that addressing this KEI would have an impact on the environment, human health, and biodiversity.</li> </ul>
<b>EU-BRITE proposal</b>
<p>To slightly amend the original EU-BRITE proposal as follows:</p> <ul style="list-style-type: none"> <li>• To include methane (CH<sub>4</sub>) as a KEI for channelled and diffuse emissions to air for both hazardous and non-hazardous waste landfills.</li> </ul>

#### 2.2.3.4 Ammonia (NH<sub>3</sub>)

<b>Initial EU-BRITE proposal</b>
31. EU-BRITE proposes to consider ammonia (NH <sub>3</sub> ) as a KEI for emissions to air.
<b>Summary of initial information, feedback and views collected through the frontloading process</b>
<ul style="list-style-type: none"> <li>• 14 out of 28 stakeholders agree with the proposal, 3 partly agree and 11 disagree.</li> <li>• Stakeholders suggested during the frontloading process that this KEI may be relevant to both hazardous and non-hazardous waste landfills.</li> <li>• The stakeholders that disagree with the proposal consider that NH<sub>3</sub> is only measured in gas and leachate pipes for occupational safety reasons and that diffuse NH<sub>3</sub> emissions from landfills are not a relevant source of this air pollutant in the atmosphere [DE, FEAD].</li> </ul>
<b>EU-BRITE assessment</b>
<ul style="list-style-type: none"> <li>• According to the information received, data seems to be available [BE, PL, HU, SK, CZ, EE, IT].</li> <li>• Several landfills in PL, BG, EE and SE report emission data above the EIEP threshold.</li> <li>• Emission data under that threshold were also found in several national MS' emission portals.</li> <li>• NH<sub>3</sub> has been considered as a KEI in other BREFs related to waste management (e.g. WT, WI).</li> <li>• According to the EIEP data (for the reporting year 2022), the landfills covered by the EIEP emitted 3 261 t of NH<sub>3</sub> to air.</li> <li>• Throughout the frontloading process, stakeholders considered that addressing this KEI would have an impact on the environment, human health, and biodiversity.</li> </ul>
<b>EU-BRITE proposal</b>
<p>To slightly amend the original EU-BRITE proposal as follows:</p> <ul style="list-style-type: none"> <li>• To include ammonia (NH<sub>3</sub>) as a KEI for channelled and diffuse emissions to air for both hazardous and non-hazardous waste landfills.</li> </ul>

#### 2.2.3.5 Carbon dioxide (CO<sub>2</sub>)

<b>Initial EU-BRITE proposal</b>
31. EU-BRITE proposes to consider carbon dioxide (CO <sub>2</sub> ) as a KEI for emissions to air.
<b>Summary of initial information, feedback and views collected through the frontloading process</b>
<ul style="list-style-type: none"> <li>• 18 out of 30 stakeholders agree with the proposal, 2 partly agree and 10 disagree.</li> <li>• Stakeholders suggested during the frontloading process that this KEI may be relevant to both hazardous and non-hazardous waste landfills.</li> </ul>

<sup>8</sup> [EU strategy to reduce methane emissions](#)

<ul style="list-style-type: none"> <li>Some stakeholders consider that CO<sub>2</sub> emissions from landfills are climate neutral as they originate from organic waste and may not be considered as a KEI [DE, FEAD, AT].</li> </ul>
<b>EU-BRITE assessment</b>
<ul style="list-style-type: none"> <li>According to the information received, data seems to be available [BE, CZ, EE, FR, IT, ES, HU, NL, PL, PT, SK].</li> <li>CO<sub>2</sub> emissions from landfills account for approximately 46 % of total greenhouse gas emissions from waste management in terms of CO<sub>2</sub> equivalent, according to the EIEP, and have increased between 2010 and 2022, whereas methane emissions, which contribute around 53 % of total CO<sub>2</sub> equivalent emissions, have decreased over the same period <sup>(9)</sup>.</li> <li>According to the EIEP data (for the reporting year 2022), the landfills covered by the EIEP emitted 11 867 946 t of CO<sub>2</sub> to air.</li> <li>Throughout the frontloading process, stakeholders considered that addressing this KEI would have an impact on the environment, human health, and biodiversity.</li> </ul>
<b>EU-BRITE proposal</b>
<p>To slightly amend the original EU-BRITE proposal as follows:</p> <ul style="list-style-type: none"> <li>To include carbon dioxide (CO<sub>2</sub>) as a KEI for channelled and diffuse emissions to air for both hazardous and non-hazardous waste landfills.</li> </ul>

### 2.2.3.6 Nitrous oxide (N<sub>2</sub>O)

<b>Initial EU-BRITE proposal</b>
31. EU-BRITE proposes to consider nitrous oxide (N <sub>2</sub> O) as a KEI for emissions to air.
<b>Summary of initial information, feedback and views collected through the frontloading process</b>
<ul style="list-style-type: none"> <li>9 out of 28 stakeholders agree with the proposal, 4 partly agree and 15 disagree.</li> </ul>
<b>EU-BRITE assessment</b>
<ul style="list-style-type: none"> <li>One stakeholder [CZ] reported that data is available.</li> <li>Several landfills in DK, ES, and PL reported N<sub>2</sub>O emissions above the threshold of the EIEP.</li> <li>N<sub>2</sub>O emissions to air were considered in the WT BREF. These emissions are produced during the composting of organic matter. The disposal of high nitrogen wastes in landfills may increase the likelihood of nitrous oxide emission.</li> <li>N<sub>2</sub>O is a potent greenhouse gas, with a global warming potential (GWP) of 265-298 over a 100-year time frame, and 273 over a 20-year time frame, making it around 3 times more potent than methane over the shorter term.</li> <li>According to the EIEP data (for the reporting year 2022), the landfills covered by the EIEP emitted 1 028 t of N<sub>2</sub>O to the air.</li> <li>Throughout the frontloading process, stakeholders considered that addressing this KEI would have an impact on the environment, human health, and biodiversity.</li> </ul>
<b>EU-BRITE proposal</b>
<p>To slightly amend the original EU-BRITE proposal as follows:</p> <ul style="list-style-type: none"> <li>To include nitrous oxide (N<sub>2</sub>O) as a KEI for channelled and diffuse emissions to air for both hazardous and non-hazardous waste landfills.</li> </ul>

### 2.2.3.7 Particulate matter (PM)

<b>Initial EU-BRITE proposal</b>
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<sup>(9)</sup> [Air pollutant emissions from landfill \(Indicator\) | European zero pollution dashboards](#)

31. EU-BRITE proposes to consider particulate matter (PM) as a KEI for emissions to air.
<b>Summary of initial information, feedback and views collected through the frontloading process</b>
<ul style="list-style-type: none"> <li>• 13 out of 29 stakeholders agree with the proposal, 8 partly agree and 8 disagree.</li> <li>• Stakeholders suggested during the frontloading process that this KEI may be relevant to both hazardous and non-hazardous waste landfills.</li> <li>• Some stakeholders consider that it is not possible to derive BAT-AELs for diffuse PM emissions to air because of a lack of monitoring/measurement [AT, DE, FEAD].</li> <li>• Combustion of biogas may not produce significant levels of PM [FEAD].</li> </ul>
<b>EU-BRITE assessment</b>
<ul style="list-style-type: none"> <li>• According to the information received, data seems to be available [BE, ELA, ES, IT, NL, PL].</li> <li>• Landfill operations are inherently dusty. Movements are usually carried out on unpaved roads, and the handling of waste and/or cover materials can lead to the emission of PM. Additionally, leachate treatment operations can also emit PM.</li> <li>• According to the EIEP data (for the reporting year 2022), the landfills covered by the EIEP emitted 738 t of PM<sub>10</sub> to air.</li> <li>• Throughout the frontloading process, stakeholders considered that addressing this KEI would have an impact on the environment, human health, and biodiversity.</li> </ul>
<b>EU-BRITE proposal</b>
To slightly amend the original EU-BRITE proposal as follows: <ul style="list-style-type: none"> <li>• To include particulate matter (PM) as a KEI for channelled and diffuse emissions to air for both hazardous and non-hazardous waste landfills.</li> </ul>

### 2.2.3.8 Hydrogen sulphide (H<sub>2</sub>S)

<b>Initial EU-BRITE proposal</b>
31. EU-BRITE proposes to consider hydrogen sulphide (H <sub>2</sub> S) as a KEI for emissions to air.
<b>Summary of initial information, feedback and views collected through the frontloading process</b>
<ul style="list-style-type: none"> <li>• 20 out of 30 stakeholders agree with the proposal, and 10 disagree.</li> <li>• Stakeholders suggested during the frontloading process that this KEI may be relevant to both hazardous and non-hazardous waste landfills.</li> <li>• It might depend on the landfilled waste [FEAD, IT] and might be relevant in co-disposal with gypsum [SE].</li> </ul>
<b>EU-BRITE assessment</b>
<ul style="list-style-type: none"> <li>• According to the information received, data seems to be available [BE, CZ, EE, FEAD, FR, HU, IT, NL, PT].</li> <li>• The LWD states that H<sub>2</sub>S must be measured regularly in a landfill.</li> <li>• Throughout the frontloading process, stakeholders considered that addressing this KEI would have an impact on the environment, human health, and biodiversity.</li> </ul>
<b>EU-BRITE proposal</b>
To slightly amend the original EU-BRITE proposal as follows: <ul style="list-style-type: none"> <li>• To include hydrogen sulphide (H<sub>2</sub>S) as a KEI for channelled and diffuse emissions to air for both hazardous and non-hazardous waste landfills.</li> </ul>

### 2.2.3.9 Nitrogen oxides (NO<sub>x</sub>) and sulphur oxides (SO<sub>x</sub>)

<b>Initial EU-BRITE proposal</b>
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31. EU-BRITE proposes to consider nitrogen oxides (NO <sub>x</sub> ) as a KEI for emissions to air.
31. EU-BRITE proposes to consider sulphur oxides (SO <sub>x</sub> ) as a KEI for emissions to air.
<b>Summary of initial information, feedback and views collected through the frontloading process</b>
<ul style="list-style-type: none"> <li>• NO<sub>x</sub>: 10 out of 28 stakeholders agree with the proposal, 5 partly agree and 13 disagree.</li> <li>• SO<sub>x</sub>: 10 out of 28 stakeholders agree with the proposal, 6 partly agree and 12 disagree.</li> <li>• There are several comments about the relationship between these emissions and the landfill gas combustion processes. Because of the potential overlap with the LCP BREF and MCPD some of them rejected including these pollutants as KEIs [DE, FEAD].</li> </ul>
<b>EU-BRITE assessment</b>
<ul style="list-style-type: none"> <li>• Six [BE, CZ, ELA, FEAD, NL, PL] stakeholders reported having data on NO<sub>x</sub>. and two [BE, FR] stakeholders reported having data available on SO<sub>x</sub>.</li> <li>• The LAN BREF is not considered to overlap with the LCP BREF and MCPD (see Section 2.1.4).</li> <li>• NO<sub>x</sub> and SO<sub>x</sub> emissions are not typically a primary concern for hazardous waste landfills as they are often associated with landfill gas combustion.</li> <li>• According to the EIEP data (for the reporting year 2022), the landfills covered by the EIEP emitted 8 161 t of NO<sub>x</sub> and 5 955 t of SO<sub>x</sub> to air.</li> </ul>
<b>EU-BRITE proposal</b>
To amend the original EU-BRITE proposal as follows: <ul style="list-style-type: none"> <li>• To collect information on techniques to prevent and/or to reduce nitrogen oxides (NO<sub>x</sub>) and sulphur oxides (SO<sub>x</sub>) for channelled emissions to air in combustion processes in landfills, not covered by the LCP BREF and MCPD.</li> <li>• Not to consider NO<sub>x</sub> and SO<sub>x</sub> as KEIs for emissions to air.</li> </ul>

### 2.2.3.10 Chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs)

<b>Initial EU-BRITE proposal</b>
31. EU-BRITE proposes to consider chlorofluorocarbons (CFCs) as a KEI for emissions to air.
31. EU-BRITE proposes to consider hydrochlorofluorocarbons (HCFCs) as a KEI for emissions to air.
<b>Summary of initial information, feedback and views collected through the frontloading process</b>
<ul style="list-style-type: none"> <li>• CFCs and HCFCs: 8 out of 30 stakeholders agree with the proposal, 3 partly agree and 18 disagree.</li> <li>• Including CFCs in landfills as a KEI might not be useful, as landfill operators may have limited influence over CFC emission rates. The amount of CFCs emitted from landfilled waste could be more closely tied to past disposal practices and natural degradation processes, rather than current operational practices [DE, FEAD].</li> <li>• A stakeholder [EEB] suggests that there is technology available to control CFC and HCFC emissions, such as high-temperature flares.</li> </ul>
<b>EU-BRITE assessment</b>
<ul style="list-style-type: none"> <li>• The disposal of CFCs and HCFCs in landfills is banned, as required by the LWD and CAW, although some residual emissions may still occur due to historical disposal practices or accidental co-disposal.</li> <li>• Two [BE, ELA] stakeholders reported that data is available, one [NL] stakeholder reported that data on HCFCs is available.</li> <li>• The frontloading process suggests that there is a lack of data.</li> <li>• According to the EIEP data (for the reporting year 2022), the landfills covered by the EIEP emitted 2.9 t of CFCs and HCFCs to air.</li> <li>• Throughout the frontloading process, stakeholders considered that addressing this KEI would have an impact on the environment, human health, and biodiversity.</li> </ul>

**EU-BRITE proposal**

To amend the original EU-BRITE proposal as follows:

- To collect data on CFCs and HCFCs for channelled and diffuse emissions to air for both hazardous and non-hazardous waste landfills. The TWG to decide at a later stage, based on the data and information collected, whether these pollutants may be considered as a KEI and/or if BAT-AELs and/or benchmarks should be derived.

**2.2.3.11 Non-methane volatile organic compounds (NMVOC)****Initial EU-BRITE proposal**

31. EU-BRITE proposes to consider non-methane volatile organic compounds (NMVOC) as a KEI for emissions to air.

**Summary of initial information, feedback and views collected through the frontloading process**

- 10 out of 29 stakeholders agree with the proposal, 6 partly agree and 13 disagree.
- Several stakeholders [DE, FEAD] state that diffuse NMVOC emissions may occur in industrial waste landfills if, for example, solvents or materials containing solvents have been deposited.

**EU-BRITE assessment**

- Three [BE, EE, NL] stakeholders reported that data is available.
- The disposal of NMVOC in landfills is banned, as required by the WAC, although some residual emissions may still occur due to historic disposal practices or accidental co-disposal.
- Throughout the frontloading process, stakeholders considered that addressing this KEI would have an impact on the environment, human health, and biodiversity.

**EU-BRITE proposal**

To amend the original EU-BRITE proposal as follows:

- To collect data on NMVOC for channelled and diffuse emissions to air for both hazardous and non-hazardous waste landfills. The TWG to decide at a later stage, based on the data and information collected, whether these pollutants may be considered as a KEI and/or if BAT-AELs and/or benchmarks should be derived.

**2.2.3.12 Other proposals from TWG members****Initial EU-BRITE proposal**

Under the initial EU-BRITE proposal 31, there was the possibility for TWG members to indicate additional pollutants to those proposed as KEIs for emissions to air.

**Summary of initial information, feedback and views collected through the frontloading process**

- The following pollutants are proposed as additional KEIs for emissions to air: aerosols, asbestos, benzene (C<sub>6</sub>H<sub>6</sub>), carbon monoxide (CO), dioxins and furans, nitrogen (N<sub>2</sub>), organic compounds, organochlorine compounds, organohalogenated compounds, organometallic compounds, organo-nitrogen compounds, organosulphur compounds, PAHs, toluene (C<sub>7</sub>H<sub>8</sub>), vinyl chloride (C<sub>2</sub>H<sub>3</sub>Cl), VOCs, xylenes (C<sub>8</sub>H<sub>10</sub>) [BE], and PFAS [BE, EEB].

**EU-BRITE assessment**

- The stakeholders proposing the above parameters indicate that no data are available for these emissions from landfills: aerosols, dioxins and furans, organohalogenated compounds, and VOCs.
- The following pollutants are included in Section 2.2.4.11: benzene (C<sub>6</sub>H<sub>6</sub>), toluene (C<sub>7</sub>H<sub>8</sub>),

<p>xylenes (C<sub>8</sub>H<sub>10</sub>), and vinyl chloride (C<sub>2</sub>H<sub>3</sub>Cl), organic compounds, organohalogenated compounds, and organochlorine compounds.</p> <ul style="list-style-type: none"> <li>• No specific justifications are provided with the TWG views/information on the additional pollutants/substances proposed as KEIs (e.g. no monitoring data available or any evidence associated with the environmental relevance for landfills).</li> <li>• PFAS may be emitted through landfill gas<sup>10</sup>.</li> </ul>
<p><b>EU-BRITE proposal</b></p>
<p>To add the following EU-BRITE proposals:</p> <ul style="list-style-type: none"> <li>• To collect information on the presence of PFAS in landfill gas.</li> <li>• To collect information on techniques to prevent and/or to reduce PFAS present in landfill gas (e.g. high-temperature flares).</li> </ul>

## 2.2.4 Odour emission

<p><b>Initial EU-BRITE proposal</b></p>
<p>32. EU-BRITE proposes to consider odour emissions as a KEI.</p> <p>33. EU-BRITE proposes to collect, during the BREF development process, information on measures/techniques to prevent and/or to reduce diffuse odour emissions.</p>
<p><b>Summary of initial information, feedback and views collected through the frontloading process</b></p>
<ul style="list-style-type: none"> <li>• 15 out of 30 stakeholders agree with the proposal, 8 partly agree and 7 disagree.</li> <li>• Throughout the frontloading process, stakeholders considered that addressing this KEI would have an impact on the environment, human health, and biodiversity.</li> <li>• Stakeholders think that odour may not be considered for permanent storage facilities in salt mines [Euromines], hazardous waste landfills [FEAD] or mineral waste landfills [Eurometaux].</li> <li>• Several stakeholders state that odour emissions may be considered for landfills containing substantial amounts of biodegradable waste [DE, FEAD, PT, SE].</li> <li>• Some stakeholders consider that no BAT-AELs could be derived [AT, FEAD].</li> <li>• There are differing views about introducing an Odour Management Plan like that included in the WT BREF [DE, FEAD, MWE].</li> </ul>
<p><b>EU-BRITE assessment</b></p>
<ul style="list-style-type: none"> <li>• In recent BAT conclusions (e.g. FDM, SA and WT BREFs), the applicability of an odour management plan is usually related to cases where an odour nuisance at sensitive receptors is expected and/or has been substantiated, while the applicability of other techniques to reduce odour emissions is generally based on the information available in the chapter on techniques to consider in the determination of BAT.</li> <li>• Analysed hazardous industrial waste landfill permits include measures for odour limitation.</li> <li>• Odour emissions could be measured using the standard EN 13725.</li> </ul>
<p><b>EU-BRITE proposal</b></p>
<p>To slightly amend the original EU-BRITE proposal as follows:</p> <ul style="list-style-type: none"> <li>• To include odour emissions as a KEI.</li> <li>• To collect information on techniques to measure odour emissions to air.</li> <li>• To collect information on techniques to prevent and/or to reduce odour emission.</li> </ul>

## 2.2.5 Emissions to water

<sup>10</sup> [A critical review of perfluoroalkyl and polyfluoroalkyl substances \(PFAS\) landfill disposal in the United States \(Thabet Tolaymat et al., 2023\)](#)

## 2.2.5.1 General

<b>Initial EU-BRITE proposal</b>
There was no initial proposal from EU-BRITE.
<b>Summary of initial information, feedback and views collected through the frontloading process</b>
<ul style="list-style-type: none"> <li>• There was no initial information, feedback and views from the TWG, as there was no initial proposal from EU-BRITE.</li> </ul>
<b>EU-BRITE assessment</b>
<ul style="list-style-type: none"> <li>• Information on waste water treatment techniques and associated data on emissions to water seem to be available.</li> </ul>
<b>EU-BRITE proposal</b>
<p>To add the following EU-BRITE proposal:</p> <ul style="list-style-type: none"> <li>• To collect information on the techniques (including emerging techniques) used to remove/abate the pollutants proposed as KEIs from leachate and contaminated waste water and associated data on emissions to water.</li> <li>• To collect information on the concentration and, where possible, load of KEIs present in both the leachate and managed waste water streams, before and after treatment.</li> </ul>

## 2.2.5.2 Contextual information: waste water characteristics

<b>Initial EU-BRITE proposal</b>
21. EU-BRITE proposes to collect information on the characteristics of emissions to water (e.g. pH, temperature, flow).
<b>Summary of initial information, feedback and views collected through the frontloading process</b>
<ul style="list-style-type: none"> <li>• 27 out of 30 stakeholders agree with the proposal, 1 partly agrees and 2 disagree.</li> <li>• Based on the responses received, this contextual information collection could be considered for both hazardous and non-hazardous waste landfills.</li> <li>• Several members emphasise the need to distinguish between direct and indirect emission, and between emission of waste water after treatment and leachate. Also and they ask to consider contextual factors such as rainfall [AT, ELA, EUROHEAT&amp;POWER, FEAD, IT, MWE].</li> <li>• It might be important to characterise the discharge for its use, whether for reuse or discharge into public waters [ES].</li> <li>• Concerns about the complexity of data collection and the potential for limited responses have been raised, highlighting the need for a clear and focused scope that includes both surface water discharges and groundwater contamination [EEB, EUROFER, MWE, PT].</li> <li>• One stakeholder proposes to include the composition of the leachate upstream of the WWT [BE].</li> <li>• There are proposals to include TSS in the LAN BREF [DE, FEAD].</li> </ul>
<b>EU-BRITE assessment</b>
<ul style="list-style-type: none"> <li>• According to the information received, data seems to be available.</li> <li>• There seems to be broad agreement among TWG members on the importance of collecting data on waste water characteristics, including parameters like pH, temperature and flow.</li> <li>• In recent BREFs (e.g. MIN, CER), information on waste water characteristics (i.e. flow, temperature, pH and conductivity) is considered contextual information.</li> <li>• It is needed to collect information on the direct or indirect character of the emissions to water to analyse the data collected.</li> <li>• Collecting data on leachate characteristics prior to treatment and wastewater after treatment,</li> </ul>

<p>including both surface water discharges and groundwater contamination, is crucial for assessing the effectiveness and efficiency of treatment processes.</p> <ul style="list-style-type: none"> <li>• Furthermore, gathering comprehensive information on the performance of wastewater treatment, including the concentration of pollutants in water emissions, is key for a thorough evaluation.</li> <li>• TSS is considered a useful parameter for indicating the performance of solids removal techniques (e.g. filtration, sedimentation) during waste water treatment.</li> </ul>
<b>EU-BRITE proposal</b>
<p>To slightly amend the original EU-BRITE proposal as follows:</p> <ul style="list-style-type: none"> <li>• To collect contextual information on the characteristics (i.e. flow, temperature, pH, BOD, TSS, conductivity, redox potential, direct or indirect releases) of waste water streams, including leachate, before and after treatment and efficiency of the waste water treatment for each concerned pollutant.</li> </ul>

### 2.2.5.3 Metals and metalloids

<b>Initial EU-BRITE proposal</b>
<p>22. EU-BRITE proposes to consider Arsenic (As), Cadmium (Cd), Chromium (Cr), Copper (Cu), Lead (Pb), Mercury (Hg), Nickel (Ni), and Zinc (Zn) and its compounds as KEIs for emissions to water.</p>
<b>Summary of initial information, feedback and views collected through the frontloading process</b>
<ul style="list-style-type: none"> <li>• As, Cd, Cr: 25 out of 29 stakeholders agree with the proposal, 2 partly agrees and 3 disagree.</li> <li>• Cu, Ni, Zn: 24 out of 30 stakeholders agree with the proposal, 2 partly agrees and 4 disagree.</li> <li>• Pb: 26 out of 30 stakeholders agree with the proposal, 2 partly agrees and 2 disagree.</li> <li>• Hg: 26 out of 30 stakeholders agree with the proposal, 1 partly agrees and 3 disagree.</li> <li>• Stakeholders suggested during the frontloading process that these KEIs may be relevant to both hazardous and non-hazardous waste landfills.</li> <li>• These metals may not be relevant to permanent storage of waste in salt mines [Euromines, FEAD].</li> </ul>
<b>EU-BRITE assessment</b>
<ul style="list-style-type: none"> <li>• According to the information received, data seems to be available.</li> <li>• Data provided by the EIEP for landfill facilities shows direct releases to water reported for several metals and metalloids, including As, Cd, Cr, Cu, Pb, Hg, Ni, and Zn. These data confirm that these substances are indeed released to water from landfills and are reported under the EIEP Regulation.</li> <li>• According to the EIEP data (for the reporting year 2022), the landfills covered by the EIEP<sup>11</sup> emitted 6 838.5 kg of As, Cd, Cr, Cu, Pb, Hg, Ni, and Zn and their compounds to water.</li> <li>• Throughout the frontloading process, stakeholders considered that addressing these KEIs would have an impact on the environment, human health, and biodiversity.</li> </ul>
<b>EU-BRITE proposal</b>
<p>To complement the original EU-BRITE proposal as follows:</p> <ul style="list-style-type: none"> <li>• To include Arsenic (As), Cadmium (Cd), Chromium (Cr), Copper (Cu), Lead (Pb), Mercury (Hg), Nickel (Ni), and Zinc (Zn) and their compounds as KEIs for emissions to water for both hazardous and non-hazardous waste landfills.</li> </ul>

<sup>11</sup> The EIEP provides information and data on emissions to air and to water for the following activity:

- 5(d) Landfills (excluding landfills of inert waste and landfills, which were definitely closed before 16.7.2001 or for which the after-care phase required by the competent authorities according to Article 13 of Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste has expired).

It should be noted that EIEP information does not distinguish between hazardous and non-hazardous waste landfills.

## 2.2.5.4 Total organic carbon (TOC) and chemical oxygen demand (COD)

<b>Initial EU-BRITE proposal</b>
22. EU-BRITE proposes to consider total organic carbon (TOC) (as total C or COD/3) as a KEI for emissions to water.
<b>Summary of initial information, feedback and views collected through the frontloading process</b>
<ul style="list-style-type: none"> <li>• 24 out of 29 stakeholders agree with the proposal, 2 partly agree and 3 disagree.</li> <li>• Stakeholders suggested during the frontloading process that this KEI may be relevant to both hazardous and non-hazardous waste landfills.</li> <li>• It is considered not relevant for landfills not containing significant organic waste [DE].</li> <li>• Either COD or TOC may be monitored in landfills, with a preference for TOC [EUROFER].</li> <li>• A stakeholder suggested adding BOD and allowing the operator to choose between TOC or COD monitoring as in the WT BREF [FEAD].</li> <li>• No rationale was provided by stakeholders who disagreed with the proposal.</li> </ul>
<b>EU-BRITE assessment</b>
<ul style="list-style-type: none"> <li>• According to the information received, data seems to be available [AT, BE, Cefic, DE, EE, ELA, ES, FEAD, FR, HR, HU, HWE, IT, NL, NO, PL, PT, SE].</li> <li>• TOC and COD are significant parameters for waste water, particularly from landfills containing organic waste. They are considered useful for indicating the performance and effectiveness of waste water treatment techniques.</li> <li>• Biodegradable compounds covered by BOD are a subset of all organic matter present in the waste water. BOD is therefore included in the parameter COD/TOC.</li> <li>• The measurement uncertainty for BOD is higher than for COD/TOC and the monitoring result is only available several days after sampling.</li> <li>• Low emission values of organic substances could be ensured without using BOD for setting permit conditions.</li> <li>• However, BOD is an indicator of the level of bio eliminability of the waste water and therefore of the efficiency of the waste water treatment.</li> <li>• According to the EIEP data (for the reporting year 2022), the landfills covered by the EIEP emitted 1 605 500 kg of TOC to water.</li> <li>• Throughout the frontloading process, stakeholders considered that addressing this KEI would have an impact on the environment, human health, and biodiversity.</li> </ul>
<b>EU-BRITE proposal</b>
To complement the original EU-BRITE proposal as follows: <ul style="list-style-type: none"> <li>• To include total organic carbon (TOC) and chemical oxygen demand (COD) as KEIs for emissions to water for both hazardous and non-hazardous waste landfills.</li> <li>• To include BOD as contextual information to be collected (see point 2.2.3.2).</li> </ul>

## 2.2.5.5 Total nitrogen (TN)

<b>Initial EU-BRITE proposal</b>
22. EU-BRITE proposes to consider total nitrogen (TN) as a KEI for emissions to water.
<b>Summary of initial information, feedback and views collected through the frontloading process</b>
<ul style="list-style-type: none"> <li>• 24 out of 29 stakeholders agree with the proposal, 2 partly agree and 3 disagree.</li> <li>• Stakeholders suggested during the frontloading process that this KEI may be relevant to both hazardous and non-hazardous waste landfills.</li> <li>• NH<sub>4</sub> may be a more suitable parameter for assessing the efficiency of the treatment process, especially in biological treatment [SE].</li> </ul>

<ul style="list-style-type: none"> <li>• Ammonium and nitrate may be considered in the LAN BREF for precautionary monitoring in the case of direct discharge to a receiving water body [DE].</li> <li>• Forms of nitrogen, including ammonia, are to be identified and distinguished from one another [FEAD].</li> <li>• One stakeholder [DE] states that TN is primarily a concern in cases where organic waste is deposited, and that leachate from landfills with minimal organic waste content may not require treatment for this parameter.</li> <li>• No rationale was provided by stakeholders who disagreed with the proposal.</li> </ul>
<b>EU-BRITE assessment</b>
<ul style="list-style-type: none"> <li>• According to the information received, data seems to be available [AT, BE, Cefic, DE, EE, ELA, ES, FR, HR, HU, HWE, IT, NL, NO, PL, SE].</li> <li>• Total nitrogen includes free ammonia and ammonium nitrogen (NH<sub>4</sub>-N), nitrite nitrogen (NO<sub>2</sub>-N), nitrate nitrogen (NO<sub>3</sub>-N) and organically bound nitrogen.</li> <li>• TN is a relevant parameter as all forms of organic and inorganic nitrogen could contribute to eutrophication.</li> <li>• According to the EIEP data (for the reporting year 2022), the landfills covered by the EIEP emitted 943 200 kg of TN to water.</li> <li>• Throughout the frontloading process, stakeholders considered that addressing this KEI would have an impact on the environment, human health, and biodiversity.</li> </ul>
<b>EU-BRITE proposal</b>
To complement the original EU-BRITE proposal as follows: <ul style="list-style-type: none"> <li>• To include total nitrogen (TN) as a KEI for emissions to water for both hazardous and non-hazardous waste landfills.</li> </ul>

### 2.2.5.6 Total phosphorus (TP)

<b>Initial EU-BRITE proposal</b>
22. EU-BRITE proposes to consider total phosphorus (TP) as a KEI for emissions to water.
<b>Summary of initial information, feedback and views collected through the frontloading process</b>
<ul style="list-style-type: none"> <li>• 22 out of 30 stakeholders agree with the proposal, 2 partly agree and 6 disagree.</li> <li>• Stakeholders suggested during the frontloading process that this KEI may be relevant to both hazardous and non-hazardous waste landfills.</li> <li>• No rationale was provided by stakeholders who disagreed with the proposal.</li> </ul>
<b>EU-BRITE assessment</b>
<ul style="list-style-type: none"> <li>• According to the information received, data seems to be available [AT, BE, Cefic, DE, EE, ELA, ES, FEAD, FR, HR, HU, HWE, IT, NO, PL, SE].</li> <li>• According to the EIEP data (for the reporting year 2022), the landfills covered by the EIEP emitted 43 500 kg of TP to water.</li> <li>• Throughout the frontloading process, stakeholders considered that addressing this KEI would have an impact on the environment, human health, and biodiversity.</li> </ul>
<b>EU-BRITE proposal</b>
To complement the original EU-BRITE proposal as follows: <ul style="list-style-type: none"> <li>• To include total phosphorus (TP) as a KEI for emissions to water for both hazardous and non-hazardous waste landfills.</li> </ul>

### 2.2.5.7 Chlorides and fluorides

<b>Initial EU-BRITE proposal</b>
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22. EU-BRITE proposes to consider chlorides (as total Cl) and fluorides (as total F) as KEIs for emissions to water.
<b>Summary of initial information, feedback and views collected through the frontloading process</b>
<ul style="list-style-type: none"> <li>• Chlorides (as total Cl): 18 out of 30 stakeholders agree with the proposal, 3 partly agree and 9 disagree.</li> <li>• Fluorides (as total F): 19 out of 30 stakeholders agree with the proposal, 3 partly agree and 8 disagree.</li> <li>• Stakeholders suggested during the frontloading process that these KEIs may be relevant to both hazardous and non-hazardous waste landfills.</li> <li>• Precautionary monitoring may be considered, but municipal WWTP may have difficulty in removing chlorides and fluorides. Also, the removal of salts from leachate may produce concentrates [DE].</li> <li>• No rationale was provided by stakeholders who disagreed with the proposal.</li> </ul>
<b>EU-BRITE assessment</b>
<ul style="list-style-type: none"> <li>• According to the information received, data seems to be available for chlorides [AT, BE, DE, ELA, ES, FEAD, FR, HU, IT, PL, PT] and fluorides [AT, BE, Cefic, DE, ELA, ES, FEAD, FR, HU, HWE, IT, PT, SE].</li> <li>• The environmental risks associated with chlorides and fluorides from landfills include groundwater contamination, surface water pollution, soil salinisation, and toxicity to plants and animals.</li> <li>• There is a standard available (EN ISO 10304) for the measurement of emissions of chloride and fluoride to water<sup>12</sup>.</li> <li>• According to the EIEP data (for the reporting year 2022), the landfills covered by the EIEP emitted 47 634 500 kg of chlorides and 10 924 kg of fluorides to water.</li> <li>• Throughout the frontloading process, stakeholders considered that addressing these KEIs would have an impact on the environment, human health, and biodiversity.</li> </ul>
<b>EU-BRITE proposal</b>
To complement the original EU-BRITE proposal as follows: <ul style="list-style-type: none"> <li>• To include chlorides and fluorides as KEIs for emissions to water for both hazardous and non-hazardous waste landfills.</li> </ul>

### 2.2.5.8 Halogenated organic compounds

<b>Initial EU-BRITE proposal</b>
22. EU-BRITE proposes to consider halogenated organic compounds (as AOX) as a KEI for emissions to water.
<b>Summary of initial information, feedback and views collected through the frontloading process</b>
<ul style="list-style-type: none"> <li>• 19 out of 29 stakeholders agree with the proposal, 3 partly agree and 7 disagree.</li> <li>• Stakeholders suggested during the frontloading process that this KEI may be relevant to both hazardous and non-hazardous waste landfills.</li> <li>• AOX are hazardous substances [BE].</li> <li>• These substances are mostly linked to specific waste streams, such as WEEE [FEAD].</li> <li>• AOX discharge may apply to both direct and indirect discharges to a receiving water body [DE].</li> <li>• This parameter may be particularly relevant for landfills associated with the pulp and paper industry [SE].</li> <li>• A MS [FI] proposes to decide later, based on data, whether AOX should be considered a KEI.</li> </ul>

<sup>12</sup> [JRC Reference Report on Monitoring of Emissions to Air and Water from IED Installations](#)

<ul style="list-style-type: none"> <li>No rationale was provided by stakeholders who disagreed with the proposal.</li> </ul>
<b>EU-BRITE assessment</b>
<ul style="list-style-type: none"> <li>According to the information received, data seems to be available for halogenated organic compounds [AT, BE, DE, ELA, ES, FEAD, FR, HR, HU, HWE, IT, PT, SE].</li> <li>The presence of halogenated organic compounds in landfill leachate is understood to result from the leaching of waste materials containing synthetic organic compounds containing chlorine, bromine or iodine atoms.</li> <li>According to the EIEP data (for the reporting year 2022), the landfills covered by the EIEP emitted 1 920 kg of AOX to water.</li> <li>Throughout the frontloading process, stakeholders considered that addressing this KEI would have an impact on the environment, human health, and biodiversity.</li> </ul>
<b>EU-BRITE proposal</b>
<p>To complement the original EU-BRITE proposal as follows:</p> <ul style="list-style-type: none"> <li>To include halogenated organic compounds as a KEI for emissions to water for both hazardous and non-hazardous waste landfills.</li> </ul>

### 2.2.5.9 Phenols

<b>Initial EU-BRITE proposal</b>
22. EU-BRITE proposes to consider phenols (as total C) as a KEI for emissions to water.
<b>Summary of initial information, feedback and views collected through the frontloading process</b>
<ul style="list-style-type: none"> <li>21 out of 29 stakeholders agree with the proposal, 1 partly agrees and 7 disagree.</li> <li>Stakeholders suggested during the frontloading process that this KEI may be relevant to both hazardous and non-hazardous waste landfills.</li> <li>To consider phenols as a KEI only in the case of direct discharge to a receiving water body [DE, FEAD]. The relevance of phenols emissions might be site-specific basis and depends on the water body into which the treated leachate is discharged [DE].</li> <li>One stakeholder [BE] proposes that a more specific parameter, such as phenol index, may serve as an additional or complementary indicator.</li> <li>No rationale was provided by stakeholders who disagreed with the proposal.</li> </ul>
<b>EU-BRITE assessment</b>
<ul style="list-style-type: none"> <li>According to the preliminary information received, data on phenols seems to be available from at least 10 MS and three industrial associations [AT, BE, DE, EE, ELA, ES, FEAD, FR, HR, HU, HWE, IT, PT].</li> <li>The evaluation of pollutant abatement techniques for determining BAT is based primarily on their technical feasibility and efficiency, regardless of the receiving environment.</li> <li>It is noted that there are two standards for the monitoring of phenols as phenol index, EN ISO 14402:1999 and the ISO 6439:1990.</li> <li>Phenol index is referred to in the WAC.</li> <li>The use of total C, phenol index, or others will be decided during the questionnaire development phase.</li> <li>According to the EIEP data (for the reporting year 2022), the landfills covered by the EIEP emitted 160 kg of phenols to water.</li> <li>Throughout the frontloading process, stakeholders considered that addressing this KEI would have an impact on the environment, human health, and biodiversity.</li> </ul>
<b>EU-BRITE proposal</b>
<p>To complement the original EU-BRITE proposal as follows:</p> <ul style="list-style-type: none"> <li>To include phenols as a KEI for emissions to water for both hazardous and non-hazardous waste landfills.</li> </ul>

### 2.2.5.10 Polycyclic aromatic hydrocarbons (PAHs)

<b>Initial EU-BRITE proposal</b>
22. EU-BRITE proposes to consider polycyclic aromatic hydrocarbons (PAHs) as a KEI for emissions to water.
<b>Summary of initial information, feedback and views collected through the frontloading process</b>
<ul style="list-style-type: none"> <li>• 14 out of 29 stakeholders agree with the proposal, 3 partly agree and 12 disagree.</li> <li>• Stakeholders suggested during the frontloading process that this KEI may be relevant to both hazardous and non-hazardous waste landfills.</li> <li>• Some PAHs are priority hazardous substances according to the Water Framework Directive. Individual PAHs (e.g. naphthalene, fluorene, anthracene, acenaphthylene) may serve as useful alternatives or complementary indicators, depending on the monitoring needs [BE].</li> <li>• Some stakeholders question the relevance of PAHs as a KEI, citing their poor solubility [DE], and suggest that KEIs might be determined at a later stage based on data [FI].</li> </ul>
<b>EU-BRITE assessment</b>
<ul style="list-style-type: none"> <li>• According to the preliminary information received, data on PAHs seems to be available from at least nine MS and one industrial association [BE, DE, EE, ELA, ES, HU, IT, NO, PL].</li> <li>• Some MS' (e.g. ES, SE) emission portals seem to demonstrate that emissions of PAHs from landfills are reported.</li> <li>• Some PAHs are priority hazardous substances according to the WFD.</li> <li>• Throughout the frontloading process, stakeholders considered that addressing this KEI would have an impact on the environment, human health, and biodiversity.</li> </ul>
<b>EU-BRITE proposal</b>
To complement the original EU-BRITE proposal as follows: <ul style="list-style-type: none"> <li>• To include polycyclic aromatic hydrocarbons (PAHs) as a KEI for emissions to water for both hazardous and non-hazardous waste landfills.</li> <li>• To identify, during the questionnaire development phase, which PAHs are relevant for the LAN BREF.</li> </ul>

### 2.2.5.11 Microplastics

<b>Initial EU-BRITE proposal</b>
22. EU-BRITE proposes to consider microplastics as a KEI for emissions to water.
<b>Summary of initial information, feedback and views collected through the frontloading process</b>
<ul style="list-style-type: none"> <li>• 10 out of 29 stakeholders agree with the proposal, 9 partly agree and 10 disagree.</li> <li>• Stakeholders suggested during the frontloading process that this KEI may be relevant to both hazardous and non-hazardous waste landfills.</li> <li>• Microplastics are undoubtedly a growing concern for human health, biodiversity and the environment [BE].</li> <li>• It would be useful to gather information on research into a reliable measurement method and to specify the size of the targeted microplastics or nanoplastics [BE].</li> <li>• It seems that there is no standardised test method for analysing microplastics in waste water [DE, FEAD, AT].</li> <li>• Not relevant for landfills associated with the steel industry, pulp and paper industry or Swedish mixed waste landfills [SE].</li> <li>• Landfills are not the main source of microplastics pollution [FR, DE].</li> </ul>

**EU-BRITE assessment**

- According to the preliminary information received, no data on microplastic emissions from landfills seems to be available.
- The widespread presence of tiny fragments of synthetic or chemically modified natural polymers in the environment is a growing concern. Small, water-insoluble particles break down slowly and may be easily ingested by living organisms, potentially harming both the environment and human health<sup>13</sup>.
- An overview of the microparticle releases of PVC and PVC additives from landfills, including the potential risk to human health and the environment has been reported to the European Commission by ECHA<sup>14</sup>.
- A standardised approach to detecting microplastics is necessary; recent reviews of detection processes from sampling to identification have highlighted the need for harmonisation in this area<sup>15</sup>.
- From the information submitted by the stakeholders, it is not clear if relevant microplastics emission and/or monitoring data are available for landfills.
- Throughout the frontloading process, stakeholders considered that addressing this KEI would have an impact on the environment, human health, and biodiversity.

**EU-BRITE proposal**

To amend the original EU-BRITE proposal as follows:

- To collect data on microplastics emissions to water for both hazardous and non-hazardous waste landfills. The TWG to decide at a later stage, based on the data and information collected, whether these pollutants may be considered as a KEI and/or if BAT-AELs and/or benchmarks should be derived.

**2.2.5.12 Per- and poly-fluoroalkyl substances (PFAS)****Initial EU-BRITE proposal**

22. EU-BRITE proposes to consider PFAS as a KEI for emissions to water.

**Summary of initial information, feedback and views collected through the frontloading process**

- 17 out of 30 stakeholders agree with the proposal, 6 partly agree and 7 disagree.
- Stakeholders suggested during the frontloading process that this KEI may be relevant to both hazardous and non-hazardous waste landfills.
- Several stakeholders express concerns about the availability of data [AT, DE, ELA].
- KEIs might be determined at a later stage based on data [FI].
- Important to determine which PFAS are relevant and how they would be analysed [SE].

**EU-BRITE assessment**

- According to the information received from five stakeholders [BE, FR, HWE, IT, SE], data is available and a MS [DK] uploaded representative permits regarding PFAS emissions.
- Studies indicate that landfill leachate contains a wide variety of PFAS. For instance, research by Lancioni et al. (2024) identified up to 70 different PFAS in landfill leachates globally. This research concludes that almost the entire load of PFAS measured in the influent landfill leachate remained in the liquid phase after conventional or advanced treatments<sup>16</sup>.
- Throughout the frontloading process, stakeholders considered that addressing this KEI

<sup>13</sup> [Commission Regulation \(EU\) 2023/2055 of 25 September 2023 amending Annex XVII to Regulation \(EC\) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals \(REACH\) as regards synthetic polymer microparticles.](#)

<sup>14</sup> ECHA – [Investigation report on PVC and PVC additives.](#)

<sup>15</sup> [Microplastics in wastewater treatment plants: Occurrence, fate and identification \(Nouha Bakaraki Turan et al., 2021\)](#)

<sup>16</sup> Lancioni, N., Blumenthal, E., Sgroi, M., Fatone, F., Frugis, A., Lazzazzara, M., Ribarova, I., Valchev, D., Lubomirova, V., Lincheva, S. (2024). D4.5 – Mass flow and fate analysis for PFAS from landfill leachate in Bulgaria and Italy.

would have an impact on the environment, human health, and biodiversity.
<b>EU-BRITE proposal</b>
To amend the original EU-BRITE proposal as follows: <ul style="list-style-type: none"> <li>To collect data on PFAS emissions to water for both hazardous and non-hazardous waste landfills. The TWG to decide at a later stage, based on the data and information collected, whether these pollutants may be considered as a KEI and/or if BAT-AELs and/or benchmarks should be derived.</li> </ul>

### 2.2.5.13 Bisphenols

<b>Initial EU-BRITE proposal</b>
22. EU-BRITE proposes to consider bisphenols as a KEI for emissions to water.
<b>Summary of initial information, feedback and views collected through the frontloading process</b>
<ul style="list-style-type: none"> <li>14 out of 30 stakeholders agree with the proposal, 4 partly agree and 12 disagree.</li> <li>Stakeholders suggested during the frontloading process that this KEI may be relevant to both hazardous and non-hazardous waste landfills.</li> <li>Some stakeholders express their concerns about the possibility of deriving BAT-AELs because of the lack of data [DE, FEAD, FI].</li> </ul>
<b>EU-BRITE assessment</b>
<ul style="list-style-type: none"> <li>According to the information received from three [BE, ELA, IT] stakeholders, data seems to be available.</li> <li>In 2022 the Commission adopted a proposal to amend the WFD which adds (among other substances) bisphenol-A to the list of priority hazardous substances</li> <li>Throughout the frontloading process, stakeholders considered that addressing this KEI would have an impact on the environment, human health, and biodiversity.</li> </ul>
<b>EU-BRITE proposal</b>
To amend the original EU-BRITE proposal as follows: <ul style="list-style-type: none"> <li>To collect data on bisphenols emissions to water for both hazardous and non-hazardous waste landfills. The TWG to decide at a later stage, based on the data and information collected, whether these pollutants may be considered as a KEI and/or if BAT-AELs and/or benchmarks should be derived.</li> </ul>

### 2.2.5.14 Aromatic brominated flame retardants (ABFRs) and phosphorus flame retardants

<b>Initial EU-BRITE proposal</b>
22. EU-BRITE proposes to consider ABFRs as a KEI for emissions to water.
<b>Summary of initial information, feedback and views collected through the frontloading process</b>
<ul style="list-style-type: none"> <li>15 out of 30 stakeholders agree with the proposal, 5 partly agree and 10 disagree.</li> <li>Stakeholders suggested during the frontloading process that this KEI may be relevant to both hazardous and non-hazardous waste landfills.</li> <li>A MS [BE] considers that phosphorus flame retardants are more relevant because of their polarity and proposes to include them as a KEI.</li> <li>One MS [DE] stated that brominated flame retardants are not soluble and therefore not relevant.</li> <li>Some stakeholders express their concerns about the possibility of deriving BAT-AELs because of the lack of data [DE, FEAD, FI].</li> </ul>

<ul style="list-style-type: none"> <li>An industrial association reported that several associates measure this pollutant weekly [HWE].</li> </ul>
<b>EU-BRITE assessment</b>
<ul style="list-style-type: none"> <li>According to the information received from three [BE, ELA, HWE] stakeholders, data seems to be available.</li> <li>ECHA has investigated, as requested by the European Commission, the uses and releases of certain aromatic brominated flame retardants (ABFRs), their (potential) hazardous properties, possible alternatives and aspects related to recycling and waste management. The investigation focused on 60 ABFRs that are potentially on the EU market<sup>17</sup>. This research also considers that some groups of organophosphorus flame retardants have been identified as an alternative to ABFRs in several applications.</li> <li>Brominated diphenylethers (congener numbers 28, 47, 99, 100, 153 and 154) are identified as priority hazardous substance under the WFD.</li> <li>Throughout the frontloading process, stakeholders considered that addressing this KEI would have an impact on the environment, human health, and biodiversity.</li> </ul>
<b>EU-BRITE proposal</b>
<p>To amend the original EU-BRITE proposal as follows:</p> <ul style="list-style-type: none"> <li>To collect data on ABFRs emissions to water for both hazardous and non-hazardous waste landfills. The TWG to decide at a later stage, based on the data and information collected, whether these pollutants may be considered as a KEI and/or if BAT-AELs and/or benchmarks should be derived.</li> </ul>

#### 2.2.5.15 Heat stabilisers (e.g. organotin compounds)

<b>Initial EU-BRITE proposal</b>
<p>22. EU-BRITE proposes to consider heat stabilisers (e.g. organotin compounds) as a KEI for emissions to water.</p>
<b>Summary of initial information, feedback and views collected through the frontloading process</b>
<ul style="list-style-type: none"> <li>12 out of 30 stakeholders agree with the proposal, 6 partly agree and 12 disagree.</li> <li>Stakeholders suggested during the frontloading process that this KEI may be relevant to both hazardous and non-hazardous waste landfills.</li> <li>Some stakeholders express their concerns about the possibility of deriving BAT-AELs because of the lack of data [DE, FEAD, FI].</li> </ul> <p>Heat stabilisers are used for preventing the degradation of PVC materials, and organotin compounds, may contaminate water and pose risks to human health and the environment because of their hazardous properties, including carcinogenicity, reproductive toxicity, and neurotoxicity.</p>
<b>EU-BRITE assessment</b>
<ul style="list-style-type: none"> <li>According to the information received from two [BE, ELA] stakeholders, data is available.</li> <li>Throughout the frontloading process, stakeholders considered that addressing this KEI would have an impact on the environment, human health, and biodiversity.</li> </ul>
<b>EU-BRITE proposal</b>
<p>To amend the original EU-BRITE proposal as follows:</p> <ul style="list-style-type: none"> <li>To collect data on heat stabilisers emissions to water for both hazardous and non-hazardous waste landfills. The TWG to decide at a later stage, based on the data and information collected, whether these pollutants may be considered as a KEI and/or if BAT-AELs and/or benchmarks should be derived.</li> </ul>

<sup>17</sup> ECHA – [Investigation report on ABFRs](#).

## 2.2.5.16 Phthalates

<b>Initial EU-BRITE proposal</b>
22. EU-BRITE proposes to consider phthalates as a KEI for emissions to water.
<b>Summary of initial information, feedback and views collected through the frontloading process</b>
<ul style="list-style-type: none"> <li>• 15 out of 30 stakeholders agree with the proposal, 4 partly agree and 11 disagree.</li> <li>• Stakeholders suggested during the frontloading process that this KEI may be relevant to both hazardous and non-hazardous waste landfills.</li> <li>• Some stakeholders express their concerns about the possibility of deriving BAT-AELs because of the lack of data [DE, FEAD, FI].</li> </ul>
<b>EU-BRITE assessment</b>
<ul style="list-style-type: none"> <li>• According to the information received from three [EE, ELA, HWE] stakeholders, data is available.</li> <li>• From the information submitted by the stakeholders, it is not clear if relevant phthalates emission and/or monitoring data are available for landfills.</li> <li>• The phthalate Di(2-ethylhexyl)phthalate (DEHP) is identified as priority hazardous substance under the WFD. According to information retrieved from ECHA database, this substance can be found in articles with material based on ‘[...] plastic (e.g. food packaging and storage, toys, mobile phones), rubber (e.g. tyres, shoes, toys) and fabrics, textiles and apparel (e.g. clothing, mattress, curtains or carpets, textile toys)’<sup>18</sup>.</li> <li>• Phthalates are classified as hazardous due to their reproductive toxicity and endocrine-disrupting properties. They are present in many products and plastic materials. If these materials end up in landfill, they will likely deteriorate, contaminating the leachate and potentially leading to their emission into the environment.</li> <li>• Throughout the frontloading process, stakeholders considered that addressing this KEI would have an impact on the environment, human health, and biodiversity.</li> </ul>
<b>EU-BRITE proposal</b>
To amend the original EU-BRITE proposal as follows: <ul style="list-style-type: none"> <li>• To collect data on phthalates emissions to water for both hazardous and non-hazardous waste landfills. The TWG to decide at a later stage, based on the data and information collected, whether these pollutants may be considered as a KEI and/or if BAT-AELs and/or benchmarks should be derived.</li> </ul>

## 2.2.5.17 Other proposals from TWG members

<b>Initial EU-BRITE proposal</b>
Under the initial EU-BRITE proposal 22, there was the possibility for TWG members to indicate additional pollutants to those proposed as KEIs for emissions to water.
<b>Summary of initial information, feedback and views collected through the frontloading process</b>
<ul style="list-style-type: none"> <li>• The following pollutants/parameters are proposed as additional KEIs for emissions to water: <math>\alpha+\beta</math> hexachlorocyclohexane, acrylonitrile, AMPA (aminomethylphosphonic acid, breakdown product of glyphosate), barium (Ba), beryllium (Be), boron (B), bromine (Br), bromodichloromethane, calcium (Ca), chlorobenzene, chloroform (trichloromethane), cyanides, dibromochloromethane, dichloromethane, hydrocarbons, iron (Fe), magnesium (Mg), mercaptans (thiols), metabolites (specifically chloridazon-desphenyl, chloridazon-methyl-desphenyl), mineral oil, non-purgeable organic carbon (NPOC), organochlorine</li> </ul>

<sup>18</sup> [Substance Information - ECHA](#)

pesticides, organophosphorus pesticides, orthophosphate, phosphate total, potassium (K), radioactive substances (including alpha/beta activity (U238, Ra226, Ra228, K40, Po210)), settleable solids, silver (Ag), sodium (Na), strontium (Sr), substances extractable with petroleum ether, sum of anionic, non-ionic and cationic surfactants, thallium (Tl), tribromomethane (bromoform), uranium (U), vinyl chloride, and volatile organohalogen compounds (VOX) [BE], antimony (Sb), benzene, toluene, ethylbenzene, xylenes (BTEX), cobalt (Co), manganese (Mn), molybdenum (Mo), tin (Sn), vanadium (V), [BE, EEB], sulphates [BE, DE, EEB], hydrocarbon oil index (HOI), free cyanide (CN<sup>-</sup>) [DE] and PCB [EEB].

- The state of the populations (e.g. measures of mortality, growth inhibition) of daphnia magna, pseudokirchneriella subcapitata [BE] and toxicity to fish eggs [DE] are proposed as KEIs for emissions to water.
- Molybdenum may be a relevant pollutant in landfills associated with the stainless-steel industry [SE].

#### **EU-BRITE assessment**

- The stakeholders supporting additional pollutants to be considered as KEIs indicate that no data are available for the following emissions from landfills: acrylonitrile,  $\alpha+\beta$  hexachlorocyclohexane, AMPA, antimony (Sb), barium (Ba), benzene, toluene, ethylbenzene, xylenes (BTEX), beryllium (Be), bromine (Br), bromodichloromethane, chlorobenzene, chloroform (trichloromethane), dibromochloromethane, dichloromethane, molybdenum (Mo), non-purgeable organic carbon (NPOC), organochlorine pesticides, organophosphorus pesticides, silver (Ag), sum of anionic, non-ionic and cationic surfactants, thallium (Tl), tin (Sn), tribromomethane (bromoform), uranium (U), vanadium (V), vinyl chloride, and volatile organohalogen compounds (VOX).
- The following pollutants are included in Section 2.2.3:  $\alpha+\beta$  hexachlorocyclohexane, bromodichloromethane, chlorobenzene, chloroform (trichloromethane), dibromochloromethane, dichloromethane, organochlorine pesticides, tribromomethane (bromoform), vinyl chloride, and volatile organohalogen compounds (VOX).
- The stakeholders making the proposal indicate that no data are available for daphnia magna or pseudokirchneriella subcapitata.
- There is data available for HOI and cyanide emissions to water.
- Hydrocarbon emissions may arise from various sources such as waste streams containing petroleum-based products, vehicle maintenance wastes, industrial process residues, and construction or demolition debris.
- Cyanide is included in Annex X to the WFD and cyanide emissions may arise from various sources such as waste streams containing industrial process residues, metal processing wastes, electroplating sludges.
- The toxicity of the discharges from landfill leachate and waste water treatments will be result of the pollutant load of KEIs considered in the previous sections.
- No specific justifications are provided with the TWG views/information on the additional pollutants/substances proposed as KEIs (e.g. no monitoring data available or any evidence associated with the environmental relevance for landfills).

#### **EU-BRITE proposal**

To add the following EU-BRITE proposals:

- To include hydrocarbon oil index (HOI) as a KEI for direct emissions to water for both hazardous and non-hazardous waste landfills.
- To include cyanide (free cyanide, expressed as CN<sup>-</sup>) as a KEI for emissions to water for both hazardous and non-hazardous waste landfills.

## **2.2.6 Water and leachate management**

### **Initial EU-BRITE proposal**

61. EU-BRITE proposes to include water management (consumption, drainage system, treatment and discharge) as a KEI.
62. EU-BRITE proposes that the TWG identify, during the BREF development process, the contextual information needed to understand and compare the specific water consumption and waste water discharge data collected through the questionnaires. (Contextual information includes applied techniques, landfill operations, methods used for monitoring and calculation, water reuse, water recycling rate, site configuration and defined boundaries, level of data aggregation, meteorological data, surrounding topography, landfill topography).

**Summary of initial information, feedback and views collected through the frontloading process**

The main comments on proposal 61 are the following:

- 22 out of 30 stakeholders agree with the proposal, 4 partly agree and 4 disagree.
- Stakeholders suggested during the frontloading process that this KEI may be relevant to both hazardous and non-hazardous waste landfills.
- Water management is a crucial aspect of landfill operations and may be considered as a KEI [FEAD, PT, AT, HR, ELA, FR, MWE, SE, CZ, IT, ES, ZWE, DK].
- Water consumption is limited to landfill operations, but water discharge may be considered as a KEI [SE, EUROFER, SK, CZ, IT, ES].
- Leachate management is a critical component of water management in landfills [BE, DE, FEAD, PT, AT, HR, ELA, FR, MWE, SE, CZ, IT, ES, ZWE, DK].
- Water balance and water budgeting are important tools for managing water in landfills [FR, CZ, IT].
- Recirculation of leachate could be an effective way to enhance leaching conditions and reduce water consumption [DK].
- Water management may be part of the Environmental Management System (EMS) [SK, Cefic].
- The WFD and the Groundwater Directive are the most suitable legislative tools for addressing water management in landfills [EUROFER].
- Data availability for water consumption and discharge varies across countries and regions [SE, IT, ES, DK].
- Techniques for removing rainwater from landfills and treating it may be defined and included in the BREF [IT].
- Site-specific factors, such as landfill siting and geological or engineered barriers, may be considered when developing guidance on leachate treatment [ZWE].

The main comments on proposal 62 are the following:

- 21 out of 30 stakeholders agree with the proposal, 6 partly agree and 3 disagree.
- Stakeholders suggested during the frontloading process that this KEI may be relevant to both hazardous and non-hazardous waste landfills.
- Water consumption and waste water discharge data may be collected with contextual information to ensure valid benchmarking and BAT derivation [FEAD, PT, AT, HR, ELA, SE, CZ, IT, ES, ZWE].
- Contextual information is essential to understand the collected data and minimise the probability of misinterpretation [AT, HR, ELA, SE, CZ, IT, ES].
- Water management is a crucial aspect of landfill operations and may be considered for all types of landfills [BE, DE, FEAD, ESWET, PL, EEB, PT, AT, HR, ELA, FR, MWE, SE, CZ, IT, ES, ZWE].
- Local factors, such as rainfall patterns and site-specific conditions, influence water consumption and waste water discharge [FEAD, PL, EEB, PT, AT, HR, ELA, SE, CZ, IT, ES, ZWE].
- Water consumption is not a KEI for permanent storage facilities in salt mines [Euromines].
- Water consumption is not a significant issue for landfills, but waste water discharge is a key environmental issue [SE, EUROFER, MWE].

**EU-BRITE assessment**

- According to the preliminary feedback provided through the frontloading stage, provisions on monitoring and reporting of water consumption and waste water discharge seem to be in place.
- Also, according to the preliminary feedback provided through the frontloading process, information is available on the water management techniques applied at the site in terms of water intake, surface and groundwater flows, and water collection and discharge.
- According to the information provided, water consumption is limited in landfill operations and may not be relevant enough to be considered as KEI.
- Information on techniques applied to reduce water consumption and waste water discharge is available.
- The identification and collection of appropriate contextual information is relevant to understand and compare the variation in water consumption and waste water discharge data between landfill installations. Some factors could explain this variability, such as climate regime (annual rainfall and evaporation rates) and water infrastructure and design.
- Throughout the frontloading process, stakeholders considered that addressing waste water discharge as a KEI would have an impact on the environment, human health, and biodiversity.

#### **EU-BRITE proposal**

To amend the original EU-BRITE proposal as follows:

- To include waste water discharge as a KEI.

To add the following EU-BRITE proposals:

- To collect data on specific water consumption and specific waste water discharge in landfill operations.
- To collect information on techniques applied to reduce water consumption and waste water discharge.
- To collect information on leachate and water management systems applied in landfill operations.

To slightly amend the EU-BRITE proposal as follows:

- The TWG to identify, during the questionnaire development phase, the contextual information needed to understand and compare the specific water consumption and waste water discharge data collected through the questionnaires. (Contextual information includes applied techniques, landfill operations, methods used for monitoring and calculation, water reuse, water recycling rate, site configuration and defined boundaries, level of data aggregation, meteorological data, surrounding topography, landfill topography).

## **2.2.7 Chemicals consumption**

For further information regarding chemicals used in landfill operations according to the TWG, see Annex 4.

Please note that the ‘Chemical frontloading phase’ is ongoing at the time of release of this background paper. As a result, a revised list of substances and chemicals used in landfill operations, which may differ from the one outlined in Annex 4, may be published at a later date. The outcome of the ‘Chemical frontloading phase’ may inform discussions on whether chemicals consumption should be considered as a KEI. If deemed relevant, the findings will also help determine which specific chemicals’ consumption should be identified as KEIs.

### **2.2.7.1 Chemicals consumption data and information collection**

#### **Initial EU-BRITE proposal**

42. EU-BRITE proposes to include the consumption of chemicals as a KEI.

43. EU-BRITE proposes to collect, during the BREF development process, data and information on the type, quantity, purpose, function and fate of chemicals used in landfilling operations under the scope of the LAN BREF.

**Summary of initial information, feedback and views collected through the frontloading process**

The main comments on proposal 42 are the following:

- 10 out of 30 stakeholders agree with the proposal, 10 partly agree and 10 disagree.
- Stakeholders suggested during the frontloading process that this KEI may be relevant to both hazardous and non-hazardous waste landfills.
- The TWG has mixed views on whether the consumption of chemicals may be considered as a KEI. The decision might depend on various factors, such as the type of site, the quantity of chemicals used, or the presence of specific processes like desulphurisation or gas upgrading.
- Several stakeholders state that chemicals are used in landfill operations, such as for the treatment of leachate and waste water, and for off-gas (LFG) treatment [BE, PT, PL, SE, CZ].
- Some stakeholders note that the use of chemicals is already regulated by other BAT conclusions or is not significant enough to be considered as a KEI [ES, FR].
- Several stakeholders disagree that chemical consumption could be considered as a KEI, citing various reasons such as low usage, limited quantities, or lack of relevance to IED objectives [Euromines, DE, FEAD, ELA, Eurometaux, MWE, EUROFER, SK, Cefic].

The main comments on proposal 43. are the following:

- 13 out of 30 stakeholders agree with the proposal, 6 partly agree and 11 disagree.
- The TWG has mixed views on whether to collect data and information on chemicals used in landfill operations.
- Several stakeholders consider collecting information on chemicals an important foundation to prevent and reduce the usage of harmful substances in landfills [PT, AT, CZ, ES, ESWET].
- One stakeholder raises concern about the fact that material saving would be at the expense of safety in waste disposal [MWE].
- Some stakeholders consider the chemical consumption to be limited and a secondary issue for landfills [FR, SK].
- Some stakeholders point out that chemicals used for stabilisation and solidification of waste before landfilling are covered by the WT BREF [FR, SE].

**EU-BRITE assessment**

- Chemical consumption is limited to specific landfill operations (e.g. treatment of leachate, waste water, odour, landfill gas).
- Leachate treatment, gas management, and odour control could have direct and indirect environmental consequences. Collecting information may be useful to prevent possible environmental risks, with the aim of applying the corresponding safety measures.
- Collecting information on chemicals used in landfill operations may be necessary to decide whether to conclude at a later stage if they should be considered as KEIs.
- The WT BREF does not cover techniques related to landfills. It covers issues related to the treatment of waste to make it more suitable for landfilling.
- Throughout the frontloading process, stakeholders considered that addressing the consumption of chemicals as a KEI would have an impact on the environment, human health, and biodiversity.

**EU-BRITE proposal**

To merge the initial EU-BRITE proposals and to amend them as follows:

- To collect data and information on the chemicals used in landfill operations under the scope of the LAN BREF. The TWG to decide at a later stage, based on the data and information collected, whether this issue may be considered as a KEI and/or if BAT-AEPLs and/or benchmarks should be derived.

## 2.2.7.2 Chemicals possible substitution, recovery and/or reuse

<b>Initial EU-BRITE proposal</b>
44. EU-BRITE proposes to collect, during the BREF development process, data and information on the possible substitution options involving alternative or less hazardous chemicals.
45. EU-BRITE proposes to collect, during the BREF development process, data and information on the recovery and reuse of auxiliary materials and chemicals in landfill operations.
<b>Summary of initial information, feedback and views collected through the frontloading process</b>
<p>The main comments on proposal 44 are the following:</p> <ul style="list-style-type: none"> <li>• 13 out of 30 stakeholders agree with the proposal, 6 partly agree and 11 disagree.</li> <li>• Stakeholders suggested during the frontloading process that this aspect may be relevant to both hazardous and non-hazardous waste landfills.</li> <li>• Several delegations agree that collecting information on substitution options could help reduce the use of hazardous chemicals and promote sustainable landfill management [BE, PT, AT, CZ, ES].</li> <li>• Some delegations suggest a case-by-case approach, citing limited consumption of chemicals or lack of information [EEB, HR, ZWE].</li> <li>• Some delegations consider that collecting this information is not necessary as it is already regulated, or not relevant [Euromines, FEAD, ELA, Eurometaux].</li> </ul> <p>The main comments on proposal 45 are the following:</p> <ul style="list-style-type: none"> <li>• 16 out of 30 stakeholders agree with the proposal, 8 partly agree and 6 disagree.</li> <li>• Stakeholders suggested during the frontloading process that this KEI may be relevant to both hazardous and non-hazardous waste landfills.</li> <li>• Several delegations agree that collecting data on the recovery and reuse of auxiliary materials and chemicals could support resource efficiency, circular economy objectives, and reduce environmental impacts [BE, PL, EEB, PT, AT, CZ, ES, ZWE].</li> <li>• Some stakeholders partially agree with the proposal, but with certain conditions or limitations, such as only considering auxiliary materials or having limited information on chemical use in landfill operations [DE, FEAD, HR, FR, SK].</li> <li>• Some delegations disagree, citing regulatory overlaps and lack of relevance to industrial landfills [Euromines, ELA, Eurometaux, MWE, EUROFER].</li> </ul>
<b>EU-BRITE assessment</b>
<ul style="list-style-type: none"> <li>• Identifying less hazardous substitution options for chemicals would lead to a reduction in hazardous chemical use and more sustainable landfill practices.</li> <li>• The use of less hazardous substances, including lower use of substances of very high concern, is listed as one of the criteria to determine BAT in Annex III to the revised IED and should be tackled in the BREF/BAT conclusions.</li> <li>• Collecting data on the recovery and reuse of auxiliary materials and chemicals could support resource efficiency and circular economy objectives in landfill operations.</li> </ul>
<b>EU-BRITE proposal</b>
<p>To slightly amend the original EU-BRITE proposals:</p> <ul style="list-style-type: none"> <li>• To collect data and information on the possible substitution options involving alternative or less hazardous chemicals.</li> </ul>

- To collect data and information on the recovery and reuse of chemicals used in landfill operations.

## 2.2.8 Auxiliary materials consumption, residues generation and management and circular economy

### 2.2.8.1 Auxiliary materials used in landfill operations

<b>Initial EU-BRITE proposal</b>
41. EU-BRITE proposes to collect, during the BREF development process, information on the auxiliary materials used in landfill operations.
<b>Summary of initial information, feedback and views collected through the frontloading process</b>
<ul style="list-style-type: none"> <li>• 21 out of 31 stakeholders agree with the proposal, 6 partly agree and 4 disagree.</li> <li>• Collecting information on auxiliary materials is important for landfill management [BE, ESWET, PL, EEB, PT, CEWEP, AT, HR, FR, SE, EUROFER, CZ, HWE, ES, ZWE].</li> <li>• Auxiliary materials play a critical role in ensuring the stability, safety, and environmental performance of landfills [BE, ESWET, PL, EEB, PT, CEWEP, AT, HR, FR, SE, EUROFER, CZ, HWE, ES, ZWE].</li> <li>• Incinerator Bottom Ash (IBA) is a complex material that requires proper management and control to mitigate environmental impacts, but also has potential benefits as a secondary raw material, storing CO<sub>2</sub> during ageing, and could be utilised through advanced stabilisation techniques to reduce leachability [ESWET, CEWEP].</li> <li>• The term ‘auxiliary materials’ is too broad and needs clarification [DE, Euromines, FEAD, SK, IT, Cefic].</li> <li>• Collecting information on auxiliary materials may be difficult and their consumption is not significant [FEAD, IT, Cefic].</li> <li>• Auxiliary materials are already governed by existing regulations [ELA, Eurometaux].</li> <li>• Collecting information on auxiliary materials is not necessary and may prioritise environmental performance over safety [ELA, MWE].</li> </ul>
<b>EU-BRITE assessment</b>
<ul style="list-style-type: none"> <li>• For the purposes of the LAN BREF, ‘auxiliary materials’ are materials used to support the construction, operation, and maintenance of a landfill, as well as to enhance the stability, safety and environmental performance of the waste disposal facility (e.g. geosynthetic materials, cover soils, drainage materials, leachate collection system components, gas collection system components, capping materials, erosion control materials).</li> <li>• Collecting information on auxiliary materials used in landfill operations could be key for improving waste management practices and reducing environmental impacts as these materials play a critical role in ensuring the stability, safety and environmental performance of landfills. The information collected may help identify best practices and improve consistency in landfill performance.</li> <li>• It would be beneficial for the TWG to work with clear definitions and guidelines for the collection of information.</li> </ul>
<b>EU-BRITE proposal</b>
To confirm the original EU-BRITE proposal as follows: <ul style="list-style-type: none"> <li>• To collect information on the types of auxiliary materials used in landfill operations.</li> </ul>

### 2.2.8.2 Recovery of residues/waste and energy recovery

#### Initial EU-BRITE proposal

45. EU-BRITE proposes to collect, during the BREF development process, data and information on the recovery and reuse of auxiliary materials and chemicals in landfill operations.
71. EU-BRITE proposes to collect, during the BREF development process, information on the generation of residues and their recovery.
72. EU-BRITE proposes to collect, during the BREF development process, contextual information on the use of waste with unique properties (e.g. on-site drainage layers, ramp or berm construction).

**Summary of initial information, feedback and views collected through the frontloading process**

The main comments on proposal 45 are the following:

- 16 out of 30 stakeholders agree with the proposal, 8 partly agree and 6 disagree.
- Stakeholders suggested during the frontloading process that this topic may be relevant to both hazardous and non-hazardous waste landfills.
- Some delegations consider that collecting data on the recovery and reuse of auxiliary materials could support resource efficiency and circular economy objectives, and reduce environmental impacts [BE, PT, AT, CZ, ES, ZWE, FR].
- Several stakeholders comment that they are not aware of cases where auxiliary materials or chemicals are reused or recovered [DE, FEAD, HR, FR].
- Some delegations disagree, citing regulatory overlaps and lack of relevance to industrial landfills [Euromines, ELA, Eurometaux, MWE, EUROFER, SK].

The main comments on proposal 71 are the following:

- 12 out of 27 stakeholders agree with the proposal, 7 partly agree and 8 disagree.
- Stakeholders suggested during the frontloading process that this topic may be relevant to both hazardous and non-hazardous waste landfills.
- Collecting information on residue generation, recovery, and site-level recycling activities may be useful in supporting circular economy goals and identifying BAT [BE, ESWET, CZ, PT, PL, EEB, IT, ES, ZWE].
- It may be helpful to distinguish between recycling, energy recovery, and other forms of waste management [EEB, ZWE].
- There is a need to clarify what is meant by ‘residues’ [FEAD, HR, Eurometaux, FR, SE, HWE, FI].
- Collecting information on recovery and residue generation may not be relevant for landfills [Eurometaux, DE, AT, ELA, MWE, EUROFER, SK, Cefic], as residues are not typically generated in significant quantities during these operations [DE, AT, ELA, MWE, EUROFER, SK, Cefic].
- Residues are limited and not significant but collecting information on them and on their recovery could still be useful and provide valuable insights [FEAD, FR, SE].

The main comments on proposal 72 are the following:

- 21 out of 29 stakeholders agree with the proposal, 5 partly agree and 3 disagree.
- Using material/waste recovered in landfill construction, such as in drainage layers or daily cover [BE, DE, PT, ELA, FR, MWE, SE, CZ, ES, FI], may offer environmental benefits, including reduced raw material use and waste minimisation [BE, CZ, ES, FI].
- Some contributors emphasise the need for technical requirements and testing to ensure the suitability of secondary materials for landfill construction [MWE, DE].
- Others partially agree, suggesting that contextual information could bring value, but with certain conditions or limitations [Eurometaux].
- A few stakeholders disagree with the proposal, citing a lack of relevance or significant impact on landfill operations [AT, SK], while others express uncertainty or lack of clarity regarding the proposal [FEAD, Eurometaux].

**EU-BRITE assessment**

- The reuse and recovery of residues/waste may support resource efficiency and circular economy objectives, and reduce environmental impacts. Collecting information on this topic could help identify whether it is done in landfill operations and assess its potential

<p>benefits.</p> <ul style="list-style-type: none"> <li>• Resource efficiency and reuse are listed as criteria to determine BAT in Annex III to the revised IED and should be addressed in the BREF/BAT conclusions, including the recovery and recycling of substances generated and used in the process and of waste.</li> <li>• The recovery of waste may be important for supporting circular economy goals, but its relevance and usefulness in the context of landfill operations may be checked. Clear guidelines for collecting information on different types of recovery, such as energy recovery, in the framework of the LAN BREF, could help address concerns and identify best practices.</li> <li>• Providing clear definitions and guidelines for collecting information, as well as ensuring that data is analysed and presented in a useful way, may help identify good practices and BAT in the context of landfill operations.</li> </ul>
<p><b>EU-BRITE proposal</b></p>
<p>To merge the initial EU-BRITE proposals and to amend them as follows:</p> <ul style="list-style-type: none"> <li>• To collect information on the generation and management of residues/waste (e.g. using waste as a substitute for auxiliary materials, for example for construction of on-site drainage layers, ramps or berms or as daily cover to prevent dispersal of lightweight waste).</li> </ul> <p>To add the following EU-BRITE proposals:</p> <ul style="list-style-type: none"> <li>• To collect information on the requirements for using residues/waste as a substitute for auxiliary materials.</li> <li>• To collect information on energy recovery (e.g. from landfill gas).</li> </ul>

## 2.2.9 Energy consumption

<p><b>Initial EU-BRITE proposal</b></p>
<p>51. EU-BRITE proposes to collect, during the BREF development process, information on energy consumption.</p> <p>52. EU-BRITE proposes that the TWG identify, during the BREF development process, the contextual information to understand and compare the energy consumption data collected.</p>
<p><b>Summary of initial information, feedback and views collected through the frontloading process</b></p>
<p>The main comments on proposal 51 are the following:</p> <ul style="list-style-type: none"> <li>• 14 out of 30 stakeholders agree with the proposal, 5 partly agree and 11 disagree.</li> <li>• Stakeholders suggested during the frontloading process that this topic may be relevant to both hazardous and non-hazardous waste landfills.</li> <li>• Several respondents believe that monitoring energy consumption in landfills could help identify opportunities for energy efficiency and reduce environmental impact [ESWET, EEB, PT, AT, ELA, ES].</li> <li>• Several respondents consider energy consumption in landfills to be limited and not a significant environmental issue [DE, FEAD, Eurometaux, MWE, SE, CZ, SK, Cefic].</li> <li>• Several respondents mention that collecting energy consumption data specifically for landfill operations could be challenging, as many landfills are co-located with other activities or facilities. Energy consumption data may be reported at the facility level, which could lead to overlaps with other BREFs [SE, ES, FR; ZWE].</li> <li>• A few respondents suggest that energy consumption data may be linked to the type of energy source used and the specific purpose of that energy use on site [EEB, ZWE].</li> </ul> <p>The main comments on proposal 52 are the following:</p> <ul style="list-style-type: none"> <li>• 17 out of 31 stakeholders agree with the proposal, 5 partly agree and 9 disagree.</li> <li>• Stakeholders suggested during the frontloading process that this topic may be relevant to both hazardous and non-hazardous waste landfills.</li> </ul>

<ul style="list-style-type: none"> <li>• Several delegations agree that collecting contextual information on energy consumption is useful for understanding the collected data and minimising the probability of misinterpretation [BE, PT, AT, SE, ZWE].</li> <li>• Some delegations believe that energy consumption data may not be extensively monitored or analysed, as it does not play a significant role in landfill operations [ELA, Eurometaux, MWE].</li> <li>• A few delegations emphasise the importance of assessing the relative value of performance improvements compared to additional energy consumption, to determine when the trade-off between energy use and performance becomes unjustifiable [EEB, ZWE].</li> </ul>
<b>EU-BRITE assessment</b>
<ul style="list-style-type: none"> <li>• According to the information received, data seems to be available [ES, HWE, IT, PT].</li> <li>• Collecting information on energy consumption might be an opportunity to identify areas where energy efficiency can be improved and the environmental impact of the landfill activities reduced.</li> <li>• The identification and collection of appropriate contextual information is relevant to understand and compare the energy performance data of the landfill operations.</li> </ul>
<b>EU-BRITE proposal</b>
<p>To slightly amend the original EU-BRITE proposal as follows:</p> <ul style="list-style-type: none"> <li>• To collect information on energy consumption (e.g. from evaporation of leachate, waste water treatment, machinery).</li> </ul> <p>To confirm the original EU-BRITE proposal as follows:</p> <ul style="list-style-type: none"> <li>• The TWG to identify the contextual information to understand and compare the energy consumption data collected.</li> </ul> <p>To add the following EU-BRITE proposal:</p> <ul style="list-style-type: none"> <li>• To collect information on techniques applied to increase energy efficiency.</li> </ul>

## 2.2.10 Decarbonisation and greenhouse gas emissions

### 2.2.10.1 Techniques related to the reduction of greenhouse gas emissions

<b>Initial EU-BRITE proposal</b>
<p>81. EU-BRITE proposes to collect, during the BREF development process, information on techniques related to the reduction of greenhouse gas emissions from the relevant landfill operations covered by the scope of the LAN BREF (e.g. landfill gas capture, prevention of landfill gas emissions, landfill gas uses, electrification).</p> <p>83. EU-BRITE proposes that the TWG identify, during the BREF development process, the information to understand and compare the collected data. (<i>Contextual information includes type of energy used/produces (including fuel types) in the installation, monitoring methods and calculations, landfill configuration and defined boundaries, size and depth of the landfills and waste characteristics</i>).</p>
<b>Summary of initial information, feedback and views collected through the frontloading process</b>
<p>The main comments on proposal 81 are the following:</p> <ul style="list-style-type: none"> <li>• 25 out of 31 stakeholders agree with the proposal, 4 partly agree and 2 disagree.</li> <li>• Stakeholders suggested during the frontloading process that this topic may be relevant to both hazardous and non-hazardous waste landfills, with particular emphasis on non-hazardous waste landfills containing substantial amounts of organic/biodegradable matter.</li> <li>• Landfill gas management is crucial for reducing greenhouse gas emissions. This includes techniques such as landfill gas capture, prevention of landfill gas emissions, and landfill gas utilisation [BE, DE, AT, HR, CZ, IT, ES, FI, ZWE, DK].</li> </ul>

- Electrification and energy efficiency measures could help reduce greenhouse gas emissions. This includes electrifying equipment, optimising energy consumption and reducing energy losses [CZ, SE, DK].
- Flaring of surplus gas could be an effective technique for reducing greenhouse gas emissions. This could be particularly useful where energy use is not feasible [DK, HR].
- The age of the landfill and the type of waste deposited are key factors in determining long-term emissions [EEB, ZWE, FI].
- The BREF may focus on reducing emissions from existing landfills, particularly those with organic waste. This is especially relevant for countries where organic waste is still landfilled [FR, IT, ES, ZWE].
- Industrial landfills, such as those associated with steel production, may not be a priority for decarbonisation efforts, as their characteristics and emission profiles may differ significantly from other types of landfills [EUROFER, Eurometaux].

The main comments on proposal 83 are the following:

- 24 out of 30 stakeholders agree with the proposal, 2 partly agree and 4 disagree.
- Many stakeholders consider that collecting contextual information is essential for ensuring accurate data interpretation and comparison across installations [BE, DE, PT, AT, HR, ELA, FR, CZ, IT, ES, ZWE]; contextual information is necessary for understanding the bigger picture of processes and may help to identify areas for improvement and optimisation [AT, HR, ELA, ES, ZWE].
- A stakeholder suggests that the First Order Decay method and energy-related data may be considered when collecting data and assessing the effectiveness of BAT [FR].
- Contextual information is only relevant for landfills where gas collection is applicable, and further discussion is needed to clarify the comparison method and unit of production [SE, SK].
- Contextual information is not relevant for permanent storage facilities in salt mines or industrial landfills associated with steel production [Euromines, EUROFER] and is only relevant for landfills receiving organic waste [Eurometaux].
- Contextual information is essential for establishing comprehensive BAT-AEL ranges and understanding emission fluctuations [EUROFER, SE].

#### **EU-BRITE assessment**

- Landfills containing organic/biodegradable matter generate methane (a GHG) emissions.
- Effective landfill gas management is essential for mitigating greenhouse gas emissions from landfills where gas is still produced.
- Decarbonisation is listed as one of the criteria to determine BAT in Annex III to the revised IED and should be tackled in the BREF/BAT conclusions.
- Information on development and application of techniques relevant to decarbonisation such as electrification and energy efficiency seems to be available for certain landfill activities.

#### **EU-BRITE proposal**

To confirm the EU-BRITE proposal as follows:

- To collect information on techniques related to the reduction of greenhouse gas emissions from the relevant landfill operations covered by the scope of the LAN BREF (e.g. landfill gas capture, prevention of landfill gas emissions, landfill gas uses, electrification).

To amend the EU-BRITE proposal as follows:

- The TWG to identify, during the questionnaire development phase, the contextual information needed to understand and compare the collected data. (*Contextual information includes type of energy used/produces (including fuel types) in the installation, monitoring methods and calculations, landfill configuration and defined boundaries, size and depth of the landfills and waste characteristics*).

### **2.2.10.2 On-site combustion plants**

<b>Initial EU-BRITE proposal</b>
82. EU-BRITE proposes to collect, during the BREF development process, information on on-site combustion plants (e.g. firing landfill gas) and their characteristics (e.g. rated thermal input), and information on the use of heat generated (e.g. direct or indirect leachate evaporation).
<b>Summary of initial information, feedback and views collected through the frontloading process</b>
<ul style="list-style-type: none"> <li>• 24 out of 30 stakeholders agree with the proposal, 3 partly agree and 3 disagree.</li> <li>• Collecting information on on-site combustion plants is crucial for understanding environmental performance and energy recovery potential [BE, DE, ESWET, PT, AT, HR, ELA, SE, SK, CZ, IT, ES, FI].</li> <li>• The primary objective may be eliminating methane emissions, rather than generating energy from captured landfill gas [EEB, ZWE].</li> <li>• On-site combustion plants may be an effective way to reduce methane emissions and recover energy, and collecting information on heat utilisation (e.g. leachate treatment, heating) [CZ, IT, ES] is important for assessing environmental performance and identifying BAT [CZ].</li> <li>• There may be overlaps with other BREFs or directives, such as the MCP Directive, which should be avoided [FR, Eurometaux, EUROFER].</li> <li>• On-site combustion plants may not be relevant for industrial landfills associated with steel production or permanent storage facilities in salt mines [Euromines, Eurometaux, EUROFER].</li> <li>• Collecting information on how landfill gas is managed is valuable, including understanding the range of processes employed to treat or utilise collected gas [ZWE, EEB].</li> </ul>
<b>EU-BRITE assessment</b>
<ul style="list-style-type: none"> <li>• Collecting information on landfill gas management might be an opportunity to identify areas for energy efficiency and reduce the environmental impact of the landfill activities regarding methane emissions.</li> </ul>
<b>EU-BRITE proposal</b>
To amend the EU-BRITE proposal as follows: <ul style="list-style-type: none"> <li>• To collect data and information on on-site combustion plants (e.g. firing landfill gas) and their characteristics (e.g. rated thermal input), and information on the use of the heat generated (e.g. direct or indirect leachate evaporation).</li> </ul>

## 3 ITEMS NOT FOR DISCUSSION AT THE KICK-OFF MEETING

### 3.1 Time schedule for drawing up the LAN BREF

This section aims to present the milestones for drawing up the LAN BREF as well as the next steps for the years 2025 and 2026.

Article 13(1) of the revised IED stipulates that the duration of the information exchange for the preparation of BREFs shall not exceed 4 years.

Considering this, EU-BRITE's proposal for the tentative time schedule for drawing up the LAN BREF is as shown in the following sections.

#### 3.1.1 Long-term planning: tentative timeline of the milestones for drawing up the LAN BREF

EU-BRITE's proposal for the tentative timeline of the milestones for the whole process of drawing up the LAN BREF is as follows:

**Table 1: Milestones for the drawing up of the LAN BREF**

Step	Milestone	Date
✓ 1	Activation of the TWG and frontloading (done)	22 November 2024
✓ 2	Nominations of TWG members (done)	31 January 2025 (deadline)
✓ 3	Frontloading (done)	16 April 2025 (deadline)
→ 4	<b>Kick-off Meeting (KoM)</b>	<b>6 – 9 October 2025 (tentative)</b>
5	Data and information collection (including questionnaire development and bulk information collection)	Q4 2025 – Q4 2026/Q1 2027 (tentative)
6	First draft of the LAN BREF (D1)	Q3 2027 (tentative)
7	TWG comments on D1	Q4 2027 (tentative)
8	Final TWG meeting	Q3 2028 (tentative)
9	Final draft of the LAN BREF delivered to the IED Article 13 Forum for its opinion	2029 (tentative)
10	Meeting of the IED Article 13 Forum to provide an opinion on the LAN BREF	2029 (tentative)
11	BAT conclusions vote at an IED Article 75 Committee meeting	2029 (tentative)
12	Publication of the BAT conclusions in the Official Journal of the European Union	2029 (tentative)
13	Publication of the BREF on the EU-BRITE website	2029 (tentative)

#### 3.1.2 Mid-term planning - next steps: tentative timeline of the data and information collection

The mid-term planning for the LAN BREF drawing up process encompasses the end of 2025 and the entirety of 2026, corresponding to Step 5 of the milestones outlined in Table 1, which focuses on the data and information collection phase of the LAN BREF. It includes the preparation of the questionnaire and the collection of bulk information.

The process to prepare this phase is presented in Section 3.4.

This data and information will allow in particular the drafting of the chapter(s) of the LAN BREF on the emission and consumption levels associated with landfills.

In addition to the collection of data and information via questionnaires, it is necessary to collect bulk information in order to draw up the other chapters of the LAN BREF, namely:

- general information on the landfilling operations covered in the scope of the BREF;
- information on the processes and techniques applied in the above-mentioned landfilling operations;
- information on techniques to consider in the determination of BAT in the above-mentioned landfilling operations and on any relevant emerging techniques;
- information on emerging techniques.

This bulk information will specifically enable the development of the LAN BREF.

The EU-BRITE proposal for the tentative timeline of the data and information collection is as follows:

**Table 2: Next steps for the information and data collection of the LAN BREF**

Step	Tentative time
<b>Identification of well-performing landfills</b>	
TWG to provide proposals of well-performing reference landfills for the data collection via template	January 2026
EU-BRITE to compile the list of well-performing reference landfills and to check its completeness	March 2026
<b>Bulk information collection</b>	
TWG to submit 'bulk' information	September 2026
<b>Data collection procedure (questionnaire development and fill-in)</b>	
EU-BRITE to prepare the questionnaire for data collection and to issue the first draft questionnaire template (Qr1)	February 2026
TWG to provide feedback on Qr1	March 2026
EU-BRITE to issue the second draft questionnaire (Qr2)	May 2026
TWG to provide feedback on Qr2	June 2026
Workshop on the questionnaire finalisation (if necessary)	June 2026
EU-BRITE to issue the draft final questionnaire for testing (Qrf)	September 2026
TWG to test the Qrf	October 2026
EU-BRITE to issue the final questionnaire (QrF) and distribution to the participating landfills	November 2026
TWG to submit filled-in questionnaires in BATIS	Q1 2027

## 3.2 Proposed structure of the LAN BREF

Initial EU-BRITE proposal	
131. EU-BRITE proposes to use the following structure of the BREF.	
<b>General information on the BREF content</b>	Main findings from all chapters
<b>Preface</b>	Tailored for LANDFILLS
<b>Scope</b>	Describes as precisely as possible which operations and activities are covered by the document. This section will also indicate activities/processes which are intentionally excluded from the scope of the BREF, while providing the reasons for such exclusions. It will also mention the main 'directly associated' activities covered by the document, even when these are not Annex I activities themselves. The relevance of other BREFs will be mentioned when considered necessary, by cross-referencing these relevant BREFs.
<b>Chapter 1</b>	<b>General information about the sector concerned</b> It provides recent general information about the landfills (as defined in Article 2(g) of Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste, receiving more than 10 tonnes of waste per day or with a total capacity exceeding 25 000 tonnes, excluding landfills of inert waste) in terms of numbers and size of installations, geographical distribution, production capacity and economics.
<b>Chapter 2</b>	<b>Applied processes and techniques</b> Brief description of the processes currently applied in landfills and 'directly associated activities' along with an indication of the techniques used to prevent and reduce emissions. The description will be aided by diagrams or flow charts.
Section 2.1	Hazardous landfills
Section 2.2	Non-hazardous landfills: municipal landfills.
Section 2.3	Non-hazardous landfills: other than municipal landfills.
<b>Chapter 3</b>	<b>Current emission and consumption levels</b>
<b>Chapter 4</b>	<b>Techniques to consider in the determination of BAT and emerging techniques</b>
<b>Chapter 5</b>	<b>BAT conclusions (including emerging techniques)</b>
Section 5.1	Generic BAT conclusions
Section 5.2	Specific BAT conclusions
Section 5.3	Emerging techniques
<b>Chapter 6</b>	<b>Concluding remarks and recommendations for future work</b>
<b>Glossary</b>	
<b>References</b>	
<b>Annexes</b>	
<b>Summary of initial information, feedback and views collected through the frontloading process</b>	
<ul style="list-style-type: none"> <li>• 13 out of 31 stakeholders agree with the proposal, 10 partly agree and 8 disagree.</li> <li>• Several opinions against differentiating between municipal waste and other than municipal waste landfills were expressed [CEWEP, DE, EEB, ELA, FEAD, FI, FR, MWE, PL, SE, SK, ZWE].</li> <li>• Some proposals suggest having an after-care section [FI, DE] and a mono-landfill section [Cefic, CEWEP, BE, FEAD, PL].</li> <li>• The BAT reference document may differentiate between existing and new landfills. In particular, existing landfills that are already in the closure or after-care phase may be considered separately [DE].</li> </ul>	

<b>EU-BRITE assessment</b>	
<ul style="list-style-type: none"> <li>• One of the key factors influencing the environmental performance of non-hazardous waste landfills is the amount of organic waste in the landfill.</li> <li>• The preliminary structure of the BREF outlines the fundamental elements of the anticipated content. Recognising the variety and unique characteristics of different landfills and processes, it will be crucial that the questionnaire contains questions allowing to account for this variety (e.g. age of the landfill, type and amount of waste, etc.). This will be defined during the questionnaire development. Based on the data collected and exchanges within the TWG, a more comprehensive structure will be developed at a later stage (i.e. drafting of D1). This detailed elaboration will occur during the drafting phase.</li> </ul>	
<b>EU-BRITE proposal</b>	
To amend the original EU-BRITE proposal as follows:	
<ul style="list-style-type: none"> <li>• To use the structure (and contents) presented below for drawing up the LAN BREF.</li> </ul>	
<b>General information on the BREF content</b>	Main findings from all chapters
<b>Preface</b>	Tailored for LANDFILLS
<b>Scope</b>	<p>Describes as precisely as possible which type of landfills and underground deposits are covered by the document. Also the activities and operations involved.</p> <p>This section will also indicate activities/processes which are intentionally excluded from the scope of the BREF, while providing the reasons for such exclusions. It will also mention the main ‘directly associated’ activities covered by the document, even when these are not Annex I activities themselves.</p> <p>The relevance of other BREFs will be mentioned when considered necessary, by cross-referencing these relevant BREFs.</p>
<b>Chapter 1</b>	<p><b>General information about the sector concerned</b></p> <p>It provides recent general information about the landfills (as defined in Article 2(g) of Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste, receiving more than 10 tonnes of waste per day or with a total capacity exceeding 25 000 tonnes, excluding landfills of inert waste) in terms of numbers and size of installations, geographical distribution, production capacity and economics.</p>
<b>Chapter 2</b>	<p><b>Applied processes and techniques</b></p> <p>Brief description of the processes currently applied in landfills and ‘directly associated activities’ along with an indication of the techniques used to prevent and reduce emissions. The description will be aided by diagrams or flow charts.</p>
Section 2.1	Landfills for non-hazardous waste (excluding underground landfills)
Section 2.1.1	Mono-landfills
Section 2.1.2	Landfills for waste with a low content of organic/biodegradable matter
Section 2.1.3	Landfills for waste with substantial content of organic/biodegradable matter
Section 2.2	Landfills for hazardous waste (excluding underground landfills)
Section 2.2.1	Landfills other than mono-landfills
Section 2.2.2	Mono-landfills
Section 2.3	Underground landfills
Section 2.4	After-care
<b>Chapter 3</b>	<b>Current emission and consumption levels</b>
<b>Chapter 4</b>	<b>Techniques to consider in the determination of BAT and emerging techniques</b>

<b>Chapter 5</b>	<b>BAT conclusions (including emerging techniques)</b>
Section 5.1	Generic BAT conclusions
Section 5.2	Specific BAT conclusions
Section 5.3	Emerging techniques
<b>Chapter 6</b>	<b>Concluding remarks and recommendations for future work</b>
<b>Glossary</b>	
<b>References</b>	
<b>Annexes</b>	
<b>Note:</b>	
The detailed structure and layout of the descriptive subsections of the BREF and related BAT conclusions will be decided when drafting D1, according to the landfill-specific data and bulk information collected.	

### 3.3 Normal operating conditions and other than normal operating conditions

<p><b>Initial EU-BRITE proposal</b></p> <p>111. EU-BRITE proposes to collect, during the BREF development process, information on ‘normal’ operating conditions and ‘other than normal’ operating conditions for the landfilling operations under the scope of the LAN BREF.</p> <p>112. EU-BRITE proposes the TWG identify, during the BREF development process, ‘normal’ and ‘other than normal’ operating conditions for the different landfilling operations under the scope of the LAN BREF.</p>
<p><b>Summary of initial information, feedback and views collected through the frontloading process</b></p> <ul style="list-style-type: none"> <li>• 21 out of 29 stakeholders agree with the proposal, 5 partly agree and 3 disagree.</li> <li>• Several stakeholders consider that the proposal is adequate [AT, CZ, EEB, FR, IT, PT, SK] and could provide a solid basis for efficient management, operational planning and risk mitigation [ES] while others consider that it is not relevant [EUROFER, DE].</li> <li>• Some other than normal operations conditions could be derived from maintenance activities, malfunctions, or emergency events [CZ].</li> </ul>
<p><b>EU-BRITE assessment</b></p> <ul style="list-style-type: none"> <li>• In order to understand the overall emissions and performance of landfills, all operational conditions for the different landfilling operations under the scope of the LAN BREF should be identified.</li> <li>• The BAT-AELs and BAT-AEPLs should reflect emission and performance levels which are obtainable when applying BAT under normal operating conditions.</li> <li>• BAT conclusions may also address ‘other than normal’ operating conditions when these are considered of concern with respect to environmental protection. ‘Other than normal’ operating conditions may be identified for each landfilling operation, where relevant, and it may be described how this ‘other than normal’ operating condition will affect emissions and performance and which technique could be applied to prevent or reduce impacts.</li> </ul>
<p><b>EU-BRITE proposal</b></p> <p>To confirm the EU-BRITE proposal as follows:</p> <ul style="list-style-type: none"> <li>• To collect information on ‘normal’ operating conditions and ‘other than normal’ operating conditions for the landfilling operations under the scope of the LAN BREF.</li> <li>• The TWG to identify ‘normal’ and ‘other than normal’ operating conditions for the different landfilling operations under the scope of the LAN BREF.</li> </ul>

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## 3.4 Information and data collection

The data collection exercise seeks information on current emission and consumption levels, and other environmental performance indicators and operational data related to a specific technique. Techniques to be considered in the determination of BAT should ensure that, to the extent possible:

- collected data reflect the current situation of the landfilling sector;
- emission and consumption data are provided with sufficient background information in a format that will facilitate assessment in order to determine BAT and, if possible, BAT-AELs and BAT-AEPLs.

This section includes the following steps:

- identification of well-performing landfills;
- data collection procedure (questionnaire design and filling-in);
- bulk information collection.

### 3.4.1 Data collection procedure (questionnaire design)

<b>Initial EU-BRITE proposal</b>
151. EU-BRITE proposes to follow the established BREF process for the collection of site/plant-specific data via questionnaires including the following: <ul style="list-style-type: none"><li>• the preparation of the draft questionnaire by EU-BRITE followed by the commenting of the TWG;</li><li>• the organisation of a questionnaire workshop to finalise the questionnaire;</li><li>• the testing of the draft final questionnaire by a selected (small) number of sites;</li><li>• the preparation of the final questionnaire by EU-BRITE;</li><li>• the distribution of the final questionnaire through Member States' representatives;</li><li>• the filling in of the questionnaires by the well-performing landfill' operators;</li><li>• the collection of the filled-in questionnaires by Member States' representatives;</li><li>• the quality check of the filled-in questionnaires by MS' representatives (possibly) with the help of a checklist;</li><li>• the submission of the quality-checked questionnaires to EU-BRITE by MS' representatives.</li></ul>
152. EU-BRITE proposes to collect data for the reference years 2024, 2023, 2022 or, if such data is not available, for the last 3 years for which data is available.
<b>Summary of initial information, feedback and views collected through the frontloading process</b>
<ul style="list-style-type: none"><li>• 25 out of 29 stakeholders agree with proposal 151 and 4 partly agree.</li><li>• 27 out of 29 stakeholders agree with proposal 152 and 2 partly agree.</li><li>• The stakeholders agree on the importance of the design of the questionnaire, to follow the KoM conclusions and the BREF Guidance on the process [SE] and considering CBI [ES, EUROFER, Eurometaux].</li></ul>
<b>EU-BRITE assessment</b>
<ul style="list-style-type: none"><li>• The content and format of the questionnaire will be addressed during the questionnaire design phase.</li><li>• The proposed procedure for the data collection is the same one that has been used in all recent BREFs (drawing up of new BREFs and updating/reviewing existing BREFs).</li><li>• The final questionnaire will be sent to, filled in by and returned by operators, followed by a first quality check of the filled-in data and information by the corresponding MS' representatives. This quality check by MS' representatives (foreseen in Section 4.2.2 of the</li></ul>

<p>BREF Guidance) is considered of paramount importance for the correct setting of BAT, BAT-AELs and BAT-AEPLs. The TWG could discuss and share experiences on best practices to ensure the data quality check, during the questionnaire development stage. This may also include the opportunity to outline the content and characteristics of the possible checklist(s) to be used by the competent authorities as useful tool(s) for the quality check.</p> <ul style="list-style-type: none"> <li>• The reference years for which data will be collected may take into account the following factors: <ul style="list-style-type: none"> <li>○ as per the BREF Guidance (Section 5.2.3), the data provided should be from recent years (especially emission and consumption data);</li> <li>○ the applied monitoring frequencies for the parameters concerned.</li> </ul> </li> </ul>
<b>EU-BRITE proposal</b>
<p>To slightly amend the original EU-BRITE proposal as follows:</p> <ul style="list-style-type: none"> <li>• To follow the established BREF process for the collection of landfill data via questionnaires including the following: <ul style="list-style-type: none"> <li>○ the preparation of the draft questionnaire by EU-BRITE followed by the commenting of the whole TWG, if necessary in several iterations;</li> <li>○ the organisation of a questionnaire workshop to finalise the questionnaire;</li> <li>○ the testing of the draft final questionnaire by a selected (small) number of landfills;</li> <li>○ the preparation of the final questionnaire by EU-BRITE;</li> <li>○ the distribution of the final questionnaire through Member States’ representatives;</li> <li>○ the filling in of the questionnaires by the landfill operators;</li> <li>○ the collection of the filled-in questionnaires by Member States’ representatives;</li> <li>○ the quality check of the filled-in questionnaires by Member States’ representatives (possibly) with the help of a checklist that the TWG and EU-BRITE could have developed;</li> <li>○ the submission of the quality-checked questionnaires to EU-BRITE by Member States’ representatives: <ul style="list-style-type: none"> <li>▪ for the non-confidential version: submission to the TWG via BATIS;</li> <li>▪ for the confidential version: submission to EU-BRITE via email;</li> </ul> </li> <li>○ the TWG decides on the content and format of the questionnaire during the preparation as described above.</li> </ul> </li> <li>• To collect data for the reference years 2024, 2023, 2022 or, if such data are not available, for the last 3 years for which data are available.</li> </ul>

### 3.4.2 Selection of well-performing landfills for the data collection

<b>Initial EU-BRITE proposal</b>
<p>141. EU-BRITE proposes that the TWG submit proposals, during the BREF development process, of well-performing (including best-performing) landfills to participate in the data collection.</p>
<b>Summary of initial information, feedback and views collected through the frontloading process</b>
<ul style="list-style-type: none"> <li>• 26 out of 30 stakeholders agree with the proposal and 4 partly agree.</li> <li>• Several stakeholders are willing to suggest well-performing landfills for data collection [MWE, EUROFER, HWE, AT].</li> <li>• A transparent understanding of what is meant by ‘well-performing’ is deemed necessary to ensure a consistent selection of landfill installations for data collection [FEAD, ELA].</li> <li>• The selection of landfill installations for data collection may represent a variety of landfills, including average and well-performing sites, to ensure that the sector is correctly represented [DE, CEWEP, IT].</li> <li>• The intention is to collect data from a range of sites, including well-performing ones, to highlight Best Available Techniques (BAT), rather than solely relying on data from best-performing sites [EEB].</li> </ul>

- Some stakeholders suggested that identifying best-performing landfills may be a heavy task and could lead to cherry-picking [Eurometaux], and may not be representative of the entire sector [NO].

**EU-BRITE assessment**

- For the purposes of data collection, TWG members are asked to propose well-performing (including best-performing) landfills.
- The LAN BREF may include performance data from environmentally well-performing landfills, detailing emissions, resource consumption and waste generation. This information will be accompanied by relevant contextual details required for the BREF chapters on ‘Techniques to consider in the determination of BAT’ and ‘Best available techniques (BAT) conclusions’, as specified in Section 5.4 of the BREF Guidance.

**EU-BRITE proposal**

To confirm the EU-BRITE proposal as follows:

- The TWG to submit proposals, during the BREF development process, of well-performing (including best-performing) landfill installations to participate in the data collection.

### 3.4.3 Expression of BAT-AELs for emissions to air and water

In order to evaluate the environmental performance of techniques (or combinations of techniques), landfill-specific data on emissions and/or on the abatement efficiency of applied techniques need to be collected during the drawing up of the LAN BREF.

The choice of the units (e.g. mg/Nm<sup>3</sup>, mg/l, g/t) to be used in the BAT conclusions for expressing BAT-AELs in the LAN BREF has a strong implication for the data collection. The TWG should agree during the development of the questionnaire on the units to be used so that the data collection can be done effectively to provide the necessary data for the assessment of the techniques to consider in the determination of BAT (i.e. ‘BAT candidates’) and for the appropriate derivation of BAT conclusions including the relevant BAT-AELs.

**Initial EU-BRITE proposal**

There was no initial proposal from EU-BRITE regarding this issue.

**Summary of initial information, feedback and views collected through the frontloading process**

- There was no initial information, feedback and views from TWG, as there was no initial proposal from EU-BRITE.
- The TWG has not shared any information or views on this matter through their contributions.

**EU-BRITE assessment**

- In recent BREFs, for emissions to air and water, units expressed as concentration of pollutant (e.g. mg/Nm<sup>3</sup>) are mainly used but load units have also been used in some cases.
- During the frontloading process the TWG was asked about the units used in monitoring emissions. This information will be used when drafting the questionnaire.
- The contextual information that needs to be collected in order to have a better understanding of data on emissions is proposed to be defined during the drafting of the questionnaire (see Section 3.4). A non-exhaustive list of such parameters/characteristics includes the process type and its main operational parameters, operating regime, process boundaries, applied integrated techniques and applied abatement techniques.
- A possible distinction between major and minor emission sources may take into consideration the particularities of the landfills concerned, mainly in terms of applied processes and expected level of emissions. This is an aspect that may be further discussed during the questionnaire development stage.

**EU-BRITE proposal**

To introduce a new EU-BRITE proposal as follows:

- To generally express BAT-AELs for emissions to air and to water in concentrations, and/or if deemed appropriate as specific loads and/or coupled with abatement efficiencies.
- To include in the data collection the information needed to evaluate emission loads, abatement efficiencies or specific energy consumption.
- During the drafting of the questionnaire(s), to clearly define all parameters influencing emission concentrations, loads or abatement efficiencies.

### 3.4.3.1 Averaging periods for BAT-AELs related to emissions to air

<b>Initial EU-BRITE proposal</b>
There was no initial proposal from EU-BRITE regarding this issue.
<b>Summary of initial information, feedback and views collected through the frontloading process</b>
<ul style="list-style-type: none"> <li>• There was no initial information, feedback and views from TWG, as there was no initial proposal from EU-BRITE.</li> <li>• The TWG has not shared any information or views on this matter through their contributions.</li> </ul>
<b>EU-BRITE assessment</b>
<ul style="list-style-type: none"> <li>• Collection of short-term emission data for setting BAT-AELs as short-term averages seems feasible.</li> <li>• The sampling time depends on the pollutant concentration in the emissions to air and on the measurement range of the analytical method used for analysis.</li> <li>• In a number of recent BREFs, averaging periods associated with BAT-AELs for emissions to air for periodic measurements are expressed as the average of three consecutive measurements of at least 30 minutes each. For the case of continuous monitoring, daily averages have been set.</li> <li>• In recent BREFs, for emissions to air, units expressed as concentration of pollutant (e.g. mg/Nm<sup>3</sup>) are mainly used but load units have also been used in some cases.</li> <li>• During the frontloading process the TWG was asked about the averaging periods used in monitoring emissions. This information will be used when drafting the questionnaire.</li> <li>• The contextual information that needs to be collected in order to have a better understanding of data on emissions is proposed to be defined during the drafting of the questionnaire (see Section 3.4).</li> </ul>
<b>EU-BRITE proposal</b>
To introduce a new EU-BRITE proposal as follows: <ul style="list-style-type: none"> <li>• To generally express BAT-AELs as short-term averages, i.e. as daily averages (for continuous measurements) or as averages over the sampling period (for periodic measurements).</li> </ul>

### 3.4.3.2 Averaging periods for BAT-AELs related to emissions to water

<b>Initial EU-BRITE proposal</b>
There was no initial proposal from EU-BRITE regarding this issue.
<b>Summary of initial information, feedback and views collected through the frontloading process</b>
<ul style="list-style-type: none"> <li>• There was no initial information, feedback and views from TWG, as there was no initial proposal from EU-BRITE.</li> <li>• The TWG has not shared any information or views on this matter through their contributions.</li> </ul>
<b>EU-BRITE assessment</b>

<ul style="list-style-type: none"> <li>• Working hours (i.e. hours when the installation is discharging) could be taken into consideration by flow-weighting the average of flow-proportional composite samples collected over one day.</li> <li>• Short-term averages also seem common and available for data collection purposes.</li> <li>• As for a number of recent BREFs, in the case of batch discharges, average values over the release duration, taken as flow-proportional composite samples may be considered. In addition, time-proportional composite samples may also be considered provided that sufficient flow stability is achieved. Spot sampling may also be considered provided that the effluent is appropriately mixed and homogeneous.</li> <li>• In recent BREFs, for emissions to water, units expressed as concentration of pollutant (e.g. mg/Nm<sup>3</sup>) are mainly used but load units have also been used in some cases.</li> <li>• During the frontloading process the TWG was asked about the averaging periods used in monitoring emissions. This information will be used when drafting the questionnaire</li> <li>• The contextual information that needs to be collected in order to have a better understanding of data on emissions is proposed to be defined during the drafting of the questionnaire (see Section 3.4).</li> </ul>
<p><b>EU-BRITE proposal</b></p> <p>To introduce a new EU-BRITE proposal as follows:</p> <ul style="list-style-type: none"> <li>• To generally express BAT-AELs as daily averages, obtained via 24-hour flow-proportional composite samples and in the case of batch discharges as average values over the release duration obtained via flow-proportional composite samples. <ul style="list-style-type: none"> <li>○ To complement that: <ul style="list-style-type: none"> <li>▪ time-proportional composite samples may also be considered provided that sufficient flow stability is achieved;</li> <li>▪ spot sampling may also be considered provided that the effluent is appropriately mixed and homogeneous.</li> </ul> </li> </ul> </li> </ul>

### 3.4.4 Expression of BAT-AEPLs on consumption, resource efficiency, reuse of materials/water and residue generation

<p><b>Initial EU-BRITE proposal</b></p> <p>There was no initial proposal from EU-BRITE regarding this issue.</p>
<p><b>Summary of initial information, feedback and views collected through the frontloading process</b></p> <ul style="list-style-type: none"> <li>• There was no initial information, feedback and views from TWG, as there was no initial proposal from EU-BRITE.</li> <li>• The TWG has not shared any information or views on this matter through their contributions.</li> </ul>
<p><b>EU-BRITE assessment</b></p> <ul style="list-style-type: none"> <li>• Collection of appropriate data and contextual information may be needed for specific energy consumption, specific water and leachate management, chemicals and auxiliary materials consumption, residues generation, circular economy and energy consumption.</li> <li>• Information and relevant data on water recycling measures are also considered important to assess the overall performance of the landfill in terms of water consumption.</li> <li>• For the averaging period, yearly average is considered the most appropriate averaging period.</li> </ul>
<p><b>EU-BRITE proposal</b></p> <p>To introduce a new EU-BRITE proposal as follows:</p> <ul style="list-style-type: none"> <li>• To collect data on energy consumption expressed as specific energy consumption (ratio of total energy consumption divided by a suitable activity rate figure) on a yearly average basis.</li> <li>• To collect data on water consumption and reuse expressed as specific water consumption on a yearly average basis. These data may be complemented by data on specific water discharge (expressed as yearly averages).</li> </ul>

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- To collect data on waste water discharge expressed as specific waste water discharge on a yearly average basis.
  - To collect data on process chemicals consumption expressed as specific process chemical consumption on a yearly average basis.
  - To collect data on residue generation expressed as specific waste generation on a yearly basis.
  - The TWG to decide at the initial stage of the questionnaire development phase on key data features, e.g. operating parameters.

## 3.5 Confidentiality issues

Paragraph 2 of Article 13 of the revised IED provides the **procedures for the handling of information qualifying as confidential business information or commercially sensitive information, including conditions in relation to anonymisation** for certain categories of stakeholders, such as civil servants and other public employees representing Member States or Union agencies, as follows:

*Without prejudice to Union competition law, information considered to be confidential business information or commercially sensitive information shall only be shared with the Commission and, after having signed a confidentiality and non-disclosure agreement, with civil servants and other public employees representing Member States or Union agencies. Information shall be anonymised, in such a manner that it does not refer to a particular operator or installation, when shared with the other stakeholders involved in the exchange of information referred to in paragraph 1.*

*Non-anonymised information may only be shared in cases where anonymising the information would not allow an effective exchange of information on BAT in the context of drawing up, reviewing and, where necessary, updating BAT reference documents, with representatives of non-governmental organisations promoting the protection of human health or the environment and representatives of associations representing the relevant industrial sectors, as appropriate, and where such representatives of organisations and associations have signed a confidentiality and non-disclosure agreement.*

*The exchange of information considered to be confidential business information or commercially sensitive information shall remain strictly limited to what is technically required to draw up, review and, where necessary, update BAT reference documents, and such confidential business information or commercially sensitive information shall not be used for other purposes.*

If any information submitted to EU-BRITE is considered confidential, it should be clearly stated when submitting the information and it should therefore not be reported directly in the BREF.

Any data considered confidential which it is thought necessary to include in the BREF will subsequently be anonymised and included after prior agreement with the provider of the data.

<b>Initial EU-BRITE proposal</b>
121. EU-BRITE proposes during the BREF development process, not to consider data collected as CBI.
<b>Summary of initial information, feedback and views collected through the frontloading process</b>
<ul style="list-style-type: none"> <li>• 15 out of 30 stakeholders agree with the proposal, 8 partly agree and 8 disagree.</li> <li>• Confidentiality of data is not relevant for the landfill sector in the same way it is for other sectors, as much of the data is already public [FEAD, IT].</li> <li>• Emission data are not generally considered to be CBI, but production volumes associated with certain industrial processes, such as steel production, may be considered confidential [SE, EUROFER].</li> <li>• Confidentiality of data is respected, but it is also acknowledged that some information, such as environmental performance data, may not be considered as CBI [HWE, MWE].</li> <li>• Data that are clearly highlighted as Confidential Business Information (CBI) are not to be considered for data collection and analysis, unless the landfill operator concerned allows it [AT, Cefic, CZ, Eurometaux, FEAD, FuelsEurope].</li> </ul>
<b>EU-BRITE assessment</b>
<ul style="list-style-type: none"> <li>• Point 2 of Article 13 of the revised IED provides the procedures for the handling of information qualifying as confidential business information or commercially sensitive information, including conditions in relation to anonymisation for certain categories of stakeholders.</li> <li>• In some cases, it might be possible to avoid the collection of confidential data by using drop-down menus with predefined ranges for the relevant parameter.</li> </ul>

- In the event that it is not possible to avoid the collection of CBI, this will be decided at the TWG level, early on during the questionnaire drafting phase.
- During the drawing up or review of recent BREFs, different practical solutions were followed for the collection and management of confidential information, such as:
  - the fields in the questionnaires containing data considered confidential may be marked with a different background colour; a separate sheet of the questionnaire may be used;
  - the questionnaire version containing the non-confidential information is posted onto BATIS whereas the questionnaire version containing the parts considered to be confidential may be submitted directly (and only) to the EU-BRITE via email and not shared with the whole TWG on BATIS.
- Experience from recent BREFs (e.g. WGC, SF, CER, STM and LVIC) shows that there are ways to overcome potential issues related to the access of TWG members to the CBI collected.

#### **EU-BRITE proposal**

To amend the original EU-BRITE proposal as follows:

- To design the questionnaire in a way that avoids requesting data considered CBI (confidential business information) as much as possible so that all data provided by operators can be posted directly onto BATIS by Member States' representatives and thus shared with the whole TWG.
- The TWG to decide during the questionnaire development phase about the type and format of potentially confidential information that needs to be collected.
- If certain data are considered CBI, the Member States' representatives in the TWG to:
  - submit the versions of the questionnaires containing the confidential information directly to the EU-BRITE via email, and
  - post the versions of the questionnaires containing the non-confidential information onto BATIS.
- The TWG to agree on the confidentiality and non-disclosure agreement to be signed for data collected as CBI to be discussed and analysed, so as to ensure the largest possible participation of TWG members, while protecting the legitimate economic interests of landfill operators and minimising the risk of disclosure.

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## 3.6 Site visits

<b>Initial EU-BRITE proposal</b>
161. EU-BRITE proposes that the TWG suggests landfills for site visits, during the BREF development process.
<b>Summary of initial information, feedback and views collected through the frontloading process</b>
<ul style="list-style-type: none"><li>• 26 out of 30 stakeholders agree with the proposal and 4 partly agree.</li><li>• Several stakeholders show their willingness to organise site visits [AT, BE, DE, ELA, EUROFER, MWE].</li></ul>
<b>EU-BRITE assessment</b>
<ul style="list-style-type: none"><li>• Site visits to landfills would be useful for the LAN BREF TWG. It would allow the participants to improve their general knowledge of the landfilling industry, of its key environmental aspects and of specific techniques through in situ observations and discussions with operators.</li><li>• Site visits also provide opportunities for the LAN BREF authors to stay in touch with the TWG members between official TWG meetings.</li><li>• To make the most efficient use of the LAN BREF TWG's and authors' time, sites where a wide range of operations and techniques are used will take precedence over sites where only one or few techniques are applied.</li></ul>
<b>EU-BRITE proposal</b>
To confirm the EU-BRITE proposal as follows: <ul style="list-style-type: none"><li>• The TWG to suggest landfills for site visits, during the BREF development process.</li></ul>

### 3.7 Emerging techniques (ET) and link with INCITE

<b>Initial EU-BRITE proposal</b>
91. EU-BRITE proposes to collect, during the BREF development process, information and performance data on emerging techniques (ET) applicable to the activities covered by the LAN BREF and associated with the KEIs to be agreed at the kick-off meeting (e.g. emissions to air and to water, consumption of energy, water, raw materials, decarbonisation, chemicals).
<b>Summary of initial information, feedback and views collected through the frontloading process</b>
<ul style="list-style-type: none"> <li>• 23 out of 29 stakeholders agree with the proposal, 6 partly agree.</li> <li>• Collecting information on emerging techniques during the BREF development process ensures that technological progress and innovation relevant to the KEIs is reflected. It helps to spot new solutions that could be future BAT, supporting continuous improvement and long-term environmental performance [BE].</li> <li>• As landfilling is not comparable with other production processes, it may only be considered if robust data linked to environmental performance is available [FEAD, MWE].</li> <li>• Some proposals have been made to consider landfill mining as an ET [AT, BE] and techniques for diffuse emissions measurement [AT, ES, FI].</li> </ul>
<b>EU-BRITE assessment</b>
<ul style="list-style-type: none"> <li>• The determination of ET is part of the information exchange, and it would be useful to collect information on ET applicable to the activities covered by the LAN BREF.</li> <li>• The Innovation Centre for Industrial Transformation and Emissions (INCITE)<sup>19</sup> collects and analyses information on innovative techniques, including emerging and transformative techniques, which contribute <i>inter alia</i> to minimisation of pollution, decarbonisation, resource efficiency and a circular economy using fewer or safer chemicals, relevant to activities within the scope of the IED. Emerging techniques relevant for INCITE should be at least at the level of TRL 6-7, namely technology demonstrated in a relevant environment (industrially relevant environment in the case of key enabling technologies) or in a system prototype demonstration in an operation environment. Therefore, INCITE may provide information on emerging techniques applicable in activities covered by the LAN BREF.</li> <li>• The proposal is generally supported as a principle.</li> <li>• Determination of ET, and potential associated levels, including the robustness of the data supporting these levels, will be part of the exchange of information within the TWG, also analysing information provided by INCITE if available.</li> </ul>
<b>EU-BRITE proposal</b>
<p>To confirm the EU-BRITE proposal as follows:</p> <ul style="list-style-type: none"> <li>• To collect information and performance data on emerging techniques (ET) applicable to the activities covered by the LAN BREF and associated with the KEIs to be agreed at the kick-off meeting (e.g. emissions to air and to water, consumption of energy, water, raw materials, decarbonisation, chemicals).</li> </ul>

<sup>19</sup> <https://innovation-centre-for-industrial-transformation.ec.europa.eu/>

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## 4 ANNEXES

### 4.1 Overview of the landfill sector

The **total number** of landfills in the EU and Norway falling under point 5.4 of Annex I to the IED, extracted from the EIEP<sup>20</sup>, is **around 2 658** (for the reporting year 2022).

Table 3, below, shows a breakdown of the total number of IED landfills per country, according to the status reported to the EIEP. In cases where data was unavailable, data from the frontloading process has been used [CZ, NO, SK].

**Table 3. Total number of IED functional landfills per Member State and Norway**

N	Member State (MS)	IED Landfills
1	Austria (AT)	151
2	Belgium (BE)	29
3	Bulgaria (BG)	82
4	Croatia (HR)	60
5	Cyprus (CY)	3
6	Czechia (CZ)	144
7	Denmark (DK)	140
8	Estonia (EE)	6
9	Finland (FI)	109
10	France (FR)	214
11	Germany (DE)	406
12	Greece (EL)	59
13	Hungary (HU)	119
14	Ireland (IE)	27
15	Italy (IT)	234
16	Latvia (LV)	12
17	Lithuania (LT)	12
18	Luxembourg (LU)	1
19	Malta (MT)	N/A
20	Netherlands (NL)	51
21	Poland (PL)	227
22	Norway (NO)	64
23	Portugal (PT)	55
24	Romania (RO)	61
25	Slovakia (SK)	78
26	Slovenia (SI)	18
27	Spain (ES)	199
28	Sweden (SE)	97
<b>Grand total</b>		<b>2658</b>

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<sup>20</sup> The EIEP provides information and data on emissions to air and to water for the following activity:

- 5(d) Landfills (excluding landfills of inert waste and landfills, which were definitely closed before 16.7.2001 or for which the after-care phase required by the competent authorities according to Article 13 of Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste has expired).

It should be noted that EIEP information does not distinguish between hazardous and non-hazardous waste landfills.

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## 4.2 Overview of the underground storages of hazardous waste sector

The total number of underground storages of hazardous waste in the EU falling under activity 5.6 of Annex I to the IED, extracted from the EIEP, is 3 (for the reporting year 2022)<sup>21</sup>.

Table 4, below, shows a breakdown of the total number of underground storages of hazardous waste per MS, according to the status reported to the EIEP and the frontloading information.

**Table 4. Total number of IED underground storages of hazardous waste per Member State reported in the EIEP [for the reporting year 2022]**

N	Member State (MS)	IED underground storages of hazardous waste
1	Finland (FI)	1
2	Greece (EL)	2
<b>Grand total</b>		<b>3</b>

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<sup>21</sup> DE has informed the EU-BRITE team that the two installations reported in the EIEP under activity 5.6 are incorrectly assigned.

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### 4.3 List of substances/chemicals proposed by the TWG

The TWG has identified through the frontloading the following substances/chemicals used in relevant landfill operations:

<b>Leachate and waste water treatment</b>
Flocculants (e.g. polymers, ferric chloride)
Coagulants (e.g. ferric chloride, calcium hydroxide)
Lime (CaO)
Activated carbon
Sulphuric acid (H <sub>2</sub> SO <sub>4</sub> )
Sodium hydroxide (NaOH)
Iron salts (e.g. ferric chloride, ferrous sulphate)
Advanced oxidants (e.g. Fenton's reagent)
Phosphoric acid
Defoamers
<b>Landfill gas management</b>
Activated carbon
Iron-based products (e.g. iron hydroxide)
Sodium hydroxide (NaOH)
<b>Odour control</b>
Activated carbon
Permanganate compounds
<b>Stabilisation, solidification and landfill capping</b>
Cement and clay-based stabilisers
Geosynthetic materials
Lime (CaO)
<b>Pest control</b>
Biocides (e.g. disinfectants (e.g. sodium hypochlorite))
<b>Other substances/chemicals</b>
Fuel and oils (for the machinery used for compaction, transportation, spreading of waste, etc.)
Anti-frothing agents (in biological treatment process)
Cleaning products (for reverse osmosis treatment plants)
Hydrochloric acid (HCl)
Nutrient additives (bioreactor landfill additives)

Please note that the 'Chemical frontloading phase' is currently ongoing, and a revised list of substances/chemicals used in landfill operations may be published at a later date.

## 4.4 List of auxiliary materials proposed by the TWG

The TWG has identified through the frontloading the following auxiliary materials used in relevant landfill operations:

<b>Geosynthetic materials</b>
Geomembranes (e.g. HDPE, LDPE)
Geotextiles
Geosynthetic clay liners
Bentonite mats
<b>Mineral materials</b>
Soil (e.g. clay, loam)
Gravel
Sand
Stone
<b>Construction materials</b>
Aggregates
Concrete
Asphalt
Steel slags
Construction and demolition waste fines
<b>Drainage and leachate collection materials</b>
Perforated pipes
Drainage gravel
Porous filter material (e.g. gravel)
Leachate collection system components
<b>Gas management materials</b>
Activated carbon filters
Gas wells
Perforated piping
Backfill for gas wells
<b>Capping and covering materials</b>
Clay layers
HDPE or LDPE geomembranes
Geotextiles
Protective soils
Daily and intermediate cover materials (e.g. excavated soil, bottom ash, alternative foams)
<b>Odour control and deodorising agents</b>
Spray additives
Biological neutralisers
Essential oils
<b>Waste water and leachate treatment materials</b>
Reagents (e.g. for coagulation, flocculation, pH correction)
Filters (e.g. membrane filters)
Reactors
Methanol (as a carbon source for microorganisms)
<b>Other materials</b>
Biomaterials (e.g. wood chips, poor quality compost)
Dust-binding agents
Fuel for mobile equipment
Materials for building roads and other structures needed to establish and operate the landfill

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## 4.5 List of residues proposed by the TWG

The TWG has identified through the frontloading the following list of residues generated in landfill operations:

<b>Leachate and waste water treatment residues</b>
Sludge from waste water/leachate treatment plants
Filter media or backwash water
Spent activated carbon
Screenings and debris from water systems
Residues from cleaning, drainage, or sedimentation systems
<b>Gas treatment residues</b>
Activated carbon and other materials from gas treatment system
Residues from maintenance and gas cleaning processes (e.g. cleaning of drainage ditches)
Spent activated carbon
Screenings and debris from gas systems
Residues from cleaning, drainage, or sedimentation systems
<b>Construction and maintenance residues</b>
Construction site residues
Materials from maintenance and cleaning of drainage ditches
Waste from maintenance activities
Geosynthetic and pipe offcuts
<b>Odour control residues</b>
Spent deodorisation agents
<b>Hazardous residues</b>
Contaminated containers and rags
Solvents
Engine maintenance waste (e.g. oils and antifreeze)
<b>Non-hazardous residues</b>
Vehicle parts
Packaging of chemical substances
Soil
<b>Non-compliant waste to be landfilled</b>
Mattresses
Tires
Rubble
Electronic waste
Batteries
Wood

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## 4.6 List of landfill operations that are the main energy consumers

The TWG has identified through the frontloading the following list of landfill operations as the primary energy consumers, along with the reasons for their high energy usage:

<b>Leachate and water management</b>
Extraction of leachate and groundwater (e.g. pumping)
Treatment systems for leachate and waste water (e.g. aeration, filtration, chemical dosing system)
<b>Landfill gas (LFG) management</b>
LFG collection (e.g. pumping)
LFG treatment (e.g. gas processing and cleaning, combustion and electricity generation)
<b>Monitoring</b>
Monitoring
<b>On-site transport</b>
Loading, hauling and downloading
<b>Waste disposal</b>
Spreading, compacting and covering
<b>Facilities management</b>
Site infrastructure security and lighting
<b>Odour control</b>
Biofilters with fans
Spray units

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## **4.7 List of techniques to reduce greenhouse gas emissions from the relevant landfill operations proposed by the TWG**

The TWG has identified through the frontloading the following list of techniques to reduce greenhouse gas emissions from relevant landfill operations:

- Aerobic and anaerobic bioreactors: Using bioreactors to accelerate waste decomposition and reduce methane production.
- Leachate recirculation: Recirculating leachate to enhance microbial activity and reduce methane production.
- Oxidative caps: Using oxidative caps to oxidise methane and reduce emissions.
- Methane-oxidising filters: Using methane-oxidising filters to reduce emissions.
- Bio-covers or composting filters: Using bio-covers or composting filters to oxidise methane and reduce emissions.
- Bio-windows: Using bio-windows to oxidise methane and reduce emissions.
- Geomembranes: Using geomembranes to prevent diffuse emissions.
- Gas upgrading systems: Using gas upgrading systems to extract CO<sub>2</sub> from captured landfill gas.
- Landfill gas capture and utilisation: Collecting and utilising landfill gas to produce, for example, electricity, heat, or biofuels.
- Flaring of landfill gas: Burning landfill gas to reduce methane emissions.
- Low-calorific flaring technology: Using technology to flare low-calorific landfill gas.
- Modelling of landfill gas formation: Using models to predict and manage landfill gas formation.
- Low-emission vehicles: Using low-emission vehicles on site to reduce indirect emissions.

Note that some of these techniques may be more effective or applicable in certain contexts or regions, and that a comprehensive approach to reducing greenhouse gas emissions from landfills may involve a combination of these techniques.