

## COMMUNICATION FROM THE COMMISSION

### European Commission Guidance concerning baseline reports under Article 22(2) of Directive 2010/75/EU on industrial emissions

(2014/C 136/03)

#### CONTENTS

1. Introduction	3
2. Objective of this guidance	4
3. Scope of this guidance	4
4. Legal provisions concerning a baseline report	4
4.1. Relevant text in the IED	4
4.2. Key words and phrases used in the IED	6
4.3. Landfill Directive	6
5. Stages in producing a baseline report	7
5.1. Stage 1: Identifying the hazardous substances that are currently used, produced or released at the installation	9
5.2. Stage 2: Identifying the relevant hazardous substances	9
5.3. Stage 3: Assessment of the site-specific pollution possibility	10
5.4. Stage 4: Site history	11
5.5. Stage 5: Environmental setting	12
5.6. Stage 6: Site characterisation	13
5.7. Stage 7: Site investigation	13
5.8. Stage 8: Production of the baseline report	15
Appendix – baseline investigation and report checklist	17

## 1. INTRODUCTION

Article 22(1) of Directive 2010/75/EU on industrial emissions (IED) provides that, ‘Without prejudice to Directive 2000/60/EC, Directive 2004/35/EC, Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration<sup>(1)</sup> and to relevant Union law on soil protection, the competent authority shall set permit conditions to ensure compliance with paragraphs 3 and 4 of this Article upon definitive cessation of activities’.

Article 22, paragraphs 2 to 4, contains provisions for the definitive cessation of activities involving the use, production or release of relevant hazardous substances in order to prevent and tackle potential soil and groundwater contamination from such substances. A key tool in this respect is the establishment of a ‘baseline report’. Where an activity involves the use, production or release of relevant hazardous substances and having regard to the possibility of soil and groundwater contamination, a baseline report is to be drawn up before starting the operation of the installation or before a permit for the installation is updated for the first time after 7 January 2013. The report will form the basis for a comparison with the state of contamination upon definitive cessation of activities. Where information produced pursuant to other national or Union law reflects the state at the time the report is drawn up, that information may be included in, or attached to, the baseline report.

Article 3(19) of the IED clarifies that the baseline report needs to provide information on the state of soil and groundwater contamination by relevant hazardous substances.

<sup>(1)</sup> OJ L 372, 27.12.2006, p. 19.

Article 22(2) specifies that a baseline report should contain at least the following information:

- '(a) information on the present use and, where available, on past uses of the site; and
- (b) where available, existing information on soil and groundwater measurements that reflect the state at the time the report is drawn up or, alternatively, new soil and groundwater measurements having regard to the possibility of soil and groundwater contamination by those hazardous substances to be used, produced or released by the installation concerned.'

According to the last subparagraph of Article 22(2) of the IED, 'the Commission shall establish guidance on the content of the baseline report.'

That guidance is established in the present Communication, for the Member States to use in the course of IED implementation. Likewise, the Commission will use it when assessing the information related to the baseline report in Member States' reports on the implementation of the IED.

It is considered that this guidance can generally be applied to all installations falling within the scope of Chapter II of the IED. However, it is important when deciding on the course of action for developing a baseline report at the installation level that consideration is given to the need for such a report to be as comprehensive as possible. It is in the operator's interest to ensure that the state of contamination of soil and groundwater identified in the baseline report is sufficiently detailed as this information will be used to determine which contamination has been added in the course of the operation of the installation concerned since the baseline has been established.

## 2. OBJECTIVE OF THIS GUIDANCE

This guidance aims to clarify in a practical manner the wording and intent of the IED so that Member States implement it in a consistent manner. However, it is not a legally binding interpretation of the IED. The only legally binding text remains that of the IED itself. Furthermore, an official interpretation of the IED can only be given by the European Court of Justice.

## 3. SCOPE OF THIS GUIDANCE

This guidance provides information on the legal provisions concerning a baseline report and covers the following elements of Article 22 of the IED that should be addressed in the baseline report:

- (i) Determining whether a baseline report is required to be produced;
- (ii) Designing baseline investigations;
- (iii) Designing a sampling strategy;
- (iv) Developing the baseline report.

This guidance does not cover those elements of Article 22 concerning actions required at the definitive cessation of activities as described in Article 22(3) and (4).

## 4. PROVISIONS REFERRING TO A BASELINE REPORT

### 4.1. Relevant text in the IED

The following key elements from the text of the IED are of relevance in relation to baseline reports.

#### *Article 3 – Definitions*

- (2) 'pollution' means the direct or indirect introduction, as a result of human activity, of substances, vibrations, heat or noise into air, water or land which may be harmful to human health or the quality of the environment, result in damage to material property, or impair or interfere with amenities and other legitimate uses of the environment;

(3) 'installation' means a stationary technical unit within which one or more activities listed in Annex I or in Part 1 of Annex VII are carried out, and any other directly associated activities on the same site which have a technical connection with the activities listed in those Annexes and which could have an effect on emissions and pollution;

(18) 'hazardous substances' means substances or mixtures as defined in Article 3 of Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures;

(19) 'baseline report' means information on the state of soil and groundwater contamination by relevant hazardous substances;

(20) 'groundwater' means groundwater as defined in point 2 of Article 2 of 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;

(21) 'soil' means the top layer of the Earth's crust situated between the bedrock and the surface. The soil is composed of mineral particles, organic matter, water, air and living organisms.

#### *Article 12 – Applications for permits*

(1) Member States shall take the necessary measures to ensure that an application for a permit includes a description of the following:

(d) the conditions of the site of the installation;

(e) where applicable, a baseline report in accordance with Article 22(2).

#### *Article 22 – Site closure*

(2) Where the activity involves the use, production or release of relevant hazardous substances and having regard to the possibility of soil and groundwater contamination at the site of the installation, the operator shall prepare and submit to the competent authority a baseline report before starting operation of an installation or before a permit for an installation is updated for the first time after 7 January 2013.

The baseline report shall contain the information necessary to determine the state of soil and groundwater contamination so as to make a quantified comparison with the state upon definitive cessation of activities.

The baseline report shall contain at least the following information:

(a) information on the present use and, where available, on past uses of the site;

(b) where available, existing information on soil and groundwater measurements that reflect the state at the time the report is drawn up or, alternatively, new soil and groundwater measurements having regard to the possibility of soil and groundwater contamination by those hazardous substances to be used, produced or released by the installation concerned.

Where information produced pursuant to other national or Union law fulfils the requirements of this paragraph that information may be included in, or attached to, the submitted baseline report.

The Commission shall establish guidance on the content of the baseline report.

(3) Upon definitive cessation of the activities, the operator shall assess the state of soil and groundwater contamination by relevant hazardous substances used, produced or released by the installation. Where the installation has caused significant pollution of soil or groundwater by relevant hazardous substances compared to the state established in the baseline report referred to in paragraph 2, the operator shall take the necessary measures to address that pollution so as to return the site to that state. For that purpose, the technical feasibility of such measures may be taken into account.

Without prejudice to the first subparagraph, upon definitive cessation of the activities, and where the contamination of soil and groundwater at the site poses a significant risk to human health or the environment as a result of the permitted activities carried out by the operator before the permit for the installation is updated for the first time after 7 January 2013 and taking into account the conditions of the site of the installation established in accordance with Article 12(1)(d), the operator shall take the necessary actions aimed at the removal, control, containment or reduction of relevant hazardous substances, so that the site, taking into account its current or approved future use, ceases to pose such a risk.

(4) Where the operator is not required to prepare a baseline report referred to in paragraph 2, the operator shall, upon definitive cessation of the activities, take the necessary actions aimed at the removal, control, containment or reduction of relevant hazardous substances, so that the site, taking into account its current or approved future use, ceases to pose any significant risk to human health or the environment due to the contamination of soil and groundwater as a result of the permitted activities and taking into account the conditions of the site of the installation established in accordance with Article 12(1)(d).

#### 4.2. Key words and phrases used in the IED

For the purpose of this guidance the following clarifications are provided to enhance understanding of the following terms used in the context of the IED.

**‘Relevant hazardous substances’** (Article 3(18) and Article 22(2), first subparagraph) are those substances or mixtures defined within Article 3 of Regulation (EC) No 1272/2008 on the classification, labelling and packaging of substances and mixtures (CLP Regulation) which, as a result of their hazardousness, mobility, persistence and biodegradability (as well as other characteristics), are capable of contaminating soil or groundwater and are used, produced and/or released by the installation.

**‘The possibility of soil and groundwater contamination at the site of the installation’** (Article 22(2), first subparagraph) covers a number of important elements. Firstly, due consideration should be given in a baseline report to the quantities of hazardous substances concerned – where very small quantities are used, produced or released on the site of the installation then the possibility of contamination is likely to be insignificant for the purpose of producing a baseline report. Secondly, baseline reports must consider the soil and groundwater characteristics of the site and the impact of those characteristics on the possibility of soil and groundwater contamination taking place. Thirdly, for existing installations, their characteristics may be considered where they are such that it is impossible in practice that contamination can take place.

The term **‘contamination’** is understood as being interchangeable with the term **‘pollution’** as defined in Article 3(2) of the IED.

**‘Quantified comparison’** (Article 22(2), second subparagraph) requires the ability for both the extent and degree of contamination to be compared between a baseline report and that at the time of the definitive cessation of activities. Solely qualitative comparisons are therefore excluded by the use of this term in Article 22(2). It is in the operator’s interest to ensure that quantification is sufficiently accurate and precise to enable a meaningful comparison at the definitive cessation of activities.

The **‘information necessary to determine the state of soil and groundwater contamination’** (Article 22(2), second subparagraph) is understood as including at least the following two elements:

- Information on the present use and, where available, on past uses of the site. In the context of this requirement, the term **‘where available’** should be understood as being accessible to the operator of the installation whilst having regard to the reliability of such information on past uses.
- Information on the concentrations in the soil and groundwater of those relevant hazardous substances that will be used, produced or released by the installation. Where known future developments at the site at the time the report is drawn up may result in additional hazardous substances being used, produced or released, it is advisable to include information on the concentrations in the soil and groundwater of those relevant hazardous substances as well. Where such information does not already exist, new measurements should be taken where there is a possibility of soil and groundwater contamination by those hazardous substances to be used, produced or released by the installation (see also above on the meaning of ‘Quantified’).

#### 4.3. Landfill Directive

Landfills represent a particular type of activity under the IED (Annex I, activity 5.4) as they are also covered by Council Directive 1999/31/EC on the landfill of waste (Landfill Directive). Article 1(2) of the Landfill Directive makes clear that for those landfills that are subject to the IPPC Directive (2008/1/EC), the relevant technical requirements are contained within the Landfill Directive and that the relevant technical requirements of the IPPC Directive are fulfilled when the Landfill Directive is complied with.

As the provisions of Article 22 of the IED were not included under the former IPPC Directive, it cannot be concluded that in case of landfills no baseline report would be required. The provisions of the Landfill Directive, in particular point 3 of its Annex I (general requirements concerning the protection of soil and groundwater) should ensure that no hazardous materials enter into the soil and groundwater. Furthermore, the Landfill Directive contains several useful elements for drawing up a baseline report, which should be complemented on a case-by-case basis. For the quantification of the soil and groundwater status, particular procedures and methods may be necessary to take account of the particular features of a landfill (lining). In case other directly associated activities take place on the site of a landfill, these may require by themselves that a baseline report has to be produced.

#### 5. STAGES IN PRODUCING A BASELINE REPORT

A number of key tasks should be undertaken to both determine whether a baseline report needs to be produced for a particular situation and in order to produce the baseline report itself.

Eight stages have been identified in this process, covering the following main elements:

Stages 1-3: to decide whether a baseline report is required;

Stages 4-7: to determine how a baseline report has to be prepared;

Stage 8: to determine the content of the report.

Where during stages 1-3 it is demonstrated on the basis of the available information that a baseline report is not required, there is no need to progress to the later stages. A record of such a demonstration should be made and held by the competent authority, including the reasons for such a decision.

It may be that an installation that is not required to produce a baseline report would make changes to the activities on site in the future such that a baseline report will be required, for example when hazardous substances are proposed to be included in a new process for the first time. In that case, the need to produce a baseline report in connection with the update of the permit shall be reassessed in line with this guidance.

Where possible, use should be made of existing information for completing stages 1 to 5.

In some cases, information supplied in accordance with the requirements of Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment may be usefully used to inform elements of the baseline report.

Also, the following sources of information might be of relevance for drawing up the baseline report:

- information gathered in the context of Directive 2012/18/EU of the European Parliament and of the Council of 4 July 2012 on the control of major-accident hazards involving dangerous substances (Seveso III Directive), in particular in relation to stage 4;
- information included in the BAT reference documents, especially the one on Emissions from Storage, in particular in relation to stages 6 and 7.

However, where this is not possible new information should be collected.

Whilst the stages are numbered 1-8 for ease of reference, it is possible for the stages to be undertaken in a different order or simultaneously.

Table 5.1

**Main stages of preparing the baseline report**

Stage	Activity	Objective
1.	Identify which hazardous substances are used, produced or released at the installation and produce a list of these hazardous substances.	Determine whether or not hazardous substances are used, produced or released in view of deciding on the need to prepare and submit a baseline report.
2.	Identify which of the hazardous substances from Stage 1 are 'relevant hazardous substances' (see Section 4.2).  Discard those hazardous substances that are incapable of contaminating soil or groundwater. Justify and record the decisions taken to exclude certain hazardous substances.	To restrict further consideration to only the <b>relevant</b> hazardous substances in view of deciding on the need to prepare and submit a baseline report.
3.	For each relevant hazardous substance brought forward from Stage 2, identify the actual possibility for soil or groundwater contamination at the site of the installation, including the probability of releases and their consequences, and taking particular account of:  — the quantities of each hazardous substance or groups of similar hazardous substances concerned;  — how and where hazardous substances are stored, used and to be transported around the installation;  — where they pose a risk to be released;  — In case of existing installations also the measures that have been adopted to ensure that it is impossible in practice that contamination of soil or groundwater takes place.	To identify which of the relevant hazardous substances represent a potential pollution risk at the site based on the likelihood of releases of such substances occurring.  For these substances, information must be included in the baseline report.
4.	Provide a site history. Consider available data and information:  — In relation to the present use of the site, and on emissions of hazardous substances which have occurred and which may give rise to pollution. In particular, consider accidents or incidents, drips or spills from routine operations, changes in operational practice, site surfacing, changes in the hazardous substances used.  — Previous uses of the site that may have resulted in the release of hazardous substances, be they the same as those used, produced or released by the existing installation, or different ones.  Review of previous investigation reports may assist in compiling this data.	Identify potential sources which may have resulted in the hazardous substances identified in Stage 3 being already present on the site of the installation.

Stage	Activity	Objective
5.	Identify the site's environmental setting including: <ul style="list-style-type: none"> <li>— Topography;</li> <li>— Geology;</li> <li>— Direction of groundwater flow;</li> <li>— Other potential migration pathways such as drains and service channels;</li> <li>— Environmental aspects (e.g. particular habitats, species, protected areas etc.); and</li> <li>— Surrounding land use.</li> </ul>	Determine where hazardous substances may go if released and where to look for them. Also identify the environmental media and receptors that are potentially at risk and where there are other activities in the area which release the same hazardous substances and may cause them to migrate onto the site.
6.	Use the results of Stages 3 to 5 to describe the site, in particular demonstrating the location, type, extent and quantity of historic pollution and potential future emissions sources noting the strata and groundwater likely to be affected by those emissions – making links between sources of emissions, the pathways by which pollution may move and the receptors likely to be affected.	Identify the location, nature and extent of existing pollution on the site and to determine which strata and groundwater might be affected by such pollution. Compare with potential future emissions to see if areas are coincident.
7.	If there is sufficient information to quantify the state of soil and groundwater pollution by relevant hazardous substances on the basis of Stages (1) to (6) then go directly to Stage 8. If insufficient information exists then intrusive investigation of the site will be required in order to gather such information. The details of such investigation should be clarified with the competent authority.	Collect additional information as necessary to allow a quantified assessment of soil and groundwater pollution by relevant hazardous substances.
8.	Produce a baseline report for the installation that quantifies the state of soil and groundwater pollution by relevant hazardous substances.	Provide a baseline report in line with the IED.

Each of the 8 stages is explained in further detail below.

#### 5.1. Stage 1: Identifying the hazardous substances that are currently used, produced or released at the installation

Produce a list of all hazardous substances dealt with inside the installation boundary (either as raw materials, products, intermediaries, by-products, emissions or wastes). This should include all hazardous substances associated with both the IED Annex I activities and directly associated activities which have a technical connection to the activities carried out and which could have an effect on soil or groundwater pollution.

Where hazardous substances are listed under trade names the chemical constituents should also be identified. For mixtures or compounds the relative proportion of the largest constituent chemicals should be identified.

#### 5.2. Stage 2: Identifying the relevant hazardous substances

From the list produced in Stage 1, determine the potential pollution risk of each hazardous substance by considering its chemical and physical properties such as: composition, physical state (solid, liquid, and gas), solubility, toxicity, mobility, persistence, etc. This information should be used to determine whether or not the substance has the potential to cause pollution of soil and groundwater. The data, together with the rationale used to interpret it, should be presented so it is clear in the baseline report why substances have been excluded or included.

Where a group of substances display similar characteristics they may be considered together provided that justification for the grouping is given.

Sources of information may include the classification and labelling inventory which contains classification and labelling information on substances notified under Regulation (EC) No 1272/2008 (the CLP Regulation) and chemical information on substances registered under Regulation (EC) No 1907/2006 (the REACH Regulation). Other sources of information can also include the risk assessment reports for 141 chemicals under Council Regulation (EEC) No 793/93 (Existing Substances Regulation). All these sources can be found on the ECHA website <sup>(1)</sup>.

Where it is clear that the hazardous substances used, produced or released at the installation are incapable of causing contamination of soil and groundwater a baseline report does not need to be produced.

The identified relevant hazardous substances should be taken forward to Stage 3 for further consideration.

### 5.3. Stage 3: Assessment of the site-specific pollution possibility

Each substance brought forward from Stage 2 should be considered in the context of the site to determine whether circumstances exist which may result in the release of the substance in sufficient quantities to represent a pollution risk, either as a result of a single emission or as a result of accumulation from multiple emissions.

Specific issues to be considered include:

- (i) The quantity of each hazardous substance handled, produced or emitted in relation to its environmental effects.

Caution must be exercised given that a continuous leakage of a limited quantity over a period of time may cause significant pollution. Where input-output information is held on hazardous substances this should be examined to determine possible emissions to soil and groundwater;

- (ii) The location of each hazardous substance on the site e.g. where it is or will be delivered, stored, used, moved around the site, emitted etc., in particular in view of the characteristics of the soil and groundwater at that part of the site;
- (iii) In case of existing installations: the presence and integrity of containment mechanisms, nature and condition of site surfacing, location of drains, services or other potential conduits for migration.

The method of storage, handling and use of relevant hazardous substances needs to be identified and whether there are any containment mechanisms to prevent emissions occurring; e.g. bunds, hard-standing, handling procedures.

A detailed physical inspection of the site is to be undertaken to verify the integrity and efficiency of the measures to prevent releases occurring.

Examples of the types of information to be gathered are:

- whether structures and site surfacing are cracked or damaged. Identify whether joints or cracks are present in the vicinity of potential emission points;
- whether there are signs of chemical attack to concrete surfaces;
- whether process drains are in good condition. Where safe to do so, inspect manholes, gullies and open drains;
- identify drainage routes, service corridors etc. and locate outfalls;
- identify signs of emissions already having been made, examine their nature and extent and consider the likelihood of emissions recurring;
- identify whether any direct or indirect emissions of hazardous substances to ground or groundwater occur on site.

Based on the above, the circumstances under which an emission to soil or groundwater may occur and the likelihood of such emissions should be described and the substances which may be emitted to the environment and result in a potential pollution risk should be identified.

<sup>(1)</sup> <http://echa.europa.eu/information-on-chemicals/>



Circumstances under which emissions may occur include:

**Accidents/Incidents** e.g. tanker overturning on site road; vessel rupturing; leaking underground tank; seal breaking; accidental discharge; leaks from drain ruptures; fire;

**Routine operations** e.g. drips during delivery or from pipe joints, small spills during decanting/transfer of product, leaks from blocked or broken drains, cracks in concrete hard-standing;

**Planned emissions** e.g. discharges to land or groundwater.

Where it is apparent that due to the quantities of the hazardous substances used, produced or released at the installation, or due to the soil and groundwater characteristics of the site there is no significant possibility for contamination of soil or groundwater, then a baseline report is not required.

In case of existing installations, where measures are taken which make it impossible in practice that contamination of soil or groundwater occurs, a baseline report is also not required.

Where, as a result of this stage, it is considered that a baseline report is not required it is still expected that a record of such a decision, including the reasons for the decision, will be made by the operator and further assessed and held by the competent authority.

#### 5.4. Stage 4: Site history

The purpose of this section is to determine which of the relevant hazardous substances identified by Stage 3 have the potential to be present on site in the soil and groundwater already as a result of activities to date and to determine whether they are coincident with potential future emission points.

The site history should consider both (i) the history of the site prior to development of the current/proposed installation and (ii) the operational history of the current/proposed installation as follows:

- (i) List the former uses of the site from green field to development of the proposed installation. Identify whether these uses are likely to have involved any of the relevant hazardous substances identified in Stage 3. If so, where were they likely to have been handled, what is the likelihood of emissions to soil/groundwater having occurred and what remediation, if any, has been undertaken? Where available, site specific data should be used.
- (ii) For an installation which is already operational at the time of producing a baseline report, what is the likelihood of emissions having occurred during the history of operations at the site? Specific points worth considering are:
  - Location, nature and extent of accidents, incidents, or direct discharges made historically (permitted or otherwise) which might have caused a release of relevant hazardous substances to soil or groundwater
  - What changes or improvements have been made to the process, chemicals handled, storage locations, disposal methods etc. and why? For example, were they as a result of a previous incident, accident, near miss etc., were they made to reduce the risk of emissions, to improve efficiency, reduce waste etc. Do they indicate emissions may have occurred?
  - Maintenance records – do these show good integrity for drains, tanks, bunds, pipelines etc.? Have they been kept since the start of the activity or were they introduced recently?
  - Details of site investigations undertaken previously and remedial works carried out.
  - Physical inspection data gathered during Stage 3 may also provide information on the presence of staining, evidence of corrosion, presence of new surfacing, etc.

### 5.5. Stage 5: Environmental setting

As a result of Stages 1-4 the locations on the site are identified where future emissions could occur and where emissions may already have occurred. Stage 5 aims to determine the fate of any such emissions, the strata and groundwater which may be affected and to establish the extent and depth to which the land needs to be characterised. This requires an understanding of the characteristics of the ground and groundwater at of the site as well as the surrounding areas that may influence the site of the installation itself.

Where available, site specific data should be used. When not available use reference data, qualitative/subjective assessment, inferred or extrapolated data. In each case the source of the data should be identified, and where this is not site specific justification for the use of the selected data and include details of any margins of error which apply.

In considering the site characteristics the following data should be collated:

#### **Topography**

Local topography and type of ground surface (concrete, open ground etc.) in the vicinity of each emission point will dictate the immediate effect of any emissions, as will the location of the emission in relation to the ground surface (e.g. ground level, above ground, overhead pipe work, below ground level etc.).

The type and slope of the ground surface can be shown on a site plan. In addition, the base of banded compounds, pits etc. relative to the surrounding ground level should be clearly identified, particularly where they are below ground level (either in part or in full).

#### **Geology and Hydrogeology**

Provide a description of the soil and rock strata beneath the site and the physico-chemical properties of each strata which may influence the fate and transport of substances through the ground.

Identify whether groundwaters (including perched waters) are present, or are likely to be present, in each of the strata and, where known, indicate the hydraulic gradient.

Provide an indication of what the soil and groundwater properties mean in terms of the movement of substances through the ground.

A simple summary of the data, rather than a full geotechnical description, is sufficient in the report, further details can be provided or made available for future reference as required.

In addition, this should draw together all available information to present the overall site conditions, rather than separating out published geology and hydrogeology from previous investigation findings and current investigation findings.

#### **Hydrology**

Indicate the presence of surface water features, their direction of flow, quality/classification and location of bed depth relative to the site surface. Provide an indication of how each water body might be affected by emissions from the site.

#### **Man-made pathways**

Identify man-made pathways, service corridors, drains, mines etc., which may act as migration routes for hazardous substances and identify the likely migration direction remembering that this may be against the natural topographic or hydraulic gradient.

#### **Surrounding land use and interdependencies**

Identify surrounding land use to determine industries/activities, especially those up gradient, which may handle the same or similar substances, and may cause pollution to migrate onto the site. In terms of pollution migration on to the site at the time of surrender of the permit it is for the operator to demonstrate that they have not caused pollution whilst operating. It is, therefore, important to know if adjacent properties could be a source of the same or similar pollutants.

### 5.6. Stage 6: Site characterisation

A description of the site should in particular demonstrate the location, type, extent and quantity of historic pollution and potential future emissions sources noting the strata and groundwater likely to be affected by those emissions

Models can be useful in this context allowing links to be made between sources of emissions, the pathways by which pollution may move and the receptors likely to be affected. Bringing together different pieces of information should help to understand better what risks there might be to both the environment and human health from contamination.

A conceptual site model is a representation setting out both the existing levels of pollution and possible future pollution sources for a given area of land. This can be produced using the information obtained in Stages 3-5. This is likely to comprise existing information and, to a lesser extent new information that is not related to Stage 7 below. Where the operator proposes to use existing information in order to inform the development of a conceptual site model, the reliability, accuracy and appropriateness of the data should be considered.

Rather than provide a single general model of the site, either as a drawing, or text, it may be preferable to produce more detailed individual models for each area of concern at the installation. For example, a conceptual model of the area around a tank, which could indicate the construction of the bund, the direction of slope of the ground, whether fill points are inside or outside the bund, the type of surfacing around the area, and the underlying geology and water table. This information would then be used to suggest where any relevant hazardous substances that are released may end up.

The nature and complexity of conceptual site models will vary by site and by the activity or activities undertaken.

### 5.7. Stage 7: Site investigation

If there is sufficient information from Stages 1-6 to characterise the site both laterally and vertically and to allow the baseline status in terms of quantified levels of pollution of soil and groundwater by relevant hazardous substances to be defined, then go directly to Stage 8. When choosing to use existing information the operator, in providing it, and competent authority, in assessing it, need to be aware of the uncertainty and risk associated with using such data. Such risks include:

- historic data failing to take adequate account of releases of relevant hazardous substances that may have taken place in the period since the original data was collected;
- historic data failing to take account of all relevant hazardous substances but rather focussing on a proportion of the relevant hazardous substances; and
- historic data failing to take into account changes in the activities undertaken on site since its original collection that may have resulted in changes to the hazardous substances used, produced or released from the installation.

The best way of ensuring that data is comprehensive is to ensure the method of determination as well as analysis are clearly established and communicated. In the case of existing installations, where the reliability and quality of historic soil state information cannot be established (for example because the results are based on out of date methods or were incomplete) the most suitable course of action is to re-take the measurements.

Where only part of the site can be characterised or there is insufficient information on which to formulate a baseline report then additional information should be obtained by site investigation. New measurement, whether taken prior to commissioning or as a result of a permit review, is the best method of obtaining a baseline on the state of the soil and groundwater.

## Sampling strategy

Where it is established that new measurements will be needed, consideration of suitable sampling strategies i.e. the way in which new measurements of soil and groundwater will be undertaken, is required. For choosing the most appropriate strategy, it is advisable to communicate between operator and competent authority.

Selected sampling strategies should provide sufficient confidence that measurements and samples taken accurately reflect the actual level of contamination by relevant hazardous substances so as to enable a determination of the current state and condition of the soil and groundwater. The baseline report should include the proposed method for assessing the contamination status of the site e.g. the statistical tests to be used and any ISO/CEN, or in their absence, national standards to be applied. In reporting the results of the baseline investigation, the approach to sampling as well as the methods of analysis need to be adequately described in the report. It follows that, when the site is assessed at the definitive cessation of activities, it will be necessary to use the same approach and either the same methods or methods which have been shown to produce comparable analytical performance.

Sampling strategies should:

- be focused on identified relevant hazardous substances and their hazardous degradation products and metabolites to be evaluated in respect of their physico-chemical properties in relation to the probability of contamination of the soil or the groundwater;
- take into account the hydrogeological and hydraulic conditions of the site. Suitable upstream/downstream measuring points must be reviewed prior to their establishment on the site of the installation. The possible dynamics in respect of directions of flow and fluctuations in the groundwater table should be taken into consideration in groundwater inspections;
- recognise the impact of natural and process-related influencing factors on the samples taken and the sampling strategy (place and method), contaminant linkage, heterogeneity of the pollutant distribution in the soil or in the groundwater, the handling of the sample between the time of obtaining it and its measurement and the measurements taken within the laboratory; and
- consider from the outset the capture of both the current state (including historic contamination) of pollution as well as the need for assessment of pollution at the definitive cessation of activities. Clear mapping and marking of the sampling points is a pre-requisite.

Either non-targeted sampling, targeted sampling or a combination of both is recommended. The selection must be made having regard to the site setting, conditions and local environment, including the nature and quantity of substances to be measured. A description of these approaches is provided below. Where a different sampling technique is proposed e.g. multi-incremental sampling, the level of reliability of results in comparison to non-targeted or targeted approach should be considered by both the operator and competent authority:

- (i) Targeted sampling — is focused sampling in zones of suspected pollutant concentrations (storage points, transshipment points or the like). As with non-targeted sampling, a prior decision is needed on what probability of detection is required, having regard to the costs involved.
- (ii) Non-targeted sampling — is typically sampling, which, with adequate data density, produces clear and unequivocal information about the average substance concentrations and about their range. Given that this approach looks to produce an accurate representation of the entire site by using uniform sampling over the entire installation the selection of sampling locations must not be influenced by external circumstances such as the existing buildings and use or suspected pollutant concentrations. Difficulties may be encountered when using non-targeted sampling for existing sites with respect to established structures, services and utilities.

This approach treats the site as an area of land requiring baseline data (i.e. the site is treated as a single entity and the layout of the installation or the specific risks posed by tanks, process plant etc. do not need to be taken into account). In adopting such an approach, a prior decision will be needed on what the probability of identifying pollution should be in each case, having regard to the inevitably higher number of samples and associated costs needed to provide higher probability.

### Uncertainties associated with soil and groundwater data

In respect of uncertainties associated with soil and groundwater data for both non-targeted and targeted sampling, there are two important elements to consider:

- (i) Groundwater baseline data collection: Groundwater conditions can change more quickly than soil conditions and groundwater quality is subject to change and variation due to factors external to the permitted process such as seasonal variation in groundwater level and quality, other pollution sources, migration of contaminant plumes, changes in pH value or the reduction and oxidation potential of the aquifer, heavy rainfall events etc. The sampling of more than one set of groundwater data in order to establish baseline state (e.g. a set of quarterly monitoring results covering a one year period as a minimum) can significantly improve the confidence with which an operator can report baseline state of the groundwater.
- (ii) Use of statistical data analysis techniques for assessing soil data: Statistical methods can assist in quantifying the uncertainty attached to estimates of the average or mean concentration of contaminants in soils and thereby provide a more informed basis for decision making by site assessors and regulators. Measured contaminant concentrations obtained during a site investigation can be compared against a user defined 'critical concentration' or indicator of risk.

If statistical methods are to be used then the data obtained during the investigation must be assessed to be suitable for this purpose (e.g. sufficient data from appropriate depths, locations and of consistent quality). Employing this approach requires a well-developed conceptual model, as described in Stage 6, which then informs the sampling strategy needed to collect data suitable for statistical analysis

### Analysis of samples

To ensure comparability of the baseline investigation results with those taken at a later date, validated methods of analysis should be applied (i.e. formal and documented proof that an analytical method is suitable for its intended purpose and is accurate and reproducible). Where CEN or ISO standards, or in their absence, national standards exist, these should be applied.

The essential requirement is that the analytical performance of methods used in compiling the baseline report and in assessing the site at definitive cessation be directly comparable with each other. It is particularly important that the scope and recovery of the determinant(s) in the method be directly comparable. Especially since laboratory best practice may change over time, it is paramount to ensure that the methods of analysis used are adequately described in order to inform future analysis as required under the IED.

It is possible that, following an investigation to collect baseline soil and groundwater data, further investigation could be needed e.g. if the investigation identified historic pollution (created as a result of the permitted activities or otherwise) requiring further delineation and remediation.

Following site investigation further or updated conceptual site models may be required as described under Stage 6.

### 5.8. Stage 8: Production of the baseline report

The purpose of this stage is to summarise all of the evaluated information collected in Stages 1-7 to produce a report which identifies the state of soil and groundwater contamination by relevant hazardous substances. The baseline report itself should provide an accurate and clear description about what data has been used to establish the state of the soil and groundwater, what methods have been used to sample and analyse the substrata and how the results have been verified, statistically or methodologically. It should, in essence, clearly outline a series of actions that are fully reproducible at site cessation together with the results so as to enable a quantified comparison. A checklist is included in the Appendix to this document for this purpose.

Where potentially polluting substances are present the baseline report should identify which strata or groundwater bodies they are associated with and describe their concentration, nature and extent. Providing a clear statement of which relevant hazardous substances are not present is just as important as identifying those which are.

The baseline report should:

- be presented in a logical and structured format;
- contain sufficient information to establish the scope and impact of the current activity or activities covered by the permit, including the dates of all relevant soil and groundwater measurements;
- provide a clear and accurate description of the approaches used and the results obtained by the assessment as well as the location of any intrusive works, wells, boreholes and other sampling points in accordance with a standardised geographic referencing system;
- provide a clear description of the analytical techniques used to establish the concentrations of hazardous substances in soil and groundwater with reference where appropriate to national or international standards used as well as any guidance provided by Member States that existed at the time of the investigation;
- state the scientific uncertainties and limitations of the approach taken in preparing the report;
- Include all relevant technical data (measurements, calibration certificates, analytical standards, accreditations, maps, sampling logs etc....) so as to ensure, at final cessation, a valid quantified comparison can be made.

Variation in the type, depth and presentation of baseline reports between different activities covered by the IED is anticipated and acceptable so long as it remains possible to determine adequately the state of soil and groundwater contamination by relevant hazardous substances at the time the report is assembled.

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## Appendix

**Baseline investigation and report checklist**

<p>DECIDING WHETHER A BASELINE REPORT IS REQUIRED</p> <p>Identification of the hazardous substances used, produced or released at the installation</p> <p>Assessment to identify those hazardous substances that are capable of contaminating soil or groundwater (relevant hazardous substances)</p> <p>Identification of the possibility of the relevant hazardous substances actually causing contamination</p> <p>Identification of any possible sources of historical contamination</p>
<p>DETAILS OF DATA COLLECTION</p> <p><b>Existing data</b></p> <p>Relevant plans of the installation (showing boundaries and key points of interest).</p> <p>Review and summary of previous reports, with report references</p> <p>Summary of any risk assessment carried out at the site of installation relevant for baseline data collection</p> <p><b>Site Investigation</b></p> <p>Rationale for investigation – may include list of potential contaminant sources relevant to each proposed investigation location</p> <p>Constraints applicable to the placement of site investigation locations</p> <p>Methods used for forming exploratory holes e.g. boreholes, trial pits, window samples</p> <p>Methods used for collecting, preserving and transporting samples to the analytical laboratory</p> <p><b>Sampling &amp; Monitoring</b></p> <p>Rationale for sampling strategy e.g. if targeted rationale of targets; if non-targeted justification for spacing and layout</p> <p>Description and explanation of monitoring programmes for groundwater and surface waters</p> <p>Details of monitoring and sampling including locations, depths, frequencies</p> <p><b>Analysis</b></p> <p>Rationale for selection of analytical methods</p> <p>Description and performance of analytical methods.</p>
<p>PRESENTATION &amp; INTERPRETATION OF DATA WITHIN TEXT OF REPORT</p> <p>Description of conditions encountered at the site, including groundwater regime and surface water features</p> <p>Summary tables of chemical analyses and site monitoring</p> <p>Description of type, nature and spatial distribution of contamination, with plans where appropriate</p> <p>Analysis of the data set and derivation of representative concentrations for individual contaminants to a suitable level of significance</p> <p>Evaluation of site investigation results against the outline conceptual model</p>

PRESENTATION OF RAW DATA (ANNEX TO REPORT)

Plan showing monitoring and sample point locations

Description of site works and on-site observations

Exploratory borehole, core or drilling logs

Details of response zone and other construction details of borehole monitoring installations

Monitoring results

Description of samples submitted for analysis

Relevant Quality Assurance/Quality Control data – this may include accreditations of staff, calibration certificates of equipment, laboratory accreditations (national and international standards)

Laboratory analytical reports, completed in accordance with the relevant QA/QC data, including relevant international analytical or test method standards.

Chain of custody records for sample and data collected