

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

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Contents

1.	Objective of this guidance.....	1
2.	Introduction.....	1
3.	Scope of this guidance	2
4.	Legislative background to the requirements for a baseline report	2
4.1.	Relevant text from the IED	2
4.2.	Clarification of relevant key words and phrases used in the IED.....	4
5.	Stages in producing a baseline report.....	5
5.1.1.	Stage 1: Identifying the hazardous substances that are currently used, produced or released at the installation	7
5.1.2.	Stage 2: Identifying the relevant hazardous substances, i.e. those which have the potential to cause soil and groundwater contamination	8
5.1.3.	Stage 3: Assessment of the site-specific pollution risk.....	8
5.1.4.	Stage 4: Site history	10
5.1.5.	Stage 5: Environmental setting	11
5.1.6.	Stage 6: Conceptual site model.....	12
5.1.7.	Stage 7: Site investigation.....	12
5.1.8.	Stage 8: Production of the baseline report	16
	Annex I – Baseline investigation and report checklist.....	17
	Annex II – Other relevant elements from Directive 2010/75/EU concerning the baseline report	18

1. OBJECTIVE OF THIS GUIDANCE

This guidance is intended to assist stakeholders by developing the wording and intent of Directive 2010/75/EU on industrial emissions (IED)¹ so that Member States implement it in a consistent manner. It is not a legally binding interpretation of the IED as the legally binding text remains that of Directive 2010/75/EU. Final judgments concerning the interpretation of the IED can only be made by the European Court of Justice.

2. INTRODUCTION

Article 22 of the IED 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 '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.

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

It is considered that this guidance can generally be applied to all installations falling within the scope 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 pollution has been added in the course of the operation of the installation concerned since the baseline has been established.

¹ OJ L 334, 17.12.2010

3. SCOPE OF THIS GUIDANCE

This guidance covers the following elements of Article 22 of the IED:

- i) The legislative background to the requirement for a baseline report;
- ii) Determining whether a baseline report is required to be produced;
- iii) Designing baseline investigations;
- iv) Designing a sampling strategy; and
- v) Development of 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. LEGISLATIVE BACKGROUND TO THE REQUIREMENTS FOR A BASELINE REPORT

4.1. Relevant text from the IED

The following key elements from the text of the IED are of greatest relevance in relation to baseline reports. Underlined terms are clarified in section 4.2. Other relevant IED text is included in Annex II to this guidance.

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. Clarification of relevant 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'** 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, according to evaluation by suitably qualified and experienced persons, as a result of their hazardousness, mobility, persistence and biodegradability (as well as other characteristics), are capable of contaminating soil or groundwater.

- **'the possibility of soil and groundwater contamination at the site of the installation'** in the context of Article 22(2) covers two 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.

- The term **'contamination'** while not defined in the IED, is understood as being interchangeable with the term **'pollution'** as defined in Article 3(2) of the IED.

- **'Quantified comparison'** in the context of Article 22(2) 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).

- The **'information necessary to determine the state of soil and groundwater contamination'** 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 data 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').

5. STAGES IN PRODUCING A BASELINE REPORT

The following key tasks should be undertaken to both determine whether a baseline report needs to be produced and in order to produce the baseline report itself. It should be noted that during stages 1-3 the available information may indicate that a baseline report is not required. In such cases there is no need to progress to the later stages, albeit that where such a decision is made during Stage 3 then a record of such a decision should be kept by the competent authority including the reasons for such a decision. Where possible, use should be made of existing information for completing stages 1 to 5. 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 stages 3, 4 and 5 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.	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. If yes: produce a list of all hazardous substances
2.	Identify which of the hazardous substances from Stage 1 which, according to evaluation by suitably qualified and experienced persons, as a result of their hazardousness in respect of toxicity, mobility, persistence and biodegradability (as well as other characteristics), are capable of contaminating soil or groundwater. 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 relevant hazardous substances that are capable of contaminating soil or groundwater in view of deciding on the need to prepare and submit a baseline report.
3.	For each relevant hazardous substance brought forward from	To identify which of the hazardous substances from Stage 2 represent a

	<p>Stage 2, identify the actual possibility for soil or groundwater contamination at the site of the installation, including the probability of releases and the consequences of releases, taking particular account of:</p> <ul style="list-style-type: none"> - the quantities of each hazardous substance concerned; - how and where they are stored; - how they are to be transported around the installation - how they are used - where they are emitted - measures that have been and, for new installations, will be adopted to protect soil and groundwater at the installation. 	<p>potential pollution risk at the site based on the likelihood of emissions of such substances occurring.</p> <p>These are the 'relevant' hazardous substances for which information must be included in the baseline report.</p> <p>Note: Where it is found that, due to the quantities of the hazardous substances used, produced or released, that there is no possibility of soil and groundwater contamination a baseline report does not need to be prepared or submitted. However, in those cases it is expected that a record of such a decision, including the reasons for the decision, will be made and held by the competent authority.</p>
4.	<p>Provide a site history. Consider:</p> <p>i) In relation to the present use of the site, collect information 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.</p> <p>ii) 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.</p> <p>Review of previous investigation reports may assist in compiling this data.</p>	<p>Identify potential sources which may have resulted in the relevant hazardous substances identified in Stage 3 being present on the site of the installation.</p>
5.	<p>Identify the site's environmental setting including:</p> <ul style="list-style-type: none"> - Topography; - Geology; - Direction of groundwater flow; - Other potential migration pathways such as drains and service channels; 	<p>Determine where hazardous substances may go if emitted 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</p>

	<ul style="list-style-type: none"> - Environmental aspects (e.g. particular habitats, species, protected areas etc); and - Surrounding land use. 	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 noting the strata and groundwater bodies 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 bodies 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 data exists then intrusive investigation of the site will be required in order to gather such information.	Collect additional data as is 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.

These stages are explained in further detail below.

It is clearly possible for an installation that is not required to produce a baseline report to 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. Where such changes are planned then the need to produce a baseline report must be reassessed in line with this guidance.

5.1.1. 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, wastes or auxiliaries). 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 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 main chemicals should be identified.

5.1.2. Stage 2: Identifying the relevant hazardous substances, i.e. those which have the potential to cause soil and groundwater contamination

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 inventory² which contains classification and labelling information on substances notified under Regulation (EC) No 1272/2008 (the CLP Regulation) and registered under Regulation (EC) No 1907/2006 (the REACH Regulation).

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.

Those substances identified as being a theoretical pollution risk should be taken forward to Stage 3 for further consideration.

5.1.3. Stage 3: Assessment of the site-specific pollution risk

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 per year relative to its toxicity;
- ii. The location of each hazardous substance on the site e.g. where it is delivered, stored, used, moved around the site, emitted etc.
- iii. At each of the above locations, identify the method of storage, handling and use of raw materials, products, emissions, wastes etc. and whether there are any containment mechanisms to prevent emissions occurring; e.g. bunds, hard-standing, handling procedures.

² <http://echa.europa.eu/regulations/clp/cl-inventory>

Where there are no containment mechanisms it is important to determine the likelihood of emissions to soil and groundwater.

iv. Undertake a detailed physical inspection of the site to determine the integrity of containment mechanisms, nature and condition of site surfacing, location of drains, services or other potential conduits for migration. Examples of the types of information which could 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.

Where an emission may occur either directly or due to an inadequacy or deterioration in a particular containment mechanism or procedure, determine the likelihood of emissions being made to soil or groundwater.

Based on the above, describe the circumstances under which an emission may occur e.g. as a result of:

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

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;

and identify which substances may be emitted to the environment and result in a potential pollution risk.

Information on the measures applied at the installation to protect soil and groundwater should be collected. In the case of new installations for which construction has yet to conclude, information on the planned measures should be identified.

Where it is apparent that due to the quantities of the hazardous substances used, produced or released at the installation there is no possibility for contamination of soil or groundwater, then the baseline report can be limited to information underpinning this conclusion.

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 and held by the competent authority.

5.1.4. 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 handled 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. However, where this is not available for a previous activity, make a subjective assessment and record an accordingly qualified response.

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.
- Site visual inspection data gathered during Stage 3 may also provide information on the presence of staining, evidence of corrosion, presence of new surfacing, etc.

5.1.5. 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 bodies 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 in the vicinity of the site.

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 bunded 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 movement 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.

Manmade pathways

Identify manmade 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 potential domino effect

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.

5.1.6. Stage 6: Conceptual site model

Produce conceptual models of the site 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. 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. Models can bring together different pieces of information to better understand what risks there might be of, and from, contamination to both the environment and human health. Where the operator proposes to use existing information in order to inform the development of a conceptual site model, consideration should be given as to the reliability, accuracy and appropriateness of the data having regard to its use in establishing model itself.

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.

5.1.7. 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 and competent authority need to make themselves aware of the uncertainty and risk associated with using such data. Such risks include:

- historic data failing to adequately take into account 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 new measurements will be required consideration of suitable sampling strategies i.e. the way in which new measurements of soil and groundwater, will be required.

Operators should select sampling strategies that 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 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. Only then, in the context of definitive cessation and the requirements set out in Article 22(3), can a quantified comparison be made between measured values that may be determined, under certain circumstances, with different methods.

Sampling strategies:

- Should be focused on identified relevant hazardous substances to be evaluated in respect of their physico-chemical properties in relation to the probability of contamination of the soil or the groundwater;
- Should 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;
- Should 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

- Should 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 should be applied. 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:

Non-targeted sampling – is typically deliberately untargeted sampling, which, when ensuring statistically adequate data density, produces representative 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). The data collection is typically done on a grid basis (although various sample patterns can be chosen such as herringbone, regular, stratified random) with the sample density and sample depths selected to ensure a specified probability of identifying pollution. It is expected that the confidence interval – the value with which one can be confident that the likelihood of capturing samples that provide an accurate representation of the actual groundwater and soil conditions and pollutants therein – should be at least 95% . This can result in a high number of samples being required, with an associated increase in the cost of the investigation (particularly where a large number of hazardous substances are used as this will increase individual sample costs).

Targeted sampling - is focused sampling in zones of suspected pollutant concentrations (storage points, transshipment points or the like), depending on the certainty attached to the results of the risk assessment, gives rise to an above-average probability of finding pollution. By virtue of its reliance on accurate analysis of risk of contamination being (either in the future or past) present, this sampling approach requires more effort in the preceding stages.

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:

1. 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 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. Statistical tests could be used to determine trends in concentrations of groundwater contaminants. Such benefits

should be seen in the context of the greater timescale and cost necessary to establish groundwater baseline state;

2. Use of statistical data analysis techniques for assessing soil data: Given the difficulties in measuring baseline levels of contaminants in soils due to the heterogeneity of most soils, statistics 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 statistics 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 and determination of the sample results

Modern laboratories and the applied techniques for chemical analysis can determine the presence and concentration of most substances; although for many of the substances falling within the CLP Regulation no standardised determination procedures presently exist. 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). Such procedures are generally standardised through adoption of specific regulations within Member States, as well as globally, and the quantitative measurement results, which depend on standardised determination procedures, are therefore typically comparable. Where CEN or ISO standards exist these should be applied.

Since laboratory best practice may change over time, there exists the potential for a procedure used in the baseline investigation to no longer correspond to the best practice upon definitive cessation of activities and may thus no longer be used for the report that will need to be produced in accordance with Article 22(3) of the IED. The inclusion, therefore, of expert insight and analysis in preparation of the baseline investigation is paramount to ensure that the methods of analysis used are adequately described in order to inform future analysis as required under the IED.

Due to the unseen nature of subsurface soils and groundwater and/or uncertainty over historic site activities and their location it is possible that following an investigation to collect baseline soil and groundwater data that 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. Where the operator chose to address this by immediate remediation (removal, containment or hazard reduction) prior to definitive cessation the baseline report would need to be updated with the new soil or groundwater data once remediation was complete.

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

5.1.8. Stage 8: Production of the baseline report

The purpose of this stage is to draw together (not reproduce) all of the 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 Annex A 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 as well as historic use (where information allows) including the dates of all and any relevant past 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 and accurate description of how data will be obtained at cessation of activities and how it will be compared to the baseline data (e.g. statistical tests to be used);
- Provide a clear description of the analytical techniques used to establish the concentrations of hazardous substances in soil and groundwater with reference to national or international standards used as well as any guidance provided by Member States that existed at the time of the investigation.
- Contain an evaluative narrative on the content in respect of the scientific uncertainties and limitations of the approach taken as well as the results obtained (particularly where existing data has been used to establish the baseline conditions).
- Include in full, relevant technical data (measurements, calibration certificates, analytical standards, accreditations, maps, sampling logs etc...) so as to ensure, at final cessation, a quantified comparison can be made having regard to the full facts about how the baseline state was technically established.

Variation in the type, depth and presentation of the data between different activities covered by the IED is anticipated and acceptable so long as it remains possible to determine the state of the soil and groundwater contamination by relevant hazardous substances from the information submitted.

ANNEX I – BASELINE INVESTIGATION AND REPORT CHECKLIST

	Essential (E) Optional (O)
PRELIMINARY REQUIREMENTS	
Identification of the environmental setting and pollution history of the installation	E
Identification of any possible sources of historical contamination	E
Identification of substances in, on or under the land, from materials currently used or produced by the activities under the permit (or are likely to be used or produced in the future) which may be a pollution risk	E
Relevant plans of the installation (showing boundaries and key points of interest).	E
Review and summary of previous reports, with report references	O
Summary of risk based requirements for baseline data collection	O
DETAILS OF DATA COLLECTION	
Site Investigation	
Rationale for investigation – may include list of potential contaminant sources relevant to each proposed investigation location	O
Constraints applicable to the placement of site investigation locations	O
Methods used for forming exploratory holes e.g. boreholes, trial pits, window samples	E
Methods used for collecting, preserving and transporting samples to the analytical laboratory	E
Sampling & Monitoring	
Rationale for sampling strategy e.g. if targeted rationale of targets; if non-targeted justification for spacing and layout	E
Description and explanation of monitoring programmes for groundwater and surface waters	E
Details of monitoring and sampling including locations, depths, frequencies	E
Analysis	
Rationale for selection of analytical parameters	E
Description of chemical analyses, in accordance with relevant national based accreditation schemes (if available)	E E
Quality assurance and quality control requirements for laboratory analyses	
PRESENTATION & INTERPRETATION OF DATA WITHIN TEXT OF REPORT	
Description of ground conditions encountered at the site, including groundwater regime and surface water features	E
Cross-sections showing site strata and shallow and deep groundwater levels	E
Summary tables of chemical analyses and site monitoring	O
Description of type, nature and spatial distribution of contamination, with plans where appropriate	E
Statistical analysis of the data set and derivation of representative concentrations for individual contaminants to a suitable level of statistical significance	E
Evaluation of site investigation results against the outline conceptual model	O
PRESENTATION OF RAW DATA (ANNEX TO REPORT)	
Plan showing monitoring and sample point locations	E
Description of site works and on-site observations	E
Exploratory borehole, core or drilling logs	E
Details of response zone and other construction details of borehole monitoring installations	E
Monitoring results	E
Description of samples submitted for analysis	E
Relevant Quality Assurance/Quality Control data – this may include accreditations of staff, calibration certificates of equipment, laboratory accreditations (national and international standards)	E
Laboratory analytical reports, completed in accordance with the relevant QA/QC data, including relevant international analytical or test method standards.	E
Chain of custody records for sample and data collected	E

ANNEX II – OTHER RELEVANT ELEMENTS FROM DIRECTIVE 2010/75/EU CONCERNING THE BASELINE REPORT

Recitals

(23) It is necessary to ensure that the operation of an installation does not lead to a deterioration of the quality of soil and groundwater. Permit conditions should, therefore, include appropriate measures to prevent emissions to soil and groundwater and regular surveillance of those measures to avoid leaks, spills, incidents or accidents occurring during the use of equipment and during storage. In order to detect possible soil and groundwater pollution at an early stage and, therefore, to take appropriate corrective measures before the pollution spreads, the monitoring of soil and groundwater for relevant hazardous substances is also necessary. When determining the frequency of monitoring, the type of prevention measures and the extent and occurrence of their surveillance may be considered.

(24) In order to ensure that the operation of an installation does not deteriorate the quality of soil and groundwater, it is necessary to establish, through a baseline report, the state of soil and groundwater contamination. The baseline report should be a practical tool that permits, as far as possible, a quantified comparison between the state of the site described in that report and the state of the site upon definitive cessation of activities, in order to ascertain whether a significant increase in pollution of soil or groundwater has taken place. The baseline report should, therefore, contain information making use of existing data on soil and groundwater measurements and historical data related to past uses of the site.

(25) In accordance with the polluter pays principle, when assessing the level of significance of the pollution of soil and groundwater caused by the operator which would trigger the obligation to return the site to the state described in the baseline report, Member States should take into account the permit conditions that have applied over the lifetime of the activity concerned, the pollution prevention measures adopted for the installation, and the relative increase in pollution compared to the contamination load identified in the baseline report. Liability regarding pollution not caused by the operator is a matter for relevant national law and, where applicable, other relevant Union law.

Article 3 - Definitions

(7) 'permit' means a written authorisation to operate all or part of an installation or combustion plant, waste incineration plant or waste co-incineration plant;

(15) 'operator' means any natural or legal person who operates or controls in whole or in part the installation or combustion plant, waste incineration plant or waste co-incineration plant or, where this is provided for in national law, to whom decisive economic power over the technical functioning of the installation or plant has been delegated;

Article 11 – General principles governing the basic obligations of the operator

Member States shall take the necessary measures to provide that installations are operated in accordance with the following principles:

(h) the necessary measures are taken upon definitive cessation of activities to avoid any risk of pollution and return the site of the operation to the satisfactory state defined in accordance with Article 22.

Article 14 – Permit conditions³

1. Member States shall ensure that the permit includes all measures necessary for compliance with the requirements of Articles 11 and 18. Those measures shall include at least the following:

(b) appropriate requirements ensuring protection of the soil and groundwater and measures concerning the monitoring and management of waste generated by the installation;

(e) appropriate requirements for the regular maintenance and surveillance of measures taken to prevent emissions to soil and groundwater pursuant to point (b) and appropriate requirements concerning the periodic monitoring of soil and groundwater in relation to relevant hazardous substances likely to be found on site and having regard to the possibility of soil and groundwater contamination at the site of the installation;

Article 16 – Monitoring requirements⁴

(2) The frequency of the periodic monitoring referred to in Article 14(1)(e) shall be determined by the competent authority in a permit for each individual installation or in general binding rules.

Without prejudice to the first subparagraph, periodic monitoring shall be carried out at least once every 5 years for groundwater and 10 years for soil, unless such monitoring is based on a systematic appraisal of the risk of contamination

³ Though this article does not actually reference the baseline report, it is likely that for most operators the monitoring locations, monitoring frequency and the design of soil and/or groundwater monitoring programmes during operations will be informed by the baseline report.

⁴ * Though this article does not actually reference the baseline report, it is likely that for most operators the monitoring locations, monitoring frequency and the design of soil and/or groundwater monitoring programmes during operations will be informed by the baseline report.