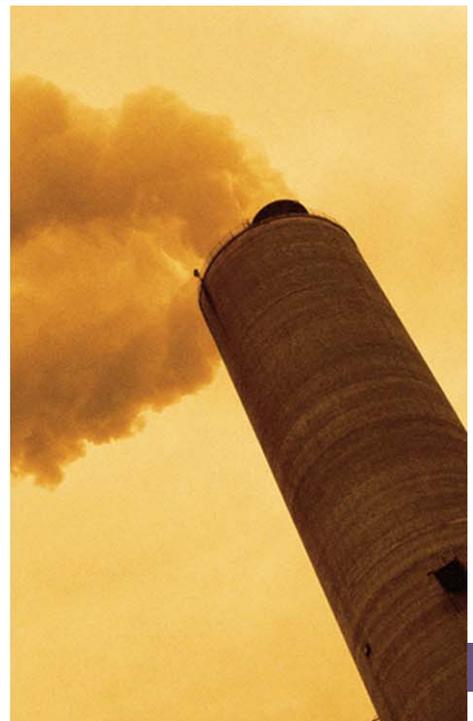


## European Commission

### Final Report

Collection and analysis of data to inform European Commission guidance on the content of the baseline report as required under Article 22(2) of Directive 2010/75/EU on industrial emissions (IED), and as defined in Article 3(19).



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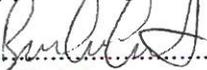
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August 2012



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# 1. Introduction

## 1.1 This report

This report has been produced as part of a series of studies brought together under the title “*Collection and analysis of data to inform certain reviews required under Directive 2010/75/EU on industrial emissions (IED) and to inform Commission Guidance on the content of the baseline report under Article 22 of the IED*” (contract number 070307/2011/600007/FRA/C3). This report specifically addresses “*gathering and analysing information to support the Commission in establishing guidance on the content of baseline reports as defined in Article 3(19) of the IED and as required under Article 22 of that Directive*”.

The purpose of this report is to provide information considered to be relevant in the development of Commission guidance on the content of the baseline report, the main purpose of which is to act as a practical tool to enable, as far as is possible, a comparison between the state of the soil and groundwater at the time the baseline report is drawn up and that at definitive cessation of the permitted activities on the site.

## 1.2 The Industrial Emissions Directive

The Commission published its proposal and an impact assessment for a Directive on industrial emissions (Industrial Emissions Integrated Pollution Prevention and Control, IED<sup>1</sup>) on 21<sup>st</sup> December 2007, which consolidated seven existing Directives related to industrial emissions into a single clear and coherent legislative instrument. These existing Directives included titanium dioxide industry related directives (78/176/EEC, 82/883/EEC, 92/112/EEC), the IPPC Directive (2008/1/EC, formerly 96/61/EC), the Solvent Emission Directive (1999/13/EC), the Waste Incineration Directive (2000/76/EC) and the LCP Directive (2001/80/EC). The Commission’s impact assessment<sup>2</sup> identified a number of problems related “(1) to shortcomings in the current legislation that lead to unsatisfactory implementation and difficulties in Community enforcement actions and, thereby, to loss of health and environmental benefits and (2) to the complexity and lack of coherence of parts of the current legal framework.”

The impact assessment and proposed Directive were informed by a series of studies undertaken over several years as part of the review of the IPPC Directive. Following agreement between Council and Parliament on 7 July 2010, the Directive (2010/75/EU) was formally adopted on 24 November 2010 and came into force on 7th January 2011.

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<sup>1</sup> “Proposal for a Directive of the European Parliament and of the Council on industrial emissions (integrated pollution prevention and control) (recast)”. European Commission, Brussels, 21<sup>st</sup> December 2007. Available from: <http://ec.europa.eu/environment/ippc/proposal.htm>

<sup>2</sup> “Commission Staff Working Document: Accompanying document to the Proposal for a Directive of the European Parliament and of the Council on industrial emissions (integrated pollution prevention and control) (recast). Impact Assessment.” European Commission, Brussels, 21<sup>st</sup> December 2007. Available from: <http://ec.europa.eu/environment/ippc/proposal.htm>

The Directive places a number of requirements on the European Commission to undertake additional actions over the coming years, one of which is to establish guidance on the content of the baseline report that is required in accordance with the provisions of Article 22(2) of the IED. There are a number of Articles within the IED that are relevant to this report as detailed in Table 1.1.

**Table 1.1 Elements of the IED of relevance to this report**

| IED Text  |
|---|
| <p><b>Recitals</b></p> <p>(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.</p> <p>(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.</p> <p>(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.</p> <p><b>Article 3 Definitions</b></p> <p>(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;</p> <p>(18) 'hazardous substances' means substances or mixtures defined in Article 3 of regulation 1272/2008 on classification, labelling and packaging of substances and mixtures;</p> <p>(19) 'baseline report' means information on the state of soil and groundwater contamination by relevant hazardous substances</p> <p>(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;</p> <p>(22) 'environmental inspection' means all actions, including site visits, monitoring of emissions and checks of internal reports and follow-up documents, verification of self-monitoring, checking of the techniques used and adequacy of the environment management of the installation, undertaken by or on behalf of the competent authority to check and promote compliance of installations with their permit conditions and, where necessary, to monitor their environmental impact;</p> <p><b>Article 12 Applications for Permits</b></p> <p>(1) Member States shall take the necessary measures to ensure that an application for a permit includes a description of the following:</p> <p><b>(d) the conditions of the site of the installation;</b></p> <p><b>(e) where applicable, a baseline report in accordance with Article 22(2);</b></p> <p><b>Article 14 Permit Conditions*</b></p> <p>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:</p> <p>(1)(b) appropriate requirements ensuring protection of the soil and groundwater and measures concerning the monitoring and management of waste generated by the installation;</p> <p>(1)(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;</p> |

## IED Text

### Article 16 Monitoring Requirements\*

(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.

### 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.

(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).

\* Though these articles do 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.

\*\* It is likely that the operator's approach to the baseline report and also the findings of the baseline report, along with ongoing monitoring reports, will have some bearing on the frequency of inspections by the regulator. It is also noted that the site visit frequency is to be risk based.

## 1.2.1 EU Legislative Context of the IED

The IED exists within the wider context of existing and planned directives for the protection of groundwater and soil at a European level. Table 1.2 details the most pertinent published and proposed EU legislation on the protection of groundwater and soil quality, which can be understood to be a relevant context within which the IED, and hence Commission guidance on the baseline report content, should be set.

**Table 1.2 EU Legislative Context of the IED in relation to Protection of Groundwater and Soil**

| Legislation  | Brief Description   |
|--|---|
| <b>EU Directives and Regulations currently in force</b>  |   |
| Water Framework Directive (WFD) 2000/60/EC   | Framework for the protection of water resources within the EU including groundwater – see below.  |
| Groundwater Directive (GD) 2006/118/EC   | <p>This directive establishes a regime which sets underground water quality standards and introduces measures to prevent or limit inputs of pollutants into groundwater. The directive establishes quality criteria that takes account local characteristics and allows for further improvements to be made based on monitoring data and new scientific knowledge. It relates to assessments on chemical status of groundwater and the identification and reversal of significant and sustained upward trends in pollutant concentrations. Member States will have to establish the standards at the most appropriate level and take into account local or regional conditions.</p> <p>The groundwater directive complements the Water Framework Directive. It requires:</p> <ul style="list-style-type: none"> <li>➤ groundwater quality standards to be established by the end of 2008;</li> <li>➤ pollution trend studies to be carried out by using existing data and data which is mandatory by the Water Framework Directive (referred to as "baseline level" data obtained in 2007-2008);</li> <li>➤ pollution trends to be reversed so that environmental objectives are achieved by 2015 by using the measures set out in the WFD;</li> <li>➤ measures to prevent or limit inputs of pollutants into groundwater to be operational so that WFD environmental objectives can be achieved by 2015;</li> <li>➤ reviews of technical provisions of the directive to be carried out in 2013 and every six years thereafter;</li> <li>➤ compliance with good chemical status criteria (based on EU standards of nitrates and pesticides and on threshold values established by Member States).</li> </ul> <p><b>Comment:</b> Groundwater monitoring and protection is required under IED and there is therefore some overlap with the GD. The concept of 'baseline level' for groundwater is introduced in the GD and monitoring by Member States is required to be adequate to detect significant and sustained upward trends in pollution.</p> |
| Environmental Liability Directive (ELD) 2004/35/EC   | <p>This directive is concerned with the prevention and remedying of environmental damage and establishes a framework based on the polluter pays principle, according to which the polluter pays when environmental damage occurs. This principle is already set out in the Treaty on the Functioning of the European Union (Article 191(2) TFEU). As the ELD deals with the "pure ecological damage", it is based on the powers and duties of public authorities ("administrative approach") as distinct from a civil liability system which is more appropriate for "traditional damage" (damage to property, economic loss, personal injury).</p> <p>The ELD makes reference to 'baseline condition' meaning the condition at the time of the damage of the natural resources and services that would have existed had the environmental damage not occurred, estimated on the basis of the best information available; where 'natural resource' means protected species and natural habitats, water and land.</p> <p><b>Comment:</b> Like the ELD, the IED is also founded upon the polluter pays principle. The IED requires Member States to take preventative measures to stop environmental damage occurring (and to require operators to provide information on any known or suspected imminent threats to the environment).</p>  |
| Regulation on Classification, Labelling & Packaging of Substances & Mixtures (CLP Regulations) 1272/2008 | <p>The United Nations Globally Harmonised System of Classification and Labelling of Chemicals (UN GHS) provides a basis for globally uniform physical, environmental, health and safety information on hazardous chemicals through the harmonisation of the criteria for their classification and labelling. It was developed at UN level with the aim of overcoming differing labelling information requirements on physical, health and environmental hazards for the same chemicals around the world. Moreover, it also aims to lower barriers to trade caused by the fact that every time a product was exported, it mostly had to be classified and labelled differently because of differing criteria.</p> <p>At the World Summit for Sustainable Development in Johannesburg 2002, the Commission, the EU Member States and stakeholders from industry and non-governmental organisations endorsed the UN recommendation to implement the GHS into domestic law by 2008. By means of a new Regulation, the EU aimed at lowering the non-tariff barriers to trade which were due to re-classification and re-labelling for the purpose of export to non-EU countries.</p> <p><b>Comment:</b> Under IED 'hazardous substances' means substances or mixtures as defined in Article 3 of</p>   |

| Legislation  | Brief Description   |
|--|---|
|  | 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.   |
| <b>Proposals</b>   |   |
| Commission Proposal for a Soil Framework Directive (proposed in the Thematic Strategy for Soil Protection COM(2006) 231) | <p>Though soil protection provisions exist within EU law, there is no specific EU legislation on soil protection. The 2006 Commission proposal for a Soil Directive aims at filling this gap and has the objective of establishing a common strategy for the protection and sustainable use of soil based on the principles of integration of soil concerns into other policies, preservation of soil functions within the context of sustainable use, prevention of threats to soil and mitigation of their effects, as well as restoration of degraded soils to a level of functionality consistent at least with the current and approved future use.</p> <p><b>Comment:</b> Soil monitoring is required under IED and there is therefore potential for overlap with the Soil Framework Directive, should this be ratified in the near to medium term.</p> |

### 1.3 The Baseline Report

Article 22 on site closure sets the key requirements, in particular the preparation of a baseline report (Article 22(2), which forms the focus of this study. The baseline report should be developed and submitted to the competent authority prior to commencement of operations, or for sites where a permit has already been issued, before that permit is updated for the first time after 7<sup>th</sup> January 2013.

*The baseline report (defined in Article 3(19)) should contain the information necessary to determine the state of the soil and groundwater prior to operations starting or before the first update of the permit after 7 January 2013 so as to allow, as far as is practical, a quantified comparison with the state upon definitive cessation of activities on the site (Article 22(3)).*

Where an operator has been required to prepare a baseline report because the installation uses, produces or releases relevant hazardous substances and there is a possibility of contamination of soil and groundwater by those substances, this will form the core of the comparative assessment between concentrations of hazardous substances in soil and groundwater at start-up (or before the permit is updated for the first time after 7 January 2013) and those at cessation.

As the IED sets obligations on the operator to return the site to the state outlined by the baseline report, where significant pollution has been caused, it is therefore in the interest of operators to establish as accurately as possible the baseline state so as to provide the best possible platform for future assessments upon definitive cessation. In the event of significant pollution having been caused, the operator will be required to take the necessary measures to address the pollution so as to ensure the site is returned to the 'baseline' state<sup>3</sup>.

The information provided in a baseline report on soil and groundwater measurements will also be used to establish, in the case of existing installations where relevant hazardous substances have been used by the permitted activities

<sup>3</sup> Such measures as may be necessary taking into account the technical feasibility of the measures.

prior to the preparation of the baseline report, whether any significant risk to human health or the environment exists 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. In this case and upon definitive cessation, the operator will be required (taking into account the condition of the site established in accordance with Article 12(1)(d)) to take action to remove, contain, control or reduce such risk in accordance with Article 22(3)(subparagraph 2).

The purpose of the baseline report is to document the state of the soil and groundwater prior to the commencement of permitted activities or, for existing installations, at the point in time the permit is first updated after 7 January 2013. It will act as a reference point for the operator to return the site to upon definitive cessation should future assessments indicate the installation has caused significant pollution by relevant hazardous substances in soil and/or groundwater.

Therefore, in summary, the baseline report should allow – through a quantified comparison – a determination to be made of whether there has been significant pollution of the soil and groundwater at the time of site closure relative to the baseline situation.

Making such determinations requires analysis of the risks and, where such risks exist, a determination of whether these are as a result of the permitted activities carried out by the operator. The determination of whether there is significant pollution or significant risk to human health or the environment has typically been a matter dealt with at the Member State level taking into account the wider context of the contaminated land regimes within the European Union<sup>4</sup>. The aspect of significant pollution, and in particular the test for significance, is not specifically relevant to the preparation of a baseline report required by Article 22(2) but there are important linkages that need to be recognised.

The information that should be presented in the baseline report relates to the physical and chemical characteristics of a defined area of land – the site of the installation - including both the soil and groundwater. Collection of this information should provide sufficient empirical evidence from which a determination of the baseline condition can be made. Supporting evidence including observations on parameters such as (but not limited to) visual and olfactory evidence of contamination, soil type and field screening for parameters such as volatile organic compounds may also be of relevance. The state of the soil should be evaluated primarily through its physical and chemical characteristics, which may be viewed in the context of additional factors such as potential background contaminants either natural or anthropogenic.

Where existing and sufficiently reliable information on soil and groundwater measurements that reflects the state at the time the baseline report is prepared is not available, operators will be required to make new measurements taking into account the possibility of contamination by the hazardous substances used, produced or released.

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<sup>4</sup> The test of significance, in the context of land contamination, can be established in law by Member States (i.e. absolute threshold values for significance set on a substance-by-substance basis) or law makers may choose to leave such judgements to be taken case-by-case by a regulatory agency or other competent authority. Any test of significant requires the site's environmental, geographical and geological factors to be taken into account, the concentrations, hazardousness and characteristics of the substances present as well as the likely exposure to receptors (environmental or human). The determination of significance is therefore requires a complex evaluation of a wide range of parameters and factors, and often requires expert judgement to ensure accuracy and validity.

Gathering such data is also necessary so as to understand if and what "historic" contamination there may have been on the site. Access to reliable and detailed information is important to ensure that the boundary between 'historic within the context of the permitted activities' and 'historic within the context of the site's use history' can be established. Such information is also useful beyond the boundary of the baseline report requirement; identifying pollution of soil or groundwater can help the operator to determine what, if any, targeted measures could be applied to reduce the risks of further pollution prior to final cessation and prepare or implement strategies to control further environmental degradation during operation thus limiting future requirements for the operator under Article 22(3) of the IED.

## 1.4 Study Considerations

As a key requirement of Directive 2008/1/EC (IPPC), many installation operators are likely to have gathered information on the condition of the site (as maintained under Article 12(1)(d) of IED). However, of the 52,000<sup>5</sup> IPPC installations permitted across Europe, there will be a substantial number not be using, producing or releasing relevant hazardous substances and of those that are, many are unlikely to have completed an assessment of the baseline conditions relating to soil and groundwater contamination in sufficient depth so as to allow a quantified comparison at definitive cessation.

In preparing a suitable method to determine the content and level of information to be provided within baseline report guidance, the following key data elements were considered to be of key importance and have therefore been prioritised:

- Contextual information which will inform the baseline reporting requirement under IED; including the use of baseline reports in the wider framework of contaminated land assessment;
- Methods for defining a sampling strategy and undertaking a baseline investigation taking into account the varying factors such as type of installation, hazardous substances used and site-specific soil and groundwater conditions;
- Other criteria that might inform the scope of a baseline report including the toxicity, eco-toxicity, dispersion characteristics and environmental fates of relevant hazardous substances at the site concerned, the sensitivity of the site specific environmental receptors and the presence of pollutant pathways, and the effectiveness of the pollution prevention measures and procedures employed by operators; and
- The sampling strategies that will determine the level of (statistical) confidence the operator or regulator can have as to the state of the soil and/or groundwater contamination at a site either at the time of establishing the baseline report or at cessation of operations.

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<sup>5</sup> Approximate figure 21 December 2007:

<http://europa.eu/rapid/pressReleasesAction.do?reference=IP/07/1985&format=HTML&aged=0&language=EN&guiLanguage=en>

In development of the main materials that could form core guidance, there was also a need to consider the relevant provisions that are needed in order to differentiate between new and existing installations and to determine what practicable courses of action the Commission can advise upon having regard to achieving the aims of the baseline report in a technically sound manner but without operators or Member States incurring excessive costs.

In developing the study method, it was necessary to understand the context that any guidance on the baseline report will be made within; one such parameter being the boundary of the baseline report and any activities that the operator will need to perform to facilitate development of the relevant information. In respect of 'site', the Commission's own analysis and guidance on the meaning of 'installation'<sup>6</sup> notes that this has been interpreted to mean a number of different things including geographic location, technical connection of processes, the physical installation fenced boundary and the area under ownership.

For the purposes of development of guidance on the baseline report and for coherence with other Community legislation, the definitions contained within the E-PRTR would appear to be the point of reference. This defines a "facility" as meaning one or more installations on the same site that are operated by the same natural or legal person, and defines "site" as meaning the geographical location of the facility. This suggests that an installation operates at a site – i.e. a geographical location – but is not necessarily the only thing at that site. The judgement on exactly what constitutes a site (i.e. taking into account the various technical connections of an installation and its directly associated activities) may need to be made by the relevant competent authority, however for the purposes of producing guidance on the baseline report, the following aspects are deemed relevant:

- The demarcation and definition of a site for the purposes of establishing the relevant area within which an assessment of the state of soil and groundwater contamination by relevant hazardous substances is made should not be constrained by physical barriers such as fences, roads, slipways or any other feature that breaks the continuity of the site boundaries. This is because pollution is not likely to respect such boundaries and could travel considerable distances from the point source;
- The directly associated activities on the site of the main annex I activity that are technically connected with such an activity or areas falling within the authority of a permit remain relevant to the definition of site when developing the baseline report (and should therefore feature within the boundary of assessment) on the basis that they produce, use or release hazardous substances or that release of such substances could feasibly travel from the point source to the technically connected facility/location; and
- Joint and several ownership of a site and therefore any imposed operational boundaries (whether physical or otherwise), should not be used to demarcate the boundary of assessment in respect of gathering such information as necessary to develop the baseline report.

Given the important role of the competent authority and any associated regulatory agency in ensuring the quality, consistency and accuracy of baseline reports and the information within them, it is considered at least prudent for these bodies to be involved the scoping of the assessment boundary prior to development of the baseline report and activities required to inform its production (e.g. the sampling strategy).

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<sup>6</sup> [http://ec.europa.eu/environment/air/pollutants/stationary/ippc/pdf/installation\\_guidance.pdf](http://ec.europa.eu/environment/air/pollutants/stationary/ippc/pdf/installation_guidance.pdf)

## 1.5 Key Definitions Relevant to this Report

The following terms are relevant to the concept of the baseline report and understanding regarding its development and future use.

- **Relevant hazardous substances** are those substances or mixtures defined within Article 3 of Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures, known as the “CLP Regulation”. The baseline report should focus on those relevant hazardous substances where, according to the evaluation by suitably qualified and experienced persons, at the ratio of their quantity and hazardousness in respect of toxicity, mobility, persistence and biodegradability (as well as other characteristics), are effectively capable of contaminating soil or groundwater. Therefore, the assessment of the state of the soil and groundwater for concentrations of all relevant hazardous substances that are used, produced or released in the installation, even in the smallest quantities, is not necessary if they cannot lead to soil and groundwater contamination<sup>7</sup>;
- The term ‘**significant**’, whilst implicit within Article 22(3) of the IED, is not directly relevant in the context of Article 22(2) on preparation of a baseline report.
- A harmonised definition of **contamination** has yet to be established within the European Union and as such the term should be understood and presented as being interchangeable with **pollution** for the purposes of developing Commission guidance on the baseline report (further discussion on this is presented in [Section 3.1](#)); and
- The **information necessary to determine the state of soil and groundwater contamination** is defined as:
  - Information on the present use and, where available, on past uses of the site. In the context of this requirement, where available can be defined as being accessible to the operator of the installation without a significant cost burden and having regard to the reliability of such data on past uses.
  - Information on the concentrations of those hazardous substances in the soil and groundwater that will be used, produced or released by the installation as well as any hazardous substances that might be used, produced or released given the known future development of the site at the time the report is drawn up. Where such information does not 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.

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<sup>7</sup> Definition adapted from a position paper by the German Scientific-Technical Association for Environmental Remediation and Brownfield Redevelopment (ITVA) on the closure-related obligations of Article 22 of Directive 2010/75/EU on industrial emissions (IED).

## 2. Information Relevant to the Study

Directive 2008/1/EC set requirements for operators to submit with their permit applications a report on the condition (Article 6(1)(d)) of the site as well as a requirement to return the site to a satisfactory state upon definitive cessation (Article 3(1)(f)). Such requirements, together with other wider-ranging environmental and land quality legislation has led to banks of knowledge and a review of available information together with consultation amongst Member States and with relevant stakeholders was considered appropriate in order to generate a picture of what is currently being done with respect to assessment of the soil and groundwater on IPPC sites.

Three main methods of data collection were employed in the gathering of information to support development of this report: web and paper-based research, direct communications (internally within AMEC plc and externally to industry bodies and experts) and a tailored questionnaire to Member States.

The following data gathering exercises were completed:

- The twenty-seven European Member States were invited to complete a proforma questionnaire focused on soil and groundwater reporting currently carried out under the requirements of the IPPC Directive and measures (current or proposed) being taken at Member State or regional level to comply with IED. A copy of the questionnaire is included in Appendix A;
- Other key stakeholders (contaminated land specialists) were contacted and invited to contribute information: CEFIC, CONCAWE, NICOLE, Eurometaux and Common Forum. The International Solid Wastes Association (ISWA) was also contacted and a review of ISWA publications was carried out by AMEC; and
- A literature review was carried out, the main sources of which are listed in Appendix B.

### 2.1 Findings from the information review

The literature review, which focused on impacts to groundwater and soil as a result of permitted industrial activities, highlighted that the terms ‘baseline’ or ‘baseline report’ in relation to land quality have different meanings in different contexts. Under IED ‘baseline report’ means ‘*information on the state of soil and groundwater contamination by relevant hazardous substances*’. This definition is general enough to be applicable to baseline reporting within the wider context of the contaminated land regime; however there is still room for different interpretations to be applied at a Member State level.

Guidance on baseline land quality reporting already exists within the EU; some within the IPPC regime operated by some Member States, but also in general contaminated land legislation, policy, and guidance within Member States and land transactions. The fact that many different applications and interpretations of ‘baseline report’ are possible even within individual Member States supports the need for suitably informative EU-wide guidance for the baseline report required under IED.

In the context of land quality there are a number of reasons, in addition to the requirements of the IED, as to why baseline reporting is necessary, such as:

- to understand, quantify or prioritise contaminated land liabilities;
- for due diligence purposes when a company seeks to acquire the operations of another organisation;
- for insurance or finance purposes, or;
- in the context of the ELD, where environmental damage to land has occurred.

### 2.1.1 Factors to consider in assessing the state of soil and groundwater contamination.

The baseline investigation should be designed such that the data collected for a particular area, zone or geological strata is considered representative to a suitable degree of statistical significance. This is important with regard to any comparison to future data that may be collected at specified points in time, including site closure at definitive cessation of the activities. Any variance between the baseline and future data will need to be considered as to whether it represents an increase in contaminant concentrations (possibly attributable to site operations) or merely a variance within statistical limits for the data set as a whole. The decision as to which of these reasons may be behind such variance will obviously have significant implications on the requirements of the permit holder at such a point. Consequently ensuring baseline data is representative, accurate and comparable is key to the assessment.

Establishment of a baseline through assessment of the state of the soil therefore requires physical collection of soil and groundwater data from the site, i.e. samples of the groundwater and soil to be actually taken at some point in time. There are a number of elements that contribute to the overall design of such an investigation; however it is recognised that derivation of a sampling and analysis strategy is key.

The main investigation to supply information for the baseline report should be comprised of, as far as is practical, a collection of all information necessary to characterise the state of the soil in terms of contaminants and other relevant parameters so as to provide comparable quantitative analysis and to refine and where necessary update any modelling that has been completed prior to the baseline investigation. Such modelling could include the conceptual model for the site, which is a desk-based analysis of the risk and impact of possible contamination scenarios taking into account the geography, hydrogeology and sub-strata (soil and ground) characteristics of the site. Such models are typically used to inform the scale of the risks from possible contamination and the design and planning of any intrusive site investigation (for example the sampling strategy, frequency and range of samples collected to ensure a representative spread based on the likely contamination scenarios). Such an investigation would typically include analysis and testing of soil, surface water and groundwater as appropriate. Other parameters used to refine the conceptual site model may also be appropriate (on a site-specific basis) including collection of particular groundwater parameters and groundwater levels.

The design of the investigation should first consider the objectives of the assessment and the nature of the site including potential future use of hazardous chemicals, historical usage, site layout and constraints. Once the initial objectives are determined it is important to clarify the following details;

- The type of investigation proposed, which may include consideration of a number of potential techniques required to collect soil or groundwater;
- The purposes for which samples are required (e.g. for chemical analysis or other tests);
- The locations from which samples are to be collected and the number of locations required;
- the number and type of samples to be collected (i.e. soil, water, gas) from each location, the depths at which they are to be collected; and
- Any monitoring requirements required outside the scope of the baseline report preparation.

Where data on the state of the soil does not exist or existing data is of insufficient quality, comparability and accuracy, sampling of the groundwater and soil at the site will be necessary. The selection of the sampling technique requires consideration of site-specific constraints such as location of structures and mobile plant, services or other such impediments. Consideration should also be made as to the analyses and tests to be carried out on each sample, and requirements for specifications such as limits of detection or particular forms of reporting,

At all times attention should be paid to the sufficiency and quality of the data, taking full account of the historical and current use(s), likely heterogeneity and underlying stratigraphy.

Locations for soil sampling should be selected based on one or both of the following approaches:

- a) targeted (judgmental) sampling, which focuses on known, suspected or point source areas of contamination - The benefits are a more cost effective means of assessing areas of greatest likelihood to have been affected by contamination. The data is however likely to show bias in that high concentrations associated with the source can only be said to be representative of the area of sampling and inferences cannot be made for the wider site area. Conversely however, dense sampling at known (or modelled) contamination 'hot-spots' can bring higher levels of quantified accuracy than non-targeted sampling, which provides greater site coverage but typically less sampling density than targeted.
- b) non-targeted sampling, which characterises the contamination status of a defined area or volume of a site or zone. This does produce a more representative data set for a wide area, however may be prone to omit discreet point sources of contamination, for example small yet concentrated patches of contamination. Managing this risk means taking samples at higher densities with shorter frequency intervals. However, the greater number of samples required the greater the cost of the investigation – here the operator and regulator must balance the cost effectiveness against the potential risk of collecting data that may not be fully representative. Limits of confidence are important to establish and these should be agreed with those determining the state or passing judgement on that determination, notably the regulatory agency or competent authority.

Although non-targeted sampling is likely to derive a data-set that is more representative of the site as a whole, the presence of site constraints such as services and plant based infrastructure, allied to the significant cost of obtaining samples over a wide area, may mean a targeted approach may be preferable in practice. Where site modelling indicates areas of differing use and possible soil contamination, zoning may be possible, with varying applications of the two sampling approaches applied variously to the different zones and identified source areas accordingly.

Interrogation of the data using application of appropriate statistical methods will help to identify outliers or results that may not be representative of the data set as a whole. Representative values within prescribed confidence limits can also be derived to further refine the conceptual site model

### 2.1.2 Key observations

The following points were deemed generally relevant to both a non-targeted and targeted approach to sampling – *the bracket indicates which stakeholders supported these views.*

- Despite having a well designed sampling programme using targeted, non-targeted or a combination of both methods, there are other factors that influence the overall level of precision and accuracy such as the contamination path and the 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 laboratory measurement / analysis itself. (*ITVA*);
- There are difficulties in accurately measuring soil baseline given the heterogeneous nature of most soils (e.g. noting that it is not possible to sample the same soil twice, also that later repeat sampling would ideally be a metre or more away from the original sample point to avoid sampling disturbed soils), leading to difficulties in comparing the condition at the start and end of activities and in deciding upon a sampling strategy. (*CEFIC, Common Forum, NICOLE, SAGTA, IMPEL Network*). Therefore careful sample design is necessary so as to ensure any measurements made at baseline are replicable at definitive cessation;
- Sampling points may be limited for existing sites (and new sites once built) in terms of access being possible for baseline investigations or later ongoing monitoring (e.g. height and width access issues for drilling rigs, presence of plant, pipes and buildings, cost to shutdown activities in order to collect samples, hazardous environments, buried services and pipes, avoiding drilling through bunds or sealed floors). (*NICOLE*);
- In order to be able to relocate the place of sampling, a fixed reference system (coordinate system in position and height) must be selected. The ground surface of the site, which changes over time, is not suitable in principle as a reference system. (*ITVA*);
- The sampling strategy for the baseline report determines the strategy for the report upon definitive cessation. If untargeted sampling (regular grid pattern) or targeted sampling is selected in the baseline report, this must also be selected in the report upon definitive cessation. (*ITVA*) This could present significant challenges where development on a site is ad-hoc over the lifetime of a permit – new structures, infrastructure or underground services could create potential difficulties in replication, the consequences being that there could be slightly higher risk of a less accurate result when a comparison to baseline is required on cessation;
- The UK and Netherlands systems, as originally set up for IPPC, intend that reference data is targeted at the areas of the site where there is a reasonable possibility that pollution of the land has or is likely to occur (taking into account the requirements of both Article 22(2) and 22(3)); and when this is in operational areas, the operator would be expected to design an investigation that takes access and physical restrictions into account and use appropriate techniques to minimise disruption and disturbance; specialists in both Member States confirmed that it was always possible to perform some investigation in these instances. (*VITO, BIO, IEEP and IVM*);

- Laboratory test methods change over time so the same soil samples tested at different times could show different results without any actual incremental pollution. (NICOLE);
- Groundwater wells and sampling boreholes that have been used for establishing baseline and/or ongoing monitoring can be damaged or destroyed or the area re-use for citing additional buildings. Installing replacement wells would result in samples being collected from different locations so that no direct comparison possible (NICOLE). It is however likely that any post start-up changes (i.e. new buildings) would require a variation to the permit and therefore discussion with the regulatory agency or competent authority. Fundamentals such as loss of sampling points or boreholes would be identified however the precise comparability at definitive cessation could be compromised; and
- The inspections that are carried out in the context of the baseline report form the basis for the stipulated quantified comparison of the soil and groundwater contamination in the event of the definitive cessation of activities. However, since these inspections are not able to predict the area affected by any accidents and major incidents or the transfer of a pollutant, it is crucial to consider to what extent any supplementary sampling areas are necessary in the context of the required evaluation of the status of the soil and groundwater inspections compared to the baseline report.

The following points were deemed relevant to the **non-targeted** approach to sampling – *the bracket indicates which stakeholders supported these views.*

- Provides the most statistically valid sampling results with the highest degree of confidence that all contamination by relevant hazardous substances has been captured as well as the most reliable analytical results. The time and effort invested in quantitative sampling will be of greater benefit to operators of sites with long histories, known significant historic contamination and where at present there is a lack of detail on the current state of soils and groundwater contamination;
- Does not require the same level of site-based risk assessment as the targeted approach in order to inform the sample design however there still remains the requirement to understand;
- Although a non-targeted approach is likely to yield the most accurate data on the whole site, this comes at a significant cost to the operator and in some cases a low cost-benefit ratio. In some instances, the cost of conducting sampling could be comparable the treatment and remediation costs. (CONCAWE, NICOLE, SAGTA, IMPEL Network);
- The timescales for non-targeted sampling and analysis to be completed are substantially greater than other methods and such intrusive investigations are more likely to be constrained on active sites (e.g. live underground services, risks to personnel due to hazardous processes, limited access to process areas due to above ground pipes and buildings). This point is particularly pertinent where an IPPC site is currently operational yet a baseline report has not been developed and as such will need to be prior to first permit update after January 2013; and
- Guidance exists in only some Member States on the sampling frequencies and layouts which can achieve a high level of confidence that any significant pollution has been identified at a site.

The following points were deemed relevant to the **targeted** approach to sampling – *the bracket indicates which stakeholders supported these views.*

- The targeted approach to assessing baseline conditions may result in a less comprehensive and reliable result when compared to the non-targeted approach albeit this will depend on the quality and

thoroughness of the risk analysis and assessment as well as how comprehensive data is on historical pollution and land uses and the quality of the information available on the present state of soil and groundwater contamination. The primary reason for this being a less robust method is that investigations are likely to be (and have historically been) targeted to areas of known or suspected historic leakage or spillage and areas where future spills are considered most likely;

- Arguably however, the targeted approach can provide sufficient information on soil and groundwater quality to enable a representative baseline to be drawn-up;
- There is a general preference towards a risk-based approach to characterising soil and groundwater quality using a targeted sampling strategy. The view from a number of relevant industry organisations is that such an approach has been used effectively across a range of contaminated land regimes and is established practice. (*CEFIC, CONCAWE, NICOLE*);
- A targeted approach based on an analysis of the risk of contamination is seen by regulators and industry in many countries as the best means of managing potential contaminated land issues and has been incorporated into government environmental regulations in the USA, Canada, Australia, New Zealand, the Netherlands and the UK. (*CONCAWE*);
- The costs associated with this approach are typically lower than for a non-targeted assessment of soil and groundwater contamination because quite often fewer physical samples are necessary to determine the presence and level of contamination as it is targeted towards specific zones or areas. Timescales are also typically shorter as fewer samples are required and therefore less analysis is necessary;
- The development of the conceptual site model and design of the sampling strategy in order to gather information on the characteristics of the soil and groundwater requires careful design. The success (and therefore the accuracy and reliability of the results) rely on the quality of the information used in assessing the risks of contamination and hence the points at which sampling will be made. Sites with lower quality, unreliable or patchy information on the historic uses and/or pollution at a site will be more susceptible to inaccuracies creeping into the sampling and the results of the analysis thereof; and
- Unreliable or patchy data poses risks for operators given the provisions of Article 22(3). Where contamination existed at the time of the production of the baseline report that was not identified in that report, operators may find themselves liable to address pollution that may have been caused as a result of previous activities on the site that were not the responsibility of the operator. In such cases the burden of proof will fall on the operator to demonstrate that the pollution was historical in nature and was not caused by the operator themselves.

### 2.1.3 Hazardous Substances

Article 22(2) requires that the scope of the baseline report be focused on any relevant hazardous substances (defined in Article 3(18) of the IED with reference to the CLP Regulation) where it can be established, in conjunction with the subsequent closure of an installation, those substances can be present in the soil and/or groundwater subject to two tests:

- 1) That such hazardous substances are used, produced or released (covering future as well as current and past in the case of existing installations) in the course of the activities of the installation; and
- 2) There exists the possibility of soil or groundwater contamination by such hazardous substances.

Therefore, a basic prerequisite for the obligation to prepare a baseline report is that it has been possible to establish that in both these two tests, a positive answer is determined.

This therefore makes the analysis of possibility (as well as probability) a particularly important task within the scoping stage (during permit application preparation for new installations or as part of preparing an update to the permit for the first time after 7 January 2013 for existing installations). This assessment and analysis of risk is something that many industrial operators will be familiar with simply because it is a techniques used not only in assessment of contaminated land post-closure but also it is used in health and safety, operational safety and many other applications. Further consideration is made as to how the Commission might address this area in Section 3.1 of this report.

Commission guidance should therefore be clear and obvious about the importance of the steps to be taken by the operator to ensure sufficient consideration is given to achieving as precise an understanding as is practical about the possibility of contamination from future activities and – having regard to the provisions set out in Article 22(3)(subparagraph 2) – past activities, where these were carried out by the operator before any relevant update after 7 January 2013.

In any guidance produced, the review of information indicates that in respect of scoping the baseline report, there needs to be sufficient clarity around the fact that operators need not consider those substances for which the possibility of contamination of the soil or the groundwater does not or cannot exist (or in the case of existing installation has not existed) in the first place. This burden of proof on the operator to do this is already in existence generally in industrial contaminated land assessment. In addition, the guidance should make clear that the definition of hazardous substance as afforded by Article 3(18) does not include a waste, as defined in Directive 2006/12/EC on waste, is not a substance, mixture or article (considered relevant in so far as Article 1 (scope) and Article 2 (definitions) of Regulation 1272/2008 on classification, labelling and packaging), and is, therefore, not considered for the purpose of Article 22 of the IED to be included, even if it meets the relevant criteria for hazardousness.

## 2.2 Review of BAT Reference Documents

A high level review of the adopted BAT Reference documents (BREFs) was carried out to identify those sectors where guidance on the assessment of soil and groundwater was provided under IPPC. Details on the observations made as a result of these summary reviews is included in Appendix B. In summary, the majority of sectoral BREFs, as adopted under IPPC, do not currently provide guidance which would inform the development of baseline report guidance in the context of IED, although some exceptions are noted. Groundwater is generally mentioned along with soil as an environmental receptor that should be protected through the use of BAT for pollution prevention measures and particularly at site decommissioning stage.

## 2.3 Review of information provided by Member States

Responses from Member States to the questionnaire on baseline reports (Appendix A) were extremely positive with returns being received from the following twenty one Member States: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, Germany, Hungary, Ireland, Italy, Latvia, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain and the United Kingdom. Table 2.1 summarises the more pertinent responses from Member States regarding development of guidance on baseline reports.

**Table 2.1 Initial data identified and main data gaps**

| Element investigated   | Summary of responses  | Evidence for necessary future actions by Member States   |
|--|---|--|
| <p>Details of guidance already in existence in Member States under IPPC that will fulfil or could be adapted to fulfil the requirements of the baseline report, including existing guidance on sampling strategy for baseline condition assessment, criteria for determination of relevant hazardous substances and statistical procedures used at cessation of activities for specific installation types or soil/ groundwater conditions</p> | <p>The majority of the Member States have not published guidance under the IPPC regime on how to assess the baseline soil and groundwater condition at installation sites.</p> <p>The Netherlands, Belgium, Bulgaria, Romania and the UK have existing guidance which may be suitable or adaptable (the guidance in the Netherlands and Belgium is not specific to IPPC, rather it covers a wider remit of soil protection at the national or regional level).</p> <p>Spain has not produced guidance at the national level however some regional guidance is available which may be adaptable.</p>   | <p>The responses to the questionnaire indicate that most Member States are likely to need to produce new guidance to assist operators to comply with IED (in obtaining and presenting appropriate site condition data to support the design of a baseline investigation). What is unclear is the extent to which guidance exists in other land assessment contexts (e.g. the assessment of historic contamination and/or assessment of sites in support of planning applications) that may be adaptable.</p> |
| <p>Extent of guidance on the content of the baseline report and any draft guidance in development.</p>   | <p>In addition to the Netherlands, Belgium, Romania and the UK, who have existing guidance, the Czech Republic, Bulgaria and Poland are in the process of developing guidance. It is notable that in the Czech Republic the proposed approach is to have an authorised expert in geology define the baseline for installation sites (rather than operators), and only where data was considered to be insufficient would further investigation and monitoring be needed.</p> <p>The remaining Member States are generally holding off developing specific guidance until the Commission publishes guidance on the content of baseline reports.</p>  | <p>There are no significant data gaps associated with this issue. The questionnaire responses indicate that most Member States are aware that they will need to develop new guidance to cope with the requirements of the IED. As the guidance is not yet published those Member States who believe they have already got suitable guidance should be encouraged to carry out a review to ensure that their approach is consistent with the Commission's guidance, once published.</p>                       |
| <p>Extent of the application of quantitative approaches to assessment of the soil and groundwater contamination at definitive cessation of permitted activities.</p>   | <p>The vast majority of Member States do not currently assess the condition of the site at definitive cessation of permitted activities against baseline values<sup>8</sup>. Therefore, there has historically been a lack of clear signals for operators on collection and collation of relevant information on the state of soil and groundwater contamination by hazardous substances, particularly prior to the issue of an IPPC permit. This means for some operators, new data on the state of soil and groundwater contamination will be required in order to develop a suitable baseline report.</p> <p>In general the approach by Member States has been to ensure that there are no significant risks to human health or the environment, although the means of assessing whether a significant risk exists to these receptors varies between Member States.</p> <p>Methods of calculating remediation criteria for soil and/or groundwater exist in some Member States including the Belgium, Netherlands, the UK, Finland, Hungary and Romania.</p> | <p>Only a minority of Member States currently require comparison of soil and groundwater data at the start of operations with conditions at the end of operations and this will therefore be a relatively new concept for many Member States in the context of industrial permitting.</p>  |
| <p>Approach to assessment of suitability for use at the start of permitted operations or the cessation of operations and assessment of</p>   | <p>There is significant variation throughout the Member States in terms of how and when sites are assessed to be suitable for use.</p>  | <p>This issue presents significant challenges in achieving a harmonised approach across Member States to soil and groundwater assessment under</p>   |

<sup>8</sup> Baseline values are the concentrations of contaminants in soils or groundwater as measured during the baseline investigation, to which the site would have to be remediated back to if it was found that contamination levels by relevant hazardous substances were elevated at cessation of permitted operations. These values could potentially be lower than concentrations which would be considered to pose a significant risk to human health or environmental receptors.

| Element investigated  | Summary of responses  | Evidence for necessary future actions by Member States  |
|---|---|---|
| 'satisfactory state'  | <p>In Germany and in the Flanders region of Belgium, the site assessment is at the end of activities, but in Brussels and Wallonia assessment is needed at the start and cessation of 'risk' activities.</p> <p>In Finland sites are assessed using a risk-based approach for their suitability for future use at cessation of activities.</p> <p>In Romania sites are assessed at cessation of activities to determine whether pollution has occurred and then if remediation is required sites are to be brought as close as possible to their 'natural status', including removing any significant risks.</p> <p>Slovakia also requires that sites are assessed to ensure that they do not pose significant risk to the environmental or to human health at cessation of activities, however the assessment is based on whether permit conditions can be seen to have been broken, potentially allowing a release to ground.</p> <p>Latvia has legislation designed to identify the state of soil, and regulators have powers to require monitoring of soil quality for specific pollutants against threshold values, which could be applied to IED sites.</p> <p>Similarly in Poland and some regions of Spain, soil and land quality standards have been developed for present and planned land use categories, though it is not clear when operators of an IED site would need to carry out an assessment.</p> <p>In the UK and Ireland the various legislative regimes for planning will trigger an assessment of whether sites are suitable for use at the start of activities, if the site is a new development; however operational sites would not need to assess suitability for use at the start of a permit.</p> <p>It is noted that in the UK (and likely other Member States) the system of assessing suitability for use under the planning regime requires all potential sources of historic contamination to be considered. If however the ground condition of an IED site is assessed at cessation of activities, only contaminants that could potentially have been released by the installation's operations are likely to be considered. It is possible that further investigation would be needed in order that a planning application for a new use could be approved, taking account of pre-existing contaminants which could pose a risk to humans or the environment.</p> | <p>IED.</p> <p>The questionnaire responses indicate that there are significant variations in how regulators across the Member States assess the conditions of groundwater and soils at industrial sites at the end of IPPC permitted operations. Some Member States use a 'suitable for use' approach to assessment (i.e. the sites must be deemed to be suitable for continued industrial use, or in some Member States sites must be suitable for more sensitive future uses). This approach may or may not involve the collection of soil and groundwater data for assessment against defined criteria. Other Member States including the UK and Netherlands have taken 'satisfactory state' to mean no deterioration from baseline conditions and require remediation back to baseline rather than on a risk basis. The responses to the questionnaire do not always make clear what approach the Member State currently takes.</p> |
| Current or future requirements for operators to monitor site conditions during permitted operations | <p>Only a minority of the Member States currently require ongoing monitoring of the soil and/or groundwater condition, and only a few have published guidance.</p> <p>In Belgium some periodical monitoring of soil and groundwater is required for higher risk sites.</p> <p>In Bulgaria some permits include ongoing monitoring requirements.</p> <p>The Czech Republic is considering an approach whereby an authorised expert in soil and groundwater would define a monitoring frequency in individual permits.</p> <p>In Finland monitoring requirements are set on a site specific basis in permits and there is some guidance on monitoring soil and groundwater.</p> <p>The UK takes a dynamic approach to monitoring of site condition; England and Wales would expect operators to measure any suspected pollution immediately after it</p>  | <p>The IED requires ongoing monitoring of soil and groundwater for some installations and the questionnaire response indicates that most Member States do not currently require this under IPPC. A minority of Member States do set monitoring requirements within permits so this is done on a site specific basis rather than a general basis. In these instances such data could support development of a baseline report, for existing and permitted activities, where one was not developed prior to the issue of the permit.</p> <p>The literature review has generally identified that ongoing soil monitoring is considered to be problematic and less</p>  |

| Element investigated | Summary of responses   | Evidence for necessary future actions by Member States   |
|----------------------|--|--|
|                      | occurred; in Northern Ireland some permits specify ongoing monitoring and the need for it is assessed on a site by site basis (i.e. the regulator takes a risk based approach); in Scotland the guidance does encourage operators to collect ongoing data and in some instances monitoring frequencies are written into permits. | useful than ongoing groundwater monitoring as a means of potentially identifying pollution issues. |

The responses received from the Member States to date vary in the level of detail provided and in some instances in the degree of relevance to the question posed. To avoid unnecessary text within the main report, contains the template questions posed to Member States together with a summary of the main points for some of the most pertinent elements based on responses received.

### 3. Summary of information relevant to the development of guidance on baseline reports

The review of the literature and consultation with Member States and other stakeholders has indicated variance (sometimes significantly so) between the contaminated land assessment regimes in place within Member States, such that the evidence points to a clear need for guidance to help secure a more harmonious implementation of the new provisions under the IED. The review has highlighted several key points:

- the need for clarity around the language used within Article 22 (including, for example, definitions for ‘contamination’, ‘possibility’ and ‘where available’);
- how to determine whether a baseline report is needed; and
- the purpose and scope of the baseline report.

It is accepted that for the most part Member States should, through their own legal frameworks, interpret and where necessary define specific concepts embedded in European directives. In the case of baseline report and having regard to commitment to produce guidance and the complexities outlined in this section of the report, there may still be a requirement for Member States to define and clarify within their own legal frameworks the key concepts associated with preparation and submission of a baseline report as required by Article 22(2).

#### 3.1 Discussion of key definitions

As previously noted in Section 2, there are certain terms included in Article 22(2) that require and Commission guidance to clarify in respect of how they should be interpreted when seeking to comply with the requirements of the IED. These terms are already established and in-use throughout the industrial sectors and the review of information showed a clear need to ensure readers of the guidance can better understand these terms with specific regard to the requirement to prepare and submit a baseline report. The words in *italics* are AMEC’s suggestions of text that could reasonably be adapted for the purposes of developing Commission guidance.

- **Relevant hazardous substances** are those substances or mixtures defined within Article 3 of Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures, known as the “CLP Regulation”. *The baseline report should cover those relevant hazardous substances where, according to the evaluation by suitably qualified and experienced persons, at the ratio of their quantity and hazardousness in respect of toxicity, mobility, persistence and biodegradability (as well as other characteristics), are effectively capable of contaminating soil or groundwater.*<sup>9</sup>;
- A strict definition of ‘**where available**’ having regard to the provision of information on soil and groundwater measurements has yet to be agreed and may be best left for Member States to determine

<sup>9</sup> Definition adapted from a position paper by the German Scientific-Technical Association for Environmental Remediation and Brownfield Redevelopment (ITVA) on the closure-related obligations of Article 22 of Directive 2010/75/EU on industrial emissions (IED).

through the enactment of national or local laws or guidance. Should the Commission choose to provide an interpretation (rather than a definition) within the guidance, this could be based on the following:

- *Information can be considered ‘available’ where it exists and:*
  - *is held by the operator at present;*
  - *resides within the public domain or can be made freely available to the operator given the intended use to support development of a baseline report – this would include, for example ground inspections, site contamination inspections and other substratum inspections previously submitted to a regulatory agency in relation to the site of the installation; or*
  - *is privately held and can be acquired through application of reasonable measures, taking into account the economic feasibility of obtaining such information – which could include research of historic documents and records pertaining to use of the site, pollution incidents and condition of the substratum;*
  - *is not subject to strict or specific terms on disclosure (e.g. existing confidentiality agreements) or classifications made by Member State authorities such that disclosure could compromise the national security of, or prejudice, that or any other Member State.*
- **What is meant by contamination?** For the purposes of the baseline report, contamination should be defined, using a ‘before and after’ context, as “a change in the state of the soil and groundwater, in particular an increase in the concentration of hazardous substances from a value that could reasonably be anticipated to be the background value, as a result of a release of a hazardous substance from permitted activities at the installation”.

This definition is centred on the concept of contamination being an anthropogenic input of a substance (or substances) into groundwater and soil as a result of industrial activity and as such could be likened to pollution in the broader sense. Taking this line, contamination could be defined within the guidance as ‘*any pollution of soil and groundwater by one or more hazardous substances as a result of the use, production or release of those substances of relevance as defined by Article 3(18)*’.

This avoids any confusion around ‘contamination’ as a term which has other established meanings within the contaminated land regimes in operation in Member States, in particular the assessment of contamination at final cessation.

- What is meant by the ‘**possibility of soil and groundwater of contamination**’.

Established thought on this matter is that possibility is determined using a traditional hazard/likelihood analysis to establish the risk (a quantified risk assessment). Taken to its extreme, there are few scenarios where one is clearly able to establish with absolute certainty that an event (for example a release of pollution) will not occur. This would mean that taken literally there exists in almost all cases the possibility (no matter how small) for soil and groundwater contamination to occur from industrial activities that use, produce or release hazardous substances. In this sense, Commission guidance could therefore take a line that where a possibility exists, no matter how small, the operator is required to prepare and submit a baseline report. This would mean that many industrial sites permitted under IED would be required to prepare such a report even if they are employing the most appropriate and robust containment, safety and pollution protection measures. This would create significant additional costs for industry and in most cases it would be difficult to clearly link the requirement to a genuine positive

environmental outcome, even taking into account the fact that at final cessation a baseline report exists with which a fully quantified comparison could be made.

Based on external research and internal consultation, AMEC do not believe that there is a single established value (threshold) where one could say, for example, below this level there is a possibility and above it there is not. Such judgements are complex and typically made on a case-by-case basis taking into account a wide range of factors and assessed using expert judgement. There are acknowledged examples of the use of balance of possibilities (i.e. 50% or more), 95% confidence level, 98% confidence level (or higher) of an event not happening. The evidence suggests these decisions are being taken by agencies, regulators or other competent bodies on an individual basis at the Member State level. Therefore the Commission guidance could advocate continued use of such discretionary decision making so long decisions are based on *‘A fully quantified, science-based risk-assessment to establish, to a recognised degree of certainty, whether and to what extent there exists the possibility that use, production or release of a hazardous substances as a result of activities at the installation may cause contamination.*

As there is no current recognised threshold value for possibility and to prevent a situation where industry operators may seek to exploit a lack of clarity, the approach that could be taken within Commission guidance would be to advise Member States *“to produce guidance, supported by legally-binding rules or regulations, that provides clear guidelines to competent authorities and other bodies with enforcement duties and to explain how to determine and decide, on a case-by-case basis, what constitutes a possibility having regard to Article 22(2)”*.

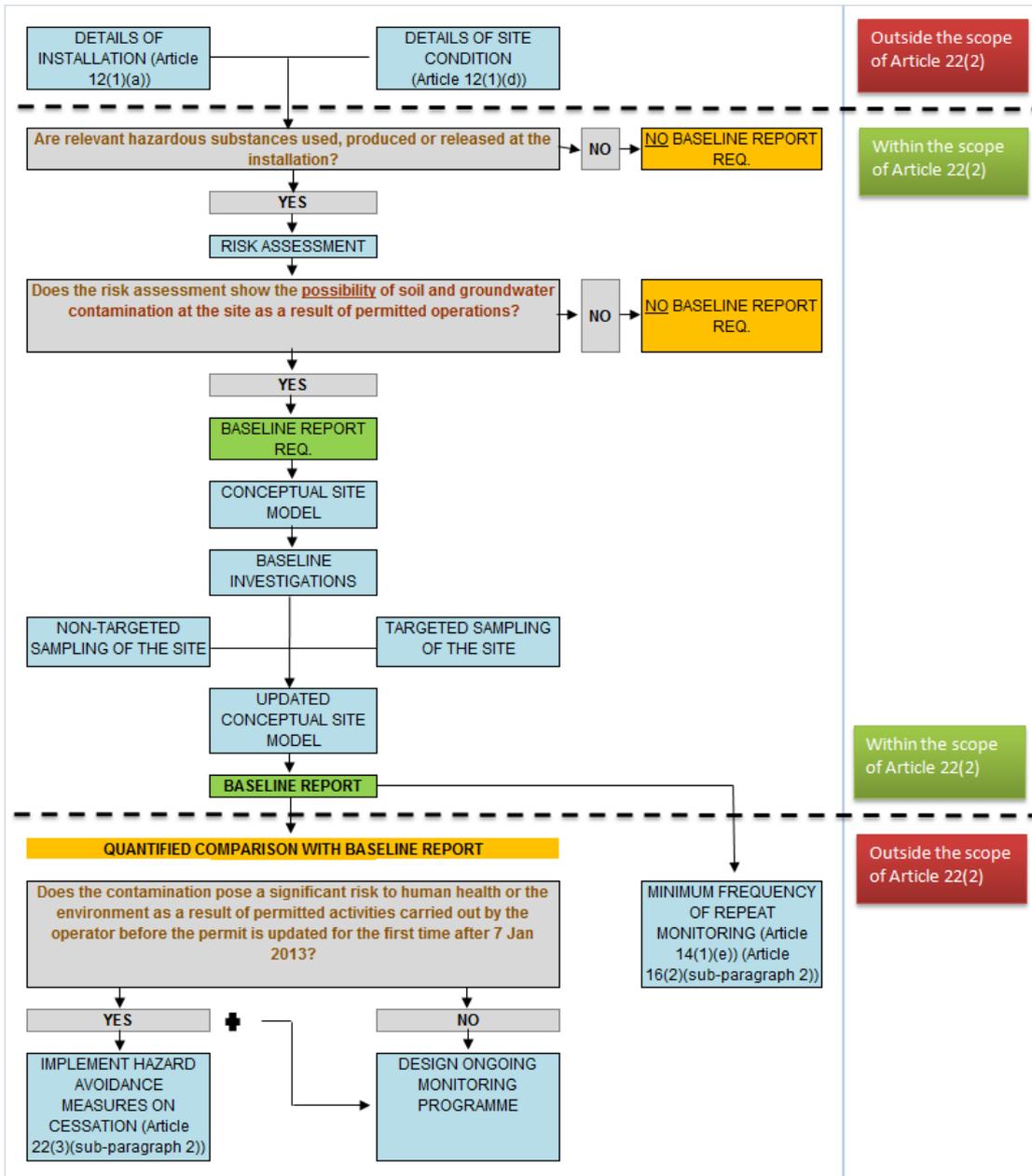
Where the latter approach is taken, it predisposes the competent authority or regulatory agent to require early and close communication and involvement with the operator, either at the permit application and planning stages (new installations) or at such time the permit is first updated after 7 January 2013 (existing installations). The Commission baseline report guidance should therefore provide advice to Member State competent authorities as well as operators on the importance of ensuring open and transparent dialogue and communications to determine whether a baseline report is required.

Neither of the approaches is truly satisfactory; the first means operators are likely to incur costs that are disproportionate to the risks posed (to which we anticipate a strong industry response) and the second avoids a situation where Commission guidance gives information on when the possibility for such contamination exists. The use of science or engineering-based risk analysis and assessment to defined and internationally recognised standards to determine the possibility would allow operators to assess the risks and in consultation with the competent authority and to reach a conclusion on whether or not a baseline report was required.

### 3.2 Structure of the guidance

This section of the report seeks to deal with the main issues and elements associated with how Commission guidance could be structured such that it includes all relevant materials necessary and presents in both in a clear manner and having regard to the existing arrangements that both Member States and industry would seek to build upon in complying with the requirements of Article 22(2). Figure 3.1 shows (in a flow-chart format) the core activities that are understood to be necessary in order to determine whether a baseline report is required and if so necessary actions to prepare one that fully meets the requirements of the IED. The subsequent sub-sections deal with each relevant component in turn.

Figure 3.1 Inputs, activities and outputs in the development of the baseline report



### 3.2.1 Linkages with other elements of Article 12

In accordance with Article 12 of IED and in order for operators and regulators to understand firstly the necessity for and then secondly the adequacy of the scope of a baseline investigation and report, there must be sufficient data available on the permitted activity to identify:

- What hazardous substances are or will be used at the installation (with associated data available on their toxicity and likely behaviour if released to the environment);
- What pollution prevention measures are or will be in place (BAT or beyond BAT); and
- What monitoring and inspection of the pollution prevention measures has taken place to date or will take place during operations.

Although addressing this requirement is not a focus for Article 22 (it lies outside the scope), it is nonetheless crucial in establishing key information and data that will be included in the baseline report should one be required. This could be managed through a short section within the guidance document dealing with the interactions between Article 12(1)(a) on the installation and its activities and Article 12(1)(d) on the conditions of the site of the installation. The evidence suggests the quality and completeness of ‘site condition assessment reports’ varies and as such the guidance should note that further work may be required for operators of existing installations in order to inform whether or not a baseline report is required. The Commission may choose to reference the following important elements within any guidance produced:

- *The accuracy and completeness of the data and information on use, production or release of hazardous substances as well as the characteristics of the site, its substrata and groundwater is paramount. Where preparation and submission of a baseline report is necessary, it is the quality of this information that will influence the overall quality and reliability of the site investigation.*

### 3.2.2 Determining whether a baseline report is required

This study has found evidence (in the form of successful implementation across a number of Member States) that the risk-based approach could be adopted for the purposes of meeting Article 22(2) of the IED, in particular the assessment of the possibility of contamination by hazardous substances, where the conclusions reached are through robust, science-based risk assessment methodologies that take account of toxicological information, site specific conditions and local circumstances. In determining whether a baseline report is required, the following key tasks (shown in Figure 3.1) are believed to be:

- a full and accurate characterisation of the site condition and setting (Article 12(1)(d));
- details on the activities, processes and substances used, produced or released by the installation (Article 12(1)(a)); and
- assessment of the likelihood of events that could lead to a release of hazardous substances causing contamination to soils and/or groundwater using established and recognised science-based risk assessment methodologies.

The development of these separate components should then be used to answer two fundamental questions:

1. Do the activities at the installation involve the use, production or release of hazardous substances as defined in Regulation (EC) 1272/2008 on classification, labelling and packaging of substances and mixtures or have they done since the first permit issue?

2. Is there a possibility that use, production or release can result [or has resulted in the case of existing installations where an update of the permit is made for the first time after 7 January 2013] in the contamination of the soil and groundwater at the site of the installation, taking into account the relevant legal definitions or case-by-case evaluation mechanisms set at the Member State level?

The first question is relatively simple to answer based on inventory of the substances used, produced or released by the permitted site. The second question is more complex to answer requiring the definition of an absolute value (threshold) in regards to possibility or the use of established risk assessment methodologies<sup>10</sup> to determine whether there is a possibility (i.e. a quantified risk) of contamination by hazardous substances occurring or having occurred as a result of the permitted activities. The impact of the contamination, whether significant or otherwise, from hazardous substances in soil or groundwater arising as a result of activities at the permitted installation is of no relevance for Article 22(2) and the guidance should make this point to avoid any confusion.

For existing sites, there is likely to be some information already available and in some cases this information (provided in advance of the submission for a permit under IPPC or a variation or update to that permit) could well be of sufficient completeness and depth so as to allow the operator to clearly establish if there is a risk of contamination and what the nature of that risk is having regard to factors including the pollution prevention measures employed, site surface, geology, topography and hydrogeology as well as the hydrology and structure/composition of the soil substrata.

### 3.2.3 Designing the baseline investigations

Once it is established that a baseline report is required to prepare and submit a baseline report, the next phase is to determine what information is available and how relevant is that information with regard to the provision of information on the state of the soil and groundwater in respect of contamination by the hazardous substances for which there has been a possibility of contamination established. In this context, the baseline investigation should be designed such to feed the necessary information into the baseline report such that it will make a quantifiable comparison at final cessation possible. The following principles are considered to be of importance based on a review of the evidence:

- *The demarcation and definition of a site for the purposes of establishing the relevant area within which an assessment of the state of soil and groundwater contamination by relevant hazardous substances is made should not be constrained by physical barriers such as fences, roads, slipways or any other feature that breaks the continuity of the installation margins.*
- *Joint and several ownership of a site and therefore any imposed operational boundaries (whether physical or otherwise), should not be used to demarcate the boundary of assessment in respect of gathering such information as necessary to develop the baseline report.*

<sup>10</sup> The review of evidence shows a wide range of risk assessment methodologies could be adapted to meet the purposes intended and set out in this report. In April 2012, the UK competent authority published new guidance including a re-drafted section on risk assessment (<http://www.defra.gov.uk/publications/2012/04/10/pb13735contaminated-land/>) however it is accepted that there are different approaches adopted in other Member States each with specific merits. A critique of these approaches was not possible within the timescale and budget of this study.

Given the important role of the competent authority and any associated regulatory agency in ensuring the quality, consistency and accuracy of baseline reports and the information within them, it is considered at least prudential for these bodies to be involved the scoping of the assessment boundary prior to development of the baseline report and activities required to inform its production (e.g. the sampling strategy).

Compilation of the relevant information to be used in design of the baseline investigation<sup>11</sup> should include but not be limited to:

- *detail on the site history and the site setting – including environmental sensitivity and ground conditions status, topography, geology, established structures, services (above and below ground), demolished or historic structures as well as adjacent land where access may be required for sampling of soil or groundwater;*
- *a description of the activities undertaken on the site including the use, production and release of any relevant hazardous substances;*
- *information on previous pollution incidents, spills or accidents that have occurred on the site both as a result of current as well as past ‘historic’ operations, including any measurements already made (e.g. where these are not suitable directly for use in baseline reporting);*
- *physical properties and characteristics of the hazardous substances used, produced or released (or have been) where it has been established there is a possibility of contamination occurring or having occurred;*
- *details of the hydrogeological and hydraulic conditions present at the site;*
- *issues for existing operational installations such as access constraints or health and safety constraints for ground investigation and the need to protect existing pollution prevention measures;*
- *international and national standards for ground investigation and soil and groundwater sampling and analysis;*
- *methodology for assessing changes in contamination status prior to and after cessation of activities (e.g. statistical tests to be used); and*
- *EU and Member State guidance on ground investigation.*

A review and evaluation of this information should be made having regard to its completeness, reliability and suitability based on possible changes in the site conditions as well as evolution in methodologies for sampling and analysing.

### The role of the conceptual site model in baseline reporting

An established mechanism in design of a baseline investigation is to prepare a conceptual site model (CSM)<sup>12</sup>, which is a representation setting out the critical pollutant linkages of concern for a particular land contamination

<sup>11</sup> A significant amount of this information will already exist by virtue of the need for it at earlier stages in the permit application process

problem. It brings together different pieces of information such that an understanding of what risks there might be of and from contamination to both the environment and human health. CSM is a widely used tool<sup>13</sup> that organises available information about a site in a clear and transparent structure and facilitate the identification of data and information gaps.

**Figure 3.2 Example rendering of a conceptual site model**

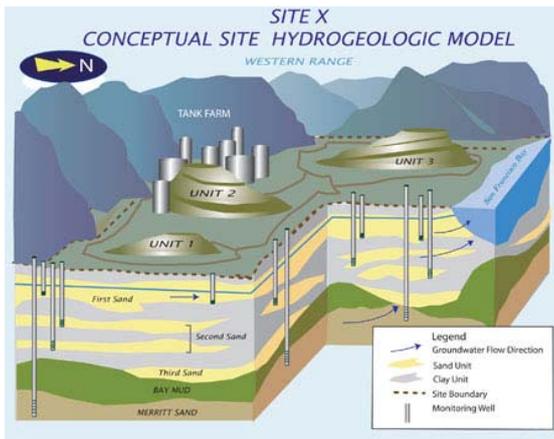


Image courtesy of Science-Art.com

As an important tool in the design of any subsequent baseline investigations, there may therefore be a need for the guidance to advocate the submission of a conceptual model (where the technique is used) at an early stage in the baseline report preparation process in order for the baseline report to be appropriately scoped and the regulator armed with sufficient information to assess the findings of the baseline report if one is subsequently submitted by the operator.

Application of the conceptual site model (see below) and accompanying risk assessment to the design of the site investigation is common practice and does not require extensive coverage in the guidance on the baseline report. It will be more important for the Commission guidance to indicate the information necessary so as to inform what data needs to be gathered.

### The requirement for new measurements in baseline investigations

In making preparations for a baseline investigation to supply data for the baseline report, the operator may have questions over exactly what information is 'necessary', the extent that existing information can be used and what uncertainties need to be accounted for in its use and how the data should be collected such that it ensures a quantified comparison can be made at cessation. Where no information or measurements that reflect the current status of soil and groundwater in respect of hazardous substances exist, new measurements will be required.

<sup>12</sup> More information on this is widely available, one example being: <http://www.eugris.info/EUGRISmain.asp?e=48&Ca=2&Cy=0>

<sup>13</sup> The US EPA provides a comprehensive description of the specific components to this technique ([www.epa.gov/superfund/health/conmedia/soil/pdfs/attacha.pdf](http://www.epa.gov/superfund/health/conmedia/soil/pdfs/attacha.pdf))

On this point it is felt the guidance can add additional clarity and strengthen the case; new measurement, whether taken prior to commissioning or as a result of a permit review after 7 January 2013 is the best method of obtaining a baseline on the state of the soil and groundwater. Older results can be used but the operator and competent authority needs to make themselves aware of the uncertainty and risk associated with using such data. The best way of achieving this 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 guidance should indicate the most suitable course of action is to re-take the measurements; other options will always be compromised to a degree.

Proposed text relating to the use of existing information is as follows: *Where the operator proposes to use existing information in order to inform the development of a conceptual site model, baseline investigation or the baseline report itself, consideration should be made as to the reliability, accuracy and appropriateness of the data having regard to its use in establishing the state of the soil and groundwater;*

If new investigation is required, questions such as ‘what baseline investigation is required to ensure full compliance with the IED’ and ‘what key things should be covered in designing a sampling strategy’ may be asked by operators. Some of these elements are to a certain extent already covered within existing guidance at the Member State level, although not always in the context of a baseline report. Given the evidence suggesting the wide variance in availability of guidance and contaminated land practice, the guidance needs to strike a balance between being too prescriptive or too flexible. One way of addressing this would be to prepare a simple FAQ (frequently asked questions) section for competent authorities and operators. In some cases answers would need to point to national or local rules, in others the Commission could provide an interpretation of the IED text in respect of achieving compliance.

The baseline report itself need not be an overly long or complex document but 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 make a quantified comparison possible.

### 3.2.4 Other considerations relating to baseline investigations

The soil and groundwater quality of installation sites permitted under IED will be of interest beyond the remit of IED because these sites typically include some of the most polluting existing industries and may include sites which have a long history of industrial operations with potential to have caused land contamination. In such cases, Member State competent authorities should already be aware of these sites and be involved in on-going monitoring, remediation or site maintenance activities. This section of the report summarily touches upon some of the wider issues that sit within the context of the wider contaminated land assessment and management regimes but that are not directly related to the production and content of the baseline report required under Article 22(2) of the IED. It is not anticipated that this detail will form part of the final guidance but may be partially used in supporting statements or preamble.

1. Operators should, and in many cases will be required to, take other factors into consideration whilst also ensuring they are compliant with Article 22, including the site setting (e.g. presence of polluting neighbours and the operator's potential liability for causing pollution on neighbouring sites or being the victim of on site contaminant migration from a neighbour's operations), reputation (being seen to do more than the minimum to comply with environmental legislation), compliance with other national or regional contaminated land legislation, commercial drivers for understanding potential land contamination liabilities, and avoiding potential remediation liability at the end of operations.
2. Evaluation and quantified comparison of baseline state with that at definitive cessation. This is one of the most fundamental purposes of developing a baseline report – to enable the operator to make a quantified comparison between the levels of contamination existing at the start of permitted activities and those at the end. In this respect, the ITVA set out some plausible and informative commentary on this matter which has been provided to the Commission under separate submission.
3. Set in the context of the requirements on operators at final cessation and taking into account some of the comments received, there may need to be guidance on interpretation of the two different parts of Article 22(3), to which the baseline report is directly related only to the first subparagraph. The second subparagraph is concerned with addressing significant risk to human health or the environment as a result of contamination caused by the operator prior to the establishment of the state of the soil and groundwater in the baseline report. The distinction needs to be made that operators may potentially be required to conduct restoration to baseline, remediation or in some cases a combination of both to ensure full compliance with the Directive.
4. There is significant public interest and potentially reputational risk around how an operator effectively measures the soil state and how any contamination is dealt with at final cessation. Whilst this does not necessary form a part of guidance from the Commission, setting it in context this may be relevant.
5. 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 (in effect complying with Article 22(3) ahead of the requirement to do so to reduce future corporate liabilities where this was a result of permitted operations prior to the permit update after 7 January 2013), the baseline report would need to be updated with the new soil or groundwater data once remediation was complete.

In such cases, it would probably fall to the competent authority of the Member State to exercise judgement based on local factors and the timescales for permit review, update and the on-going or planned remediation as to whether a baseline is set at that point or deferred to a future point once works are complete.

6. Selection and use of soil assessment criteria: The derivation of soil guideline values in Member States that have published values (either derived by or recognised by environmental regulators) or systems developed to calculate values is likely to reflect specifics of the Member State such as the most common land use types, soil conditions and contaminants of concern. Member States who have not derived their own assessment criteria would therefore need to be prompted in the baseline report guidance to give careful consideration to the use of values developed in another country to ensure that these were appropriate to the conditions in the Member State and to the site in question. It is known that variation currently exists in how well developed risk assessment systems for contaminated land risk assessment are across the Member States.<sup>14</sup>

### 3.2.5 Sampling strategy

Where it is established new measurements will be required (in the case of new installations or existing installations where the completeness, quality and reliability of existing information does not enable the state of the soil and groundwater to be determined), consideration of suitable sampling strategies will be required. The elements that should reasonably be covered in guidance are as follows:

*“Operators should select sampling strategies that provide sufficient confidence 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 to be made. The operators should include in the baseline report the proposed method for assessing whether there has been a change in the contamination status of the site during its operation, e.g. the statistical tests to be used. In reporting the results of the baseline investigation, operators should take all reasonable measures to ensure that the approach to sampling as well as the methods of analysis is adequately described in the baseline 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.”*

The main components to consider when determining the suitability of the sampling strategy include:

- It should be focused on identified and speciated hazardous substances which must be evaluated in respect of their physico-chemical properties in relation to the possibility of contamination of the soil or the groundwater;
- Taking into account the hydrogeological and hydraulic conditions, suitable upstream/downstream measuring points for must be reviewed prior to their establishment on the site of the installation. The

<sup>14</sup> A study was carried out by NICOLE in 2004 ('Risk Assessment Comparison Study', April 2004) which compared human health risk assessment models/systems commonly used in European Member States and also Norway and Switzerland. It was found that development and acceptance of risk assessment as a tool for the management of contaminated land was growing however the level of development varied considerably. Risk assessment systems (for assessing soil analysis results) were found to have been developed commercially rather than specifically to support the approach to contaminated land of a particular country or region.

possible dynamics in respect of directions of flow and fluctuations in the groundwater table must be taken into consideration in groundwater inspections<sup>15</sup>;

- Recognising the impact of natural and process-related influencing factors on the samples taken, in particular in the "soil" matrix in terms of sampling, treatment and measurement as well as 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
- Given the factors already outlined in regards of repeatability, due consideration must be given at sample design stage to ensuing capture of current state (including historic contamination) as well as being replicable at definitive cessation. Clear mapping and marking of the sampling points is a pre-requisite.

The guidance may refer to the two common strategies in use; non-targeted sampling and targeted sampling. ), either one or a combination of the two could be suitable – 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:** Deliberately untargeted sampling, which in the case of statistically adequate data density produces representative information about the average substance concentrations and about their range. Since the accuracy of representation is tied to the unrestricted selection of sampling locations, this must not be influenced by external circumstances such as the existing buildings and use or suspected pollutant concentrations. This method is likely to be less suitable for existing sites that have established structures, services and utilities.

This approach to baseline investigation 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 baseline 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 'hot spots'.

This can result in a very 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). This approach would work best on a site still to be developed rather than an existing installation, but even in the case of a new build installation, once constructed it would probably be difficult to replicate the baseline investigation (at permit cessation) due to the access constraints such as buildings, services, process plant, unless the entire installation was decommissioned and then demolished.

- **Targeted sampling:** Focused sampling in zones of suspected pollutant concentrations (storage points, transhipment 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 contamination at above-average

<sup>15</sup> The IED concerns itself with the baseline state of the soil and groundwater within the site of the installation itself however in some cases assessment of whether it may be prudent or necessary to sample, particularly in the case of highly mobile hazardous substances and for groundwater, outside the boundary of the site to determine the presence and concentration.

concentrations. 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.

In respect of the choice of sampling strategy, there are also two pertinent points to note:

- Groundwater baseline data collection:** As noted in the literature review, 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. Averaged well or borehole samples potentially allow operators to set trigger values which can be used in future monitoring as a warning level that further results can be compared to (and where results are found to exceed the trigger value further investigative actions are taken). 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;
- 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). Guidance documents on the use of statistics for contaminated land assessment have been published in Member States including the UK<sup>16</sup> and also internationally<sup>17</sup> (this project has not included an assessment of which Member States have established guidance on the use of statistics in soil or groundwater data assessment as this will not necessarily be required in order for Member States to comply with IED). Existing guidance stresses the need for a well developed conceptual model 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 or standard determination procedures presently exist. To ensure comparability of the baseline investigation results

<sup>16</sup> A document was published in 2008 by CL:AIRE and CIEH, with support from SAGTA, entitled ‘Guidance on Comparing Soil Contamination Data with a Critical Concentration’ which provides advice on the use of statistical techniques in the assessment of soil contamination data and also directs practitioners to other relevant publications such as the Environment Agency’s ‘Secondary Model Procedures for the Development of Appropriate Soil Sampling Strategies for Land Contamination’, R&D Technical Report P5-066/TR from 2000.

<sup>17</sup> One example provided is the United States Environmental Protection Agency (USEPA) publication ‘Guidance on Choosing a Sampling Design for Environmental Data Collection’, EPA QA/G-55, 2002.

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.

Since the 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). In such a scenarios and where the quantitative measurement results are not directly comparable with one another, expert analysis and evaluation is likely to be required. The inclusion therefore of expert insight and analysis in preparation of the baseline investigation and subsequent evaluation is paramount – it is believed many operators will choose to contract out scientific expertise in this field.

For the reasons indicated above, in conjunction with the preparation of the baseline report, care must be taken to ensure that the methods of analysis used are adequately described. Only in this way, in the context of the cessation of operation of the installation, can a proper comparison be made between the measured values which are determined under certain circumstances with different methods.

### 3.2.6 Development of the baseline report

The guidance needs to set out the purpose and scope of a baseline report. It will be for the Commission to establish the tone and content of the exact text however a proposal for consideration is presented as follows:

*“The purpose of the guidance on baseline reports is to enable Member States and competent authorities to ensure the requirements of Article 22 (as well as related Articles) of the IED are met by operators in regard of establishing whether a baseline report is required and if so what information must be included so as to determine the state of soil and groundwater contamination and enable a quantified comparison to be made at definitive cessation of activities between that state and the baseline state.”*

*“The purpose of the baseline report is to provide clear and unambiguous documented evidence that allows the state of the soil and groundwater to be determined prior to commencement of activities or following the first update of an existing permit after 7 January 2013 in respect of levels of contamination by those hazardous substances where, it can be reasonably foreseen there is the possibility that use, production or release of those substances could cause contamination at the site of the installation”*.

Prescribing the exact content of a baseline report will prove challenging given the points raised earlier in this section of the report. Competent authorities are going to be required to make considered evaluations and determinations on the state of the soil and groundwater in respect of hazardous substances and so it makes sense for the Commission guidance to set an outline framework for the baseline report without being too prescriptive about its content or the precise nature of the works contained within in. It appears there are several areas where guidance to Member States would prove advantageous:

1. Clearly establish the general principles the baseline report must conform to.
  - a. Be presented in a logical and structured format;
  - b. 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 measurements;
  - c. Provide a clear and accurate description of the approaches used and the results obtained by the operator or appointed contractor as well as the location of any intrusive works, wells, boreholes and other sampling points in accordance with a standardised geographic referencing system;
  - d. 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);
  - e. 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.
  - f. Contain an evaluative narrative on the content, informed by a suitably qualified and experienced person 'an expert in contaminated land', 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).
  - g. 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.
2. Outline, in brief, the main elements that the operator should include within the baseline report submitted to the relevant competent authority, noting that variance in the type, depth and presentation of the data between Member States is anticipated and acceptable so long as it remains possible to determine the state of the soil and groundwater contamination from the information submitted. A draft checklist is included in Appendix C for this purpose.



## 4. Conclusions on development of guidance and a framework for baseline reporting

### General points

- Commission guidance must be developed in the context that existing guidance on baseline land quality reporting already exists within the EU. The fact that such guidance is in existence and there is significant variance in the approaches taken by individual Member States supports the need for suitably informative EU-wide guidance for the baseline report required under IED.
- As the IED sets obligations on the operator to return the site to the state outlined by the baseline report, where significant pollution has been caused, it is in the interest of operators to establish as accurately as possible the baseline state so as to provide the best possible platform for future assessments upon definitive cessation.
- The review of information has highlighted some aspects where Commission guidance needs to focus on, which are:
  - the need for clarity around the language used within Article 22 (including, for example, definitions for ‘contamination’, ‘possibility’ and ‘where available’);
  - how to decide when a baseline report is needed;
  - further detail on the purpose, scope and content of the baseline report.
- Accepting that the Commission are required to produce baseline report guidance, this report has highlighted certain complexities, particularly around definitions and evaluation of risk, that means there may still be a requirement for Member States to define and clarify within their own legal frameworks the key concepts associated with preparation and submission of a baseline report as required by Article 22(2). To ensure a more harmonised implementation, Commission guidance could ‘strongly advise’ Member States to implement regulations and associated guidance that are always used by operators with respect to specific elements of baseline report preparation – in particular the determination of whether or not a baseline report is required.

### Deciding if a baseline report is required

- Establishing whether or not the installation uses, produces or releases hazardous substances defined by Article 3 of the CLP Regulation should be a relatively simple assessment; the preparation of a decision flow-chart would be a solution for the baseline report guidance.
- Establishing whether there is or is not a possibility that these substances could cause contamination of soils and groundwater is less straightforward and one without a wholly satisfactory solution. Given the complexities of risk characterisation and assessment and taking into account substance and site-specific factors, it is concluded that there is not a single established value (threshold) that could be used for defining whether there is or is not a possibility of contamination. Such judgements are complex and typically made on a case-by-case basis taking into account a wide range of factors and assessed using expert judgement.

- Commission guidance could take one of two approaches; both with merits and constraints.
  - **Defining possibility in absolute terms** would mean most operators (where hazardous substances are used, produced or released) are likely to need to prepare and submit a baseline report. In many cases, the costs of doing this could be viewed as disproportionate to the actual risks posed based on the likelihood of contamination occurring.
  - **Leaving the definition up to Member States** and their competent authorities is likely to produce a less harmonious implementation of Article 22(2) as ultimately a subjective judgement (typically by experts or suitably qualified persons) based on statistical probability that there is or is not a possibility of contamination will need to be made. The likely outcome is that fewer operators will be required to produce a baseline report but many operators are likely to need to conduct a risk assessment to determine the risk of possible contamination occurring as a result of the activities (past or future).
- At this time and without a more detailed review across Member States on the mechanisms, methods and standards for pollution prevention and contamination risk assessment, it is not possible to draw a clear conclusion on which approach is best. Certainly, the absolute approach is clearer and more decisive but more costly; the risk-assessment approach is more aligned to current practices and would be less expensive but it must be applied in a defined framework and using established science-based risk assessment methods to recognised standards that meet the requirements of the Directive.

## New measurements

- Where existing and sufficiently reliable information on soil and groundwater measurements that reflects the state at the time the baseline report is prepared is not available, operators will be required to make new measurements taking into account the possibility of contamination by the hazardous substances used, produced or released.
- Operators may seek to reduce costs through reliance on data that may have been produced either as part of the initial application for a permit or in previous investigations. Given the variable nature of the data that Member States have reported currently exists on site condition and baseline characteristics, some Member States are likely to need to do more to require their operators to ensure they are able to meet the necessary quality, completeness and reliability tests for data to support baseline report development.
- The baseline report guidance should therefore advise that data within previous reports which includes soil and/or groundwater data should be treated with caution (for example where the operator intends to use this to help establish baseline conditions). This is because:
  - soil and groundwater data can become out of date within a few years, e.g. laboratory techniques evolve over time as do the assessment criteria used;
  - conditions at the site may have changed since sampling took place either because the site has a relatively dynamic subsurface environment, new processes, substances or activities have been introduced or because additional (perhaps unknown) pollution has occurred;
  - the quality of the data may not meet current standards (e.g. laboratory analysis results may not be accredited or may not cover relevant substances (e.g. results may be provided for total petroleum hydrocarbons as opposed to speciated aliphatic and aromatic range hydrocarbons);

- sample collection methods could also be flawed (e.g. samples submitted for volatiles analysis were not handled correctly to minimise the loss of volatiles prior to analysis);
- samples may not have been collected from appropriate areas of the site or from appropriate strata or depths.

In these instances professional judgement will need to be employed as to which data may inform baseline conditions and the guidance should recommend as such.

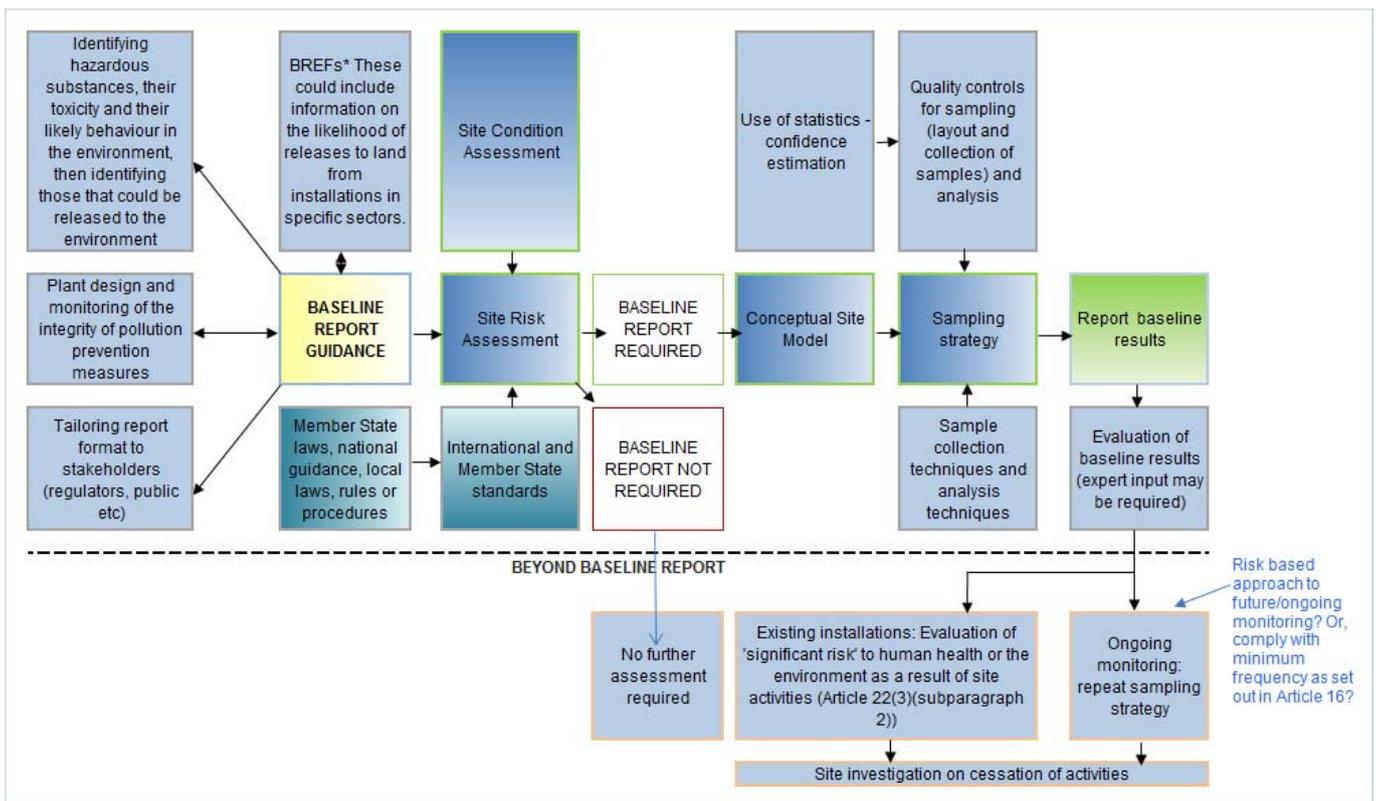
### Sampling as part of baseline investigations

- Although non-targeted sampling is likely to derive a data-set that is more representative of the site as a whole, the presence of site constraints such as services and plant based infrastructure, allied to the significant cost of obtaining samples over a wide area, may mean a targeted approach may be preferable in some cases.
- Where site modelling indicates areas of differing use and possible soil contamination, zoning may be possible, with varying applications of the two sampling approaches applied variously to the different zones and identified source areas accordingly.
- For new installations, non-targeted sampling may be more appropriate to establish a baseline condition, for existing installations there will be significant practical challenges in applying this approach and targeted will, in most cases, be the better option.
- The following principles are relevant to the sampling and analysis of data that is required to prepare a baseline report:
  - Operators should use appropriate sample collection techniques and procedures (based on international standards) when sampling soil or groundwater for the collection of baseline data (i.e. using appropriate intrusive techniques for the ground conditions, and ensuring that samples are representative of the soil on site and can be referenced to a specific point on site and a specific depth and stratum);
  - Samples should be handled appropriately on site and submitted with full chain of custody to an appropriately accredited laboratory for chemical analysis (ideally a laboratory which can meet the international ISO/IEC17025 standard and any other relevant standards within Member States).
  - Operators should be able to demonstrate that appropriate quality systems are in place for sample handling e.g. storage in appropriate containers at appropriate temperatures, maximum holding times for analytes are met where soil or groundwater parameters are subject to change once sampling has taken place. This applies for small or large and complex investigations;
  - Laboratory data should be checked for completeness and accuracy (e.g. ensuring results are correctly identified by sample location and depth), and anomalous results should be queried with the laboratory (e.g. where the corresponding borehole log suggests the sample was clean but the results indicate elevated concentrations of contaminants). Data which is compromised should also be identified (e.g. where the laboratory identifies an error or where there was an issue on site or at the laboratory with sample handling). This applies whether assessors wish to use statistics to assess the results or not (e.g. baseline results simply reported as absolute values);

- Where practical, it makes sense to hold baseline data (e.g. results of laboratory analysis) for the permit lifespan in electronic format to minimise the potential for errors to occur during data handling and assessment. All data should be backed-up and recoverable;
- Scale plans should be produced showing the sample locations. Plans should be created on scale mapping and sample location coordinates and elevations should be surveyed so that these can be shown in their correct location in relation to the site and its surrounding environment; and
- Records of the site investigation should be kept and reported; with details such as the methods used, the dates of the work and field observations. Detailed logs should be produced of exploratory holes, including details of the construction of groundwater monitoring wells.

### Principles associated with development of the baseline report

Figure 4.1 Main elements required in determination, preparation and submission of a baseline report



- Based on the evidence reviewed to date, the professional judgement of the consultants and the comments made by Member States, industry specialists and other commentators, the development of a baseline report, where it is required, should be made having regard to the following main requirements:
  - It should be prepared before the commissioning of a new installation falling within the scope of the IED and be submitted as part of the permit application process. In the case of existing installations, the baseline report should be prepared prior to the first permit update after 7 January 2013;

- It should be focused on those hazardous substances defined as substances or mixtures within Regulation (EC) 1272/2008 on classification, labelling and packaging and where such substances will be (or have been in the case of existing installations) used, produced or released and where there exists the possibility of contamination of soil or groundwater by these substances at the site;
- It should provide sufficient empirical evidence of the baseline condition of the soil and groundwater and therefore be based on the best evidence available to the operator or where there are concerns regarding the reliability, accuracy or completeness, supplemented with new information.
- It need not be an overly long or complex document but 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 make a quantified comparison possible
- It should contain such information as is necessary to enable a quantified comparison of the state of the soil and groundwater, in respect of contamination by relevant hazardous substances, at definitive cessation of activities with that at the start of operations or before the permit is first updated after 7 January 2013. This should include at least the following:
  - Information on the present use and, where available, on the historic use(s) for the site, including, *inter alia*, a comprehensive description of the main activities undertaken, location of buildings, storage vessels and tanks (above and below ground), details of pollution or spillages as a result of operations, releases or accidents, location of site services (including water mains, drainage, pipelines, gas and other utilities); and
  - Information on soil and groundwater measurements taken that reflect the state of the soil and groundwater at the time the baseline report is drawn up, which will include at least:
    - the date of sampling, analysis and reporting;
    - a list of the hazardous substances sampled and tested for;
    - a description of the investigative methods used and the sampling strategy by which samples have been obtained;
    - the location (identifiable using standard latitudinal/longitudinal coordinate-based referencing) of samples taken, boreholes, pits, wells or other intrusive works carried out in determining the state of the soil and groundwater; and
    - a record of the test methods and laboratory standards used in analysis.
- It should be of high quality and be developed by suitably qualified and experienced personnel using sampling approaches that achieve the required confidence interval<sup>18</sup> in respect of the probability

<sup>18</sup> 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 – associated with sampling is often cited as 95% but may also be 98% or in some cases the ‘balance of probability i.e. >50%

that the sampling will accurately reflect actual contamination levels for all relevant hazardous substances, and laboratory-based exploratory and determination procedures that are, for the most part, standardised in the relevant regulations throughout the world and are reproducible as such; and

- It should identify the proposed technique for the comparison of the data at cessation of activities, e.g. any statistical tests to be used;
- It should be developed taking into account the other related requirements for soil and groundwater protection within Directive 2010/75/EU including, but not limited to: Article 3, which requires operators to identify the hazardous substances used or stored at the installation; Article 14, which requires operators to detail the surveillance and maintenance of measures employed for the prevention of pollution of soil and groundwater and monitoring of its state; Article 16, which deals with the requirement for ongoing environmental monitoring and Article 22(3)(subparagraphs 1 and 2), which set out the actions to be taken by the operator at the point of site closure and permit surrender.

# **Appendix A**

## **Member State Questionnaire and Summary of Selected Responses**



## Member State Questionnaire (pro-forma)

To Members of IEEG  
Member State IPPC responsible experts for baseline condition reports

Subject Project for the European Commission DG Environment, Ref: Ares (2011) 918813.  
Collection and analysis of data to inform certain reviews required under Directive 2010/75/EU on industrial emissions (IED)

Topic **Reporting in line with Article 22 on the need to establish guidance on the content of baseline reports as defined in Article 3(19)**

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## Background

Directive 2010/75/EU on industrial emissions (IED) places an obligation in Article 22 on the European Commission to establish guidance on the content of baseline reports as defined in Article 3(19) of the IED.

AMEC has been contracted by the European Commission to gather and analyse information to support the Commission in the development of guidance on the content of the baseline report under Article 22 of the IED. With this in mind, it would be helpful if you could provide information against the questions listed below. **We recognise that given the recent nature of the coming into force of the Directive that the measures you propose to use to implement Article 22 may be in their infancy.** We would like to emphasise, however, that all information will be useful. Furthermore, where you implemented measures under the IPPC Directive or national legislation implementing the IPPC Directive that are similar in nature to the baseline report requirements under Article 22, then we would also like to receive information on such measures including any guidance that you may have developed at a national / regional level.

Where your response makes reference to legislation or guidance that you have developed it would be helpful if this could either be attached to your response or provided as a link to the relevant location online.

### **Introduction to questions**

*Article 22(2) of the IED Directive requires, 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 to prepare and submit a baseline report. This is required before starting operations or before a permit is updated for the first time after 7 January 2013.*

*As there are similarities to the requirement under Article 6 of the IPPC Directive to provide a description of the conditions of the site of the installation, questions 1 to 6 seek to clarify existing measures already in place under IPPC for (baseline) site condition reporting. Questions 7 to 13 relate to how the new requirements under IED will be implemented.*

## Questions

1. Article 6(1)(d) of the IPPC Directive requires applications for permits to include information on the conditions of the site of the installation. To what extent have you developed guidance on such

information with regard to the conditions of soil and groundwater at the installation. Where available please provide copies of any such guidance developed or an electronic link to the document(s).

| Member State | Details |
|--------------|---------|
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2. Does your Member State apply a consistent approach to the review of site condition reports under IPPC or is there variation (e.g. differing devolved approaches, or by installation type)?

| Member State | Details |
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*Article 22(3) requires that 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, the operator shall take the necessary measures to address that pollution so as to return the site to that state.*

3. Article 3(1) of the IPPC Directive is similar in that it requires that the necessary measures are taken upon cessation of activities to avoid any pollution risk and return the site of operation to a satisfactory state. Does your Member State currently publish guidance on techniques to be used to restore the site to a satisfactory state? If so, please provide details of this guidance.

| Member State | Details |
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4. Under IPPC do you currently require operators of the installation return the site to its baseline condition as an absolute value at cessation of activities?

4a. If not, do you take a risk-based approach to setting the remediation target for a site at cessation of activities?

4b. If a risk based approach is currently taken to setting remediation targets, how and where is the acceptable level of risk to the environment and current/future site users defined (or alternatively how is the use of the site, to which the permitted site must be made suitable for, selected e.g. the current use and/or a future use)?

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5. Of the IPPC permitted sites that have ceased operation to date in your Member State, what proportion were required to carry out some remediation in order to surrender their permit?

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| Member State | Details |
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6. Does your Member State currently have in place any guidance or legislation which encourages or requires operators regulated under IPPC to state whether the site is suitable for use (in terms of not posing significant risks to the environment and current or future site users) at the time of permit application or at the point of cessation of activities? If so, please provide some detail.

6a. If not, is your Member State currently developing guidance or legislation which covers the above? If so, please provide detail on how sites are to be assessed as suitable for use (i.e. not posing any significant risks to human health or the environment) and how/where the 'use' or 'uses' will be defined.

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| Member State | Details |
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7. Please explain the measures (including guidance or legislative changes) currently in place or planned to achieve the requirements for a baseline report under Article 22 (2) of IED. Outline whether these measures are being, or will be, taken on a national, regional or sector-specific level. If planned, please provide detail of when they will come into being.

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| Member State | Details |
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8. Do the measures noted in question 1 above make a distinction between the requirements of Article 12(1)(d), the conditions of the site of the installation and Article 12(1)(e), a baseline report in accordance with Article 22(2) (where applicable)?

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| Member State | Details |
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9. Are the main requirements and methodologies for collecting data to develop a baseline report compliant with the requirement of Article 22(2) of IED currently defined (e.g. in existing IPPC guidance)? If yes, please provide a reference. If no, please indicate whether there are any plans to define these requirements and how it is intended you will achieve this.

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| Member State | Details |
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10. Are you currently developing any new guidance on the content, or completion, of a baseline report? If so, please provide detail on how 'baseline' condition (the determination of the state of soil and groundwater contamination) is to be defined by the operator.

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| Member State | Details |
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11. Does existing guidance or legislation that relates to development of a baseline report encourage or require operators to take into account the general condition of the soil at the installation (in addition to identifying the presence and/or concentrations of potentially polluting substances) e.g. extent of soil sealing, current soil organic content, etc.? If so, please provide detail.

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| Member State | Details |
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- 11a. Is your Member State currently developing guidance or legislation which covers the above? If yes, please provide details.

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| Member State | Details |
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12. Does guidance currently exist or are you developing any guidance that requires or encourages operators to check that baseline conditions have not changed during the permitted operations (i.e. before cessation of operations) in order to minimise potential remediation effort and/or cost at the end of operations? Although not required by the IED, this is a requirement of the Environmental Liability Directive for any soil damage caused after 2007.

- 12a. If yes, what guidance is provided to operators as to how frequently they should monitor soil and/or groundwater condition and how they should do this? Please include detail as to whether this guidance is national, regional or sector specific.

- 12b. Is your Member State in the process of developing any guidance or legislation which covers the above? If yes, please provide some detail (of research to date or guidance in draft).

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| Member State | Details |
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13. Are there other measures that you have applied at a national / regional level with regard to establishing the state of contamination of soil and / or groundwater that may provide relevant information for the contents of the baseline report under IED? Wherever possible please provide links to relevant legislation / guidance that has been developed.

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| Member State | Details |
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## Overview of Member State Questionnaire Responses

**Table A.1 Overview of data received from Member States in response to the proforma**

| Response provided to questionnaire   | Member State: | AT     | BE     | BG    | CZ     | DE     | DK    | EE     | FI     | IE     | IT  | LV    | NL     | PL     | ES     | SI    | SK    | UK     | RO    | HU     | PT     |
|--|---------------|--------|--------|-------|--------|--------|-------|--------|--------|--------|-----|-------|--------|--------|--------|-------|-------|--------|-------|--------|--------|
| Has guidance already been developed under IPPC on reporting of soil and groundwater conditions?  |               | Red    | Yellow | Green |        |        | Red   | Yellow |        |        |     |       | Green  |        |        |       |       | Green  | Green |        | Red    |
| Is a consistent approach taken to review of site condition reports across all IPPC installations?  |               | Red    | Yellow | Green | Red    | Red    | Red   | Yellow |        | Red    | Red | Red   | Green  | Red    | Red    |       |       | Green  |       |        |        |
| Does guidance exist on how to return the site to 'satisfactory state' under IPPC?  |               | Red    | Green  | Red   |        |        | Red   | Red    | Green  | Red    | Red |       | Green  | Red    |        |       | Green | Yellow | Green | Green  |        |
| How remediation targets are set (absolute value or risk based approach).   |               | Yellow | Yellow |       | Yellow | Yellow |       | Yellow | Yellow | Yellow |     |       | Yellow | Yellow | Yellow |       |       | Yellow |       | Yellow | Yellow |
| Do measures exist or are at planning stage to implement Article 22 (2) of IED requiring baseline report.   |               |        | Green  | Green | Green  | Green  | Green |        | Green  | Red    | Red |       | Green  | Green  |        | Red   | Green | Yellow | Green | Green  |        |
| Is a distinction made between reporting on site condition and the baseline report under IED?   |               |        | Red    | Green | Green  | Green  |       |        |        |        |     |       | Green  | Red    |        | Red   |       | Yellow |       |        |        |
| Are the main requirements of the baseline report defined in existing guidance or work in progress?   |               | Red    | Green  | Green | Green  | Green  | Green | Yellow | Yellow | Red    | Red | Green | Green  | Red    |        | Red   | Red   | Green  | Green | Green  |        |
| Is guidance in development on content or completion of baseline report?  |               | Red    | Red    | Red   | Green  | Green  | Red   |        | Red    | Red    | Red |       | Red    | Green  | Yellow | Green | Red   | Yellow | Red   | Red    |        |
| Does guidance exist or is being developed on ongoing monitoring of soil and groundwater during permitted operations?   |               | Red    | Green  | Green | Green  | Red    | Red   | Green  | Yellow |        | Red |       |        |        | Red    | Red   |       | Green  | Green |        |        |
| Member State has legislative or other measures requiring operators to establish condition of soil and groundwater at their site that could inform IED baseline report? |               |        | Red    |       | Red    |        | Green | Yellow | Green  |        | Red | Red   | Green  |        |        | Green | Green | Green  | Red   | Red    |        |

- Comprehensive response – positive to question asked
- Comprehensive response – subject to interpretation (see questionnaire for details)
- Comprehensive response – negative to question asked
- No data or insufficiently clear information

## Summary of Selected Member State Responses

A more detailed summary of the most relevant responses is provided below in order to inform the assessment of how soil and groundwater reporting requirements under IED are likely to impact on individual Member States.

### To what extent has guidance been developed on information required with regard to the conditions of soil and groundwater at the installation.

A minority of the Member States have produced guidance specific to IPPC to advise operators on the content of a report on the site's condition in relation to soil and/or groundwater to support a permit application (including Bulgaria, Netherlands, United Kingdom and Romania). However the majority of Member States have some form of legislation which requires the condition of soil and groundwater to be considered at permitted installations and in some cases reported, without there being specific guidance on the content of a site report required as part of an IPPC permit application. In some Member States it is likely that only where historic contamination was suspected that soil and/or groundwater data would be provided. Austria, Denmark and Portugal have stated that they have no relevant guidance and the response from Slovakia indicates that details of soil and groundwater conditions would be unlikely to be included in a permit application.

For countries with established guidance – BE, BG, NL, RO, UK - it is likely that this can be adapted to meet the baseline reporting requirement under IED. In preparing this report, AMEC examined selected components of these guidance documents to better understand what they were guiding operators on and to what extent, without substantial alteration, they could fulfil the role of ensuring operators understood their obligations under Article 22(2). For the remaining Member States entirely new guidance may be needed, particularly since the focus in many Member States is likely to be in identifying potentially significant risks to human or environmental receptors caused by historic contamination, rather than taking identifying the baseline conditions for soil and groundwater in relation to potential future contamination by the installation during the permit period.

### Is a consistent approach to the review of site condition reports applied or is there variation (e.g. differing devolved approaches, or by installation type)?

Only three Member States (Bulgaria, the Netherlands and United Kingdom) stated that they take a consistent approach to the review of site condition reports at the commencement of a permit. Finland stated that it has produced guidance for making permit decisions for small and medium sized installations.

Nine of the Member States stated that there was not a consistent approach applied at the Member State level to the review of reports on site condition of industrial facilities at permit issue. In some instances this is because there is no site report guidance, there are also differing regional approaches/requirements in some Member States (e.g. Belgium and Spain). In most Member States where any soil and groundwater

data has been provided by an operator in support of a permit application it is likely that a case by case approach would be applied to assessing the adequacy of the data, possibly with variation in approach between local regulatory departments.

In order for the IED to be implemented in a harmonious manner across the Member States it is desirable that both the format of baseline reports and the manner in which they are assessed are consistent. Assessment of the baseline report by an appropriately competent person should ensure to some degree that reports are of comparable quality, completeness and reliability within the Member State. Given that this burden is likely to fall on agents of the state, it is likely that many Member States' regulatory bodies would need to develop their own internal guidance. There would also be a need for an adequate number of specialists in soil and groundwater to be available to cope with the numbers of permit applications (although permit review periods are often staggered such that this can relieve pressure spots on regulatory resources).

### Does your Member State currently publish guidance on techniques to be used to restore the site to a satisfactory state?

Very few of the Member States have published guidance defining 'satisfactory state' under IPPC (Belgium, Finland, Hungary, the Netherlands, Romania and the United Kingdom).

Austria, Bulgaria, Denmark, Estonia, Ireland, Italy and Poland stated that they have produced no relevant guidance.

Other Member States have no detailed guidance but would require that sites are cleaned up at cessation of operations. However clean up could range from safely decommissioning operations and leaving the site free of waste to actually carrying out a subsurface investigation, then risk assessment, in relation to contamination in soils or groundwater in order to establish whether remediation is required).

Later questions also deal with risk assessment however the response to this question does indicate a wide variety of approaches in assessing sites at cessation of operations; with likely variation in the level of technical understanding of soil and groundwater contamination required by both the operator and the regulator.

As some Member States already have established methods for establishing the level of contamination at a site and then assessing the risks from land contamination it is not considered appropriate for the baseline report guidance to detail this process, however guidance should refer all Member States to available Europe-wide points of reference for best practice (such as NICOLE, Common Forum etc) and to international standards and guidance.

**Do you currently require operators of the installation to return the site to its baseline condition as an absolute value at cessation of activities or is a risk-based approach to setting the remediation target for a site at cessation of activities used?**

The vast majority of Member States, including Austria, Belgium, Czech Republic, Germany, Hungary, Denmark, Finland, Ireland, Italy, Latvia, Poland, Portugal Romania, Spain and Slovakia stated that they would use some form of risk based appraisal of site condition at the end of operations in order to assess whether remediation is needed. However, the nature of the risk assessments is likely to vary widely e.g. ranging from a high level assessment of whether the site appears clean and the operator appears to have operated and decommissioned the site safely without causing soil or groundwater contamination (and in accordance with permit conditions), to a detailed intrusive site investigation and report where soil and groundwater contaminant levels are compared against relevant assessment criteria in order to assess whether there are risks to humans or environmental receptors.

The Netherlands use the absolute baseline value for soil and groundwater as the point of comparison at cessation of operations; and would require remediation of contamination which was identified at the end of operations in excess of baseline values (without there necessarily being an identified significant risk to human or environmental receptors). England and Wales in the UK also take this approach to an extent (defined as ‘no deterioration’) however if an operator could prove that it was unsustainable or not practicable to remove the contamination then it would be acceptable not to remediate back to baseline and a risk based approach would be adopted to ensure there were no significant risks to humans or environmental receptors.

Both Bulgaria and Estonia referenced the baseline condition being an absolute (threshold) value though it is not clear from the responses whether the regulators in these Member States would expect sites to be returned to the baseline condition (i.e. specifically below the threshold value set by the baseline report) at cessation of operations.

**Please explain the measures (including guidance or legislative changes) currently in place or planned to achieve the requirements for a baseline report under Article 22 (2) of IED.**

Over half of the Member States who responded have made initial plans to implement the requirements of the IED. The majority commented that they are awaiting the Commission’s guidance before finalising legislation or guidance within their Member State. A few Member States commented that their existing guidance and/or legislation is likely to be suitable to meet the requirements of IED with minor amendments, these included Belgium, the Czech Republic, the Netherlands and some parts of the UK (England and Wales) and Romania. The majority of Member States are awaiting the Commission’s guidance on the baseline report before they draft any new guidance on the baseline report required under IED.

Do the measures you propose for advising on preparation of baseline report make a distinction between the requirements of Article 12(1)(d), the conditions of the site of the installation and Article 12(1)(e), a baseline report in accordance with Article 22(2) (where applicable)?

Only a minority of Member States (Bulgaria, the Czech Republic, Denmark and the Netherlands) responded that they would make this distinction, some Member States said that they are not planning to make a distinction (Belgium, Poland and Slovenia) and the majority are awaiting Commission guidance on this issue.

Does existing guidance or legislation that relates to development of a baseline report encourage or require operators to take into account the general condition of the soil at the installation (in addition to identifying the presence and/or concentrations of potentially polluting substances) e.g. extent of soil sealing, current soil organic content, etc.?

A minority of Member States (including Bulgaria, the Netherlands and Romania) answered that they do require information on general soil characteristics. The majority of the Member States would require operators to focus on providing data on the presence and concentrations of relevant contaminants. However, a site investigation to acquire soil and groundwater data would generally involve consideration of the site specific geology and hydrogeology, and in general, where operators provide technical data on concentrations of contaminants in soils they will have also obtained some information on more general soil characteristics such as the soil type (made ground, clay, sand, silt etc), and also information on the general condition of the site soils e.g. in terms of extent of hardstanding cover.

Does guidance currently exist or are you developing any guidance that requires or encourages operators to check that baseline conditions have not changed during the permitted operations?

A few Member States already require (under IPPC) or are developing guidance/legislation under IED which recommends/requires ongoing monitoring for some installations (mainly identified on a case by case basis by the regulator). Member States who favour an approach of ongoing monitoring rather than just at the start and end of a permit include Belgium, Bulgaria, the Czech Republic, Estonia, Finland, the UK and Romania. However, a significant number of the Member States have not currently put in place any requirement for ongoing monitoring or developed guidance on this for operators of industrial installations.

It is noted elsewhere in this report that ongoing environmental monitoring can potentially identify problems at an earlier stage than waiting until cessation of operations to check soil and groundwater conditions, by which point larger scale remediation may be needed if a problem (e.g. a leakage from an underground pipe) has gone otherwise unchecked. Ongoing monitoring is also required under Article 14(1)(e) and Article 16 of IED.

Are there other measures that you have applied at a national / regional level with regard to establishing the state of contamination of soil and / or groundwater that may provide relevant information for the contents of the baseline report under IED?

Most Member States responded to the effect that they have legislative or other measures for investigation of soil and groundwater quality that may be transferable or at least loosely applicable to the requirements under IED to produce a baseline report (and assessment of the condition of a site at the end of a permit). In some instances this relates to the existence of technical guidance on how to collect and assess soil and groundwater data and/or the general existence of a regime for assessment of contaminated land (mainly in relation to historic contamination). In other responses reference is made to interacting legislation that would also apply to industrial facilities or new developments (e.g. building control considerations whereby new buildings must be deemed safe in relation to any contaminants that may be present in the ground).



## **Appendix B**

# **Additional Analysis and Evidence**



## Literature Review

**Table B1 Key Sources of Information for the Literature Review**

| Source  | Description   |
|---|---|
| <b>Contaminated Land Specialist Networks and Organisations within EU</b>  |   |
| Common Forum on Contaminated Land in the European Union   | <p>The COMMON FORUM on Contaminated Land, initiated in 1994, is a network of contaminated land policy makers and advisors from national ministries in European Union Member States and European Free Trade Association countries.</p> <p>It introduced “Risk Based Land Management” as a central concept in European contaminated land approaches and demonstrated that European Union wide harmonisation can arise if all stakeholders realise the benefits of this, even without a formal European Union policy.</p>  |
| NICOLE (Network for Industrially Contaminated Land in Europe)   | A leading forum on contaminated land management in Europe, promoting co-operation between industry, academia and service providers on the development and application of sustainable technologies.  |
| SAGTA (Soil and Groundwater Technology Association)   | The Soil and Groundwater Technology Association (SAGTA) is a not-for-profit association of member organisations drawn from UK companies representing many major landholding sectors.  |
| CL:AIRE and CIEH (Contaminated Land: Applications in Real Environments and the Chartered Institute of Environmental Health) | <p>CL:AIRE is the UK’s independent body promoting sustainable remediation of contaminated land and groundwater. CL:AIRE was created with the backing of the UK government in 1999 as a not-for-profit company to encourage the demonstration and research of practical solutions for the clean up of contaminated land, and to provide a sustainable alternative to disposing of waste in landfill sites.</p> <p>The CIEH is a registered charity and the professional voice for environmental health in the UK. It provides <a href="#">information, evidence and policy advice</a> to local and national government and environmental and public health practitioners in the public and private sectors. As an awarding body, the CIEH provides <a href="#">qualifications</a>, events, and support materials on topics relevant to health, wellbeing and safety to develop workplace skills and best practice.</p> |
| <b>European Environmental Networks</b>  |   |
| IMPEL Network (European Union Network for the Implementation and Enforcement of Environmental Law)                          | An informal network of the environmental authorities of EU Member States, acceding and candidate countries, and Norway. The European Commission is also a member. The Network’s objective is to create the necessary impetus in the European Community to make progress on ensuring a more effective application of environmental legislation.  |
| <b>Industry Specific Organisations</b>  |   |
| CEFIC (The European Chemical Industry Council)  | Cefic is the voice of 29,000 large, medium and small chemical companies in Europe, which provide 1.2 million jobs and account for 21% of world chemicals production. Cefic represents its members and interacts daily on their behalf with international and EU institutions, non-governmental organizations, the international media and other stakeholders.   |

| Source   | Description  |
|--|--|
| CONCAWE (Conservation of Clean Air and Water in Europe)  | CONCAWE was established in 1963 by a small group of leading oil companies to carry out research on environmental issues relevant to the oil industry. Its membership has broadened to include most oil companies operating in Europe. The scope of CONCAWE's activities has gradually expanded in line with the development of societal concerns over environmental, health and safety issues. These now cover areas such as fuels quality and emissions, air quality, water quality, soil contamination, waste, occupational health and safety, petroleum product stewardship and cross-country pipeline performance. |
| ISWA (International Solid Waste Association)   | ISWA is an international, independent and non-profit making association, working in the public interest to promote and develop sustainable waste management worldwide. ISWA has members around the world and is the only worldwide association promoting sustainable and professional waste management. The Association is open to individuals and organisations from the scientific community, public institutions and public and private companies working in the field of and interested in waste management.   |
| <b>Environmental Regulators</b>  |  |
| Environment Agency (England and Wales)   | UK Executive Non-departmental Public Body responsible to the Secretary of State for Environment, Food and Rural Affairs and a Welsh Government Sponsored Body responsible to the Minister for Environment and Sustainable Development.   |
| Network of European Environment Protection Agencies (EPA Network)  | The EPA Network is an informal grouping bringing together the heads and directors of environment protection agencies and similar bodies across Europe. The network exchanges views and experiences on issues of common interest to organisations involved in the practical day-to-day implementation of environmental policy.  |
| <b>Independent Research Organisations</b>  |  |
| VITO, BIO Intelligence Service, Institute of European Environmental Policy (IEEP) and IVM (Institute for Environmental Studies, Netherlands) | <p>VITO is an independent research organisation, VITO provides innovative technological solutions as well as scientifically based advice and support in order to stimulate sustainable development and reinforce the economic and social fabric of Flanders, Belgium.</p> <p>BIO Intelligence Service is a network of people who work together to lower environmental impacts of product production and consumption.</p> <p>The IEEP is an independent research organisation concerned with policies affecting the environment in Europe and beyond.</p>   |
| <b>UK Environmental Journals</b>   |  |
| Brownfield Briefing  | UK publication primarily concerned with brownfield development providing coverage, expert commentary, analysis and interviews with key figures in the industry, along with reports on management, legal and insurance issues.  |
| Environmental Data Services (ENDS)   | UK journal for professionals, delivering news, analysis and reference across the carbon, environmental and sustainability agenda.  |

## Review of the BREF Documents

The following observations were made in relation to soil monitoring (most BREFs at least mention the possibility of soil and groundwater contamination however the observations below are specifically concerned with the collection of soil and groundwater data):

- Twenty-three of the thirty-one BREFs reviewed make no mention of soil monitoring (not every one of the thirty-five BREFs was reviewed);
- The Monitoring REF (July 2003) makes reference to deposition surveys for incinerators however there is no general guidance on soil monitoring for other sectors. The need for soil monitoring to be researched and developed for the next review of this BREF is identified. An approximate cost for individual boreholes is provided, though no rationale is given as to when these are needed;
- The Emissions from Storage BREF (July 2006) makes reference to BAT for prevention of emissions to soil and groundwater. The need to take into account the soil characteristics in relation to corrosiveness of plant materials where below ground structures are present is mentioned, along with understanding the soil bearing capacity where tanks are to be situated. Soil vapour monitoring within tank bunds is mentioned as a means to detect leakage from atmospheric tanks, combined with understanding of soil permeability. Section 4.1.6.1.8 of the BREF details a risk-based approach for emissions to soil below tanks it is commented that “*a combination of good design, proper construction and a proper inspection and maintenance level, together with certain technical measures can achieve a ‘negligible risk’ for soil pollution*”;
- The BREF for Production of Iron and Steel (February 2012), includes notes on pollution prevention design and refers to local soil conditions;
- The Mineral Oil and Gas Refineries BREF (February 2003) refers to soil monitoring in Section 3.2.6 and provides approximate costs for soil monitoring, without providing a rationale as to when monitoring might be needed. Annex I describes the system in the Netherlands with regard to soil and groundwater protection for the refining sector. This refers to risk based assessment under the Dutch Soil Protection Act (Wbb) which stipulates no risk to people and the environment, multi-functionality of the soil, the duty of care, prevention of migration of pollutants beyond location boundaries in the case of historical soil pollution, and also the obligatory clean up of soil and groundwater if so-called intervention values are exceeded, as defined by each component and each soil type. In all refineries in the Netherlands measures must have been taken to at least make an inventory of soil and groundwater pollution (possibly similar to baseline data collection);
- The Smitheries and Foundries BREF (May 2005) refers to potential sources of emissions to soil, risks during decommissioning are mentioned and the need to have a site closure plan which may include measures to collect soil data at the end of operations to assess pollution caused by the activities;
- The Intensive Rearing of Poultry and Pigs BREF (July 2003) refers to soil characteristics in relation to soil capacity and design of lagoons. The use of impermeable floors to prevent

leakages reaching ground is noted. Potential for soil impacts to occur due to emissions of nitrogen and phosphorous resulting from application of manure to land is highlighted. In order to understand emission levels it is stated that factors such as climate and soil characteristics must be taken into account. Similarly in the Food, Drink and Milk Industries BREF (August 2006) impacts to soil are mentioned in relation to soil spreading and lagoon;

- The Common Waste Water and Waste Gas Treatment/ Management Systems in the Chemical Sector BREF (February 2003) states that a site inventory should include the quality of the soil, this is largely in relation to construction of lagoons, and the corrosiveness of the soil is also an issue for this sector in relation to below ground plant/structures. There is also mention of the need to prevent soil pollution by hazardous substances by adequate storage and handling measures; and
- The Chlor-Alkali Manufacturing BREF (December 2001) makes mention of soil monitoring at cessation of activities to check for any impacts.

In summary, the majority of sectoral BREFs, as adopted under IPPC, do not currently provide guidance which would inform the development of baseline report guidance in the context of IED, although some exceptions are noted above. Groundwater is generally mentioned along with soil as an environmental receptor that should be protected through the use of BAT for pollution prevention measures and particularly at site decommissioning stage. However, on-going monitoring or baseline monitoring is not normally mentioned.



## **Appendix C**

# **Draft Baseline Report Checklist**



| <i>Baseline Investigation &amp; Report Checklist</i>   | Essential (E)<br>Optional (O) |
|--|-------------------------------|
| <b>PRELIMINARY REQUIREMENTS</b>  |                               |
| 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                             |
| <b>DETAILS OF DATA COLLECTION</b>  |                               |
| <b>Site Investigation</b>  |                               |
| 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                             |
| <b>Sampling &amp; Monitoring</b>   |                               |
| 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                             |
| <b>Analysis</b>  |                               |
| Rationale for selection of analytical parameters   | E                             |
| Description of chemical analyses, in accordance with relevant national based accreditation schemes (if available)  | E                             |
| Quality assurance and quality control requirements for laboratory analyses   | E                             |
| <b>PRESENTATION &amp; INTERPRETATION OF DATA WITHIN TEXT OF REPORT</b>   |                               |
| 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 |
| <b>PRESENTATION OF RAW DATA (ANNEX TO REPORT)</b>   |   |
| 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  | E |