



Sourcebook on EU Environmental Law

Prepared by IEEP for the EPE Banks:

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The European Bank for Reconstruction and Development (EBRD),
London;
The European Investment Bank (EIB), Luxembourg;
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FOREWORD

In May 2006, five European multilateral financial institutions launched the “European Principles for the Environment” (EPE), and subscribed to a common Declaration recognising the comparable approach taken by the Signatories to environmental management and to the integration of environmental considerations in their respective operations and mandates. The Signatory institutions, hereafter referred to as 'the EPE Banks', are:

- The Council of Europe Bank (CEB), Paris;
- The European Bank for Reconstruction and Development (EBRD), London;
- The European Investment Bank (EIB), Luxembourg;
- The Nordic Environment Finance Corporation (NEFCO), Helsinki; and
- The Nordic Investment Bank (NIB), Helsinki.

Through the EPE, the Signatory institutions, desiring to promote the European Union's approach to environmental sustainability, which is as strong as any that exists, committed themselves, subject to their respective environmental policies, to applying EU principles, practices and standards to all projects financed by them.

The EPE consist of the guiding environmental principles enshrined in the EC Treaty and the project-specific practices and standards incorporated in EU secondary legislation on the environment, the EU environmental *acquis*. As part of the EPE, the Signatory institutions also aim to promote best EU practice in the fields of environmental management, transparency, public consultation and reporting.

The geographical scope of the EPE covers at least the respective regions of operations of each Signatory institution, or any other geographic area it deems appropriate, including the Member States of the EU (EU 27) and European Economic Area (EEA) countries, the EU Accession, Acceding¹, Candidate and potential Candidate Countries and the Countries that are covered in the "EU's European Neighborhood and Partnership Instrument".

In the EU Member States, the EEA countries, the EU Accession, Acceding, Candidate and potential Candidate Countries, the EPE Banks have agreed to provide financing to public or private sponsors of projects only where the projects comply with the EPE principles and the relevant secondary EU legislation. Projects in this region should also comply with any obligations and standards enshrined in relevant Multilateral Environmental Agreements (MEAs), according to applicable EU law.

In all other countries, projects financed by the EPE Banks are expected to comply with the appropriate EU environmental principles, practices and standards, subject to local circumstances². In such financing, the Signatory institutions will apply the EPE, with reference to such factors as the costs of application, the local conditions that prevail and the time frame for the phased application for implementing the EPE.

¹ Currently there are no Accession and Acceding States.

² With regards to EU financing, due respect for the European Neighbourhood Policy and the EU policy towards Russia should be given.

The purpose of this Sourcebook is to serve as a practical and user-friendly reference document for the sponsors of projects in the countries concerned, which are eligible for funding from the EPE Banks, on all applicable EU environmental legislation, practices and standards, both cross-sectoral and sector-specific, which they need to take into account in project planning and development.

This Sourcebook is designed to enable project sponsors, particularly those from outside the EU, to identify the EU environmental standards which projects supported by EPE Banks are expected to meet. It consolidates the main features of key EU sector specific and thematic environmental legislation, in terms of the requirements, especially qualitative and quantitative standards, relevant to the project financing activities of the EPE Banks. It contains links to the full text of the legislation, guidelines and other available supporting material to which the user can refer for further guidance.

The Sourcebook is not intended to provide a full, comprehensive overview or summary of the EU environmental *acquis* in its entirety or legal advice on its interpretation. It has been developed to meet the special primary information needs of project developers and sponsors, EPE Bank staff, as well as third parties involved in the project financing activities of the EPE Banks, such as other financial institutions, including financial intermediaries, and environmental consultants. To this end it focuses in particular on project-specific standards and requirements that are sufficiently clear and specific as to be directly applicable to an individual investment. Moreover, for practical reasons, it has been necessary to confine the scope of the Sourcebook to a limited number of key sectors in which the EPE Banks' project financing is concentrated. These sectors have been selected based on a cross-section of the Banks' current lending priorities. Consequently, the Sourcebook does not cover every single activity which may conceivably be eligible for funding by any of the Signatory institutions.

The Sourcebook is not designed for public authorities in the Member States (national, regional or local government or public sector agencies) which are primarily responsible for the transposition, implementation and enforcement of EU environmental legislation in accordance with the EC Treaty and national public law. It does not comprehensively cover the legal obligations and technical and administrative duties which are incumbent on those public authorities and which do not, or only very indirectly, have an impact on the development and implementation of projects that fall within the portfolio of the EPE Banks. Administrative obligations and procedures to be implemented by public authorities are only referred to, to the extent necessary for a proper understanding of the general scheme of EU environmental legislation and in so far as they may directly or indirectly - but not only remotely - affect project developers and sponsors.

Most of the EU environmental legislation is in the form of Directives, which, legally speaking, are addressed to Member State governments and do not impose obligations directly on private sector operators. According to Article 249 of the EC Treaty, a Directive "shall be binding, as to the result to be achieved, upon each Member State to which it is addressed, but shall leave to the national authorities the choice of form and methods" of implementation. Each Member State has the obligation to transpose a Directive into national law, which means taking legislative, regulatory or

administrative legally binding measures to incorporate into its national legal order the rights and obligations set out in the Directive and ensure they are fully applicable to all persons, private and public, for which they are intended. Transposition thus includes not merely the reproduction of the words of a Directive in national law, but also requires such additional provisions as may be necessary to ensure that national law as a whole properly achieves the result intended by the Directive. Where the provisions of a Directive, as is often the case, leave a measure of discretion to the Member States as to the means of achieving a particular result, the competent national legislative or regulatory authority has a duty to exercise that discretion so as to give full effect to these provisions within the limits of the discretion granted. This means that any project developer or sponsor will always need to refer to the applicable national law of the Member State on whose territory the project is to be implemented to know the precise nature and extent of their legal obligations as they derive from EU law and national implementing legislation.

Some EU environmental legislation is in the form of Regulations, which, again according to Article 249 of the EC Treaty, are legally binding and directly applicable in all Member States and can impose obligations directly on any persons or entities subject to the jurisdiction of the Member States. When this particular EU legislative instrument is used, which is relatively rare in the field of environmental policy, there is no need for transposition into national law, but Member States may still need to adopt complementary legislative, regulatory or administrative measures to ensure the practical application and enforcement of the rights and obligations set out in the Regulation. Also, Member States will need to designate the authorities that are competent for such practical application and enforcement.

Finally, some EU environmental standards are laid down in non-binding form, through such instruments as recommendations, reference notes or technical guidance documents. Depending on the context and purpose, such instruments are issued by the European Commission, the Council, the European Parliament and Council jointly, or by EU agencies which have been tasked with scientific, technical and administrative functions in the implementation of certain policies. For some matters, the EU institutions may not deem it appropriate to use their powers to lay down binding environmental standards, but instead decide to issue formal, non-binding recommendations, another instrument provided for in Article 249 of the EC Treaty. Such formal recommendations are rather rare in the field of environmental policy.

In the context of this Sourcebook, the most important examples of non-binding EU standards are the 'reference notes on best available techniques' ('BAT Reference Notes' or, in short, 'BREFs') for the sectors covered by Directive 2008/1/EC on integrated pollution prevention and control (IPPC). These BREFs are developed through a process of information exchange and technical consensus-building between Member States, the industries concerned and environmental organisations, managed by the European IPPC Bureau (a unit of the Commission's Joint Research Centre), and are published by the Commission for use by the competent authorities of the Member States and industry. Each BREF is a document containing technical information on what is considered to be 'best available techniques' (BAT) and the associated emission limit values or performance standards for a particular activity or process subject to the permitting requirements of Directive 2008/1/EC. These documents are intended for use as reference notes by the competent authorities in the

process of laying down emission limit values and other conditions of operation in the permits they issue to operators of these activities, but the technical description of BAT is not legally binding on them.

Similar, non-binding technical guidance documents have been issued by the Commission to assist Member States in the implementation of other Directives or Regulations. Some secondary legislation explicitly mandates the Commission or, in particular cases, the competent EU regulatory agency (such as the European Chemicals Agency in the case of REACH) to prepare such guidance material to assist the Member States in implementing the legislation. In other cases, guidance material is developed without an explicit mandate in secondary legislation, in response to questions of interpretation or practical issues which arise during the course of implementation. It should be pointed out, however, that, in accordance with the Treaty, only the Court of Justice of the European Communities (ECJ) has jurisdiction to deliver an authoritative and binding interpretation of any provision of EU law, whatever its form. Important decisions of the ECJ on the interpretation of key aspects of the environmental *acquis* are occasionally referred to in the relevant chapters of this Sourcebook.

LIST OF ACRONYMS

AEI	Average Exposure Indicator
AEVs	Accredited Environmental Verifiers
AN	Ammonium nitrate
AOX	Absorbable organically bound halogens
BAT	Best Available Techniques
BATNEEC	Best Available Technology Not Involving (Entailing) Excessive Costs
BEP	Best Environmental Practice
BFBC	Bubbling fluidised bed combustion
BREFs	Best Available Techniques Reference Documents
CAN	Calcium ammonium nitrate
CDM	Clean development mechanism
CCGT	Combined Cycle Gas Turbine
CCW	Coal combustion waste
CFBC	Circulating fluidised bed combustion
CHP	Combined heat and power (cogeneration)
CO	Carbon monoxide
CO ₂	Carbon dioxide
DBB	Dry bottom boiler
DLN	Dry low NO _x premix burners
E-PRTR	European Pollutant Release and Transfer Register
EA	Environmental assessment
EC	European Community
EEC	European Economic Community
ECHA	European Chemicals Agency
ECJ	European Court of Justice
EED	Energy efficient design
EEE	Electrical and electronic equipment
EEMs	Electrically efficient motors
EHS	Environment, Health and Safety
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
ELV	Emission limit values
ELVs	End of life vehicles
EMAS	Eco-management and Audit scheme
EMS	Environment Management System
ENEMS	Energy efficiency management system
EPS	Expanded polystyrene
ESP	Electrostatic precipitator
ETS	Emission Trading Scheme
EU	European Union
FBC	Fluidised bed combustion
FF	Fabric filter
FGD	Flue-Gas Desulfurisation
FGD (dsi)	Dry sorbent injection
FDG (sd)	semi dry
FGD (wet)	Wet flue-gas desulphurisation

FGT	Flue-gas treatments
GHG	Greenhouse gas emissions
GIIP	Good International industry Practices
HCl	Hydrogen chloride
HF	Hydrogen fluoride
HFO	Heavy fuel oil
HRSG	Heat and Recovery Steam Generators
HVAC	Heating, ventilation and air conditioning
I-TEQ	International toxic equivalent scheme
ICS	Industrial cooling systems
IFC	International Finance Cooperation
IFRS	International financial reporting standards
IPPC	Integrated Pollution, Prevention and Control
LCP	Large Combustion Plant
LCPD	Large Combustion Plants Directive
LEA	Low excess air
LECA	Light expanded clay aggregate
LPG	Liquefied petroleum gas
NAP	National allocation plan
NH ₃	Ammonia
NGOs	Non governmental organisations
NO _x	Nitrogen Oxides
NPK	Nitrogen/phosphorous/potassium
NREAP	National Renewable Energy Action Plan
NVZ	Nitrate Vulnerable Zones
OECD	Organisation for Economic Cooperation and Development
PAC	Powdered Activated Carbon
PAHs	Polycyclic aromatic hydrocarbons
PBDE	Polybrominated diphenyl ethers
PC	Pulverised combustion
PCBs	Polychlorinated biphenyls
PFBC	Pressurised fluidised bed combustion
PRTR	Pollutant Release and Transfer Registers
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RFG	Reformulated gasoline
ROHS	Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment
SACs	Special areas of conservation
SCI	Sites of Community importance
SCR	Selective Catalytic Reduction
SEA	Strategic Environmental Assessment
SEED	Safety evaluations of existing dams
SO ₂	Sulphur oxides
SNCR	Selective Non Catalytic Reduction
SPAs	Special protection areas
SSP	Single superphosphate
TOC	Total Organic Carbon
TSP	Triple superphosphate

TSS	Total suspended solids
TWG	Technical working group
VOC	Volatile organic compounds
VSDs	Variable speed drivers
WBB	Wet bottom boiler
WCD	World Commission on Dams
WEEE	Waste Electrical and Electronic equipment

1 CROSS-SECTORAL REQUIREMENTS

1.1 Environmental Impact Assessment (EIA)

Background to EIA

The Directive on the assessment of the effects of certain public and private projects on the environment Directive (85/337/EC as amended by 97/11/EC and 2003/35/EC³, hereafter “EIA Directive”), is one of the items of EU environmental legislation with the most wide-ranging implications for project developers. It requires a systematic assessment of the likely environmental impacts of projects in a wide range of sectors. The EIA process mandated by the Directive seeks to help ensure that project development and planning decisions take environmental impacts into account by incorporating adequate measures to avoid or reduce and if possible offset potential impacts from the planning stage, selecting lower impact projects and rejecting projects whose likely impacts are considered unacceptable by the competent national authorities. However, EIA is only an aid to the decision-making process, making it more transparent and informed. Indeed, the EIA Directive creates procedural rather than substantive obligations and Member States are not obliged to, though they may refuse projects that damage the environment merely on account of the results of the EIA process.

Introduction to the EIA Process

When a project is likely to have a significant effect on the environment (see below), developers are required to submit a certain minimal amount of information concerning the project and its effects to the competent authorities in the Member State concerned. Additionally, the public, relevant authorities and other Member States where the project may have transboundary effects, have to be consulted on the planned development. The entire process is commonly referred to as an Environmental Impact Assessment (EIA). Depending on the national implementing legislation in the Member State in question, the EIA may be integrated into existing procedures granting consent for projects or established as a separate procedure specifically to comply with the Directive. However, the Directive does not prevent Member States from laying down stricter national rules regarding the scope and procedure for environmental assessments of planned developments within their jurisdiction.

The EIA is required to identify, describe and assess the direct and indirect effects of the project on the following factors:

³ Council Directive of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1985L0337:20030625:EN:PDF>

- human beings, fauna and flora;
- soil, water, air, climate and the landscape;
- material assets and the cultural heritage;
- the interaction between the above mentioned factors.

EIA Coverage and Exemptions

Projects covered by the EIA Directive are divided into Annex I and Annex II projects. Those listed in Annex I must always be subjected to an EIA before consent is given and those listed in Annex II might require an EIA based on a screening process described in the next section. Both Annex I and Annex II are appended to this chapter for ease of reference.

Projects whose details are adopted by a specific act of national legislation are exempt from all provisions of the Directive, as are projects serving national defence purposes, based on a case-by-case examination.

Member States may also, “in exceptional cases”, exempt specific projects in whole, or in part, from the provisions of the EIA Directive, in accordance with Article 2(3). Nowhere in the Directive is there any specification of what “exceptional cases” might cover. The Commission has published a guidance document⁴ addressing this question in 2006. However, this guidance is not of a binding nature and the interpretation of Article 2(3) rests with the European Court of Justice. According to the Commission:

- The term "exceptional cases" is likely to be interpreted narrowly.
- The exemption might normally be used in a civil emergency, though not all civil emergencies qualify for the exemption.
- There would need to be a pressing reason to justify the exemption, e.g. a serious threat to life, health or human welfare; to the environment; to political, administrative or economic stability; or to security.
- The exemption is unlikely to be justified if it is intended to meet a situation that could be both anticipated and prevented.

In the event that a project is deemed to be an ‘exceptional case’, the Member State must make public its reasons and must consider whether another form of assessment would be appropriate and whether the public should be informed of the information collected. The Member State is also required to inform the Commission of its decision to exempt a particular development prior to granting development consent. The Commission subsequently forwards all the relevant documents to the other Member State.

⁴ European Commission, *Clarification of the Application of Article 2(3) of the EIA Directive*, http://ec.europa.eu/environment/archives/eia/pdf/eia_art2_3.pdf

Main Stages of the EIA Process

Screening

Screening is the process of determining whether an EIA is required or not. Projects in Annex I always require an EIA. These Annex I projects cover major projects with potentially large environmental impacts - such as roads, power plants, industrial plants etc. Projects listed in Annex II might require an EIA and must be subjected to screening in order to evaluate whether they are likely to have significant environmental effects, and hence require an EIA. The screening process is determined through national law and is done by:

- a case-by-case examination of projects; or
- thresholds and criteria established by the Member State concerned; or
- a combination of both.

The factors to be taken into account when examining a project or setting thresholds or criteria on a national level are listed in Annex III and cover:

- The characteristics of the project such as size, pollution and nuisances, production of waste, use of natural resources;
- The location of the project, with particular regard to environmental sensitivity of the area that will be affected by the project; including effect on existing land use, natural resources and the absorption capacity of the natural environment;
- The potential impact of the project, with particular regard to its geographical extent, trans-frontier nature, extent of impact, duration, frequency and reversibility.

Most of the Member States are using a combination of both thresholds/criteria and case-by-case examination for screening Annex II projects. For some Annex II projects there is a great deal of variation across Member States regarding the levels at which some of the thresholds are set. However, according to a ruling by the European Court of Justice, Member States can only set such thresholds if they do not have the effect of excluding whole classes of Annex II projects from the EIA process altogether.⁵

The Directive also requires the screening of any changes or extensions of projects listed in Annex I and II that have already been authorized, executed or are in the process of being executed, and which may have significant adverse effects on the environment. Generally, Member States employ either a case-by-case or a threshold approach to consider whether to require an EIA where there are changes or extensions. Where thresholds are used, these are set as a proportion (often 25%) of the threshold criterion.

⁵ Judgment of 24 October 1996, Case C-72/95, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:61995J0072:EN:HTML>

Further to a ruling of the ECJ, if a development can be identified on its own as a project within Annex I, it will not constitute a ‘modification’ for the purposes of Annex II.⁶

The latest review⁷ of the EIA Directive in 2009 found that when establishing thresholds for Annex II projects, Member States often exceed their margin of discretion, either by taking account only of some selection criteria in Annex III or by exempting some projects in advance. The review points out that the selected level at which a threshold has been set has clear implications for the amount of EIA activity.

In 2008 the Commission published a guidance document⁸ clarifying the scope and definition of project categories in Annexes I and II. It aims to ensure that those projects likely to have significant effects on the environment do not fall outside the scope of the Directive due to issues of interpretation. It is also intended to provide an overview of existing useful sources of information at EU level, including rulings of the European Court of Justice (ECJ), definitions provided in other Directives and relevant guidance documents.

Note also that some Member States have included additional project categories to those in the Annexes of the EIA Directive into their domestic legislation, requiring an EIA.

The decision by the national competent authority on whether to carry out an EIA or not must be made public.

It is worth noting that a developer may not try to avoid the requirements of an EIA by deliberately dividing projects into two or more separate entities so that each individual part would not require an EIA in and of itself and therefore the project as a whole would not be assessed. This practice, sometimes referred to as “salami-slicing”, is not in accordance with the requirements of the EIA Directive.

All projects that have been screened to require an EIA must also be subjected to a requirement for development consent.

Scoping and environmental impact statement

The scoping stage sets the coverage and detail of the EIA process, based on the information specified in Annex IV. Scoping evaluates which impacts and issues to consider and ensures that the impact assessment provides all the relevant information. During the scoping stage, before submitting the application for development consent,

⁶ Judgment of 11 August 1995, Case C-431/92, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:61992J0431:EN:HTML>

⁷ European Commission, Study concerning the report on the application and effectiveness of the EIA Directive, June 2009, http://ec.europa.eu/environment/eia/pdf/eia_study_june_09.pdf

⁸ European Commission(2008), *Interpretation of definitions of certain project categories of Annex I and II of the EIA Directive*, 2008-022, 2008

the developer has the right to request from the competent authority an opinion on the information to be required. By doing this the developer might avoid potential delays later on in the process as well as ensure a better quality assessment. In some Member States the competent authority is required to provide this information regardless of any requests from the developer.

The environmental information acquired during the assessment is to be submitted to the competent authority by the developer together with the application for development consent. The Directive does not prescribe in what form this information must be presented, but national implementing legislation often refers to an Environmental Impact Statement (EIS) or similar form. Whatever the form determined by national law, the information shall include at least:

- A description of the project with information on its site, design and size.
- The data required to identify and assess the main effects the project is likely to have on the environment.
- A description of the measures envisaged to avoid, reduce and possibly remedy significant adverse effects.
- An outline of the main alternatives studied by the developer and the main reasons for his choice, taking into account the environmental effects.
- A non-technical summary of the above information.

Annex IV of the Directive contains a more detailed list of information to be provided by the developer, but this is indicative only, as the Directive stipulates that this information is to be provided only as far as the Member State considers it relevant to a given stage of the consent procedure, to the characteristics of the proposed project and to the environmental features likely to be affected, and reasonable having regard to current knowledge and methods of assessment. Thus the exact range of information to be provided depends on national law, subject to the minimum requirements set out above. Member States can either lay down uniform guidelines or provide some discretion to competent authorities as to exactly how much information they require a developer to provide.

Public participation and consultation

Any request for development consent and the information supplied by the developer must be made public within reasonable time-frames to allow members of the public concerned the opportunity to express their opinion before consent for the development is granted. Authorities with specific environmental responsibilities that are likely to be concerned by a project must also be given an opportunity to express their opinion. Member States are required to specify the time-frames and procedural arrangements for public participation in their national legislation and to ensure that the 'public concerned' also has access to a review procedure before a court of law to challenge the substantive or procedural legality of decisions and acts or omissions within the scope of the EIA process. The 'public concerned' includes those who have an interest in the environmental decision-making procedures, such as NGOs.

Where a project is likely to have effects in another Member State, the developer's information is to be forwarded to that Member State and should serve as a basis for any consultations between authorities in the two Member States. Where a project is

likely to have significant trans-boundary effects, there are enhanced procedures for consultation between Member States.

The detailed arrangements for consultation will differ in each Member State, since national law shall determine the manner in which the consultation will take place and fix an appropriate time limit on the various stages of the procedure so as to ensure that a decision on a proposed development is taken within a reasonable time frame. Some Member States have also introduced consultation with the public during the screening and scoping stages, even if not required by the EIA Directive.⁹

Approval process

The relevant competent authority in a Member State assesses the information submitted by developers and the results of public consultations in their consideration of a proposed development project. Once a decision has been made, the competent authority is required to inform the public (and concerned Member States where the procedure for projects with trans-boundary effects has been applied) of the content of their decision and any conditions attached. In addition the public must be informed as to the reasons and considerations upon which the decision was based, and the competent authority must if necessary, describe the measures which will be taken to minimise adverse environmental effects.

Relationship between EIA and Strategic Environmental Assessment (SEA)

In addition to the EIA procedure described in this chapter, Directive 2001/42/EC¹⁰ on the assessment of the effects of certain plans and programmes on the environment (hereafter the SEA Directive) has also introduced a separate, strategic environmental assessment (SEA) procedure. Both procedures differ in their scope. The SEA Directive applies to plans and programmes, whereas the EIA Directive applies only to projects. The EIA Directive covers both public and private projects, whereas the SEA Directive applies to plans and programmes which are subject to preparation and/or adoption by public authorities or which are required by legislative, regulatory or administrative provisions. Consequently the SEA covers in general only public plans and programmes even if it might in some cases apply to privatised utilities.

There is also a functional link between the EIA and SEA Directives. The SEA Directive requires that an environmental assessment shall be carried out for all plans and programmes, which are prepared for certain sectors “and which set the framework for future development consent of projects listed in Annexes I and II” of the EIA Directive.

⁹ Further guidance on good approaches to public participation in practice can be found in the *Good Practice Handbook on Public Participation in Making Local Environmental Decisions* <http://www.unecce.org/env/pp/ecases/handbook.pdf>

¹⁰ Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2001:197:0030:0037:EN:PDF>

The possible overlap between the EIA and the SEA Directives is discussed in Article 11(1) and (2) of the SEA Directive. In these cases Article 11(1) states that other Community law requirements, such as the EIA Directive, relating to an environmental assessment of plans and programmes apply concurrently with the SEA Directive. These could be cases where plans and programmes provide for several projects to which the EIA Directive applies. Article 11(2) deals with the avoidance of a duplication of assessment in situations where the plan or programme comprises the development consent for a project. In these cases the Directive suggests a co-ordinated approach covering the aspects of both the EIA and the SEA Directives.

Plans and programmes are not defined in the SEA Directive. The guidance by DG Environment on the SEA Directive gives examples of what might be thought of as a plan in some Member States or as a programme in others. The guidance recognises that it is not possible to provide a rigorous distinction between the two and that the name alone will not be a sufficiently reliable guide¹¹. Consequently the hierarchical structure between policies (not covered by SEA), plans, programmes (covered by SEA) and projects (covered by EIA) is not as clear as it could be. In any case the norm is that in strategic decision-making the hierarchy between tiers moves down from plans to programmes to projects, but not always. Sometimes this top-down model can be reversed as in certain large scale projects subject to EIA, such as those for harbours or nuclear installations, which might begin to drive plans and programmes that require an SEA.

¹¹ European Commission, *Implementation of Directive 2001/42 on the Assessment of the Effects of Certain Plans and Programmes on the Environment*, http://ec.europa.eu/environment/archives/eia/pdf/030923_sea_guidance.pdf

PROJECTS SUBJECT TO ARTICLE 4 (1)

1. Crude-oil refineries (excluding undertakings manufacturing only lubricants from crude oil) and installations for the gasification and liquefaction of 500 tonnes or more of coal or bituminous shale per day.
2. — Thermal power stations and other combustion installations with a heat output of 300 megawatts or more, and
 - nuclear power stations and other nuclear reactors including the dismantling or decommissioning of such power stations or reactors (*) (except research installations for the production and conversion of fissionable and fertile materials, whose maximum power does not exceed 1 kilowatt continuous thermal load).
3. (a) Installations for the reprocessing of irradiated nuclear fuel.
 - (b) Installations designed:
 - for the production or enrichment of nuclear fuel,
 - for the processing of irradiated nuclear fuel or high-level radioactive waste,
 - for the final disposal of irradiated nuclear fuel,
 - solely for the final disposal of radioactive waste,
 - solely for the storage (planned for more than 10 years) of irradiated nuclear fuels or radioactive waste in a different site than the production site.
4. — Integrated works for the initial smelting of cast-iron and steel;
 - Installations for the production of non-ferrous crude metals from ore, concentrates or secondary raw materials by metallurgical, chemical or electrolytic processes.
5. Installations for the extraction of asbestos and for the processing and transformation of asbestos and products containing asbestos: for asbestos-cement products, with an annual production of more than 20 000 tonnes of finished products, for friction material, with an annual production of more than 50 tonnes of finished products, and for other uses of asbestos, utilization of more than 200 tonnes per year.
6. Integrated chemical installations, i.e. those installations for the manufacture on an industrial scale of substances using chemical conversion processes, in which several units are juxtaposed and are functionally linked to one another and which are:
 - (i) for the production of basic organic chemicals;
 - (ii) for the production of basic inorganic chemicals;
 - (iii) for the production of phosphorous-, nitrogen- or potassium-based fertilizers (simple or compound fertilizers);
 - (iv) for the production of basic plant health products and of biocides;
 - (v) for the production of basic pharmaceutical products using a chemical or biological process;
 - (vi) for the production of explosives.
7. (a) Construction of lines for long-distance railway traffic and of airports (1) with a basic runway length of 2 100 m or more;
 - (b) Construction of motorways and express roads (2);
 - (c) Construction of a new road of four or more lanes, or realignment and/or widening of an existing road of two lanes or less so as to provide four or more lanes, where such new road, or realigned and/or widened section of road would be 10 km or more in a continuous length.
8. (a) Inland waterways and ports for inland-waterway traffic which permit the passage of vessels of over 1 350 tonnes;

(*) Nuclear power stations and other nuclear reactors cease to be such an installation when all nuclear fuel and other radioactively contaminated elements have been removed permanently from the installation site.

(1) For the purposes of this Directive, 'airport' means airports which comply with the definition in the 1944 Chicago Convention setting up the International Civil Aviation Organization (Annex 14).

(2) For the purposes of the Directive, 'express road' means a road which complies with the definition in the European Agreement on Main International Traffic Arteries of 15 November 1975.

▼ **M1**

- (b) Trading ports, piers for loading and unloading connected to land and outside ports (excluding ferry piers) which can take vessels of over 1 350 tonnes.
- 9. Waste disposal installations for the incineration, chemical treatment as defined in Annex IIA to Directive 75/442/EEC ⁽¹⁾ under heading D9, or landfill of hazardous waste (i.e. waste to which Directive 91/689/EEC ⁽²⁾ applies).
- 10. Waste disposal installations for the incineration or chemical treatment as defined in Annex IIA to Directive 75/442/EEC under heading D9 of non-hazardous waste with a capacity exceeding 100 tonnes per day.
- 11. Groundwater abstraction or artificial groundwater recharge schemes where the annual volume of water abstracted or recharged is equivalent to or exceeds 10 million cubic metres.
- 12. (a) Works for the transfer of water resources between river basins where this transfer aims at preventing possible shortages of water and where the amount of water transferred exceeds 100 million cubic metres/year;
(b) In all other cases, works for the transfer of water resources between river basins where the multi-annual average flow of the basin of abstraction exceeds 2 000 million cubic metres/year and where the amount of water transferred exceeds 5 % of this flow.

In both cases transfers of piped drinking water are excluded.

- 13. Waste water treatment plants with a capacity exceeding 150 000 population equivalent as defined in Article 2 point (6) of Directive 91/271/EEC ⁽³⁾.
- 14. Extraction of petroleum and natural gas for commercial purposes where the amount extracted exceeds 500 tonnes/day in the case of petroleum and 500 000 m³/day in the case of gas.
- 15. Dams and other installations designed for the holding back or permanent storage of water, where a new or additional amount of water held back or stored exceeds 10 million cubic metres.
- 16. Pipelines for the transport of gas, oil or chemicals with a diameter of more than 800 mm and a length of more than 40 km.
- 17. Installations for the intensive rearing of poultry or pigs with more than:
 - (a) 85 000 places for broilers, 60 000 places for hens;
 - (b) 3 000 places for production pigs (over 30 kg); or
 - (c) 900 places for sows.
- 18. Industrial plants for the
 - (a) production of pulp from timber or similar fibrous materials;
 - (b) production of paper and board with a production capacity exceeding 200 tonnes per day.
- 19. Quarries and open-cast mining where the surface of the site exceeds 25 hectares, or peat extraction, where the surface of the site exceeds 150 hectares.
- 20. Construction of overhead electrical power lines with a voltage of 220 kV or more and a length of more than 15 km.
- 21. Installations for storage of petroleum, petrochemical, or chemical products with a capacity of 200 000 tonnes or more.

▼ **M2**

- 22. Any change to or extension of projects listed in this Annex where such a change or extension in itself meets the thresholds, if any, set out in this Annex.

⁽¹⁾ OJNo L 194, 25. 7. 1975, p. 39. Directive as last amended by Commission Decision 94/3/EC (OJ No L 5, 7. 1. 1994, p. 15).

⁽²⁾ OJ No L 377, 31. 12. 1991, p. 20. Directive as last amended by Directive 94/31/EC (OJ No L 168, 2. 7. 1994, p. 28).

⁽³⁾ OJ No L 135, 30. 5. 1991, p. 40. Directive as last amended by the 1994 Act of Accession.

PROJECTS SUBJECT TO ARTICLE 4 (2)**1. Agriculture, silviculture and aquaculture**

- (a) Projects for the restructuring of rural land holdings;
- (b) Projects for the use of uncultivated land or semi-natural areas for intensive agricultural purposes;
- (c) Water management projects for agriculture, including irrigation and land drainage projects;
- (d) Initial afforestation and deforestation for the purposes of conversion to another type of land use;
- (e) Intensive livestock installations (projects not included in Annex I);
- (f) Intensive fish farming;
- (g) Reclamation of land from the sea.

2. Extractive industry

- (a) Quarries, open-cast mining and peat extraction (projects not included in Annex I);
- (b) Underground mining;
- (c) Extraction of minerals by marine or fluvial dredging;
- (d) Deep drillings, in particular:
 - geothermal drilling,
 - drilling for the storage of nuclear waste material,
 - drilling for water supplies,with the exception of drillings for investigating the stability of the soil;
- (e) Surface industrial installations for the extraction of coal, petroleum, natural gas and ores, as well as bituminous shale.

3. Energy industry

- (a) Industrial installations for the production of electricity, steam and hot water (projects not included in Annex I);
- (b) Industrial installations for carrying gas, steam and hot water; transmission of electrical energy by overhead cables (projects not included in Annex I);
- (c) Surface storage of natural gas;
- (d) Underground storage of combustible gases;
- (e) Surface storage of fossil fuels;
- (f) Industrial briquetting of coal and lignite;
- (g) Installations for the processing and storage of radioactive waste (unless included in Annex I);
- (h) Installations for hydroelectric energy production;
- (i) Installations for the harnessing of wind power for energy production (wind farms).

4. Production and processing of metals

- (a) Installations for the production of pig iron or steel (primary or secondary fusion) including continuous casting;
- (b) Installations for the processing of ferrous metals:
 - (i) hot-rolling mills;
 - (ii) smitheries with hammers;
 - (iii) application of protective fused metal coats;
- (c) Ferrous metal foundries;
- (d) Installations for the smelting, including the alloyage, of non-ferrous metals, excluding precious metals, including recovered products (refining, foundry casting, etc.);
- (e) Installations for surface treatment of metals and plastic materials using an electrolytic or chemical process;

▼ **M1**

- (f) Manufacture and assembly of motor vehicles and manufacture of motor-vehicle engines;
- (g) Shipyards;
- (h) Installations for the construction and repair of aircraft;
- (i) Manufacture of railway equipment;
- (j) Swaging by explosives;
- (k) Installations for the roasting and sintering of metallic ores.

5. Mineral industry

- (a) Coke ovens (dry coal distillation);
- (b) Installations for the manufacture of cement;
- (c) Installations for the production of asbestos and the manufacture of asbestos-products (projects not included in Annex I);
- (d) Installations for the manufacture of glass including glass fibre;
- (e) Installations for smelting mineral substances including the production of mineral fibres;
- (f) Manufacture of ceramic products by burning, in particular roofing tiles, bricks, refractory bricks, tiles, stoneware or porcelain.

6. Chemical industry (Projects not included in Annex I)

- (a) Treatment of intermediate products and production of chemicals;
- (b) Production of pesticides and pharmaceutical products, paint and varnishes, elastomers and peroxides;
- (c) Storage facilities for petroleum, petrochemical and chemical products.

7. Food industry

- (a) Manufacture of vegetable and animal oils and fats;
- (b) Packing and canning of animal and vegetable products;
- (c) Manufacture of dairy products;
- (d) Brewing and malting;
- (e) Confectionery and syrup manufacture;
- (f) Installations for the slaughter of animals;
- (g) Industrial starch manufacturing installations;
- (h) Fish-meal and fish-oil factories;
- (i) Sugar factories.

8. Textile, leather, wood and paper industries

- (a) Industrial plants for the production of paper and board (projects not included in Annex I);
- (b) Plants for the pretreatment (operations such as washing, bleaching, mercerization) or dyeing of fibres or textiles;
- (c) Plants for the tanning of hides and skins;
- (d) Cellulose-processing and production installations.

9. Rubber industry

Manufacture and treatment of elastomer-based products.

10. Infrastructure projects

- (a) Industrial estate development projects;
- (b) Urban development projects, including the construction of shopping centres and car parks;
- (c) Construction of railways and intermodal transshipment facilities, and of intermodal terminals (projects not included in Annex I);
- (d) Construction of airfields (projects not included in Annex I);
- (e) Construction of roads, harbours and port installations, including fishing harbours (projects not included in Annex I);
- (f) Inland-waterway construction not included in Annex I, canalization and flood-relief works;

▼ **M1**

- (g) Dams and other installations designed to hold water or store it on a long-term basis (projects not included in Annex I);
- (h) Tramways, elevated and underground railways, suspended lines or similar lines of a particular type, used exclusively or mainly for passenger transport;
- (i) Oil and gas pipeline installations (projects not included in Annex I);
- (j) Installations of long-distance aqueducts;
- (k) Coastal work to combat erosion and maritime works capable of altering the coast through the construction, for example, of dykes, moles, jetties and other sea defence works, excluding the maintenance and reconstruction of such works;
- (l) Groundwater abstraction and artificial groundwater recharge schemes not included in Annex I;
- (m) Works for the transfer of water resources between river basins not included in Annex I.

11. Other projects

- (a) Permanent racing and test tracks for motorized vehicles;
- (b) Installations for the disposal of waste (projects not included in Annex I);
- (c) Waste-water treatment plants (projects not included in Annex I);
- (d) Sludge-deposition sites;
- (e) Storage of scrap iron, including scrap vehicles;
- (f) Test benches for engines, turbines or reactors;
- (g) Installations for the manufacture of artificial mineral fibres;
- (h) Installations for the recovery or destruction of explosive substances;
- (i) Knackers' yards.

12. Tourism and leisure

- (a) Ski-runs, ski-lifts and cable-cars and associated developments;
 - (b) Marinas;
 - (c) Holiday villages and hotel complexes outside urban areas and associated developments;
 - (d) Permanent camp sites and caravan sites;
 - (e) Theme parks.
13. — Any change or extension of projects listed in Annex I or Annex II, already authorized, executed or in the process of being executed, which may have significant adverse effects on the environment ► **M2** (change or extension not included in Annex I) ◀;
- Projects in Annex I, undertaken exclusively or mainly for the development and testing of new methods or products and not used for more than two years.

1.2 Disclosure of Environmental Information and Public Participation

The relevant requirements in this area flow mainly from the provisions of the Aarhus Convention on access to information, public participation in decision-making and access to justice in environmental matters, which has been ratified by the EU and all its Member States (except Ireland), as well as by most of the Banks' partner countries in the EECCA region (except Russia), and of the Convention's Kiev Protocol on Pollutant Release and Transfer Registers (PRTR), which entered into force in October 2009 though not yet ratified by all EU Member States and has already been implemented in EU law. In addition to these provisions which are part of the environmental *acquis*, there are also some provisions in Directives and Regulations concerning company law, accounting standards and securities which require the disclosure of particular environmental information held by corporations.

Disclosure of Environmental Information Held by Public Authorities

The provisions of the Aarhus Convention with respect to access to information have been implemented in EU law through Directive 2003/4/EC¹² on public access to environmental information. This legislation imposes obligations on public authorities in the Member States, as defined in the Directive itself. Its effect on the planning and implementation of industrial and infrastructure projects is therefore indirect, unless such projects are undertaken directly by public authorities themselves. It is to be noted that the definition of "public authority" in Directive 2003/4/EC is rather broad and includes not only governmental bodies or public administrations at national, regional or local level, performing public administrative functions under national law, but also "any natural or legal person having public responsibilities or functions, *or providing public services*, relating to the environment under the control of" bodies or persons exercising governmental authority or performing public administrative functions. This definition includes providers of environmental management services under the control of public authorities, regardless of their legal status, such as, for example, holders of concessions or public contracts for municipal waste management or operators of urban waste water treatment facilities, which may act as promoters of projects eligible for Bank funding.

Directive 2003/4/EC establishes the 'right' to access to environmental information, requiring 'the widest possible systematic availability and dissemination to the public' of such information. Its provisions are discussed here to the extent that they may apply directly or indirectly to projects or activities within the scope of the Sourcebook.

'Environmental information' is defined as all information in 'written, visual, aural, electronic or any other material form' and covering the following:

- the state of the elements of the environment;

¹² Directive 2003/4/EC of the European Parliament and of the Council of 28 January 2003 on public access to environmental information and repealing Council Directive 90/313/EEC, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:041:0026:0032:EN:PDF>

- factors, such as substances, energy or noise, affecting elements of the environment;
- measures, such as policies, and activities affecting or likely to affect the elements or factors;
- reports on the implementation of environmental legislation;
- economic analyses and assumptions used within the framework of measures and activities; and
- the state of human health and safety, including the contamination of the food chain, conditions of human life, cultural sites and built structures in as much as they are affected by environmental elements.

Article 3 places a general duty on Member States to ensure that public authorities make available environmental information held by or for them, to anyone requesting it. Environmental information held ‘by’ or ‘for’ a public authority includes information that is in the possession of the public authority, whether or not it produced such information, as well as information that is being held on behalf of the public authority. In practice, public authorities hold a lot of environmental information submitted to them by third persons pursuant to various requirements of environmental legislation, including information on projects and activities subject to authorisation or impact assessment requirements.

There are a limited number of grounds on which Member States may provide in their national implementing legislation that public authorities may refuse a request for access to information. Within the scope of this Sourcebook, the most relevant grounds concern cases in which:

- the request concerns material in the course of completion or unfinished documents or data;
- the request concerns internal communications;
- disclosure of the information would adversely affect intellectual property rights;
- disclosure of the information would adversely affect the confidentiality of commercial or industrial information where provided for by national or Community law to protect legitimate economic interests;
- disclosure of the information would adversely affect the interests or protection of the person who has supplied information on a voluntary basis without being under a legal obligation to do so, unless that person consents to the release of such information.

Any grounds for refusal are to be interpreted in a restrictive way, taking into account the public interest of disclosure. The latter two above-mentioned grounds for refusal cannot be invoked where the information relates to emissions into the environment. Information must be supplied in part if it can be separated out from items exempted under the Directive’s confidentiality provisions.

An applicant who considers that his or her request was ignored, wrongfully refused, inadequately answered or otherwise not dealt with in accordance with the Directive is to have access to a review procedure. Under Article 6, such a procedure can involve reconsideration by the same or another public authority, or review by an independent

and impartial body established by law. Member States are, in addition, to ensure that the applicant has access to a review procedure before a court or other independent and impartial body established by law. Decisions taken by such bodies are to be binding on the public authority holding the information.

More general requirements for the proactive dissemination of environmental information are set out in Article 7 of Directive 2003/4/EC. Member States are to ensure that public authorities organise environmental information with a view to its active and systematic dissemination. Environmental information is to become progressively available in easily accessible electronic databases. The information that is to be disseminated proactively includes, inter alia:

- data or summaries of data derived from the monitoring of activities affecting or likely to affect the environment;
- authorizations with a significant impact on the environment and environmental agreements or a reference to the place where such information can be requested or found; and
- environmental impact studies and risk assessments concerning environmental elements or a reference to the place where such information can be found.

European Pollutant Release and Transfer Register

Regulation (EC) No 166/2006¹³ imposes requirements on operators of certain installations to make available data on emissions, releases and transfers of specified pollutants for dissemination through the European Pollutant Release and Transfer Register (E-PRTR). This Regulation was adopted to implement the Kiev Protocol on Pollutant Release and Transfer Registers (PRTR) to the Aarhus Convention, which was signed in May 2003 by 36 countries and the EC, and entered into force as a matter of international law in October 2009 after the threshold of 16 ratifying parties was reached in July 2009. E-PRTR is in force as directly applicable EU law in all EU Member States. The reporting requirements and register cover a range of pollutants, including major air pollutants, the six greenhouse gases included in the Kyoto Protocol, heavy metals and chlorinated organic compounds and off-site transfers of waste and releases. E-PRTR replaces an earlier scheme, based on a provision of the IPPC Directive (EPER), from 2007 onwards. It builds on the same principles as EPER but goes beyond it, by including reporting on more pollutants, more activities, releases to land, releases from diffuse sources and off-site transfers of waste and releases, public participation and annual instead of triennial reporting. Member States are now required to provide the Commission with data collected from operators every year, starting from 2007, while additional information will have to be reported every three years from June 2009.

Disclosure of Environmental Information Held by Corporations

Apart from the specific E-PRTR mechanism for mandatory disclosure of information on emissions, releases and transfers of pollutants by public or private operators of

¹³ Regulation (EC) No 166/2006 of the European Parliament and of the Council of 18 January 2006 concerning the establishment of a European Pollutant Release and Transfer Register and amending Council Directives 91/689/EEC and 96/61/EC, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:033:0001:0017:EN:PDF>

specific installations, no general mandatory requirements have been developed on the EU level regarding the disclosure of environmental information by companies to different stakeholders such as consumers, investors or the wider public. There are however some EU requirements in force as part of the legislation on company law and financial markets relating to the disclosure of environmental information to the extent that it is material to the financial performance or the financial position of a company. These requirements mainly affect quoted and large companies.

The main EU legislation in this area is Fourth Council Directive 78/660/EEC¹⁴ on the annual accounts of certain types of companies (e.g., public companies limited by shares or by guarantee, private companies limited by shares or by guarantee), and related Seventh Council Directive 83/349/EEC¹⁵ on consolidated accounts, Directive 86/635/EEC¹⁶ on the annual accounts and consolidated accounts of banks and other financial institutions, and Directive 91/674/EEC¹⁷ on the annual accounts and consolidated accounts of insurance undertakings, which were amended several times since they first came into force.

In 2003, Directive 78/660/EEC was amended by Directive 2003/51/EC¹⁸ (Modernisation Directive) to expand reporting requirements by including an obligation for companies to include non-financial 'key performance indicators relevant to the particular business in the analysis of their business development and performance in their annual reports (amended Article 46). This includes information relating to environmental (...) matters', to the extent that this is 'necessary for an understanding of the company's development, performance or position.' However, Member States may exempt small and medium-sized companies from this requirement to provide non-financial information.

The introduction of this expanded reporting requirement for large firms had been preceded by a non-binding Commission recommendation¹⁹ regarding the disclosure of environmental issues in the annual accounts and annual reports of companies, adopted

¹⁴ Fourth Council Directive of 25 July 1978 based on Article 54 (3) (g) of the Treaty on the annual accounts of certain types of companies, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1978L0660:20070101:EN:PDF>

¹⁵ Seventh Council Directive of 13 June 1983 based on the Article 54 (3) (g) of the Treaty on consolidated accounts, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1983L0349:20070101:EN:PDF>

¹⁶ Council Directive of 8 December 1986 on the annual accounts and consolidated accounts of banks and other financial institutions, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1986L0635:20060905:EN:PDF>

¹⁷ Council Directive of 19 December 1991 on the annual accounts and consolidated accounts of insurance undertakings, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1991L0674:20060905:EN:PDF>

¹⁸ Directive 2003/51/EC of the European Parliament and of the Council of 18 June 2003 amending Directives 78/660/EEC, 83/349/EEC, 86/635/EEC and 91/674/EEC on the annual and consolidated accounts of certain types of companies, banks and other financial institutions and insurance undertakings, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32003L0051:EN:NOT>

¹⁹ Recommendation 2001/453/EC of 30 May 2001 on the recognition, measurement and disclosure of environmental issues in the annual accounts and annual reports of companies, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2001:156:0033:0042:EN:PDF>

in 2001. This recommendation provides details with respect to requirements for recognition, measurement and disclosure of environmental expenditures, environmental liabilities and risks, and related assets that arise from transactions and events affecting the financial position and results of the reporting company. This includes issues such as the offsetting of liabilities and expected recoveries in the balance sheet, the capitalisation of environmental expenditures or provisions for site-restoration and dismantling costs.

In 2006, Directive 78/660/EEC was again amended by Directive 2006/46/EC in order to introduce provisions regarding the publication of a corporate governance statement in annual reports or separately. The preamble to the amending Directive indicates that environmental issues may be included in the corporate governance statement as long as necessary for an understanding of the company's development, performance and position.

Directive 2001/34/EC²⁰ on the admission of securities to official stock exchange listing and on information to be published on those securities (as amended by Directives 2004/109/EC on the harmonisation of transparency requirements regarding securities, and Directive 2003/71/EC on the prospectus to be published when securities are offered to the public or admitted to trading) provides some additional requirements on environmental reporting. The aim of this legislation is to consolidate measures regarding the admission of securities to stock exchange, and financial information provided to investors and to harmonise requirements for the drafting, approval and distribution of the prospectus to be published when securities are offered to the public or admitted to trading on a regulated market. In order to build investor's confidence and to allow an informed assessment of business performance and assets, it requires the disclosure of non-financial information, which may also address environmental issues, though this is not specifically mentioned.

EU legislation also aims to harmonise the financial statements of quoted companies by applying international financial reporting standards (IFRS)²¹. Regulation (EC) No 1606/2002²² requires the application of international accounting standards in the Community, to ensure a high degree of transparency and comparability of financial statements. According to International Accounting Standard 37, sufficient information shall be disclosed in the notes describing provisions, contingent liabilities and assets to enable users to understand their nature, timing and amount. This may also refer to environmental issues. The International Accounting Standard Board (IASB) intends to amend IAS 37, including measurement requirements, in the third quarter of 2010.

²⁰ Directive 2001/34/EC of the European Parliament and of the Council of 28 May 2001 on the admission of securities to official stock exchange listing and on information to be published on those securities, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2001L0034:20070120:EN:PDF>

²¹ <http://www.iasb.org/>

²² Regulation (EC) No 1606/2002 of the European Parliament and of the Council of 19 July 2002 on the application of international accounting standards, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2002R1606:20080410:EN:PDF>

Public Participation

Public participation in specific environmental decision-making processes is guaranteed by the Aarhus Convention and the EU legislation that has been adopted for its implementation. The relevant provisions apply to different kinds of decision-making processes: authorisation procedures for site-specific projects or activities which may have a significant effect on the environment, the preparation and modification or review by national public authorities of certain plans or programmes, and the preparation and adoption by national public authorities of environmental regulations. Taking into account the purpose of the Sourcebook and its project-driven focus, the latter two categories of provisions are not covered.

The relevant decision-making procedures which fall within the scope of this Sourcebook and are subject to public participation requirements in accordance with the Aarhus Convention are the environmental impact assessment (EIA) procedure established pursuant to Directive 85/337/EEC and the environmental permitting procedure laid down in Directive 2008/1/EC on integrated pollution prevention and control (IPPC) which applies to a wide range of industrial and agricultural activities. Since they form an integral part of these procedures, the public participation requirements, which were strengthened by Directive 2003/35/EC, are covered in the respective chapters of this Sourcebook on EIA (Chapter 1.1) and IPPC (Chapter 1.4).

Compliance with these consultation and participation requirements is mandatory as a matter of EU law. While primary responsibility for implementing these procedures lies with the competent public authorities in the Member States, project developers and investors have a clear interest in cooperating with public authorities to ensure full implementation of the required procedures, since non-compliance may have serious legal consequences for project implementation. Indeed, Member States have the obligation to provide, in accordance with their national legal system, access to a judicial or administrative review procedure which allows "members of the public concerned" to "challenge the substantive or procedural legality of decisions, acts or omissions" subject to public participation requirements under Directive 85/337/EEC or Directive 2008/1/EC.

1.3 Environmental Liability

Introduction

Directive 2004/35/EC²³ on environmental liability with regard to the prevention and remedying of environmental damage, intends to give effect to the ‘polluter pays principle’ by imposing liability on businesses for the prevention and remediation of environmental damage. The Directive does not as such set sector-specific standards, but has legal implications for a number of activities which are of relevance to identifiable sectors. It acknowledges that certain liability rules already exist within the Member States and therefore leaves several key elements of the liability regime to Member States’ discretion. The Directive addresses only environmental damage and damaging events which occur after 30 April 2007 and gives precedence to pre-existing international convention regimes concerning liability for damage caused by marine and nuclear activities, subject to review of their effectiveness in 2014 (see Box 1). This chapter will first consider the specific activities and operators which are subject to the provisions of the Directive, then explain its restrictive definition of the notion of environmental damage which may give rise to liability under the Directive and finally explain the preventive and remedial obligations of operators resulting from such liability.

Box 1: Exceptions

The Directive sets out a number of circumstances in which it will either not apply or only apply under certain conditions:

- where the damage or threat of damage is caused by either (a) an act of armed conflict, hostilities, civil war or insurrection or (b) a natural phenomenon of exceptional, inevitable and irresistible character;
- where damage or threats are caused by diffuse pollution – unless a causal link can be established between the damage and the activities of individual operators;
- activities the main purpose of which is to serve national defence or international security or whose sole purpose is protection from natural disasters;
- any damage or threat where liability would come under any of five international conventions covering marine oil and hazardous substance pollution, and the onshore carriage of dangerous goods, as set out in Annex IV;
- where national legislation protects the operator’s right to limit his liability under either the Convention on Limitation of Liability for Maritime Claims (LLMC) 1976 or the Strasbourg Convention on Limitation of Liability in Inland Navigation (CLNI) 1988;
- cases covered by the Treaty establishing the European Atomic Energy Community (EURATOM) or any of five international conventions governing liability for nuclear activities, as listed in Annex V

²³ Directive 2004/35/CE of the European Parliament and of the Council of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2004L0035:20060501:EN:PDF>

Strict Liability for Annex III Activities and Fault-based Liability for Other Occupational Activities

The Directive introduces two types of liability regimes: a strict liability regime and a fault-based liability regime. Strict liability is introduced for the operators of risky or potentially risky activities listed in the Directive. These ‘Annex III’ activities include activities releasing heavy metals into water or into the air, installations producing dangerous chemicals, management of landfill sites and incineration plants, and the deliberate release into the environment of genetically modified organisms (see Box 2). Under this regime, an operator can be held liable even if he has not committed any fault, though there are a few cases in which he can be exempted from liability.

Firstly, an operator is not required to bear the cost of preventive or remedial action where he can prove that the damage or threat was caused by a third party and occurred despite appropriate safety measures being in place, or resulted from compliance with a compulsory order or instruction from a public authority, other than an order or instruction in response to an emission or incident caused by the operator’s own activities (*force majeure*).

Secondly, Member States may allow the operator not to bear the cost of remedial actions where he can demonstrate that he was not at fault or negligent and that the damage was caused by an emission or event expressly authorised by, and fully in accordance with the conditions of, an authorisation granted under national laws which implement the Community legislation listed in Annex III (the compliance or permit defence).

Thirdly, Member States may allow the operator not to bear the cost of remedial actions where he can demonstrate that he was not at fault or negligent and that the damage was caused by an emission or activity or any manner of using a product in the course of an activity which the operator demonstrates was not considered likely to cause environmental damage according to the state of scientific and technical knowledge at the time when the emission was released or the activity took place (the state-of-the-art defence).

Box 2: ‘Annex III’ Activities

Annex III lists the occupational activities that are strictly liable for remedial and preventive action when damage occurs or is imminently threatened. The list is based on activities which are subject to authorisation, notification or permitting requirements under other Community environmental laws, as follows:

1. Installations subject to permit under Directive 2008/1/EC.
2. Waste management operations under Directive 75/442/EEC and Directive 91/689/EEC, including operations of landfill sites under Directive 1999/31/EC and the operation of incineration plants under Directive 2000/76/EC – Member States may decide not to include ‘the spreading of sewage sludge from urban waste water treatment plants, treated to an approved standard, for agricultural purposes’.
3. Discharges to inland surface water, subject to authorisation under Directive 76/464/EEC.
4. Discharges to groundwater subject to authorisation under Directive 80/68/EEC.
5. Discharge or injection of pollutants into surface water or groundwater subject to permit, authorisation or registration under Directive 2000/60/EC.
6. Water abstraction and impoundment subject to authorisation under Directive 2000/60/EC.

7. Manufacture, use, storage, processing, filling, release into the environment and on site transport of:
 - dangerous substances as defined in Directive 67/548/EEC.
 - dangerous preparations as defined in Directive 1999/45/EC.
 - plant protection products as defined in Directive 91/414/EEC.
 - biocidal products as defined in Directive 98/8/EC.
8. Transport by road, rail, inland waterways, sea or air of dangerous goods or polluting goods, as defined in either Directive 94/55/EC, Directive 96/49/EC or Directive 93/75/EEC.
9. Installations subject to authorisation under Directive 84/360/EEC.
10. Contained use of genetically modified micro-organisms subject to Directive 90/219/EEC.
11. Deliberate release into the environment, transport and placing on the market of genetically modified organisms subject to Directive 2001/18/EC.
12. Transboundary shipment of waste subject to authorisation or prohibited under Regulation (EEC) No 259/93.
13. Management of waste from extractive industries under Directive 2006/21/EC.
14. Operation of sites for the geological storage of carbon dioxide pursuant to Directive 2009/31/EC.

As made clear by the wording of the previous paragraph, it is up to the Member States to stipulate in their national legislation whether operators will be able to make use of the permit defence and state-of-the-art defence. However, up until now only a few Member States have not made available these defences to their economic operators.

On the other hand a fault-based regime is introduced for other economic operators: they may be liable for preventing or remedying damage to species and habitats, but only if they are found to be at fault or negligent. The fault-based regime does not apply to water and land damage.

Definition of Environmental Damage

The Directive covers three kinds of ‘environmental damage’, which are each further detailed and defined:

- Damage to protected species and natural habitats;
- Damage to water; and,
- Damage to land.

Damage to protected species and habitats (also referred to as ‘biodiversity damage’) means any damage that has significant adverse effects on their reaching or maintaining favourable conservation status, with the significance of an effect determined in relation to the condition of the relevant feature before the harmful event occurred (‘baseline condition’) and against a series of criteria set out in Annex I (see below). The species and habitats concerned are those protected under Directives 2009/147/EC and 92/43/EEC and, where a Member State so determines, nationally protected habitats and species, not listed in the two Directives (see Chapter 1.14).

Water damage is defined as any damage that significantly adversely affects the ecological, chemical and/or quantitative status and/or ecological potential, as defined in Directive 2000/60/EC, of the waters concerned, with the exception of adverse effects where Article 4(7) of that Directive applies (see Chapter 1.12).

Land damage is defined as any land contamination that creates a significant risk of human health being adversely affected as a result of the direct or indirect introduction, in, on or under land, of substances, preparations, organisms or micro-organisms.

The threshold for damage to species and habitats is further qualified by definitions of “conservation status” in relation to each and by the inclusion in Annex I of additional criteria for deciding whether particular cases of damage count as significant.

For habitats, conservation status means the sum of the influences acting on a natural habitat and its typical species that may affect its long-term natural distribution, structure and functions, as well as the long-term survival of its typical species. That status is deemed “favourable” when:

- its natural range and areas it covers within that range are stable or increasing;
- the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future; and
- the conservation status of its typical species is favourable.

For species, conservation status means the sum of the influences acting on the species concerned that may affect the long-term distribution and abundance of its populations, with that status taken as “favourable” when:

- population dynamics data indicate that a species is maintaining itself on a long-term basis as a viable component of its natural habitats;
- its natural range is neither being reduced nor is likely to be reduced for the foreseeable future; and
- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

Annex I was added to determine what would count as a significant adverse effect on favourable conservation status. It states that significance is to be assessed by reference to conservation status at the time of the damage, the services provided by the amenities they produce and their capacity for natural regeneration. Any damage to species and habitats with a proven effect on human health must also be deemed significant.

Preventive and Remedial Action

Where damage has not yet occurred but there is an imminent threat of damage, the Directive obliges the operator of the activity posing the threat to take the necessary preventive measures without delay. Member States must require operators to inform the competent authority of all relevant aspects of the situation, where appropriate and, in any case, whenever the preventive measures do not succeed in removing the threat. The competent authority has the discretionary power to:

- require the operator to provide information on any imminent threat or suspicion of such a threat;
- give instructions to the operator on the nature of the preventive measures to be taken; or

- take the necessary measures itself.

Where environmental damage has occurred, the operator is obliged to inform the competent authority without delay of all relevant aspects of the situation and to take:

- all practicable steps immediately to control, contain, remove or otherwise manage the contaminants and other damaging factors in order to mitigate the harm; and
- the necessary remedial measures, in accordance with rules set out in the Directive.

The competent authority has the power to:

- require the operator to provide supplementary information on any damage;
- require the operator to take or give instructions to the operator on steps to mitigate the harm;
- give instructions on the necessary remedial measures; or
- take those measures itself.

In the case of either an imminent threat or actual damage, where the operator fails to comply with his obligations, can not be identified or is, for some reason, not required to carry out the necessary measures (because, for example, of one of the defences), the authority may take the action itself, but is not under a duty to do so and, in the case of remedial action, should only do so as a last resort.

Remediation Rules

Where damage has occurred, operators must identify potential remedial options, in accordance with rules set out in Annex II, and submit them to the competent authority for approval. The authority must then select the appropriate remedy, in accordance with Annex II and in co-operation with the operator. In so doing, the authority must invite interested parties, anyone who owns the land where remedial action will take place, to submit their views and must take those views into account.

As far as damage to water and protected species and habitats is concerned, the environment is to be restored to its baseline condition by means of three types of remediation:

- primary remediation – meaning remedial measures which directly return the damaged natural resources or impaired services to, or towards, baseline condition;
- complementary remediation – meaning either development of alternative natural resources or measures taken at a different site, to compensate for the fact that primary remediation has not fully restored the damaged features; and
- compensatory remediation – meaning actions taken to compensate for “interim losses” of natural resources or services that arise between the date when the damage occurs and the time when primary remediation is fully achieved, the actions to consist of additional improvements to protected natural habitats or species, or water, at either the damaged site or elsewhere.

Where primary remediation does not achieve full restoration to baseline, complementary remediation must be undertaken. Compensatory remediation is to be undertaken to deal with interim losses, which are losses which result from the inability of damaged natural resources or services to perform their ecological functions or provide services to other natural resources or to the public until the primary or complementary measures have taken effect. Any significant risk to human health must also be removed.

Annex II says much less about land damage. As a minimum, contaminants must be removed, controlled, contained or diminished to the extent that the contaminated land, taking account of its current use or approved future use at the time when the damage occurred, no longer poses any significant threat to human health.

Cost Allocation in Cases of Multiple Party Causation

The Directive does not impose any cost allocation model in case the environmental damage has been caused by more than one party. There are traditionally two ways of dealing with the allocation of costs in such circumstances: joint and several liability or proportionate liability. “Joint and several liability” means that, where a group of operators are liable for the cost of remediation, each member of that group is also responsible for the whole amount, irrespective of their actual contribution to the damage. “Proportionate liability” means that each operator bears a proportion of the costs that are clearly identifiable as their contribution to the damage.

So it is important to know that it depends on the Member State, in which the environmental damage occurs, to stipulate what kind of allocation model applies and in particular how liability between the producer and the user of a product will be spread.

Insurances or Other Financial Security Schemes

The Directive does not require operators to take out financial security products (like insurances, bank guarantees, the pooling of funds, financial guarantees given to a subsidiary by the parent company, etc.). This is because financial products purely related to environmental damage do not exist yet on a large scale. It remains to be seen whether the Commission will come up in 2010 with proposals for a system of harmonised mandatory financial security.

1.4 Integrated Pollution Prevention and Control - Permitting Requirements

Introduction

Directive 2008/1/EC²⁴ on integrated pollution prevention and control (hereafter referred to as IPPC Directive) defines the obligations with which the largest installations operating industrial and agricultural activities must comply. It establishes a procedure for authorising these activities and defines the principles of the conditions to be included in all permits, particularly in terms of pollutants released.

Directive 2008/1/EC uses an 'integrated approach', which implies that permits must take into account the whole environmental performance of a plant, covering e.g. emissions to air, water and soil, generation of waste, use of raw materials, energy efficiency, noise, prevention of accidents, and site remediation upon closure. Manufacturers and authorities thus have to think about all emissions and impacts in the design of the whole plant ('clean technology') rather than relying on 'end-of-pipe' techniques.

Installations Subject to IPPC

Integrated pollution prevention and control concerns new or existing industrial and agricultural activities, as defined in Annex I to Directive 2008/1/EC. These activities are grouped into six categories: energy; production and processing of metals; minerals; chemicals; waste management; and 'other'. The 'other' group includes facilities operating in the areas of pulp and paper production, textile treatment, tanning, food production, and intensive rearing of poultry and pigs. Threshold values for different categories of installation, where these exist, are set out in Annex I.

IPPC installations are to be operated in such a way that certain general principles are followed. These are: to take all appropriate preventive measures against pollution, namely the 'best available techniques' (BAT – see below); to ensure no significant pollution is caused; to avoid waste production and to recover or safely dispose of the waste produced; to use energy efficiently; to take the necessary measures to prevent accidents; and to remediate and clean up the site upon cessation of the activity.

Directive 2008/1/EC also requires that operators regularly provide the competent authorities with results of emission monitoring. Operators must also inform the authorities of any significant accidents without delay, and must provide the authorities with the necessary access and assistance to enable inspections and other monitoring functions to be carried out.

²⁴The IPPC Directive, first published in 1996, has been known for over a decade as Directive 96/61/EC. In light of a number of amendments, a new codified version was issued - Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:024:0008:0029:EN:PDF>.

IPPC Permits

In principle, each facility covered by Directive 2008/1/EC must be made subject to authorization through permitting. However, Directive 2008/1/EC allows Member States to prescribe some requirements for certain types of installations in general binding rules instead of including them in individual permits. This depends on the national legislation in the Member State concerned.

Applications for permits are to describe: the installation and its activities; the materials, substances and energy used or generated; site conditions; emissions from the installation and significant environmental effects; techniques to prevent and reduce emissions; measures for the prevention and recovery of waste; further measures to comply with the basic obligations of operators; and proposed monitoring measures. Information generated in respect of any other legislation, including Directive 85/337/EEC (EIA – see Chapter 1.1), may be included as part of an IPPC application. The Directive also requires a non-technical summary to be included with the permit application.

There are some specific requirements for the content of permits. All permits must include details of the applicable standards for emissions to air, water and land. Emission limit values (ELVs) must be defined for pollutants likely to be emitted in significant quantities, in particular for certain priority pollutants listed in Directive 2008/1/EC (see Box 1). The permit may not contain ELVs for CO₂ for those activities that are already regulated by the EU ETS (Directive 2003/87/EC - see Chapter 1.11). It is important to note that Directive 2008/1/EC does not actually prescribe any ELVs. These are to be determined on an individual basis, taking account of BAT for individual installations drawing on the information contained in the BAT Reference Documents (BREFs). Relevant emission levels associated with BAT, as laid down in these BREFs, are referred to in subsequent, sector-specific chapters of this Sourcebook.

Box 1: Main polluting substances to be taken into account if relevant for fixing emission limit values

Air

1. Sulphur dioxide and other sulphur compounds.
2. Oxides of nitrogen and other nitrogen compounds.
3. Carbon monoxide.
4. Volatile organic compounds.
5. Metals and their compounds.
6. Dust.
7. Asbestos (suspended particulates, fibres).
8. Chlorine and its compounds.
9. Fluorine and its compounds.
10. Arsenic and its compounds.
11. Cyanides.
12. Substances and preparations which have been proved to possess carcinogenic or mutagenic properties or properties which may affect reproduction via the air.
13. Polychlorinated dibenzodioxins and polychlorinated dibenzofurans.

Water

1. Organohalogen compounds and substances which may form such compounds in the aquatic environment.
2. Organophosphorus compounds.

3. Organotin compounds.
4. Substances and preparations which have been proved to possess carcinogenic or mutagenic properties or properties which may affect reproduction in or via the aquatic environment.
5. Persistent hydrocarbons and persistent and bioaccumulable organic toxic substances.
6. Cyanides.
7. Metals and their compounds.
8. Arsenic and its compounds.
9. Biocides and plant health products.
10. Materials in suspension.
11. Substances which contribute to eutrophication (in particular, nitrates and phosphates).
12. Substances which have an unfavourable influence on the oxygen balance (and can be measured using parameters such as BOD, COD, etc.).

Source: Annex III of Directive 2008/1/EC

Furthermore, if necessary a permit must prescribe requirements for protection of soil and groundwater and management of waste. In all cases, permits must contain conditions to minimize long-distance and transboundary pollution and to ensure a high level of protection for the environment as a whole. Permits must also contain monitoring requirements and an obligation to provide data to the competent authority. A permit should furthermore contain measures relating to conditions other than 'normal operating conditions', such as start-up, leaks, malfunctions, momentary stoppages or definitive cessation of operations.

A permit may not be issued unless it can be guaranteed that an installation will meet the requirements of Directive 2008/1/EC. In the case of new installations²⁵ or substantial modifications, certain information obtained during the EIA process under Directive 85/337/EEC must be taken into account in granting a permit.

Permit holders must be required to advise the competent authorities of any changes in their operations, and any substantial modifications must also be made subject to prior authorization through permitting. Furthermore, competent authorities must reconsider and, if necessary, update permit conditions periodically. Reconsideration must be undertaken *inter alia* when excessive pollution occurs or when developments in BAT (see below) allow significant emission reductions without excessive cost.

Best Available Techniques (BAT) and BAT Reference Documents (BREFs)

These are defined as the most effective techniques to achieve a high level of environmental protection. Within this definition, 'available' is specified as meaning economically and technically viable, taking into consideration costs and advantages. BATs do not only refer to the technology used at an installation, but also to the way the installation is designed, built, operated and maintained. The full definition of BAT, as provided by Directive 2008/1/EC, is shown in the box below.

Box 2: Definition of Best Available Techniques (BAT)

²⁵Installations that were put in operation after 30 October 1999 – as opposed to 'existing' installations, ie installations in operation or authorised before that date.

'Best available techniques' means the most effective and advanced stage in the development of activities and their methods of operation which indicate the practical suitability of particular techniques for providing in principle the basis for emission limit values designed to prevent and, where that is not practicable, generally to reduce emissions and the impact on the environment as a whole:

(a) *'techniques'* shall include both the technology used and the way in which the installation is designed, built, maintained, operated and decommissioned;

(b) *'available techniques'* means those developed on a scale which allows implementation in the relevant industrial sector, under economically and technically viable conditions, taking into consideration the costs and advantages, whether or not the techniques are used or produced inside the Member State in question, as long as they are reasonably accessible to the operator;

(c) *'best'* means most effective in achieving a high general level of protection of the environment as a whole.

Source: Article 2 (12) of Directive 2008/1/EC

In determining BAT, special consideration must be given to certain factors, including: the use of low-waste technology; the use of less hazardous substances; the furthering of recovery and recycling; the consumption of raw materials and water; and energy efficiency.

Directive 2008/1/EC requires that information is exchanged between Member States and the industries concerned on BAT associated monitoring and developments in them. On the basis of this information exchange, the Commission has established a process for the production of BAT Reference Documents (BREFs).

BREFs are produced by the European IPPC Bureau in Seville, which collates information on techniques, environmental performance, etc, for different industrial sectors from the EU and beyond. These documents aim to inform relevant decision makers about what may be technically and economically available to industry in order to improve their environmental performance, providing guidance on sectoral BAT.

BREFs are not legally binding, but Member States' competent authorities should take them into account in setting permit conditions. When discussing specific BREFs in subsequent chapters, reference is occasionally made to "split views" about a particular aspect of BAT. This means that no full consensus could be reached between participants in the drafting process of the BREF in question on what constitutes BAT in that particular instance.

In total 32 BREF were published between 2000 and 2007, covering different sectors. Some of the earliest BREFs, finalised in 2000, are now being revised in light of new processes and technologies available. Three drafts BREFs are available, they concern cement, lime and magnesium oxide manufacturing industries, non-ferrous metals industries and production of iron and steel industries.

The full text of BREFs and the drafts, together with background information, can be found on the Bureau's website²⁶. A list of BREFs with the dates of adoption is given in Table 1. Note that there is a timetable in operation for revision of the BREFs.

Table 1: Overview of BAT Reference Documents (BREFs)

BREF	Date Adopted
Pulp and Paper manufacture	December 2001
Iron and Steel production	December 2001
Cement and Lime production	December 2001
Cooling Systems	December 2001
Chlor-Alkali manufacture	December 2001
Ferrous Metal processing	December 2001
Non-Ferrous Metal processes	December 2001
Glass manufacture	December 2001
Tanning of hides and skins	February 2003
Textile processing	July 2003
Monitoring systems	July 2003
Refineries	February 2003
Large Volume Organic Chemicals	February 2003
Smitheries and Foundries	May 2005
Intensive Livestock Farming	July 2003
Emissions from storage of bulk or dangerous materials	July 2006
Common waste water and waste gas treatment and management systems in the chemical sector	February 2003
Economic and cross media issues under IPPC	December 2001
Large Combustion Plant	July 2006
Large Volume Inorganic Chemicals - Ammonia, Acids & Fertilisers	August 2007
Large Volume Inorganic Chemicals - Solid & Others	August 2007
Slaughterhouses and Animal By-products	May 2005
Food, Drink and Milk processes	August 2006
Ceramics	August 2007
Management of Tailings and Waste-Rock in Mining Activities	Finalised document to Commission July 2004
Surface treatment of metals	August 2006
Surface treatments using solvents	August 2007
Waste Incineration	August 2006
Waste Treatments [Previously Waste Recovery/Disposal activities]	August 2006
Speciality inorganic chemicals	August 2007
Organic fine chemicals	August 2006
Polymers	August 2007
Energy Efficiency	Finalised document to Commission, June 2008

Source: <http://eippcb.jrc.es/pages/FActivities.htm>

²⁶ <http://eippcb.jrc.es>

Details of individual BREFs are found in Chapters in Section 2 of this Sourcebook where they are applicable. However, the IPPC Directive requires authorities to take account of the effects of installations on the environment as a whole, and of cost considerations in determining BAT, as well as to consider local conditions. Therefore, a BREF on economic and cross media effects was developed. The key conclusions from this BREF are presented here as they apply to all activities under the Directive.

Cross-media guidelines

In order to determine BAT, there is a need to select the technique that is the most effective in achieving a high general level of protection of the environment taken as a whole. To achieve this in practice, there are likely to be instances where it will not be clear which technique offers the highest level of protection. Where this is the case, there may be a need to carry out an assessment to identify which technique is 'best'. The BREF sets out four guidelines which can lead the user through the process of determining which out of a choice of techniques is the best environmental option:

- The information that is necessary to scope and identify the alternative techniques under consideration;
- The compilation of an inventory of the emissions from each of the alternative techniques and of the resources that they use. Such an inventory can be an important precursor to apply subsequent guidelines;
- The steps necessary for estimating the environmental effects. There will usually be a range of emissions, discharges or resources used by the alternative techniques under consideration, and this looks at ways of expressing the environmental effects so that comparisons can be made between the alternatives. Calculations can be used that allow a wide range of pollutants to be expressed so that they can be compared and collated into seven environmental themes; human toxicity, global warming, aquatic toxicity, acidification, eutrophication, ozone depletion and photochemical ozone creation potential. The evaluation of energy use and the production of waste should be considered;
- The comparison of different environmental effects and how to come to a decision as to which of the alternatives offers the highest general level of protection for the environment as a whole.

The costing methodology

The Directive also requires that the likely costs and benefits are taken into consideration when determining BAT. The BREF therefore describes a costing methodology. Five guidelines are presented that allow the user to set out the costs transparently, so that the options can be validated, audited and compared in an equitable way:

- The scoping and identification of the alternative options.
- The gathering and validation of the cost data.
- Defining which costs are being collated in the evaluation. This requires the identification of those costs that relate to investment expenditure and those that relate to operating and maintenance costs.

- Processing and presenting the cost information. The BREF describes how to deal with exchange rates, inflation, discounting, and for calculating annual costs.
- How to relate costs to environmental protection.

Evaluating the alternatives

Once the environmental effects and the costs have been established, there needs to be some way of comparing them. The BREF examines ways of expressing cost effectiveness and means of valuing the environmental benefits from implementing a technique. This allows the economic cost of implementing a technique to be balanced against the environmental benefit that it delivers. This can help clarify whether or not implementing a technique represents value for money in terms of environmental benefit.

Economic viability in the sector

In the definition of BAT in Directive 2008/1/EC, “available” includes a requirement that techniques that are determined to be BAT are those that are ‘developed on a scale which allows implementation in the relevant industrial sector, under economically and technically viable conditions’. The BREF sets out a framework for assessing economic viability. Within this framework, the critical issues that need to be considered are the ‘industry structure’, the ‘market structure’, and the ‘resilience’ of the sector. Where it is found that implementing the proposed techniques will not undermine the viability of the sector but there still remain concerns about the economic impact, then an evaluation can be carried out as to whether the implementation can be eased by looking at the ‘speed of implementation’. Although an assessment of economic viability is an inherent part of determining BAT, a detailed assessment is expected to be carried out only to resolve a claim that a technique (or a combination of techniques) is too expensive to be BAT. That claim is considered most likely to come from the industrial sector concerned. The burden of proof in such an argument rests with those who object to the proposed BAT.

Emission Limits

Emission limit values (ELVs) or equivalent parameters imposed in permits are to be based on BAT, but may not prescribe any specific technique or technology to be used. When setting ELVs in the permit, competent authorities may take into account the technical characteristics of the installation, its geographical location and local environmental conditions.

However, a number of ELVs established by earlier EU legislation remain applicable. These include the following:

- Directive 2006/11/EC on discharges of dangerous substances to water;
- Directive 92/12/EEC on waste from the titanium dioxide industry;
- Directive 2001/80/EC on large combustion plants;
- Directive 2000/76/EC on waste incineration;
- Directive 87/217/EC on asbestos pollution ;
- Directive 1999/13/EC on solvent emissions.

The Directive stipulates that the legislation listed above is to provide ‘minimum’ standards. This implies that, if an assessment of BAT were to determine a stricter requirement, this would prevail and would have to be reflected in the permit. In addition, if attainment of any EU environmental quality standard (such as for air or water – see Chapters 1.11 and 1.12) needs stricter control than is achievable by BAT, then additional measures must be required in the permit.

In 2003 the Directive establishing the EU emissions trading scheme (ETS) for greenhouse gases (2003/87/EC) was adopted. This affects some IPPC installations and, to ensure an effective regime, the Directive 2008/1/EC was amended so that IPPC permits are not required to set emission limit values for the greenhouse gases subject to emissions trading.

Public Information and Participation

The Directive requires Member States to ensure that applications for IPPC permits are made available for public review and comment before a decision is reached and that competent authorities disclose information on the reasons for the permitting decisions that they make.

With regard to IPPC, Member States are hence required to ensure that the public concerned is given early and effective opportunities to participate in the procedure for issuing a permit for new installations or for any substantial change, and for permit updating. The results of emission monitoring should also be made available to the public. In the course of the decision-making procedure, the details of which are laid down in the national legislation of each Member State, the public should be informed by public notices or other means, on:

- the application for a permit or the proposal for an update;
- where applicable, the fact that a decision is subject to a national or transboundary environmental impact assessment or to consultations between Member States;
- the competent authorities involved;
- the nature of possible decisions or draft decisions;
- where applicable, the details relating to a proposal for a permit/conditions update;
- the times/places/means by which information will be made available; and
- the arrangements for public participation and consultation (eg information by bill posting, consultation by written submission etc) as determined by the national law of the Member State concerned.

The public concerned is entitled to express comments and opinions to the competent authorities before a decision is taken, and authorities are required to take these opinions in due account.

When a decision is taken, competent authorities are also required to inform the public and make available: the content of the decision, including a copy of the permit, conditions and subsequent updates; and the reasons on which the decision was based, including information on the public participation process.

Case law

One case before the ECJ is relevant to the interpretation of Directive 2008/1/EC (Case 437/07). However, as this case concerns the interpretation of 'poultry' this case is described in Chapter 2.6.1 of this Sourcebook.

1.5 Industrial Risk Prevention and Management

Introduction

The risks for man and the environment arising from any industrial activity are of two kinds: routine risks in normal operating conditions, and exceptional risks such as fires, explosions and massive emissions of dangerous substances when an activity gets out of control. Risk prevention and management measures linked to routine operational risks are covered by legislation that is mostly substance specific and primarily aimed at occupational health and safety. For the purpose of this Sourcebook the industrial risk prevention and management measures of exceptional risks are more relevant. Directive 96/82/EC²⁷ on the control of major-accident hazards involving dangerous substances, the so called Seveso II Directive, deals with the prevention and management of these kinds of risks.

Requirements of the Seveso II Directive

The Directive applies to establishments where dangerous substances are present in specified quantities.²⁸ An ‘establishment’ is the whole area under the control of an operator and an ‘installation’ is a technical unit within an establishment.

Dangerous substances are defined as a substance, mixture or preparation listed in Annex I, Part I of the Directive, or alternatively they have to fulfil criteria laid down in Annex I, Part II (see below). The quantities that trigger the requirements of the Directive for each dangerous substance/category of dangerous substances are listed in two columns. The first column sets the qualifying quantity for “lower tier” sites and the second column sets the qualifying quantity for “upper tier” sites. The risk of a major accidents increases in relation to quantities and hence the Directive imposes more obligations on “upper tier” sites (higher qualifying quantity) than “lower tier” sites (lower qualifying quantity). These obligations will be explained in more detail under the relevant headings.

²⁷ Council Directive 96/82/EC of 9 December 1996 on the control of major-accident hazards involving dangerous substances, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1996L0082:20031231:EN:PDF>

²⁸ However, the following activities are excluded from the scope of Directive 96/82/EC:

- military establishments, installations or storage facilities;
- hazards created by ionizing radiation;
- transport of dangerous substances outside the establishments covered by the Directive
- transport of dangerous substances in pipelines outside establishments covered by this Directive;
- exploitation (exploration, extraction and processing) of minerals in mines, quarries, or by means of boreholes, with the exception of chemical and thermal processing operations and storage involving dangerous substances;
- offshore exploration and exploitation of minerals, including hydrocarbons; and
- waste land-fill sites, with the exception of operational tailings disposal facilities, including tailing ponds or dams, containing dangerous substances.

The main requirements to be fulfilled by the operator, the role of the competent authority and the link to land use planning are discussed in more detail below.

Notification

A notification is required for both lower and upper tier establishments. The operator is to send the competent authority a notification including formal details (address etc.), information sufficient to identify the dangerous substances or category of substances involved, the quantity and form of the substances, the activity or proposed activity and the environment of the establishment (elements liable to cause a major accident or aggravating its consequences). New establishments must be notified a reasonable period before construction or operation.

Major Accident Prevention Policy

A document setting out the operator's major accident prevention policy is only required for lower tier establishments. The major accident prevention policy is designed to guarantee a high level of protection by appropriate means, structures and management systems, taking into account the principles listed in Annex III of the Directive.

Safety report

A safety report is only required for upper tier establishments. Operators are required to produce a safety report to enable the competent authority to draw up external emergency plans and to make decisions about siting new activities around existing establishments.

As a minimum the safety report must contain an inventory of dangerous substances and the following information listed in Annex II of Directive 96/82/EC:

- a description of the site and its environment including identification of installations and activities which could present a major accident hazard;
- a description of the installation;
- identification and accidental risks analysis and prevention methods; and
- measures to limit the consequences of an accident.

Safety reports for new establishments are to be sent to the competent authority within a reasonable period of time before construction or operation. The competent authority is to inform the operator of the conclusions of its examination of the safety report and may prohibit the use of the establishment.

The Commission has issued guidance on safety reports²⁹, specifying the information to be contained in them, but it does not prescribe a particular format for presenting the information.

²⁹ Guidance on the preparation of a safety report to meet the requirements of Directive 96/82/EC as amended by Directive 2003/105/EC (Seveso II), http://mahbsrv.jrc.it/downloads-pdf/safety_report_guidance_EN.pdf

Even if the guidance document on the preparation of safety reports is useful in itself, the guidance on risk assessments in land use planning is of more interest as it can be used by land use planners as a reference document for the assessment of industrial risks.

Emergency plans

Drawing up emergency plans is only required for upper tier sites. The operator needs to draw up an internal emergency plan for the measures to be taken inside the establishment. The operator is also required to supply the competent authority with the necessary information to enable the competent authority to draw up external emergency plans. The aim of the external emergency plan is to contain incidents so as to minimise the effects, to communicate the necessary information to the public and to the services and authorities in the area, and to provide for the restoration of the environment following a major accident.

The competent authority is to identify establishments where the possibility of major accidents may be increased because of their location or proximity. Information is then to be exchanged so as to take account of the overall hazard and co-operation is required in preparing the external emergency plan and informing the public. This can be an issue in large industrial estates where more than one installation falls under Seveso II criteria (see Chapter 2.8.7).

In 2007 the Commission continued its "horizontal" legal action against 14 Member States where emergency plans for so-called upper-tier establishments were lacking in breach of the Seveso II Directive. During 2008 most Member States made significant progress towards getting the necessary plans in place and several cases were closed. However in a few cases, the Commission was obliged to refer the matter to the Court.³⁰

Land use planning

Measures taken by Member States pursuant to the requirements of Directive 96/82/EC may affect the siting of new projects and activities. Indeed, Member States are to ensure that preventing major accidents and limiting their consequences are taken into account in land use policies, in particular in siting new establishments, in modifications to existing establishments and in new developments such as transport links and residential areas. Account is to be taken, in the long term, of the need to maintain appropriate distances between establishments and residential areas and areas of particular natural sensitivity.

³⁰ CEC (2009), 26th annual report on monitoring the application of Community law (SEC(2009) 1684/2

The land use planning guidance report³¹ brings together the understanding of the land use planners and risk assessment experts. The report provides guidance for risk assessments in land use planning in general as far as the major accident potential of industrial establishments is concerned.

Prohibition of Use

Member States are to prohibit the use or bringing into use of any establishment where the measures taken by the operator for prevention or mitigation of major accidents are seriously deficient. Member States may prohibit use or bringing into use if the operator has not submitted the notification or safety report. Operators may appeal against such a prohibition order.

³¹ Land Use Planning Guidelines in the context of Article 12 of the Seveso II Directive 96/82/EC as amended by Directive 105/2003/EC, also defining a technical database with risk data and risk scenarios, to be used for assessing the compatibility between Seveso establishments and residential and other sensitive areas listed in Article 12. http://mahbsrv.jrc.it/downloads-pdf/landuseplanning_guidance_EN.pdf

▼ **B**

ANNEX I

APPLICATION OF THE DIRECTIVE

INTRODUCTION

1. This Annex applies to the presence of dangerous substances at any establishment within the meaning of Article 3 of this Directive and determines the application of the relevant Articles thereof.
2. Mixtures and preparations shall be treated in the same way as pure substances provided they remain within concentration limits set according to their properties under the relevant Directives given in Part 2, Note 1, or their latest adaptation to technical progress, unless a percentage composition or other description is specifically given.
3. The qualifying quantities set out below relate to each establishment.
4. The quantities to be considered for the application of the relevant Articles are the maximum quantities which are present or are likely to be present at any one time. Dangerous substances present at an establishment only in quantities equal to or less than 2 % of the relevant qualifying quantity shall be ignored for the purposes of calculating the total quantity present if their location within an establishment is such that it cannot act as an initiator of a major accident elsewhere on the site.
5. The rules given in Part 2, Note 4 governing the addition of dangerous substances, or categories of dangerous substances, shall apply where appropriate.

▼ **M2**

6. For the purposes of this Directive, a gas is any substance that has an absolute vapour pressure equal to or greater than 101,3 kPa at a temperature of 20 ° C.
7. For the purposes of this Directive, a liquid is any substance that is not defined as a gas and that is not in the solid state at a temperature of 20 ° C and at a standard pressure of 101,3 kPa.

▼ **B**

PART 1

Named substances

Where a substance or group of substances listed in Part 1 also falls within a category of Part 2, the qualifying quantities set out in Part 1 must be used.

Column 1	Column 2	Column 3
Dangerous substances	Qualifying quantity (tonnes) for the application of	
	Articles 6 and 7	Article 9
▼ M2 Ammonium nitrate (see note 1)	5 000	10 000
Ammonium nitrate (see note 2)	1 250	5 000
Ammonium nitrate (see note 3)	350	2 500
Ammonium nitrate (see note 4)	10	50
Potassium nitrate (see note 5)	5 000	10 000
Potassium nitrate (see note 6)	1 250	5 000
▼ B Bromine	20	100
Chlorine	10	25
Nickel compounds in inhalable powder form (nickel monoxide, nickel dioxide, nickel sulphide, trinickel disulphide, dinickel trioxide)		1
Ethyleneimine	10	20
Fluorine	10	20
Formaldehyde (concentration ≥ 90 %)	5	50

▼ B

Column 1	Column 2	Column 3
Dangerous substances	Qualifying quantity (tonnes) for the application of	
	Articles 6 and 7	Article 9
Hydrogen	5	50
Hydrogen chloride (liquefied gas)	25	250
Lead alkyls	5	50
Liquefied extremely flammable gases (including LPG) and natural gas	50	200
Acetylene	5	50
Ethylene oxide	5	50
Propylene oxide	5	50
Methanol	500	5 000
4, 4-Methylenebis (2-chloraniline) and/or salts, in powder form		0,01
Methylisocyanate		0,15
Oxygen	200	2 000
Toluene diisocyanate	10	100
Carbonyl dichloride (phosgene)	0,3	0,75
Arsenic trihydride (arsine)	0,2	1
Phosphorus trihydride (phosphine)	0,2	1
Sulphur dichloride	1	1
Sulphur trioxide	15	75
Polychlorodibenzofurans and polychlorodibenzodioxins (including TCDD), calculated in TCDD equivalent		0,001
<p>▼ M2</p> <p>The following CARCINOGENS at concentrations above 5 % by weight:</p> <p>4-Aminobiphenyl and/or its salts, Benzotrichloride, Benzidine and/or salts, Bis (chloromethyl) ether, Chloromethyl methyl ether, 1,2-Dibromoethane, Diethyl sulphate, Dimethyl sulphate, Dimethylcarbamoyl chloride, 1,2-Dibromo-3-chloropropane, 1,2-Dimethylhydrazine, Dimethylnitrosamine, Hexamethylphosphoric triamide, Hydrazine, 2- Naphthylamine and/or salts, 4-Nitrodiphenyl, and 1,3 Propanesultone</p>	0,5	2
<p>Petroleum products:</p> <p>(a) gasolines and naphthas,</p> <p>(b) kerosenes (including jet fuels),</p> <p>(c) gas oils (including diesel fuels, home heating oils and gas oil blending streams)</p>	2 500	25 000

1. *Ammonium nitrate (5 000/10 000): fertilisers capable of self-sustaining decomposition*

This applies to ammonium nitrate-based compound/composite fertilisers (compound/composite fertilisers containing ammonium nitrate with phosphate and/or potash) in which the nitrogen content as a result of ammonium nitrate is

- between 15,75 % ⁽¹⁾ and 24,5 % ⁽²⁾ by weight, and either with not more than 0,4 % total combustible/organic materials or which fulfil the requirements of Annex II of Directive 80/876/EEC,
- 15,75 % ⁽³⁾ by weight or less and unrestricted combustible materials,

and which are capable of self-sustaining decomposition according to the UN Trough Test (see United Nations Recommendations on the Transport of Dangerous Goods: Manual of Tests and Criteria, Part III, subsection 38.2).

2. *Ammonium nitrate (1 250/5 000): fertiliser grade*

This applies to straight ammonium nitrate-based fertilisers and to ammonium nitrate-based compound/composite fertilisers in which the nitrogen content as a result of ammonium nitrate is

- more than 24,5 % by weight, except for mixtures of ammonium nitrate with dolomite, limestone and/or calcium carbonate with a purity of at least 90 %,
- more than 15,75 % by weight for mixtures of ammonium nitrate and ammonium sulphate,
- more than 28 % ⁽⁴⁾ by weight for mixtures of ammonium nitrate with dolomite, limestone and/or calcium carbonate with a purity of at least 90 %,

and which fulfil the requirements of Annex II of Directive 80/876/EEC.

3. *Ammonium nitrate (350/2500): technical grade*

This applies to:

- ammonium nitrate and preparations of ammonium nitrate in which the nitrogen content as a result of the ammonium nitrate is
 - between 24,5 % and 28 % by weight, and which contain not more than 0,4 % combustible substances,
 - more than 28 % by weight, and which contain not more than 0,2 % combustible substances,
- aqueous ammonium nitrate solutions in which the concentration of ammonium nitrate is more than 80 % by weight.

4. *Ammonium nitrate (10/50): 'off-specs' material and fertilisers not fulfilling the detonation test*

This applies to:

- material rejected during the manufacturing process and to ammonium nitrate and preparations of ammonium nitrate, straight ammonium nitrate-based fertilisers and ammonium nitrate-based compound/composite fertilisers referred to in notes 2 and 3, that are being or have been returned from the final user to a manufacturer, temporary storage or reprocessing plant for reworking, recycling or treatment for safe use, because they no longer comply with the specifications of Notes 2 and 3;
- fertilisers referred to in note 1, first indent, and Note 2 which do not fulfil the requirements of Annex II of Directive 80/876/EEC.

⁽¹⁾ 15,75 % nitrogen content by weight as a result of ammonium nitrate corresponds to 45 % ammonium nitrate.

⁽²⁾ 24,5 % nitrogen content by weight as a result of ammonium nitrate corresponds to 70 % ammonium nitrate.

⁽³⁾ 15,75 % nitrogen content by weight as a result of ammonium nitrate corresponds to 45 % ammonium nitrate.

⁽⁴⁾ 28 % nitrogen content by weight as a result of ammonium nitrate corresponds to 80 % ammonium nitrate.

▼ **M2**

5. Potassium nitrate (5 000/10 000): composite potassium-nitrate based fertilisers composed of potassium nitrate in prilled/granular form
6. Potassium nitrate (1 250/5 000): composite potassium-nitrate based fertilisers composed of potassium nitrate in crystalline form

▼ **B**

► **M2** 7. ◀ Polychlorodibenzofurans and polychlorodibenzodioxins

The quantities of polychlorodibenzofurans and polychlorodibenzodioxins are calculated using the following factors:

International Toxic Equivalent Factors (ITEF) for the congeners of concern (NATO/CCMS)			
2,3,7,8-TCDD	1	2,3,7,8-TCDF	0,1
1,2,3,7,8-PeDD	0,5	2,3,4,7,8-PeCDF	0,5
		1,2,3,7,8-PeCDF	0,05
1,2,3,4,7,8-HxCDD	} 0,1	1,2,3,4,7,8-HxCDF	} 0,1
1,2,3,6,7,8-HxCDD		1,2,3,7,8,9-HxCDF	
1,2,3,7,8,9-HxCDD		1,2,3,6,7,8-HxCDF	
1,2,3,4,6,7,8-HpCDD	0,01	2,3,4,6,7,8-HxCDF	
OCDD	0,001	1,2,3,4,6,7,8-HpCDF	} 0,01
		1,2,3,4,7,8,9-HpCDF	
		OCDF	0,001

(T = tetra, P = penta, Hx = hexa, HP = hepta, O = octa)

PART 2

Categories of substances and preparations not specifically named in Part 1

Column 1	Column 2	Column 3
Categories of dangerous substances	Qualifying quantity (tonnes) of dangerous substances as delivered in Article 3 (4), for the application of	
	Articles 6 and 7	Article 9
1. VERY TOXIC	5	20
2. TOXIC	50	200
3. OXIDIZING	50	200
▼ M2 4. EXPLOSIVE (see note 2) where the substance, preparation or article falls under UN/ADR Division 1.4	50	200
5. EXPLOSIVE (see note 2) where the substance, preparation or article falls under any of: UN/ADR Divisions 1.1, 1.2, 1.3, 1.5 or 1.6 or risk phrase R2 or R3	10	50
▼ B 6. FLAMMABLE (where the substance or preparation falls within the definition given in Note 3 (a))	5 000	50 000
7 a. HIGHLY FLAMMABLE (where the substance or preparation falls within the definition given in Note 3 (b) (1))	50	200

▼ **B**

Column 1	Column 2	Column 3
Categories of dangerous substances	Qualifying quantity (tonnes) of dangerous substances as delivered in Article 3 (4), for the application of	
	Articles 6 and 7	Article 9
7 b. HIGHLY FLAMMABLE liquids (where the substance or preparation falls within the definition given in Note 3 (b) (2))	5 000	50 000
8. EXTREMELY FLAMMABLE (where the substance or preparation falls within the definition given in Note 3 (c))	10	50
▼ M2 9. DANGEROUS FOR THE ENVIRONMENT risk phrases:		
i) R50: 'Very toxic to aquatic organisms' (including R50/53)	100	200
ii) R51/53: 'Toxic to aquatic organisms; may cause long term adverse effects in the aquatic environment'	200	500
▼ B 10. ANY CLASSIFICATION not covered by those given above in combination with risk phrases:		
(i) R14: 'Reacts violently with water' (including R14/15)	100	500
(ii) R29: 'in contact with water, liberates toxic gas'	50	200

NOTES

▼ **M2**

1. Substances and preparations are classified according to the following Directives and their current adaptation to technical progress:

Council Directive 67/548/EEC of 27 June 1967 on the approximation of the laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances ⁽¹⁾,

Directive 1999/45/EC of the European Parliament and of the Council of 31 May 1999 concerning the approximation of laws, regulations and administrative provisions of the Member States relating to the classification, packaging and labelling of dangerous preparations ⁽²⁾.

In the case of substances and preparations which are not classified as dangerous according to either of the above directives, for example waste, but which nevertheless are present, or are likely to be present, in an establishment and which possess or are likely to possess, under the conditions found at the establishment, equivalent properties in terms of major-accident potential, the procedures for provisional classification shall be followed in accordance with the relevant article of the appropriate Directive.

In the case of substances and preparations with properties giving rise to more than one classification, for the purposes of this Directive the lowest qualifying quantities shall apply. However, for the application of the rule in Note 4, the qualifying quantity used shall always be the one corresponding to the classification concerned.

For the purposes of this Directive, the Commission shall establish and keep up to date a list of substances which have been classified into the above categories by a harmonised Decision in accordance with Directive 67/548/EEC.

⁽¹⁾ OJ 196, 16.8.1967, p. 1. Directive as last amended by Regulation (EC) No 807/2003 (OJ L 122, 16.5.2003, p. 36).

⁽²⁾ OJ L 200, 30.7.1999, p. 1. Directive as amended by Commission Directive 2001/60/EC (OJ L 226, 22.8.2001, p. 5).

M

2. An 'explosive' means:

- a substance or preparation which creates the risk of an explosion by shock, friction, fire or other sources of ignition (risk phrase R2),
- a substance or preparation which creates extreme risks of explosion by shock, friction, fire or other sources of ignition (risk phrase R3), or
- a substance, preparation or article covered by Class 1 of the European Agreement concerning the International Carriage of Dangerous Goods by Road (UN/ADR), concluded on 30 September 1957, as amended, as transposed by Council Directive 94/55/EC of 21 November 1994 on the approximation of the laws of the Member States with regard to the transport of dangerous goods by road ⁽¹⁾.

Included in this definition are pyrotechnics, which for the purposes of this Directive are defined as substances (or mixtures of substances) designated to produce heat, light, sound, gas or smoke or a combination of such effects through self-sustained exothermic chemical reactions. Where a substance or preparation is classified by both UN/ADR and risk phase R2 or R3, the UN/ADR classification shall take precedence over assignment of risk phrases.

Substances and articles of Class 1 are classified in any of the divisions 1.1 to 1.6 in accordance with the UN/ADR classification scheme. The divisions concerned are:

Division 1.1: 'Substances and articles which have a mass explosion hazard (a mass explosion is an explosion which affects almost the entire load virtually instantaneously).'

Division 1.2: 'Substances and articles which have a projection hazard but not a mass explosion hazard.'

Division 1.3: 'Substances and articles which have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion hazard:

- (a) combustion of which gives rise to considerable radiant heat; or
- (b) which burn one after another, producing minor blast or projection effects or both.'

Division 1.4: 'Substances and articles which present only a slight risk in the event of ignition or initiation during carriage. The effects are largely confined to the package and no projection of fragments of appreciable size or range is to be expected. An external fire shall not cause virtually instantaneous explosion of virtually the entire contents of the package.'

Division 1.5: 'Very insensitive substances having a mass explosion hazard which are so insensitive that there is very little probability of initiation or of transition from burning to detonation under normal conditions of carriage. As a minimum requirement they shall not explode in the external fire test.'

Division 1.6: 'Extremely insensitive articles which do not have a mass explosion hazard. The articles contain only extremely insensitive detonating substances and demonstrate a negligible probability of accidental initiation or propagation. The risk is limited to the explosion of a single article.'

Included in this definition are also explosive or pyrotechnic substances or preparations contained in articles. In the case of articles containing explosive or pyrotechnic substances or preparations, if the quantity of the substance or preparation contained is known, that quantity shall be considered for the purposes of this Directive. If the quantity is not known, then, for the purposes of this Directive, the whole article shall be treated as explosive.

B

3. 'Flammable', 'highly flammable', and 'extremely flammable' in categories 6, 7 and 8 mean:

(a) flammable liquids:

substances and preparations having a flash point equal to or greater than 21 °C and less than or equal to 55 °C (risk phrase R 10), supporting combustion;

⁽¹⁾ OJ L 319, 12.12.1994, p. 7. Directive as last amended by Commission Directive 2003/28/EC (OJ L 90, 8.4.2003, p. 45).

▼ **B**

(b) highly flammable liquids:

1. — substances and preparations which may become hot and finally catch fire in contact with air at ambient temperature without any input of energy (risk phrase R 17),

▼ **M2**

- substances and preparations which have a flash point lower than 55 °C and which remain liquid under pressure, where particular processing conditions, such as high pressure or high temperature, may create major-accident hazards;

▼ **B**

2. substances and preparations having a flash point lower than 21 °C and which are not extremely flammable (risk phrase R 11, second indent);

(c) extremely flammable gases and liquids:

1. liquid substances and preparations which have a flash point lower than 0 °C and the boiling point (or, in the case of a boiling range, the initial boiling point) of which at normal pressure is less than or equal to 35 °C (risk phrase R 12, first indent), and

▼ **M2**

2. gases which are flammable in contact with air at ambient temperature and pressure (risk phrase R12, second indent), which are in a gaseous or supercritical state, and
 3. flammable and highly flammable liquid substances and preparations maintained at a temperature above their boiling point.
4. In the case of an establishment where no individual substance or preparation is present in a quantity above or equal to the relevant qualifying quantities, the following rule shall be applied to determine whether the establishment is covered by the relevant requirements of this Directive.

This Directive shall apply if the sum

$q_1/Q_{U1} + q_2/Q_{U2} + q_3/Q_{U3} + q_4/Q_{U4} + q_5/Q_{U5} + \dots$ is greater than or equal to 1,

where q_x = the quantity of dangerous substance x (or category of dangerous substances) falling within Parts 1 or 2 of this Annex,

and Q_{Ux} = the relevant qualifying quantity for substance or category x from column 3 of Parts 1 or 2.

This Directive shall apply, with the exception of Articles 9, 11 and 13, if the sum

$q_1/Q_{L1} + q_2/Q_{L2} + q_3/Q_{L3} + q_4/Q_{L4} + q_5/Q_{L5} + \dots$ is greater than or equal to 1,

where q_x = the quantity of dangerous substance x (or category of dangerous substances) falling within Parts 1 or 2 of this Annex,

and Q_{Lx} = the relevant qualifying quantity for substance or category x from column 2 of Parts 1 or 2.

This rule shall be used to assess the overall hazards associated with toxicity, flammability, and eco-toxicity. It must therefore be applied three times:

- (a) for the addition of substances and preparations named in Part 1 and classified as toxic or very toxic, together with substances and preparations falling into categories 1 or 2;
- (b) for the addition of substances and preparations named in Part 1 and classified as oxidising, explosive, flammable, highly flammable, or extremely flammable, together with substances and preparations falling into categories 3, 4, 5, 6, 7a, 7b or 8;
- (c) for the addition of substances and preparations named in Part 1 and classified as dangerous for the environment (R50 (including R50/53) or R51/53), together with substances and preparations falling into categories 9(i) or 9(ii);

The relevant provisions of this Directive apply if any of the sums obtained by (a), (b) or (c) is greater than or equal to 1.

1.6 Environmental Management Systems

Introduction

The Community eco-management and audit scheme (EMAS), established in 1993 and revised in 2009 by Regulation (EC) No 1221/2009³², is a voluntary EU system recognising organisations that strive to continually improve their overall environmental performance. EMAS establishes environmental policies, programmes and management systems, and requires their regular review or audit. The scheme also makes more information on the environmental performance of participating organisations available to the public and encourages the active involvement of employees in the establishment of an environmental management system (EMS).

Registration and Compliance under EMAS

The Community Eco-management and Audit scheme (EMAS) can be applied by all organisations which have an environmental impact, whether they are a company, corporation, firm, enterprise, authority or institution, public or private. The scheme is entirely voluntary. Organisations wishing to register under the scheme are required to undertake the following activities:

- An initial **environmental review** of all direct and indirect environmental aspects of activities, products and services – past, present and planned. Direct environmental aspects cover activities an organisation has management control over including; emissions to air and water, management of waste, use of natural resources, and effects on biodiversity. Indirect environmental aspects cover activities an organisation does not have full control over and includes product related issues, capital investments, and the practices of contractors or suppliers (Annex I of the Regulation states that an organisation should ‘endeavor to ensure’ that parties acting on its behalf comply with the organisation’s environmental policy with regards to contracted activities). Once these aspects have been identified, the organisation should decide, using established criteria, which of these have a significant impact. The environmental review should include legislative, regulatory and other requirements; a register of significant impacts; a description of the criteria used; an examination of existing environmental management practices; and an evaluation of feedback from the investigation of previous incidents.

³² Regulation (EC) No 1221/2009 of the European Parliament and of the Council of 25 November 2009 on the voluntary participation by organisations in a Community eco-management and audit scheme (EMAS), repealing Regulation (EC) No 761/2001 and Commission Decisions 2001/681/EC and 2006/193/EC, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:342:0001:0045:EN:PDF>

- In light of this review, the organisation should establish an environmental management system (**EMS**) which meets the following requirements:
 - **Environmental Policy.** A definition of the organisation's environmental policy provided by top management. This should include; a commitment to continual environmental improvement and preventing pollution, compliance with relevant legislation, establish a framework for setting and reviewing environmental objectives, be communicated to all employees, and made available to the public.
 - **Planning.** The organisation should establish and maintain a procedure to identify the environmental aspects of its activities and applicable legal requirements, and should be able to demonstrate its legal compliance with environmental legislation, including permits and permit limits. The organisation is also required to set out environmental objectives and targets at each relevant level/function and establish an environmental management programme(s) for achieving these.
 - **Implementation and operation.** Identify roles, responsibilities and authorities for implementation and operation, resources to be dedicated and training needs for employees. Establish procedures for internal communication and consider processes for external communication; procedures for documentation, operational control, emergency preparedness and response.
 - **Checking and corrective action.** Procedures to monitor and measure characteristics of operations and activities with a significant environmental impact; to investigate non-conformance with and corrective/preventative action; and for record-keeping and periodic internal audits.
 - **Management review.** The organisation's top management should undertake periodic reviews of the EMS to ensure its continued appropriateness and effectiveness.
- The operation of the EMS is to be **audited** by internal or external auditors, at intervals of no longer than three or four years. The frequency with which an audit is undertaken depends on the nature of activities, the significance of environmental impacts, the urgency of the problems detected in previous audits, and the history of environmental problems.
- An **annual environmental statement** is to be prepared for public consumption on the basis of the initial environmental review and each subsequent audit. As set out in Annex IV, the statement should include *inter alia*:
 - The environmental policy and a brief description of the environmental management system of the organisation.
 - A description of all the direct and indirect environmental aspects of the organisation's activities which result in significant environmental

impacts.

- A description of the environmental objectives and targets in relation to the significant environmental aspects and impacts.
- A summary of the data available on the performance of the organisation against its environmental objectives and targets with respect to its significant environmental impacts. The data should allow for year-by-year comparison to assess the development of environmental performance.
- Other factors including performance against legal provisions with respect to significant environmental aspects.

Organisations operating in multiple geographic locations may publish one corporate environmental statement which indicates the environmental impacts of each specific site of operation.

- The environmental review together with the environmental statement, management system and audit procedure is to be submitted for review and **validation** by an independent accredited environmental verifier (AEV).
- This validated statement is to be forwarded to the competent body in the Member State in which the organisation is seeking registration. After registration this statement should be made publicly available.

Seven of the Annexes to the Regulation set out in more detail requirements relating to environmental policies, programmes and management systems; auditing; the accreditation and functioning of environmental verifiers; the information to be provided to the competent body at the time of registration; and a comparison between EMAS and ISO14001.

Implementing EMAS

In order to implement EMAS, organisations must comply with the legal requirements of relevant environmental legislation; ensure that their EMS and audit programme is verified every three years; and any updated information in the environmental statement is validated every 12 months. Article 6(2) of Regulation (EC) No 1221/2009 stipulates that companies should forward yearly updates of their environmental statement (which have been validated by the environmental verifier) to the national competent body. The Regulation allows a deviation in the frequency of reporting for small organisations (as defined in Commission Recommendation 2003/361/EC) and certain local / public authorities provided that these organisations meet specific conditions (Article 7).

Organisations should openly communicate the environmental impacts of activities with the public and interested parties and annual environmental statements should be freely and easily accessible. Organisations are also required to involve employees in the process of improving environmental performance.

In measuring environmental performance, organisations can use **core indicators and other relevant environmental performance indicators**. As set out in Annex IV, core indicators are to focus on performance with respect to energy efficiency, material

efficiency, water, waste, biodiversity and emissions. Performance in relation to more specific environmental aspects, as identified in an organisation's environmental statement, should also be reported as relevant.

Registered organisations may use the **EMAS logo** (Annex V) on validated information and environmental statements and on letterheads and other advertising information. The logo may not be used (Article 10) to advertise products, or be written on the products or their packaging. Use of the logo should not create confusion with environmental product labels.

National Accreditation Systems and Competent Bodies

National competent bodies are responsible for registering participating organisations in each Member State. These national bodies should be the first point of contact for an organisation wishing to register under EMAS. Competent bodies provide information about relevant administrative procedures, possible funding opportunities and technical assistance available in a particular region or country. Competent bodies update a national list of registered organisations every month and communicate this to the Commission. Organisations breaching regulatory requirements are deleted or suspended from registration until the infringement is rectified.

Member States establish a system for the accreditation and supervision of **accredited environmental verifiers** (AEVs). An updated list of AEVs is sent to the Commission every six months, which then publishes an overall list in the *Official Journal*. The Commission is to promote collaboration between national accreditation systems to ensure consistency in the criteria and procedures for accreditation.

The register of environmental verifiers and EMAS registered organisations is maintained by the Commission and is available from the Commission's EMAS web pages³³. The Commission will also maintain and make publically available a database of best practices on EMAS, and a list of Community resources for the funding of EMAS implementation and related projects and activities. A forum, constituted of all accreditation bodies, is to be set up by these bodies and will meet at least once yearly in the presence of the Commission to develop guidance for and supervision of environmental verifiers. The forum is also to develop procedures for a peer review process of accreditation systems of the Member States in order to ensure that these meet the requirements of the Regulation.

Additional Information

EMS requirements include the requirements set out in Section 4 of the EN ISO 14001:2004, ie on the definition of the scope of EMS, communication and training issues, environmental aspects, etc; and a number of additional issues. Annex II sets out EMS requirements to be met under the EN ISO 14001:2004 standard and additional issues to be addressed by organisations under EMAS.

Organisations that meet European and international standards for issues relevant to EMAS and are certified as being compliant with those standards will be considered to

³³ http://ec.europa.eu/environment/emas/index_en.htm

meet the requirements of Regulation (EC) No 1221/2009 provided that the standards and accreditation requirements for certification bodies are recognised by the European Commission as set out in Article 45. Approved standards and recognised accreditation requirements are published in the *Official Journal*.

While participation in the scheme is entirely voluntary, there are a number of efforts to integrate EMAS in other EU environmental policies. Organisations with an EMAS registration which includes product design may use their EMS to demonstrate that their product complies with the applicable implementing measure of Directive 2009/125/EC³⁴ establishing a framework for the setting of ecodesign requirements for energy-related products. EMAS is recognised by the Commission as an important instrument to promote corporate social responsibility (COM(2006)136 and COM(2002)347). Directive 2002/96/EC³⁵ on waste electrical and electronic equipment (WEEE) encourages organisations that carry out waste treatment operations to introduce certified EMS in accordance with the EMAS Regulation. Directive 2004/17/EC³⁶ and Directive 2004/18/EC³⁷ on public procurement refer to EMAS or an equivalent standard of environmental management to certify measures put in place by public authorities. A Commission Communication on implementation of Directive 2008/1/EC concerning integrated pollution prevention and control (IPPC)³⁸ notes that implementing an EMS, such as EMAS, facilitates compliance with the requirements of the Directive, such as applications and monitoring reports³⁹. Certain Member States have introduced a system of ‘regulatory relief’ for EMAS-registered industrial installations which includes *inter alia* less frequent inspections, permit reviews; less detailed monitoring reports; and lower inspection fees.

³⁴ Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products (recast), <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:285:0010:0035:EN:PDF>

³⁵ Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment (WEEE), <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2002L0096:20090112:EN:PDF>

³⁶ Directive 2004/17/EC of the European Parliament and of the Council of 31 March 2004 coordinating the procurement procedures of entities operating in the water, energy, transport and postal services sectors, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2004L0017:20100101:EN:PDF>

³⁷ Directive 2004/18/EC of the European Parliament and of the Council of 31 March 2004 on the coordination of procedures for the award of public works contracts, public supply contracts and public service contracts, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2004L0018:20100101:EN:PDF>

³⁸ Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control (Codified version), <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2008L0001:20090625:EN:PDF>

³⁹ Commission of the European Communities, Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee, and the Committee of the Regions - On the Road to Sustainable Production Progress in implementing Council Directive 96/61/EC concerning integrated pollution prevention and control, COM(2003)354, http://eur-lex.europa.eu/LexUriServ/site/en/com/2003/com2003_0354en01.pdf

1.7 Management of Chemicals

The bulk of EU legislation on the management of chemicals consists of rules governing the marketing and use of particular categories of chemical products, either substances or preparations – rules which essentially relate to pre-marketing notification, registration and authorization systems, testing, classification, packaging, labelling, safety data sheets and other forms of safety information. It also includes a set of harmonized restrictions on the placing on the market and use of specific hazardous substances and preparations.

Consistent with the scope and purpose of the Sourcebook, this chapter will focus on general requirements which may affect the use of chemicals and management of risks associated with such use in bank-financed industrial projects, to the extent that they impose obligations directly on the operators/developers. These include requirements concerning development and testing, production and process use of chemicals. Requirements concerning process or diffuse use emissions will be covered in respect of specific processes or activities in the relevant sectoral chapters. Those concerning storage will be covered in the chapter concerning prevention and management of major industrial risks.

Since 1 June 2007, the key provisions of EU law which directly regulate the development and testing, production and process use of chemical substances and preparations are now laid down in Regulation (EC) No 1907/2006⁴⁰ concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH). This Regulation (hereafter referred to as REACH), which entered into force on 1 June 2007, establishes a new regulatory framework for chemical substances in the European Union. The European Chemicals Agency (ECHA), established under the Regulation and based in Helsinki, is responsible for managing technical, scientific and administrative aspects of REACH, and ensuring consistency in its application. This chapter will therefore focus on the most relevant provisions of REACH.

Scope of REACH

The REACH Regulation lays down provisions, underpinned by the precautionary principle, applying to the manufacture, placing on the market or use of substances on their own, in preparations or in articles and to the placing on the market of preparations. It is based on the principle that it is for manufacturers, importers and downstream users to ensure that they manufacture, place on the market or use substances that do not adversely affect human health or the environment. The purpose of REACH is to ensure a high level of protection of human health and the

⁴⁰ Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2006R1907:20071123:EN:PDF>

environment, as well as the free circulation of substances on the internal market, while enhancing competitiveness and innovation.

It is to be noted that the REACH Regulation applies without prejudice to other EU 'workplace and environmental legislation'. This implies that the provisions of REACH are additional to the chemicals-related provisions of EU occupational health and safety legislation, which falls outside the scope of this Sourcebook, as well as to substance-related and sector-specific provisions of other environmental legislation, including some which directly affect activities and projects covered by this Sourcebook, and are discussed in the relevant sectoral chapters.

For the purposes of this Sourcebook, only the provisions relating to the manufacture and use of chemicals in activities and projects falling within its scope will be considered and discussed here. This chapter does not aim at providing a comprehensive overview of the provisions concerning the placing on the market or use of chemicals, as this would go way beyond the scope of the Sourcebook, which deals with standards for site-specific activities rather than marketed products.

The provisions of REACH, which are directly applicable in all Member States, impose obligations on a wide range of persons. For our purposes, the most important categories of REACH addressees are:

- **manufacturers:** any natural or legal persons established in an EU Member State who produce substances or extract them in the natural state in an establishment located within the EU;
- **producers of articles:** any natural or legal persons who make or assemble an article within the meaning of REACH (see below) in an establishment located within the EU;
- **downstream users:** any natural or legal person established in an EU Member State, other than a manufacturer (or importer), who use a substance, either on its own or in a preparation, in the course of industrial or professional activities) in an establishment located within the EU. Distributors and consumers are not regarded as downstream users for the purpose of REACH;
- **actors in the supply chain:** all manufacturers and/or importers and/or downstream users in a supply chain.

The manufacturer or the importer of a substance or the producer or importer of an article submitting a registration for a substance is known as a 'registrant'.

For the purpose of REACH, a substance means 'a chemical element and its compounds in the natural state or obtained by any manufacturing process, including any additive necessary to preserve its stability and any impurity deriving from the process used, but excluding any solvent which may be separated without affecting the stability of the substance or changing its composition', while a preparation is 'a mixture or solution composed of two or more substances'. REACH applies not only to chemical substances and preparations, but also to certain articles, defined 'as an object which during production is given a special shape, surface or design which determines

its function to a greater degree than does its chemical composition'. The 'use' of a substance includes 'any processing, formulation, consumption, storage, keeping, treatment, filling into containers, transfer from one container to another, mixing, production of an article or any other utilisation'. An industrial or professional use of a substance by the registrant is referred to as 'registrant's own use'.

Registration Requirement

The basic principle laid down in Article 5 of REACH is that substances on their own, in preparations or in articles shall not be manufactured or placed on the market in the EU unless they have been registered in accordance with the relevant provisions of the Regulation where this is required.

The registration obligation applies, *inter alia*, to any person who manufactures a substance, either on its own or in one or more preparation(s), in quantities of one tonne or more per year.⁴¹ Producers of *articles* shall also submit a registration to the Agency for any substance contained in those articles, if the substance is present in those articles in quantities totalling over one tonne per producer per year and 'is intended to be released under normal or reasonably foreseeable conditions of use'.

If the first condition is met but the substance is not intended to be released, it is exempted from the registration procedure, but a less onerous *notification* requirement will have to be complied with by the producer of articles, if the substance concerned has been identified as a potential substance of very high concern and listed by the Agency in accordance with the procedure laid down in Article 59(1) of REACH, and is present in the producer's articles above a concentration of 0,1 % weight by weight. This notification requirement shall, however, not apply where the producer can exclude exposure to humans or the environment during normal or reasonably foreseeable conditions of use including disposal. In such cases, the producer or importer shall supply appropriate instructions to the recipient of the article. Nevertheless the Agency always has the right to take a decision requiring a producer to submit a registration for a substance in articles if it has grounds for suspecting that the substance is released from the articles and that such release presents a risk to human health or the environment.⁴²

Special provisions and further exemptions from the general registration requirement apply, under conditions specified in REACH, to:

- monomers and polymers;
- substances, on their own, in preparations or in articles, which have been registered and which are subject to a recovery process;
- on-site isolated intermediates and transported isolated intermediates;

⁴¹ For further details, see ECHA, Guidance on registration, http://guidance.echa.europa.eu/docs/guidance_document/registration_en.htm?time=1270046207

⁴² For further details, see ECHA, Guidance on requirements for substances in articles, http://guidance.echa.europa.eu/docs/guidance_document/articles_en.htm?time=1270046308

- active substances and co-formulants manufactured or imported for use in plant protection products or biocidal products only and included in certain lists established under the relevant EU legislation on these products;
- substances, preparations and articles used in 'product and process orientated research and development' in pilot plant or production trials and tests, as further defined in REACH (Article 3(22)).⁴³

When the registration duty applies, the registrant has the obligation to submit a comprehensive technical dossier to the Agency. The nature and level of detail of the information to be submitted with the registration and the extent of the studies to be performed by the registrant increases depending on the volume of production. If the substance is manufactured in quantities of 10 tonnes or more per year additional information is to be included in the technical dossier and the registrant shall also submit a chemical safety report, documenting a chemical safety assessment performed according to specifications laid down in REACH, and identify and apply appropriate risk reduction measures. If the threshold of 100 tonnes per manufacturer per year is exceeded, yet more information will have to be provided, and the most onerous data collection and provision requirements apply above the threshold of 1000 tonnes.

A registrant may start or continue the manufacture of a substance or production of an article if he receives no indication to the contrary from the Agency within three weeks after the submission date. During this period, the Agency will undertake a completeness check of the registration in order to ascertain that all information required has been submitted. If it finds a registration to be incomplete, it shall inform the registrant within the three-week period and set a reasonable deadline for submission of further information. Once the registration is complete, a registration number and registration date shall be assigned by the Agency.

Thus, the Regulation implies that no production operations involving substances subject to registration may be started prior to completion of the registration procedure as provided in REACH. The registration requirements as described above have been in force since 1 June 2008. Of course, there are transitional provisions for 'phase-in substances' as defined in Article 3(20) of REACH. In such cases, manufacturers or producers are given more time to prepare for registration and fulfil the requirements of the new REACH system. The registration deadline for phase-in substances varies according to the quantities manufactured and certain hazardous properties which they may have, in accordance with the provisions of Article 23 of the Regulation. However, in order to benefit from this transitional regime, potential registrants of phase-in substances had a duty to pre-register with the Agency between 1 June and 1 December 2008 in accordance with Article 28. If they failed to do so, they became subject to normal registration requirements immediately upon expiry of this period. According to the accompanying document of the 26th annual report on monitoring the

⁴³ For further details, see ECHA, Guidance on Scientific Research and Development (SR&D) and Product and Process Oriented Research and Development (PPORD), http://guidance.echa.europa.eu/docs/guidance_document/ppord_en.htm?time=1270046439

application of Community law (SEC(2009) 1684/2, ECHA received about 2.7 millions pre-registration dossiers.

Other Requirements Resulting from REACH

REACH imposes other obligations on actors in the supply chain. For instance, there is a general duty for any supplier, ie a person placing a substance on the market, on its own or in a preparation, to compile a safety data sheet and provide it to the recipient of the substance or preparation, when it meets the criteria for classification as dangerous in accordance with Directives 67/548/EEC⁴⁴ (substances) or 1999/45/EC⁴⁵ (preparations) or is persistent, bioaccumulative and toxic according to criteria laid down in REACH. However, this obligation applies not only to the manufacturer but also to other actors in the supply chain and is related to the act of supplying (ie placing on the market) rather than to actual manufacture. It therefore largely falls outside the scope of this Sourcebook and will not be further discussed here.

Downstream users of substances or preparations may also have a duty to perform a chemical safety assessment and prepare a chemical safety report under certain conditions specified in Article 37 of REACH, or to provide certain information to the supplier to enable the latter to identify the use and possible exposure and assess the risks associated with it. This obligation potentially applies in the context of a very wide range of projects and activities within the scope of this Sourcebook from 1 June 2008.⁴⁶

Finally, for substances of very high concern included in Annex XIV of REACH, an authorisation requirement will apply to ensure that risks from those substances are properly controlled and that they are progressively replaced by suitable alternatives. This implies that, subject to certain exceptions, any placing on the market or use of these substances shall be subject to a prior authorisation to be granted by the European Commission in accordance with a procedure and subject to detailed conditions laid down in the Regulation. However, the authorisation provisions of REACH will only become effective once the first substances have been included in Annex XIV, which will occur only after completion of a complex decision-making procedure, which started in 2009.

⁴⁴ Council Directive 67/548/EEC of 27 June 1967 on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31967L0548:EN:HTML>

⁴⁵ Directive 1999/45/EC of the European Parliament and of the Council of 31 May 1999 concerning the approximation of the laws, regulations and administrative provisions of the Member States relating to the classification, packaging and labelling of dangerous preparations, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1999L0045:20070601:EN:PDF>

⁴⁶ For further details, see ECHA, Guidance for Downstream Users, http://guidance.echa.europa.eu/docs/guidance_document/du_en.htm?time=1270046500

1.8 Waste Prevention and Management

European level policy on waste is one of the most extensive and long established in the environmental sphere, with the first measures being adopted in the 1970s. Europe's policy has been conceived in order to: promote waste recovery in particular recycling; reduce the hazardousness of waste; and the negative impacts associated with waste's management. Increasingly the emphasis is not only on better management of waste but its minimisation and the prevention of generation – this is very much linked to improved manufacturing processes and broader efforts to increase the efficiency of resource use.

The main focus of this section is waste specific EU legislation and requirements. European waste policy is, however, also complemented by measures laid down in other cross-sectoral, as well as sector or substance specific legislation. Under Directive 2008/1/EC on IPPC, installations must take waste production into account when preventing and minimising emissions to air, water and land. Additionally, IPPC installations must ideally avoid producing waste and when waste is produced they must ensure this is recovered or, when recovery is technically and economically impossible, that waste is disposed of while avoiding or reducing any impact on the environment (for further details see Chapter 1.4). Certain waste management activities, especially large scale disposal operations, are also covered by the requirements of Directive 85/337/EEC on environmental impact assessment (for further details see Chapter 1.1).

Guiding Principles of Waste Management

As waste policy in Europe has evolved over the last 35 years a set of principles have been developed that help guide the management of waste in EU Member States, the nature of action to be taken by both public authorities and economic operators in the Member States. When managing waste the following should be borne in mind:

- *Protecting health and the environment.* In the EU waste must be managed and disposed of without endangering human health or the environment.
- *The waste hierarchy.* Current EU waste legislation is based on a concept known as the waste hierarchy. This means that, ideally, waste should be prevented and what cannot be prevented should be re-used, recycled and recovered as much as feasible, with disposal and specifically landfilling used as little as possible. Waste prevention is closely linked to life cycle thinking and broader environmental policy priorities such as the need for efficient use of natural resources. The waste hierarchy principles cannot, however, be applied in a strict way and judgements will always need to be made as to the most appropriate treatment method based on environmental impact.
- *The proximity principle.* This principle implies that the transport of waste should be minimised with waste being disposed of as close to source as possible.

- *Self sufficiency in disposal.* Closely linked to aims for proximate waste treatment, the EU has a goal to be self sufficient in waste disposal at the European level and also for each Member State, as far as possible, to be self sufficient.
- *Liability for aftercare.* This concept is closely linked to rules ensuring the producer is responsible for paying for the full costs of disposal. Following on from significant problems with abandoned and old landfills/disposal sites, financial guarantees are required from operators to ensure that ongoing monitoring and any pollution incidents are paid for. The liability for the waste remains with the operator until the site is explicitly closed by the regulator.
- *Life cycle thinking.* This is an important emerging concept. The intention is that potential waste generation and the ability to recycle a product should be considered at all stages of its life cycle from design onwards. This covers everything from ensuring contaminants are limited in products to facilitate recycling to ensuring reductions in packaging do not lead to additional waste eg due to breakage of materials. Ultimately the production of a product should not be separated from its end of life impacts.

The Waste Framework Directive

Many of these principles are enshrined in Directive 2006/12/EC⁴⁷ on waste. Originally adopted in 1975 (as Directive 75/442/EEC) this Directive has been extensively amended over the years and was therefore codified in 2006. While not containing quantitative targets it requires the permitting of all waste disposal and recovery operations subject to limited and conditional exceptions and sets out definitions and approaches which apply in all waste-related legislation. It also requires Member States to develop national waste management plans setting out how these principles and regulatory requirements will be translated into action.

In terms of understanding waste management in the EU it is important to be aware of the content of the waste framework Directive and the rules it sets; key elements and points of note are summarised below, in so far as they may be of direct or indirect relevance to activities or projects within the scope of this Sourcebook.

- *The definition of waste.* This is a notoriously difficult thing to determine and extensive lists and catalogues have been developed at EU level in order to aid interpretation. In terms of EU law the Directive sets out that anything that falls into the categories set out in Annex I of the Directive (appended to this section) is considered to be waste.
- *The definitions of both waste disposal and recovery.* This is considered to be the activities set out in Annex II of the Directive and appended to this section.

⁴⁷ Directive 2006/12/EC of the European Parliament and of the Council of 5 April 2006 on waste, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:114:0009:0021:EN:PDF>

- ***The definition of waste management.*** Under the Directive management is considered as including the collection, transport, recovery and disposal of waste, including the supervision of such operations and after care of disposal sites.
- ***Permitting Waste Management Activities.*** Under the Directive all activities termed as disposal, in line with the list appended to this section, must operate under a permit. Permits to dispose of waste cover the following: the types and quantities of waste; the technical requirements; the safety precautions to be taken; the disposal site; and the treatment method. A permit may be refused if it is considered that the activities are ‘unacceptable from the point of view of environmental protection’. Recovery operations must also be permitted in order to ensure they are being operated in a way that protects the environment and human health. There are specific circumstances under which activities can be exempted from requiring a permit, if so provided by the national legislation of the Member State concerned. Establishments that are collecting and transporting waste must be registered with the authorities. All waste disposal, recovery, collection and transport activities are subject to periodic inspection – inspection regimes and methodologies vary across Member States.
- ***Protecting the environment and health.*** The Directive is very explicit in that waste disposal or recovery must be conducted without endangering human health and without using processes which could harm the environment. It is stated that activities shall be conducted: without risk to water, air or soil, or to plants or animals; without causing a nuisance through noise or odours; and without adversely affecting the countryside or places of special interest.
- ***Adopting BATNEEC.*** The Directive requires that disposal facilities be developed in line with the principle of the Best Available Technology Not Involving (Entailing) Excessive Costs (BATNEEC). This is linked to principles of BAT set out in Directive 2008/1/EC (see Chapter 1.4).
- ***Ensuring a chain of custody.*** Under the Directive producers, as well as operators of disposal and recovery operations must all keep records of the quantity of waste they receive, its nature, origin and any onward destination, frequency of collection, mode of transport and treatment method.
- ***Improving waste management.*** The Directive specifically requires Member States to encourage firstly the prevention or reduction of waste production and its harmfulness; and secondly the recovery of waste by means of recycling, reuse or reclamation, or the use of waste as a source of energy.
- ***Ensuring that the polluter pays.*** The Directive clearly sets out that the producer (or legal holder) must bear all the costs of disposing of wastes.

In 2008 the European Parliament and Council adopted Directive 2008/98/EC⁴⁸ on waste. As of the 12 December 2010 this will repeal Directive 2006/12/EC, as well as the Hazardous Waste (91/689/EC) and Waste Oils Directives (75/439/EEC).

Directive 2008/98/EC sets a new baseline for waste prevention, disposal, recovery, reuse and recycling in Europe. While some of the core responsibilities under 2006/12/EC are retained in Directive 2008/98/EC, such as the requirement for waste installations to be permitted, the new Directive also introduces some significant changes relating to the treatment of waste in the EU. For the purposes of clarity the important changes under Directive 2008/98/EC and key elements that will remain unchanged from 2006/12/EC are set out below.

Major changes to EU law associated with Directive 2008/98/EC:

- The emphasis on prevention is increased, with requirements for Member States to take action. Member States must report, by 2015, on the setting of waste prevention and decoupling objectives for 2020. National waste prevention programmes must be established by (approx) the end of 2013.
- The waste hierarchy of prevention, preparing for reuse, recycling, other recovery and disposal is defined as a priority order, to be abided by in waste prevention and management legislation. It is, however, possible to depart from the order to achieve the best environmental outcome based on life cycle impacts.
- Reuse is redefined, making it an activity applied to products and components that are not waste. A new concept, 'preparing for reuse' covers processes by which waste products are prepared for reuse without re-processing. This creates an additional stage in the waste hierarchy, splitting the concept of the reusing of products into two categories - those that have and have not become waste.
- There is a new definition of recycling. While this still focuses on the reprocessing of materials, it is now linked to the definition of recovery and specifically excludes activities such as backfilling and the reprocessing of waste materials into fuels.
- There are new definitions for recovery and disposal, although they are still based largely on the same non-exhaustive lists as in Directive 2006/12/EC.
- Incineration activities for processing municipal solid waste can be classed as recovery operations, as long as they generate energy above a given efficiency threshold.
- The separate collection of paper, metal, plastic and glass must be in place by 2015.
- By 2020, Member States must take all 'necessary measures' to ensure that at least 50 per cent of paper, plastics, metal and glass from households and similar origins is prepared for reuse or recycled.

⁴⁸ Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:312:0003:0030:EN:PDF>

- By 2020, Member States must take all ‘necessary measures’ to ensure at least 70 per cent of non-hazardous construction and demolition waste is reused, recycled or undergoes material recovery.
- Extended producer responsibility requirements are introduced, empowering Member States to make producers responsible for managing and financing the treatment of associated waste. It is still unclear how Member States will choose to implement these requirements, as they have been given considerable flexibility.
- Procedures are established for developing criteria for what constitutes a waste by-product and when waste ceases to be waste. Within the Directive conditions are listed that, if met, mean a substance is not, or is no longer, waste. The Directive also proposes a mechanism whereby the generic conditions can be complemented by substance or object specific criteria developed under the comitology procedure. Specific end-of-waste criteria will be established for at least aggregates, paper, glass, metal, tyres and textiles.
- The promotion of the collection and treatment of biowaste, along with the environmentally safe use of resultant materials.
- At EU level technical minimum standards for treatment activities requiring a permit may be adopted. These may include best-available techniques and key environmental impacts and set standards for the quality of treatment and the process requirements.
- Derogations from the ban on mixing hazardous and other wastes are altered to enable mixing, provided that activities are permitted, the environment and human health are protected and mixing operations conform to best-available techniques.

Key elements that will be retained under the new regime:

- The definition of waste and the use of a ‘waste list’.
- Basic requirements for permits to carry out waste treatment, with Member States having the ability to exempt certain disposal and recovery operations.
- Requirements for the inspection of waste-treatment operations and those collecting or transporting waste.
- The requirement to produce waste management plans.
- The requirement to manage hazardous waste in a way that protects human health and the environment. Hazardous waste remains defined by reference to a hazardous waste list, now annexed to the Directive.
- The requirements to collect and manage waste oils separately (although, there is no longer any preference given to reprocessing of waste oils).

Dealing with Specific Waste Streams and Waste Management Activities

Under the ‘umbrella’ of the waste Directive there is a raft of other legislation intended to address certain waste streams and disposal processes. These contain targets and objectives to improve specific approaches to waste management. These stream and process specific measures are set out below to the extent they are likely to be relevant, directly or indirectly, for the activities and projects within the scope of this Sourcebook.

Measures aimed at reducing the hazards and negative environmental impacts of particular waste management operations

- *Hazardous waste Directive.* Directive 91/689/EEC takes as its starting point the provisions of Directive 2006/12/EC on waste and introduces stricter requirements for operations involving hazardous waste and contains a specific list of wastes considered to be hazardous. See Chapter 2.4.1 for further details
- *Landfill Directive.* Directive 1999/31/EC sets out requirements in terms of acceptance criteria for landfills, liability, permitting, monitoring, management and aftercare for landfills. See Chapter 2.4.3 for a detailed description of requirements
- *Incineration of waste Directive.* Directive 2006/76/EC sets out requirements and conditions covering the incineration and co incineration of wastes. The Directive is intended to protect the environment and human health and sets out limit values and permitting requirements. See Chapter 2.4.2 for details
- *Shipment of waste.* Regulation 1013/2006⁴⁹ lays down rules to monitor and control the shipment of waste within, into and out of the EU. Under these rules the export of hazardous waste for recovery is prohibited to non OECD states and the export of all waste to non OECD countries for disposal is banned. It should be noted that this Directive applies to all waste both solid and liquid including large scale items, for example ships for dismantling.

Selected measures aimed at managing specific waste streams

- *Directive on the disposal of PCBs.* Polychlorinated biphenyls (PCBs) caused grave concern after their ability to accumulate in the environment was noted and due to their inability to biodegrade. Following concerns about massive decline in sea bird populations, and more generally for aquatic life, various measures were introduced to restrict their sale and use. Directive 96/59/EC⁵⁰ sets out a system to eliminate PCBs from the waste stream. It sets out steps to identify PCBs and ensure their disposal. The Directive requires the disposal of waste PCBs, and the disposal or decontamination of equipment, ‘as soon as possible’. Equipment containing PCBs must be disposed of and decontaminated by 31 December 2010.
- *Directive on the management of waste from extractive industries.* Directive 2006/21/EC sets out specific requirements for the management of waste from mines, quarries and other extractive industry. It contains requirements for improved planning, financial guarantees from the operators, provisions for

⁴⁹ Regulation (EC) No 1013/2006 of the European Parliament and of the Council of 14 June 2006 on shipments of waste, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2006R1013:20071130:EN:PDF>

⁵⁰ Council Directive 96/59/EC of 16 September 1996 on the disposal of polychlorinated biphenyls and polychlorinated terphenyls (PCB/PCT), <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31996L0059:EN:HTML>

aftercare and specific requirements in relation to management of tailings and acidic/contaminated runoff from tailings. See Chapter 2.5.2 for full details

Selected measures promoting recycling and reductions in hazardous materials within specific common waste streams

- *Packaging and Packaging waste Directive*. Directive 94/62/EC⁵¹ aims to reduce the impact of packaging on the environment, to harmonise national measures in order to prevent distortions to competition and to ensure the free movement of packaged goods. The Directive seeks to achieve the aims by:
 - requiring Member States to establish return, collection and recovery systems;
 - setting a number of targets for recovery and recycling, and
 - guaranteeing free circulation within the EU of packaging which meets certain essential requirements

- *Waste electronic and electrical equipment (WEEE) Directive, supported by the Directive on the restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (ROHS)*. Directive 2002/96/EC⁵² is designed to tackle the rapid expansion in the level of WEEE being disposed of, encouraging increased levels of recycling of EEE and providing incentives to ensure that future EEE is designed in an environmentally more efficient way. The Directive establishes producer responsibility for WEEE with producers responsible for the EEE that they put upon the EU market place. This is complemented by specific targets for the recovery and recycling of WEEE, requiring collection systems to be set up, and encouraging the design and production of electrical and electronic equipment (EEE) to take future reuse, recycling and recovery into account. Though mainly focused on WEEE from private households, the definition of WEEE in the Directive also includes waste from other sources, which because of its nature and quantity is similar to that from private households. Directive 2002/96/EC is complemented by the Directive 2002/95/EC⁵³, which ensures that hazardous substances that cause major problems during waste management phases are not used in EEE. The RoHS directive bans lead, cadmium, mercury, hexavalent chromium and the PBB and PBDE families of brominated flame retardants in EEE being put on the EU market (although a set number of exemptions to these rules have been granted).

⁵¹ Directive 94/62/EC of the European Parliament and of the Council of 20 December 1994 on packaging and packaging waste, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1994L0062:20050405:EN:PDF>

⁵² Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment (WEEE), <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2002L0096:20080321:EN:PDF>

⁵³ Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2002L0095:20080321:EN:PDF>

Case law

Due to the uncertainties surrounding the definition of waste and other treatment options including recycling there has been a catalogue of cases brought forward to try and clarify these issues. Some of the key European Court of Justice cases of relevance are set out below, categorized by the key issues under debate.

Definition of waste

- C-457/02: 11/11/2004 – This case clarified that the definition of waste should not be interpreted as excluding all production and consumption residues. Moreover, importantly the ruling set out that the definition of waste cannot be construed as covering exclusively substances or objects intended for, or subjected to, the disposal or recovery operations mentioned in Annexes II A and II B of the Directive, to that Directive or in the equivalent lists. As a consequence it was clarified that Annexes IIA and II B represent indicative lists rather than comprehensive lists.
- C-235/02:15/01/2004 – This case ruled on the issue of by-products versus waste. The Court set out that petroleum coke produced intentionally or in the course of producing petroleum fuels in an oil refinery which is certain to be used as fuel to meet the energy needs of the refinery and those of other industries does not constitute waste.
- C-114/01: 11/09/2003 – In this case the Court clarified the definition of waste stating that leftover rock and residual sand from ore dressing from mining activities must be classified as waste unless they are to be used subsequently for the filling-in of galleries of that mine or where there is a definite prospect for their use for that purpose.
- C-9/00:18/04/2002 - The Court held that, having regard to the principle established in earlier cases, the concept of waste should be interpreted widely in order to limit its inherent risks, the classification of by-products should be confined to situations in which the reuse of the goods, materials or raw materials is not a mere possibility but a certainty, without any further processing prior to reuse and as an integral part of the production process.
- C-418/97 to C-419/97:15/06/2000 – In these cases the Court specifically examined if products discarded by some but are then, for example, used by others as a fuel source (eg wood chips) are considered to be waste. The Court ruled that the idea that material had been discarded should not necessarily be regarded as a basis for determining if a material is waste. It stated that each classification should be individually assessed.
- C-129/96:18/12/1997– This case examined what is considered a waste, when it becomes waste and how this might differ from a by-product. The Court ruled that a substance cannot be excluded from the definition of waste on the grounds that it directly or indirectly forms an integral part of an industrial production process.
- C-224/9, C-304/94, C-342/94, C-224/9v5: 25/06/1997 – This case dealt with the fundamental question of when a material is waste and when this material ceases to be waste. The Court importantly ruled that the definition of "waste" should not exclude substances and objects capable of economic reutilisation even if the materials in question may be the subject of a transaction or quoted on public or private commercial lists. Moreover, the fact that a substance is classified as a re-usable residue without its characteristics or purpose being considered irrelevant in determining if a material is waste, that is just because it 'could' be re-used or re-

processed does not mean for the time being it is not considered waste in need of management.

- C-206/88 and C-207/88:28/03/1980 – These cases examined whether residue materials with economic value are considered to be waste. It was ruled that the definition of ‘waste’ should not exclude substances and objects which are capable of economic reutilisation. The concept does not presume that the holder disposing of a substance or an object intends to exclude all economic reutilisation of the substance or object by others.

Definition of recycling

- C-444/00:19/06/2003 – This important case clarified the point at which a waste material can be considered to be recycled. The Court ruled that recycling could only be deemed to have taken place when the secondary material has been reprocessed into a new product. This has important implications for the recycling industry and manufacturers dealing with secondary raw materials, who are (based on this ruling) considered to be handling waste materials if reprocessing secondary raw materials into goods.

Defining recovery and disposal

- C-307/00 to C-311/00: 27/02/2003 – This series of cases lead to a number of linked rulings which ruled that a treatment operation cannot simultaneously be considered both a disposal and recovery operation. The determining of whether the operation is disposal or recovery should be on a case by case basis.
- C-116/01: 03/04/2003 – This case dealt with the question of classifying waste treatment operations. It ruled that waste treatment processes comprising several stages must be classified as a disposal or recovery operation. The Court also ruled that the calorific value of waste to be combusted is not a relevant basis to determine whether an operation is deemed disposal or recovery.
- C-6/00:27/02/2002 – This case focused on whether the deposit of waste in disused mines is considered a disposal or recovery operation. The Court ruled that the deposit of waste in disused mines does not constitute waste disposal and that the classification of such activities should be completed on a case by case basis.

Annex I of Directive 2006/12/EC – Defining Waste

In essence the following categories are considered to be waste under EU law.

CATEGORIES OF WASTE

- Q1 Production or consumption residues not otherwise specified below
- Q2 Off-specification products
- Q3 Products whose date for appropriate use has expired
- Q4 Materials spilled, lost or having undergone other mishap, including any materials, equipment, etc., contaminated as a result of the mishap
- Q5 Materials contaminated or soiled as a result of planned actions (e.g. residues from cleaning operations, packing materials, containers, etc.)
- Q6 Unusable parts (e.g. reject batteries, exhausted catalysts, etc.)
- Q7 Substances which no longer perform satisfactorily (e.g. contaminated acids, contaminated solvents, exhausted tempering salts, etc.)
- Q8 Residues of industrial processes (e.g. slags, still bottoms, etc.)
- Q9 Residues from pollution abatement processes (e.g. scrubber sludges, baghouse dusts, spent filters, etc.)
- Q10 Machining/finishing residues (e.g. lathe turnings, mill scales, etc.)
- Q11 Residues from raw materials extraction and processing (e.g. mining residues, oil field slops, etc.)
- Q12 Adulterated materials (e.g. oils contaminated with PCBs, etc.)
- Q13 Any materials, substances or products the use of which has been banned by law
- Q14 Products for which the holder has no further use (e.g. agricultural, household, office, commercial and shop discards, etc.)
- Q15 Contaminated materials, substances or products resulting from remedial action with respect to land
- Q16 Any materials, substances or products which are not contained in the abovementioned categories.

Extract from Annex II A of Directive 2006/12/EC – Defining Disposal

DISPOSAL OPERATIONS

- NB: This Annex is intended to list disposal operations such as they occur in practice. In accordance with Article 4, waste must be disposed of without endangering human health and without the use of processes or methods likely to harm the environment.
- D 1 Deposit into or on to land (e.g. landfill, etc.)
 - D 2 Land treatment (e.g. biodegradation of liquid or sludgy discards in soils, etc.)
 - D 3 Deep injection (e.g. injection of pumpable discards into wells, salt domes or naturally occurring repositories, etc.)
 - D 4 Surface impoundment (e.g. placement of liquid or sludgy discards into pits, ponds or lagoons, etc.)
 - D 5 Specially engineered landfill (e.g. placement into lined discrete cells which are capped and isolated from one another and the environment, etc.)
 - D 6 Release into a water body except seas/oceans
 - D 7 Release into seas/oceans including sea-bed insertion
 - D 8 Biological treatment not specified elsewhere in this Annex which results in final compounds or mixtures which are discarded by means of any of the operations numbered D 1 to D 7 and D 9 to D 12
 - D 9 Physico-chemical treatment not specified elsewhere in this Annex which results in final compounds or mixtures which are discarded by means of any of the operations numbered D 1 to D 8 and D 10 to D 12 (e.g. evaporation, drying, calcination, etc.)
 - D 10 Incineration on land
 - D 11 Incineration at sea
 - D 12 Permanent storage (e.g. emplacement of containers in a mine, etc.)
 - D 13 Blending or mixing prior to submission to any of the operations numbered D 1 to D 12
 - D 14 Repackaging prior to submission to any of the operations numbered D 1 to D 13
 - D 15 Storage pending any of the operations numbered D 1 to D 14 (excluding temporary storage, pending collection, on the site where it is produced)

Extract from Annex II B of Directive 2006/12/EC – Defining Recovery

RECOVERY OPERATIONS

- NB:** This Annex is intended to list recovery operations as they occur in practice. In accordance with Article 4, waste must be recovered without endangering human health and without the use of processes or methods likely to harm the environment.
- R 1 Use principally as a fuel or other means to generate energy
 - R 2 Solvent reclamation/regeneration
 - R 3 Recycling/reclamation of organic substances which are not used as solvents (including composting and other biological transformation processes)
 - R 4 Recycling/reclamation of metals and metal compounds
 - R 5 Recycling/reclamation of other inorganic materials
 - R 6 Regeneration of acids or bases
 - R 7 Recovery of components used for pollution abatement
 - R 8 Recovery of components from catalysts
 - R 9 Oil re-refining or other reuses of oil
 - R 10 Land treatment resulting in benefit to agriculture or ecological improvement
 - R 11 Use of wastes obtained from any of the operations numbered R 1 to R 10
 - R 12 Exchange of wastes for submission to any of the operations numbered R 1 to R 11
 - R 13 Storage of wastes pending any of the operations numbered R 1 to R 12 (excluding temporary storage, pending collection, on the site where it is produced)

1.9 Noise Prevention and Management

Until recently, the focus of EU legislation on noise has been on limiting noise from products, rather than on setting standards for ambient background noise. In this respect, legislation to combat noise from transport has set noise standards for vehicles, motorcycles and aircraft, rather than for roads and airports. This is because EU legislation on noise was originally intended to avoid technical barriers to trade in the internal market caused by differing standards applied in the Member States for noisy products and equipment.

Noise Directives of Greatest Relevance

Directive 2002/49/EC relating to the assessment and management of noise⁵⁴ sets a common, EU-wide approach to reducing exposure to environmental noise. This shall be done through the determination of the extent of this exposure using common assessment methods and strategic noise mapping; the provision of information to the public; and the adoption of action plans to reduce noise exposure where necessary. The Directive requires Member States to use four defined noise indicators for the purpose of noise mapping. It does not apply to noise from domestic activities, workplace noise, noise inside transport vehicles and military activities.

The mapping of noise and the development of action plans are to be undertaken by competent authorities in the Member States in two stages. In the first stage, strategic noise maps and action plans have to be prepared for all agglomerations of more than 250,000 people, major roads that carry more than six million vehicles a year, major railways that carry more than 60,000 trains a year and airports with more than 50,000 annual aircraft movements. By 18 July 2008, the competent authorities in each Member State had to draw up action plans to reduce exposure to noise in the appropriate locations, as identified by the noise maps, on the basis of limit values or other criteria chosen at the national level. This might have an implication on any project locations within already noisy areas identified by these noise maps.

In the second stage, strategic noise maps and action plans for all agglomerations of over 100,000 people, roads carrying more than three million vehicles a year and railways carrying more than 30,000 trains are to be produced. The list of these locations had to be provided to the Commission by 31 December 2008, whereas the noise maps and action plans in the second stage are to be completed within five years of the respective “stage one” requirements. The minimum requirements for the noise maps and action plans are set out in Annex IV and V of the Directive, respectively. Noise maps and action plans are to be reviewed and revised if necessary every five years, the first of them being due by 30 June 2012 at the latest.

⁵⁴ Directive 2002/49/EC of the European Parliament and of the Council of 25 June 2002 relating to the assessment and management of environmental noise, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2002:189:0012:0025:EN:PDF>

Directive 86/188/EEC on the protection of workers from the risks related to exposure to noise at work aims to protect workers from risks to their hearing by setting limits on noise levels at which preventative action is required. The Directive applies to all workers except those in sea and air transport. Employers are required to assess and, where necessary, measure noise levels to identify workers and workplaces to which the Directive applies and to determine the conditions under which its provisions apply. Noise exposures are generally to be reduced to the lowest levels reasonably practicable, taking account of technical progress and the availability of measures to control the noise. Where noise levels are likely to exceed 85 dB(A), or the peak sound pressure level exceeds 200 pascals, workers must receive adequate information and, where necessary, training. However, since this Directive falls within the scope of EU legislation on occupational health, although the application of its requirements may have incidental effects on the external environment, it will not be further discussed in the Sourcebook.

Noise pollution as an aspect to be assessed in EIA and SEA procedures

Directives 2001/42/EC and 85/337/EEC establish procedural requirements to take noise pollution into consideration in procedures for the adoption of plans and programmes (SEA) and the granting of development consent for projects (EIA). See Chapter 1.1 for further details.

1.10 Energy Efficiency

Integrated Pollution Prevention and Control (IPPC) Directive

According to Directive 2008/1/EC⁵⁵ (see also Chapter 1.4), competent authorities must ensure that installations covered by the directive are operated in such a way that, *inter alia*, energy is used efficiently. Energy efficiency is hence one of the requirements for an installation to obtain an integrated emission permit. Energy used or generated by an installation is one of the items of information to be provided to the competent authorities by the operator applying for a permit.

Energy efficiency should also be taken into consideration when determining best available techniques (BAT). In the BREF documents describing BAT, energy efficiency levels associated with BAT are often provided for different sectors. Furthermore, a general BREF on 'Energy Efficiency' was published in February 2009, addressing the subject in a cross-sectoral perspective. This BREF is summarised below. Further information on IPPC BATs is provided in Chapter 1.4, while energy efficiency associated levels are described in sector specific chapters (see in particular Chapter 2.4.2 on Waste Incineration). It should be noted that the IPPC Directive is currently subject to a process of revision, which is expected to be concluded in late 2010. Energy issues are still being widely debated, therefore it is not possible to foresee the implications of the revised Directive as yet.

For activities that are also subject to the EU Emissions Trading Scheme (Directive 2003/87/EC) Member States may choose not to impose requirements relating to energy efficiency in respect of combustion units or other units emitting carbon dioxide on the site.

Energy efficiency BREF

This document⁵⁶ is a special horizontal BREF addressing generic energy efficiency techniques.

It contains guidance and conclusions on techniques for energy efficiency that are considered to be compatible with BAT in a generic sense for all installations covered by the IPPC Directive (2008/1/EC). No associated energy savings or efficiency values could be derived for this document, although process-specific BAT for energy efficiency and associated energy consumption level are given in some of the sector-specific BREFs.

A key element to achieve energy efficiency in all IPPC installations is a formal management approach. Key elements are summarised below.

⁵⁵ Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:024:0008:0029:EN:PDF>

⁵⁶ EC/JRC 2009: IPPC Reference Document on Best Available Techniques for Energy Efficiency. February 2009. http://eippcb.jrc.ec.europa.eu/reference/brefdownload/download_ENE.cfm

Energy efficiency management

BAT is to adhere to an energy efficiency management system (ENEMS) that incorporates: commitment of top management; definition of an energy efficiency policy; planning and establishing objectives and targets; implementation of operational procedures; benchmarking; performance check-ups and corrective action; periodic review of the ENEMS by top management; impacts from eventual decommissioning (to be taken into account when designing a new unit); development of energy efficient technologies.

An ENEMS may also optionally include: preparation and publication of a regular energy efficiency statement; external validation of the management system and audit procedure; implementation and adherence to nationally/internationally accepted voluntary management systems for energy efficiency.

Continuous environmental improvement

BAT is to continuously minimise the environmental impacts by planning actions and investment on an integrated basis and considering the costs and benefits and cross-media effect.

Identification of energy efficiency aspects and opportunities for energy saving

BAT is to identify the aspects of an installation that influence energy efficiency by carrying out an external or internal audit, which should identify: energy use and type; energy using equipments; possibilities to minimise energy use, to use alternative/more efficient sources, to apply energy surplus to other processes and to upgrade heat quality.

BAT is also to use appropriate tools to identify and quantify energy optimisation, eg energy models, estimates and calculations etc.

Furthermore, BAT is to identify opportunities to optimise energy recovery within the installation, between systems within it or with a third party.

System approach to energy management

BAT is to take a system approach to energy management. Systems to be considered for optimising energy use include, process units, heating systems, cooling and vacuum, motor driven systems, lighting and drying, separation and concentration systems.

Establishing and reviewing energy efficiency objectives and indicators

BAT is to carry out all of the following activities: identify suitable energy efficiency indicators and measure their change over time; identify and record boundaries associated to the indicators and factors that can cause variation in the energy efficiency of the relevant processes, systems or units.

Benchmarking

BAT is to carry out systematic and regular comparison with sector, national or regional benchmarks when available.

Energy Efficient Design (EED)

When planning a new installation, unit or system, or when undertaking a significant upgrade, BAT is to consider all of the following activities: initiating energy efficiency design (EED), to be carried out by an energy expert, from the early stages of the design phase; selecting energy efficient technologies; collecting additional data if needed; in the initial mapping of energy consumption, identifying which parties in the project organisation will influence the future energy consumption.

Increased project integration

BAT is to seek to optimise the use of energy between more than one process/system within the installation or with a third party.

Maintaining the impetus of energy efficiency initiatives

Possible BAT to maintain the impetus of energy efficiency initiatives are to implement a specific energy management system, to use accounting for energy based on metered values, create financial profit centres for energy efficiency, benchmarking, reviewing existing management systems and/or using techniques to manage organisational change.

Maintaining expertise

BAT is to recruit or train skilled staff, take staff off-line periodically to perform fixed term/specific investigations, share in-house resources between sites, use consultants for fixed term investigations and/or outsourcing specialist systems/functions.

Effective control processes

BAT is to have systems in place to ensure that procedures are known, understood and complied with, ensure that key performance parameters are identified, optimised and monitored and that these are documented/recorded.

Maintenance

With regard to the maintenance of installations, BAT is to apply all of the following: clearly allocate responsibility for maintenance, establish a structured programme for maintenance, supported by appropriate record keeping systems and diagnostic testing; identify possible losses in energy efficiency or possibilities for improvements; identify leaks, broken equipment, worn bearings etc that affect or control energy usage, and rectify them.

Monitoring and measurement

BAT is to establish and maintain documented procedures to regularly monitor and measure key characteristics that can have significant impacts on energy efficiency.

Energy-using systems, processes, activities or equipments

The general BAT identified in the BREF applies also to energy-using systems, processes, activities or equipments.

For *combustion and steam systems*, BAT is to use sector specific techniques as defined in vertical (sector-specific) BREFs, those given in the Large Combustion Plant (LCP) BREF and in this (energy efficiency) BREF.

The techniques identified in this BREF are also meant to help optimising energy efficiency in *compressed air systems, pumping systems, heating, ventilation and air conditioning (HVAC) systems, lighting, and drying, concentration and separation processes* (for these, it is also BAT to use mechanical separation in conjunction with thermal processes).

BAT for *heat recovery* is to maintain the efficiency of heat exchangers by both monitoring the efficiency periodically and preventing or removing fouling. Techniques for cooling, contained in the Industrial Cooling Systems (ICS) BREF, rely mainly on using surplus heat rather than dissipating it through cooling. Where cooling is required, free cooling (using ambient air) should be considered.

BAT is also to seek possibilities for *cogeneration*, inside and/or outside the installation (ie with a third party – including public authorities).

For *electrical power supply*, BAT is to increase the power factor according to the requirements of the local electricity distributor, using techniques included in this BREF. Furthermore, it is also BAT to check the power supply for harmonics and apply filters if required, and to optimise the power supply efficiency by using techniques described in this document.

As for *electric motor driven sub-systems*, BAT is to use electrically efficient motors (EEMs) and variable speed drivers (VSDs). Electric motors can be optimised by optimising the entire system the motor is part of, then optimise the motor(s) according to newly-determined load requirements. Subsequently the remaining (non-optimised) motors should be optimised (eg by replacing remaining motors with EEMs, or considering some electric motors with variable speed drivers).

Energy Performance Requirements for Buildings

The objective of Directive 2002/91/EC⁵⁷ on the energy performance of buildings is to promote an improvement in the energy performance of buildings in the EU. The Directive does not set EU-wide standards for the energy efficiency of buildings, rather it sets out a common framework and lays down a number of requirements to ensure that proper action is taken by Member States. Therefore, it is national implementing legislation which determines the exact requirements for project developers resulting from the Directive. Member States were expected to implement the provision of this Directive by January 2006.

Buildings subject to the Directive

The Directive applies to all buildings, but only new buildings and those undergoing major renovation are subject to minimum energy performance requirements.

Member States are allowed to exempt certain kinds of buildings from energy performance requirements. These include industrial sites, workshops and non-residential agricultural buildings with low energy demand and non residential agricultural buildings which are in use by a sector covered by a national sectoral agreement on energy performance, and holiday homes.

Energy performance requirements for buildings

Member States are required to apply a methodology to calculate the energy performance of buildings, on the basis of a general framework set out in an Annex to the Directive. The methodology has to include at least the thermal characteristics of the building, its heating, air-conditioning and ventilation, as well as the source of its energy.

The Directive also requires Member States to set minimum standards for the energy performance of new buildings, or for large existing buildings (ie with a floor area above 1,000 m²) which undergo major renovation. The standards must take into account general indoor climate conditions, as well as external local conditions. They are to be reviewed at least every five years and updated to take into account technical progress.

Furthermore, if their floor area of new buildings is over 1,000 m², the feasibility of systems such as combined heat and power (CHP), decentralised energy supply based on renewable energy, district or block heating or cooling and heat pumps have to be considered before construction starts.

⁵⁷ Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on the energy performance of buildings, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:001:0065:0071:EN:PDF>

Energy performance certificate

An energy performance certificate is to be made available to owners or occupiers of buildings when these are constructed, sold or rented. This should provide information on the building's energy performance and include references to benchmarks to enable comparisons with other buildings and recommendations for cost-effective ways of improving energy efficiency. The validity of the certificate shall not exceed 10 years. In public buildings above 1,000 m² this certificate is to be prominently displayed.

Energy performance of boilers and air-conditioning systems

Member States are also required to lay down requirements for reducing the energy consumption and CO₂ emissions resulting from the use of boilers and air-conditioning systems.

Regular inspections of air-conditioning systems with an effective rated output of more than 12 kW should take place. The inspection should include an assessment of the air conditioning efficiency and the sizing compared to the cooling requirements of the building. Appropriate advice should also be provided to users on possible improvements, replacements or alternative solutions.

For boilers, Member States can choose between two options, provided that their impact is equivalent. They can ensure that regular inspections of boilers of an effective rated output of 20 kW to 100 kW occur and that the appropriate advice is given. For larger boilers, inspections must occur at least every two years. For boilers over 15 years old a one-off inspection is required to assess the system and recommend replacements or alternative options for reducing energy consumption. Alternatively, Member States should make sure that advice is provided, which may include inspections.

Qualified/accredited experts

Both the certification of buildings and the inspection of boilers and air-conditioning systems have to be undertaken independently by qualified and/or accredited experts. If a Member State lacked such experts, they were granted an additional three years, ie until January 2009, to apply fully the relevant provisions. Several Member States appealed to this clause to 'delay' the implementation of the Directive until 2009.

Expected development of the Directive

In November 2009 political agreement was reached on a final proposal for a recast of the Directive⁵⁸. The formal adoption of the recast Directive by the European Parliament and the Council is foreseen in early 2010. Once adopted, Member States will have two years to bring their national laws into line with the new directive. Expected changes include:

⁵⁸ Proposal for a Directive of the European Parliament and of the Council on the energy performance of buildings (recast). Brussels, 13/11/2008 COM(2008) 780 final. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0780:FIN:EN:PDF>

- The deletion of the threshold of 1000m² for buildings undergoing major renovation to meet minimum performance standards
- The Commission is to establish by 30 June 2011 a ‘comparative methodology framework’ for calculating cost-optimal levels of minimum energy performance requirements for buildings and building elements, to be adopted by all by Member States
- Inspection reports for boilers of an effective rated output of more than 20kW and air conditioning systems of more than 12kW should be handed over to the owner or tenant of the building.
- Member States shall ensure that by 31 December 2020, all new buildings are nearly zero energy buildings (ie buildings with a high energy performance, to be defined in Annex I), and after 31 December 2018, public authorities that occupy and own a new building shall ensure that the building is a nearly zero energy building.

1.11 Air Quality and Climate Change

Introduction and Scope

EU environmental law addresses the protection of the atmosphere through a series of approaches. These include:

- Setting limits on emissions of toxic pollutants to the air from stationary sources;
- Setting limits on emissions of toxic pollutants to the air from mobile sources;
- Limiting the emissions of other substances to the atmosphere, such as greenhouse gases and substances that deplete the ozone layer;
- Setting national emission ceilings for specific pollutants;
- Setting ambient standards that should be achieved in relation to air quality.

This chapter deals with the latter three issues. Stationary sources are addressed in the Chapter 1.4 which focuses on IPPC as most of the remaining EU law on industrial emissions is implemented in the context of this Directive. Mobile sources and controls on fuel or paint quality are, in effect, product standards and do not come under the scope of the Sourcebook. Thus this Chapter is focused on ambient air quality standards, national ceilings, measures to limit greenhouse gas emissions and measures to limit emissions of substances that deplete the ozone layer.

Ambient Air Quality

A series of Directives have been adopted over time by the EU with regard to setting objectives for ambient air quality. Today, action on ambient air quality is addressed by the Directive on ambient air quality and cleaner air for Europe (2008/50/EC⁵⁹). This contains ambient air quality standards, provides for the establishment of new ambient air quality standards and objectives, the assessment of air quality, the provision of information to the public, and the development and implementation of programmes to maintain air quality or to bring it to the desired levels where necessary. Specific standards for sulphur dioxide, nitrogen oxides, particulate matter, lead, benzene, carbon monoxide and ozone are contained in Directive 2008/50/EC as well as in one earlier Directive on arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons (PAHs) (Directive 2004/107/EC⁶⁰).

⁵⁹ Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:152:0001:0044:EN:PDF>

⁶⁰ Directive 2004/107/EC of the European Parliament and of the Council of 15 December 2004 relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2005:023:0003:0016:EN:PDF>

It is important to note that limit values are mandatory standards and are to be taken account of in setting emission limit values in permits issued to IPPC installations regulated by the Directive 2008/1/EC (see Chapter 1.4).

Air Quality Standards

Air quality standards can include both limit values and higher ‘alert thresholds’. Tables 1-6 provide detail on the limit values, alert thresholds and other standards adopted in Directives 2008/50/EC and 2004/107/EC.

Table 1: Sulphur dioxide limit values, alert values and compliance timetable for compliance for Directive 2008/50/EC

	Averaging period	Value	Margin of tolerance	Date by which limit period value is to be met
Hourly limit value for the protection of human health	1 hour	350 $\mu\text{g}/\text{m}^3$, not to be exceeded more than 24 times a calendar year	150 $\mu\text{g}/\text{m}^3$ (43%)	Already in force
Daily limit value for the protection of human health	24 hours	125 $\mu\text{g}/\text{m}^3$, not to be exceeded more than 3 times a calendar year	None	Already in force
Limit value for the protection of ecosystems	Calendar year	20 $\mu\text{g}/\text{m}^3$	None	N/a
Alert threshold	3 consecutive hours over an area of 100 km^2 or an entire agglomeration	500 $\mu\text{g}/\text{m}^3$	N/a	N/a

Table 2: Nitrogen dioxide and nitrogen oxide limit values, alert values and compliance timetable for compliance for Directive 2008/50/EC

	Averaging period	Value	Margin of tolerance	Date by which limit period value is to be met
Hourly limit value for the protection of human health	1 hour	200 $\mu\text{g}/\text{m}^3$, not to be exceeded more than 18 times a calendar year	50% on 19 July 1999, decreasing on 01.01.2001 and every 12 months thereafter by equal percentages to reach 0% by 01.01.2010	1 January 2010

Annual limit value for the protection of human health	Calendar year	40 µg/m ³ NO ₂	50% on 19 July 1999, decreasing on 01.01.2001 and every 12 months thereafter by equal percentages to reach 0% by 01.01.2010	1 January 2010
Limit value for the protection of ecosystems	Calendar year	30 µg/m ³ NO _x	None	N/a
Alert threshold	3 consecutive hours over an area of 100 km ² or an entire agglomeration	500 µg/m ³	N/a	N/a

Table 3: Obligations relating to PM_{2.5}: national exposure reduction target, target value and limit value

Average exposure indicator

The Average Exposure Indicator expressed in µg/m³ (AEI) shall be based upon measurements in urban background locations in zones and agglomerations throughout the territory of a Member State. It should be assessed as a three-calendar year running annual mean concentration averaged over all sampling points established pursuant to Section B of Annex V. The AEI for the reference year 2010 shall be the mean concentration of the years 2008, 2009 and 2010. However, where data are not available for 2008, Member States may use the mean concentration of the years 2009 and 2010 or the mean concentration of the years 2009, 2010 and 2011.

The AEI for the year 2020 shall be the three-year running mean concentration averaged over all those sampling points for the years 2018, 2019 and 2020. The AEI is used for the examination whether the national exposure reduction target is met.

The AEI for the year 2015 shall be the three-year running mean concentration averaged over all those sampling points for the years 2013, 2014 and 2015. The AEI is used for the examination whether the exposure concentration obligation is met.

National exposure reduction target

Exposure reduction target relative to the AEI in 2010		Year by which the exposure reduction target should be met
Initial concentration in µg/m ³	Reduction target in percent	2020
<8.5 = 8.5	0%	
>8.5 - < 13	10%	
= 13 - < 18	15%	
= 18 - < 22	20%	
> 22	All appropriate measures to achieve 18 µg/m ³	

Where the AEI in the reference year is 8.5 µg/m³ or less the exposure reduction target shall be zero. The reduction target shall be zero also in cases where the AEI reaches the level of 8.5 µg/m³ at any point of time during the period from 2010 to 2020 and is maintained at or below that level.

Exposure concentration obligation

Exposure concentration obligation	Year by which the obligation value is to be met
20 µg/m ³	2015

Target value

Averaging period	Target value	Date by which target value should be met
Calendar year	25 µg/m ³	1 January 2010

Limit Value

Averaging period	Limit value	Margin of tolerance	Date by which limit value should be met
Stage 1			
Calendar year	25 µg/m ³	20 % on 11 June 2008, decreasing on the next 1 January and every 12 months thereafter by equal annual percentages to reach 0 % by 1 January 2015	1 January 2015
Stage 2			
Calendar year	20 µg/m ³		1 January 2020
Stage 2 — indicative limit value to be reviewed by the Commission in 2013 in the light of further information on health and environmental effects, technical feasibility and experience of the target value in Member States.			

Table 4: Lead, benzene and carbon monoxide limit values, alert values and compliance timetable for compliance for Directive 2008/50/EC

	Averaging period	Value	Margin of tolerance	Date by which limit period value is to be met
Lead	Calendar year	0.5 µg/m ³	100 per cent	In force
Benzene	Calendar year	5 µg/m ³	100 per cent on 13 December 2000, reducing from 1.1.06 and every 12 months	1 January 2010

			by 1 µg/m ³ to reach 0 per cent by 1.1.2010	
Carbon monoxide	Maximum daily 8-hour mean	10 mg/m ³	60 per cent	In force

Table 5: Target values and long-term objectives for ozone as required in Directive 2008/50/EC

	Parameter	Target value for 1 January 2010
Target value for protection of human health	Maximum daily 8-hour mean	120 µg/m ³ not to be exceeded on more than 25 days per calendar year average over three years
Target value for protection of vegetation	AOT40, calculated from one hour values from May to July	18,000 µg/m ³ h averaged over five years
Long-term objective for protection of human health	Maximum daily 8-hour mean within a calendar year	120 µg/m ³
Long-term objective for protection of vegetation	AOT40, calculated from one hour values from May to July	6,000 µg/m ³ h

Table 6: Target values for pollutants in Directive 2004/107/EC. Concentrations are assessed according to the total content in the PM₁₀ fraction averaged over a calendar year.

Pollutant	Target value ng/m ³
Arsenic	6
Cadmium	5
Nickel	20
Benzo(a)pyrene	1

Compliance with limit values

Directive 2008/50/EC places a general obligation upon Member States to take the necessary measures to comply with the limit values established. Provisions are specified for three situations: those where there is a risk of exceedances occurring from time-to-time; those where pollution levels generally are higher than limit values; and than those where levels are lower than limit values.

Where there is a risk of limit values and/or alert thresholds being exceeded, action plans are to be drawn up. These plans are to indicate short-term measures to be taken to reduce the risk and limit the duration of such occurrences. Zones where limit values are exceeded, taking account of any 'margins of tolerance' which may be specified, are to be identified on lists drawn up by Member States. Member States must then prepare plans to attain the air quality limit values within specified time periods. An annex sets out the type of information to be included in improvement plans, the main elements being as follows:

- localization of excess pollution;
- general information;
- responsible authorities;

- nature and assessment of pollution;
- origin of pollution;
- analysis of the situation;
- details of pre-existing measures or projects for improvement;
- details of measures or projects adopted following implementation of the Directive; and
- details of measures or projects planned or being researched for the long term.

Plans must be available to the public, and are to be subject to scrutiny by the Commission during implementation.

In areas where the levels of two or more pollutants exceed their limit values, Directive 2008/50/EC requires preparation of integrated plans covering all of the pollutants concerned.

Zones where levels of pollution are lower than limit values are also to be listed by Member States. Member States are placed under an obligation to maintain the levels of pollutants in these zones below the limit values and to ‘endeavor to preserve the best ambient air quality, compatible with sustainable development’.

Alert thresholds

In the case of an ‘alert threshold’ being exceeded, steps must be taken to inform the public, such as through radio reports. Member States must also provide details of such exceedances to the Commission.

Competent authorities

Member States are required to designate competent authorities for implementation of Directive 2008/50/EC, including through assessment of air quality, approval of measuring devices, ensuring accuracy of measurement, analysis of assessment methods, and coordination within their territory of the operation of EU-wide quality assurance programmes.

Monitoring requirements

Directive 2008/50/EC establishes criteria for the assessment of air pollution. These include details of the location, number and type of sampling sites, as well as the use of other techniques such as modeling. Member States will have to assess ambient air quality in accordance with the provisions specified. Measurement is mandatory in ‘agglomerations’ – zones where the population concentration exceeds 250,000 inhabitants – and in zones where pollution exceeds some proportion of the limit values. Where pollution concentrations are below defined levels, greater or even exclusive use of modeling techniques is allowed⁶¹.

⁶¹ The Commission has issued guidance on the assessment of air quality under the framework Directive and its daughter Directives (available at: <http://europa.eu.int/comm/environment/air/pdf/guidanceunderairquality.pdf>).

National Emission Ceilings

Directive 2001/81/EC⁶² on national emission ceilings for certain atmospheric pollutants aims to reduce the adverse effects of acidification (water and soil), ground-level ozone (air) and eutrophication (water and soil) by setting national emission ceilings for sulphur dioxide (SO₂), nitrogen oxides (NO_x), volatile organic compounds (VOC) and ammonia (NH₃) but leaves the Member States with the flexibility to determine how to comply with them, without prejudice to compliance with any other specific requirements resulting from other EU environmental legislation.

The national emission ceilings are intended to meet “broadly” the interim environmental objectives for reduction of acidification and ground-level ozone to be achieved by 2010. Therefore the interim environmental objectives will serve as an indicator of the effectiveness of the national emission ceilings in order to meet the benchmark date 2020 for achieving the long-term goal of keeping within critical loads and protecting people against the health risks caused by air pollution.

In order to meet the long-term objectives to limit emissions of acidifying and eutrophying pollutants and ozone precursors the years 2010 and 2020 have been set as benchmarks. By the year 2010 Member States shall limit their annual national emissions of SO₂, NO_x, VOC and NH₃ to those laid down in Table 7. Note that Directive 2001/81/EC was amended by the relevant Accession Treaties to include emission ceilings for the new Member States.

⁶² Directive 2001/81/EC of the European Parliament and of the Council of 23 October 2001 on national emission ceilings for certain atmospheric pollutants, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2001L0081:20070101:EN:PDF>

This Directive covers all sources that arise from human activities apart from:

- Emissions from international maritime traffic
- Aircraft emissions beyond landing and take-off cycle
- Emissions in the Canary Islands (for Spain)
- Emissions in the overseas departments (for France)
- Emissions in Madeira and the Azores (for Portugal)

Table 7: National emission ceilings for SO₂, NO_x, VOC and NH₃, to be attained by 2010

Country	SO ₂ Kilotonnes	NO _x Kilotonnes	VOC Kilotonnes	NH ₃ Kilotonnes
Belgium	99	176	139	74
Bulgaria (²)	836	247	175	108
Czech Republic	265	286	220	80
Denmark	55	127	85	69
Germany	520	1 051	995	550
Estonia	100	60	49	29
Greece	523	344	261	73
Spain	746	847	662	353
France	375	810	1 050	780
Ireland	42	65	55	116
Italy	475	990	1 159	419
Cyprus	39	23	14	09
Latvia	101	61	136	44
Lithuania	145	110	92	84
Luxembourg	4	11	9	7
Hungary	500	198	137	90
Malta	9	8	12	3
Netherlands	50	260	185	128
Austria	39	103	159	66
Poland	1 397	879	800	468
Portugal	160	250	180	90
Romania (²)	918	437	523	210
Slovenia	27	45	40	20
Slovakia	110	130	140	39
Finland	110	170	130	31
Sweden	67	148	241	57
United Kingdom	585	1 167	1 200	297
EC 27	8 297	9 003	8 848	4 294

Source: Directive 2001/81/EC on national emission ceilings

These national emission ceilings are intended to meet broadly the following interim environmental objectives, for the Community as a whole, by 2010:

- The areas where the critical loads of acidification are exceeded shall be reduced by at least 50% compared to 1990 levels.
- The ground-level ozone concentration above the critical level for human health shall be reduced by two-thirds compared to 1990 levels.
- The ground-level ozone load related to human health shall not exceed an absolute limit of 2.9 ppm.h in any grid cell (150 km x 150 km square).
- The ground-level ozone load above the critical level for crops and semi-natural vegetation shall be reduced by one-third compared with the 1990 situation.
- The ground-level ozone load related to crops and semi-natural vegetation shall not exceed an absolute limit of 10 ppm.h (expressed as an exceedance of the critical level of 3 ppm.h).

Member States were required to draw up revised national programmes by 1 October 2006. These programmes had to include information on adopted and envisaged policies and measures and the effect of these on emissions in 2010 and be made available to the public and to appropriate organisations such as environmental organisations.

In addition Member States must prepare, annually update and report national emission inventories and emission projections for 2010 for the pollutants using specified methodologies (Annex III). The information in the emission projections must be such that it enables a quantitative understanding of the key socioeconomic assumptions.

Directive 2001/81/EC also lists a wide range of issues that must be taken into account in achieving the emission ceilings, such as, to the extent relevant within the scope of this Sourcebook:

- any new EU legislation setting emission limits for relevant sources;
- development of BAT (Best Available Techniques) (see Chapter 1.4);
- emission reduction objectives for 2008 of large combustion plants (see Chapter 2.1.1);
- development of transport emissions;
- new technical and scientific data including an assessment of uncertainties.

Case law

There has been no case law interpreting Directives 2001/81/EC or 2008/50/EC.

Greenhouse Gas Emissions

There are a variety of European measures aimed at reducing the emissions of greenhouse gases (GHGs) in line with the EU's commitment under the Kyoto Protocol and Europe's broader objective of 'limiting global climate change to 2 degrees Celsius'. The EU has also agreed a target of 20 per cent emission reduction by 2020, based on 1990 levels – this was intended to rise to 30 per cent in the event of an international agreement on GHG emission reductions for the post 2012 period ie beyond the Kyoto Protocol.

The EU's key note policy, and the one that most directly impacts on industry, is the EU emissions trading scheme established under Directive 2003/87/EC⁶³. Trading has been ongoing since 2005 with each Member State devising a national allocation plan (NAP) that sets out the number of emission allowances each installation under the scheme is to receive (see below for details).⁶⁴

While much of the debate is focused on CO₂ emissions, there are EU Directives aimed specifically at curbing other GHGs. Directive 2006/40/EC⁶⁵ restricts the use of fluorinated GHGs in cooling equipment. A central objective of Directive 1999/31/EC⁶⁶ on the landfilling of waste is to limit emissions of methane by reducing the volume of biodegradable waste being landfilled.

More generally, there are measures at the EU level intended directly to increase the availability of more 'climate friendly' technologies, that is those that, by producing energy in an alternative way, will reduce reliance on fossil fuels or that reduce the need for energy. These include requirements for renewable energy use, set out in Directive 2009/28/EC (see below); and measures to promote energy efficiency such as on energy labelling (Directive 92/75/EEC) and eco-design requirements for energy related products (Directive 2009/125/EC) – see the section on energy efficiency for further information.

In 2009 the European Council and Parliament adopted a package of measures, known as the Climate and Renewable Energy Package (CARE), aimed at delivering a 20 per cent reduction in emissions of GHGs by 2020. It was proposed that these would be amended and strengthened were an international agreement to be reached to deliver a reduction of 30 per cent by 2020, based on a 1990 base year. However, following the breakdown of international negotiations in Copenhagen during December 2009 the prospect for a raised 2020 is unclear.

⁶³ Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2003L0087:20041113:EN:PDF>

⁶⁴ Full versions of each Member States' NAP for phase II can be found at http://ec.europa.eu/environment/climat/emission/2nd_phase_ep.htm

⁶⁵ Directive 2006/40/EC of the European Parliament and of the Council of 17 May 2006 relating to emissions from air-conditioning systems in motor vehicles and amending Council Directive 70/156/EEC, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:161:0012:0018:EN:PDF>

⁶⁶ Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1999L0031:20031120:EN:PDF>

The 2009 CARE Package contained important measures of relevance to the development of installations in Europe. Importantly it included the following Directives.

- Directive 2009/28/EC⁶⁷ sets binding targets for the adoption of renewable energy, 20 per cent of energy use by 2020, and the use of renewable transport fuels, 10 per cent of all transport fuels by 2020. While the transport fuel target (anticipated to be largely met through biofuel use) applies at the same level in all Member States, the renewable energy target is differentiated by Member States based on GDP, investment in renewable energy prior to 2005 and a standard increase in renewable energy use. The differentiated Member State targets are presented in Table 8. Under the Directive Member States are required to develop National Renewable Energy Action Plans (NREAPs), to be completed by June 2010. Within these they must set out how they plan to meet their renewable energy and transport fuel targets including their anticipated trajectory for increasing renewable energy use. In addition the Directive sets out mandatory sustainability criteria to be met by all biofuels and bioliquids used to comply with the Directive's targets.

Table 8 –Allocation of the EU 20 per cent renewable energy target across the Member States

Member State	Level of renewable energy use in 2005 (%)	Proportion of energy from renewable sources by 2020 (%)	Required increase in renewable energy use (%)
United Kingdom	1.3	15	13.7
Denmark	17	30	13
Ireland	3.1	16	12.9
France	10.3	23	12.7
Germany	5.8	18	12.2
Italy	5.2	17	11.8
Netherlands	2.4	14	11.6
Spain	8.7	20	11.3
Greece	6.9	18	11.1
Belgium	2.2	13	10.8
Austria	23.3	34	10.7
Portugal	20.5	31	10.5
Cyprus	2.9	13	10.1
Luxembourg	0.9	11	10.1
Malta	0	10	10
Finland	28.5	38	9.5
Sweden	39.8	49	9.2
Slovenia	16	25	9
Hungary	4.3	13	8.7
Lithuania	15	23	8
Poland	7.2	15	7.8

⁶⁷ Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:EN:PDF>

Slovakia	6.7	14	7.3
Latvia	34.9	42	7.1
Estonia	18	25	7
Czech Republic	6.1	13	6.9
Bulgaria	9.4	16	6.6
Romania	17.8	24	6.2

- Decision 406/2009/EC⁶⁸ sets out binding targets for reduction of GHG emissions from sectors not covered by the EU Emissions trading scheme, for example transport, housing, agriculture. While a target of a 20 per cent reduction in emissions must be delivered across the EU by 2020, the target is differentiated by Member State, a process known as effort sharing. The Member State targets for non EU ETS sectors are presented in Table 9.

Table 9 – Distribution of the 20 per cent reduction target by 2020 in non EU ETS sectors by Member State

Country	Non EU ETS Effort Sharing Target for 2020
Denmark	– 20 %
Germany	– 14 %
Estonia	11 %
Ireland	– 20 %
Greece	– 4 %
Spain	– 10 %
France	– 14 %
Italy	– 13 %
Cyprus	– 5 %
Latvia	17 %
Lithuania	15 %
Luxembourg	– 20 %
Hungary	10 %
Malta	5 %
Netherlands	– 16 %
Austria	– 16 %
Poland	14 %
Portugal	1 %
Romania	19 %
Slovenia	4 %
Slovakia	13 %
Finland	– 16 %
Sweden	– 17 %
United Kingdom	– 16 %

⁶⁸ Decision No 406/2009/EC of the European Parliament and of the Council of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0136:0148:EN:PDF>

- Directive 2009/29/EC⁶⁹ extends the scope of the EU emissions trading scheme (EU ETS) and amends the approach to the allocation of emission allowances under the scheme – see detailed explanation in the dedicated section below.
- Directive 2009/31/EC⁷⁰ sets out rules for delivering geological storage for CO₂ known as Carbon Capture and Storage (CCS). While the Directive does not set in place targets for the delivery of this technology, it does set out the legal framework intended to enable its adoption. The Directive is intended to deliver environmentally safe geological storage of CO₂ and permanent containment in the ground. It puts in place criteria for identifying storage sites, a permitting regime for exploration of storage sites and for storage sites once identified. It also includes: obligations applicable during operation, closure and after closure phases of a storage sites life; CO₂ acceptance criteria; monitoring and reporting obligations; inspection requirements; emergency provisions in the case of leakage; and requirements for the provision of a financial guarantee offering a safety should an individual company run into financial difficulties.

In addition, 2009 saw the adoption of two related measures aimed at: improving emission performance standards in cars, hence reducing CO₂ emissions (Regulation EC/443/2009⁷¹); and reducing the GHG emissions from transport fuels (Directive 2009/30/EC on fuel quality standards⁷²).

The EU Emissions Trading Scheme

Directive 2003/87 established the EU emissions trading scheme (the EU ETS), the first international carbon trading system. Phase I of trading under the EU ETS commenced on 1 January 2005 and ended on 31 December 2007. The second phase corresponds with the first commitment period set by the Kyoto Protocol of 1 January 2008 until the 31 December 2012. The EU is also committed to a third phase of the EU ETS that will take place between 1 January 2013 and end of 2020. Under this later

⁶⁹ Directive 2009/29/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0063:0087:EN:PDF>

⁷⁰ Directive 2009/31/EC of the European Parliament and of the Council of 23 April 2009 on the geological storage of carbon dioxide and amending Council Directive 85/337/EEC, European Parliament and Council Directives 2000/60/EC, 2001/80/EC, 2004/35/EC, 2006/12/EC, 2008/1/EC and Regulation (EC) No 1013/2006, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0114:0135:EN:PDF>

⁷¹ Regulation (EC) No 443/2009 of the European Parliament and of the Council of 23 April 2009 setting emission performance standards for new passenger cars as part of the Community's integrated approach to reduce CO₂ emissions from light-duty vehicles, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0001:0015:EN:PDF>

⁷² Directive 2009/30/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 98/70/EC as regards the specification of petrol, diesel and gas-oil and introducing a mechanism to monitor and reduce greenhouse gas emissions and amending Council Directive 1999/32/EC as regards the specification of fuel used by inland waterway vessels and repealing Directive 93/12/EEC, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0088:0113:EN:PDF>

phase rules related to allocation of credits, both quantity and approach to allocation, will change significantly in line with Directive 2009/29/EC.

At present only emissions of carbon dioxide are covered by the scheme, although there are proposals to expand the coverage to other greenhouse gases (GHGs); in Phase II Member States do have the ability to unilaterally add sectors and gases to the scheme. Table 8 sets out details of the types of activities currently covered by the EU ETS (during phase II), as specified in annex I of the Directive. As of 1 January 2012 emissions from aviation will also be included under the scheme, with rules set out in Directive 2008/101/EC⁷³. In addition, from January 2013 (phase III onwards), petrochemicals, ammonia, aluminium, nitrous oxide and perfluorocarbons will be added, as set out in Directive 2009/29/EC. Importantly, from January 2013 installations classed as small emitters (emitting below 25,000 tCO₂ per year) can opt out of the EU ETS. Previously there has been no official threshold applied meaning all installations in the categories listed in Table 10 must be in compliance. From 2013 CO₂ emissions captured and safely stored, in line with Directive 2009/31/EC, are considered as ‘not emitted’.

Table 10: Activities covered by the EU ETS for Phase II (2008 to 2012)

<i>Activity</i>	<i>Detailed Information/Thresholds</i>
Energy Activities	Combustion installations with a rated thermal input exceeding 20 MW (except hazardous or municipal waste installations)
	Mineral oil refineries
	Coke ovens
Production and processing of ferrous metals	Metal ore (including sulphide ore) roasting or sintering installations
	Installations for the production of pig iron or steel (primary or secondary fusion) including continuous casting, with a capacity exceeding 2,5 tonnes per hour
Mineral industry	Installations for the production of cement clinker in rotary kilns with a production capacity exceeding 500 tonnes per day or lime in rotary kilns with a production capacity exceeding 50 tonnes per day or in other furnaces with a production capacity exceeding 50 tonnes per day
	Installations for the manufacture of glass including glass fibre with a melting capacity exceeding 20 tonnes per day
	Installations for the manufacture of ceramic products by firing, in particular roofing tiles, bricks, refractory bricks, tiles, stoneware or porcelain, with a production capacity exceeding 75 tonnes per day, and/or with a kiln capacity exceeding 4 m ³ and with a setting density per kiln exceeding 300 kg/m ³
Other activities	Industrial plants for the production of (a) pulp from timber or other fibrous materials (b) paper and board with a production capacity exceeding 20 tonnes per day Carbon dioxide

⁷³ Directive 2008/101/EC of the European Parliament and of the Council of 19 November 2008 amending Directive 2003/87/EC so as to include aviation activities in the scheme for greenhouse gas emission allowance trading within the Community, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:008:0003:0003:EN:PDF>

Operators of plant covered by the EU ETS must hold a GHG emission permit for each installation⁷⁴ - the required content of a permit is set out in Box 1. Importantly receipt of a permit is dependent on the ability of the operator to monitor and report on their emissions adequately. Holding a permit gives the operator the right to emit GHG from the specified installation, the level of permitted emissions ie the number of emission allowances⁷⁵ a given installation will receive, is specified separately. Until the end of 2012 the allocation of allowances will be determined for each installation within the National Allocation Plan of the Member State in which it is sited⁷⁶. Under phase II of the EU ETS Member States must grandfather ie give away to installations for free, at least 90 per cent of emission allowances. They have the right to auction the remaining 10 per cent, although this right has not been taken up by the majority of Member States, although few look set to do so. During phase III of the scheme (from January 2013) the mechanism for the allocation of permits will change significantly. Member States will no longer be able to determine the level of emissions themselves; instead the cap on emission levels under the EU ETS is determined within Directive 2009/29/EC. From 2013 the level of emission allowances issues to the sectors within the scheme will decline linearly throughout phase III. Figure 1, below, sets out the anticipated level of this decline from 2013 to 2020 under the EU ETS, compared against a base of 2005 verified emissions.

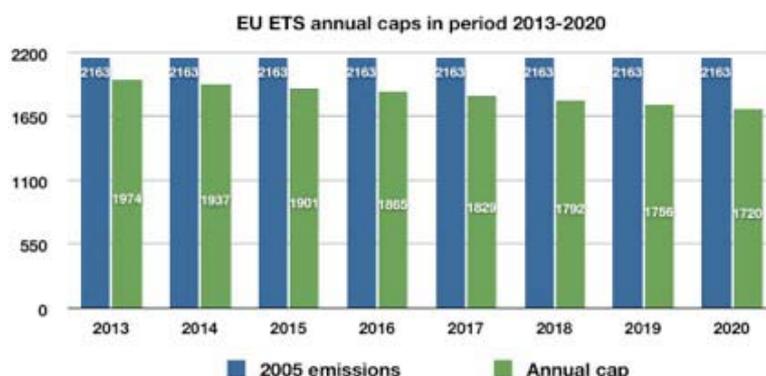
During phase III the principle of full auctioning has been embraced. From 2013, in theory, all emission allocations will cease to be grandfathered and will have to be bought by installations within an auction, based on their own anticipated needs. There is an ongoing discussion, however, as to whether some sectors should be exempted from full auctioning. As a consequences some installations will continue to receive grandfathered permits – this is known as the debate over carbon leakage (the movement of polluting industries out of the more regulated EU to other countries which have yet to adopt carbon emission reduction requirements). It should be noted that during phase III aviation will certainly not be subject to the same requirements as other sectors, particularly auctioning rules. Directive 2008/101/EC specifies that from 2013 aviation allowances will be equivalent to 95% of historical emissions in the sector and that only 15% of aviation allowances will be auctioned.

⁷⁴ ‘Installation’ means a stationary technical unit where one or more activities listed in Annex I of Directive 2003/87/EC are carried out and any other directly associated activities which have a technical connection with the activities carried out on that site and which could have an effect on emissions and pollution.

⁷⁵ ‘Allowance’ means an allowance to emit one tonne of carbon dioxide equivalent during a specified period, which shall be valid only for the purposes of meeting the requirements of Directive 2003/87/EC and shall be transferable in accordance with the provisions of that Directive.

⁷⁶ For the Phase II National Allocation Plans see http://ec.europa.eu/environment/climat/nap_websites.htm

Figure 1: Caps set by the revised ETS Directive for the post-2012 period



If an installation comes into operation during a trading period they can apply for emission allowances from the new entrant⁷⁷ reserve, held back separately for this purpose. Records of trades, emissions and allowances surrendered are held in national registries set up by each Member State. Registries are required in order to ensure the accurate accounting of the issue, holding, transfer and cancellation of allowances. It should be noted that any person may hold allowances.

Box 1: Content of the GHG Permit

- the name and address of the operator;
- a description of the activities and emissions from the installation;
- monitoring requirements, specifying monitoring methodology and frequency;
- reporting requirements; and
- an obligation to surrender allowances equal to the total emissions of the installation in each calendar year, as verified in accordance with Article 15, within four months following the end of that year.

If an installation emits fewer emissions than allowances received in a given year the operator can sell the excess on the EU trading market, intended to incentivise emission reduction. If the installation is emitting more emissions than the allowances allocated additional allowances must be bought on the market to make up the balance. At the end of each year operators must submit a verified emissions report setting out the level of GHGs emitted in the year. They must then surrender allowances for the number of tonnes of GHG produced. By 30 April each year, at the latest, all operators must have surrendered allowances equal to the total emissions from their installation during the preceding calendar year. If any operator does not surrender sufficient allowances by 30 April they are liable for the payment of an excess emissions penalty. This represents a fine of €100 per tonne of carbon dioxide equivalent emitted for which allowances have not been surrendered. In addition the operator must submit allowances equal to the excess emissions in the following calendar year.

⁷⁷ 'New entrant' means any installation carrying out one or more of the activities indicated in Annex I of Directive 2003/87/EC, which has obtained a greenhouse gas emissions permit or an update of its greenhouse gas emissions permit because of a change in the nature or functioning or an extension of the installation, subsequent to the notification to the Commission of the national allocation plan.

Effective monitoring and reporting and the verification of emissions are central to ensuring the reliability of emissions figures and confidence in the carbon market. Without these it is impossible to tell if emission reductions are real and reliable. Detailed guidance on monitoring and reporting methodologies is set out in Commission Decision 2007/589/EC⁷⁸ and must be followed when developing monitoring plans as part of a permit application and undertaking ongoing monitoring and reporting. These are also the standards that will be used by verifiers as the basis of their assessment regarding the appropriateness of monitoring regimes. Differing monitoring and reporting requirements apply to the different categories of installations covered by the EU ETS. The Directive also contains principles that monitoring and reporting regimes must follow, and which the guidelines interpret in more detail - the principles are set out in Box 2 below.

Once an operator has conducted their monitoring and reporting in a given year, they must produce an emissions report setting out the level of emissions they believe to be emanating from their installation. They must then get this report verified to ensure it is reliable, credible and based on accurate monitoring and reporting of data. The verifier must be independent of the operator. They must understand the legal provisions of the Directive and supporting guidance; the legislative, regulatory and administrative requirements of the activities being verified; and the how information related to each source of emissions at an installation is generated specifically in relation to the collection, measurement, calculation and reporting of data. Within each Member State there are approved lists of EU ETS verifiers, although at present standards are not consistent across the whole EU.

Case law

There have been a number of judgements in the European Court of Justice concerning the ETS Directive. However, these have concerned the validity, or otherwise, of Commission Decisions, rather than further interpreting the Directives.

⁷⁸ Commission Decision of 18 July 2007 establishing guidelines for the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council, 2007/589/EC, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2007D0589:20090423:EN:PDF>

Box 2: Principles for Monitoring and reporting as set out in Annex IV of the EU ETS Directive

Monitoring of carbon dioxide emissions

Emissions shall be monitored either by calculation or on the basis of measurement.

Calculation

Calculations of emissions shall be performed using the formula:

$$\text{Activity data} \times \text{Emission factor} \times \text{Oxidation factor}$$

Activity data (fuel used, production rate etc.) shall be monitored on the basis of supply data or measurement.

Accepted emission factors shall be used. Activity-specific emission factors are acceptable for all fuels. Default factors are acceptable for all fuels except non-commercial ones (waste fuels such as tyres and industrial process gases). Seam-specific defaults for coal, and EU-specific or producer country-specific defaults for natural gas shall be further elaborated. IPCC default values are acceptable for refinery products. The emission factor for biomass shall be zero.

If the emission factor does not take account of the fact that some of the carbon is not oxidised, then an additional oxidation factor shall be used. If activity-specific emission factors have been calculated and already take oxidation into account, then an oxidation factor need not be applied.

Default oxidation factors developed pursuant to Directive 96/61/EC shall be used, unless the operator can demonstrate that activity-specific factors are more accurate.

A separate calculation shall be made for each activity, installation and for each fuel.

Measurement

Measurement of emissions shall use standardised or accepted methods, and shall be corroborated by a supporting calculation of emissions.

Monitoring of emissions of other greenhouse gases

Standardised or accepted methods shall be used, developed by the Commission in collaboration with all relevant stakeholders and adopted in accordance with the procedure referred to in Article 23(2).

Reporting of emissions

Each operator shall include the following information in the report for an installation:

A. Data identifying the installation, including:

- Name of the installation;
- Its address, including postcode and country;
- Type and number of Annex I activities carried out in the installation;
- Address, telephone, fax and email details for a contact person; and
- Name of the owner of the installation, and of any parent company.

B. For each Annex I activity carried out on the site for which emissions are calculated:

- Activity data;
- Emission factors;
- Oxidation factors;
- Total emissions; and
- Uncertainty.

C. For each Annex I activity carried out on the site for which emissions are measured:

- Total emissions;
- Information on the reliability of measurement methods; and
- Uncertainty.

D. For emissions from combustion, the report shall also include the oxidation factor, unless oxidation has already been taken into account in the development of an activity-specific emission factor.

Member States shall take measures to coordinate reporting requirements with any existing reporting requirements in order to minimise the reporting burden on businesses.

Substances that Deplete the Ozone Layer

EU law related to the use of ozone depleting substances is set out in Regulation 2037/2000⁷⁹. These are specifically adopted to implement the Montreal Protocol to the Vienna Convention for the Protection of the Ozone Layer and its subsequent amendments. The Regulation bans and restricts a number of ozone depleting substances including chlorofluorocarbons (CFCs). Table 11 below sets out details of the substances covered by the Regulation.

Under Regulation 2037/2000 the production, placing on the market and use of the following is prohibited:

- chlorofluorocarbons;
- other fully halogenated chlorofluorocarbons;
- halons;
- carbon tetrachloride;
- 1,1,1-trichloroethane;
- hydrobromofluorocarbons;
- bromochloromethane.

Since 2004 no production or use of methyl bromide has been permitted. It should be noted that under exceptional circumstances competent authorities can apply for exemptions from these bans to satisfy critical and essential uses, although only to the extent permitted by international protocols.

The production of hydrochlorofluorocarbons must be phased out by 31 December 2025 as follows:

- The calculated level of the production of hydrochlorofluorocarbons in between 1 January 2008 to 31 December 2008 and in each 12-month period thereafter must not exceed 35 per cent of the calculated level of the production of hydrochlorofluorocarbons in 1997.
- The calculated level of the production of hydrochlorofluorocarbons in the period 1 January 2014 to 31 December 2014 and in each 12-month period thereafter does not exceed 20 per cent of the calculated level of the production of hydrochlorofluorocarbons in 1997.
- The calculated level of its production of hydrochlorofluorocarbons in the period 1 January 2020 to 31 December 2020 and in each 12-month period thereafter does not exceed 15 per cent of the calculated level of the production of hydrochlorofluorocarbons in 1997.

⁷⁹ Regulation (EC) No 2037/2000 of the European Parliament and of the Council of 29 June 2000 on substances that deplete the ozone layer, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2000R2037:20080101:EN:PDF>

Producers and importers shall not place hydrochlorofluorocarbons on the market or use them for their own account after 31 December 2009. The Directive also sets out detailed requirements for the use of hydrochlorofluorocarbons. Box 3 sets out the Directives requirements in relation to these specific substances.

Controlled substances contained in the following must be recovered for destruction in an environmentally acceptable way or recycled or reclaimed:

- refrigeration, air-conditioning and heat pump equipment, including domestic refrigerators and freezers;
- equipment containing solvents;
- fire protection systems and fire extinguishers.

Where controlled substances are contained in other products or equipment they must be recovered if practical. Precautionary measures must also be taken, wherever practical, to prevent and minimise leakage of controlled substances.

Box 3: Requirements relating to hydrochlorofluorocarbons

Subject to the following conditions, the use of hydrochlorofluorocarbons shall be prohibited:

- (a) in aerosols;
- (b) as solvents:
 - (i) in non-contained solvent uses including open-top cleaners and open-top dewatering systems without refrigerated areas, in adhesives and mould-release agents when not employed in closed equipment, for drain cleaning where hydrochlorofluorocarbons are not recovered;
 - (ii) from 1 January 2002, in all solvent uses, with the exception of precision cleaning of electrical and other components in aerospace and aeronautics applications where the prohibition shall enter into force on 31 December 2008;
- (c) as refrigerants:
 - (i) in equipment produced after 31 December 1995 for the following uses:
 - in non-confined direct-evaporation systems,
 - in domestic refrigerators and freezers,
 - in motor vehicle, tractor and off-road vehicle or trailer air conditioning systems operating on any energy source, except for military uses where the prohibition shall enter into force on 31 December 2008,
 - in road public-transport air-conditioning,
 - (ii) in rail transport air-conditioning, in equipment produced after 31 December 1997;
 - (iii) from 1 January 2000, in equipment produced after 31 December 1999 for the following uses:
 - in public and distribution cold stores and warehouses,
 - for equipment of 150 kw and over, shaft input,
 - (iv) from 1 January 2001, in all other refrigeration and air-conditioning equipment produced after 31 December 2000, with the exception of fixed air-conditioning equipment, with a cooling capacity of less than 100 kW, where the use of hydrochlorofluorocarbons shall be prohibited from 1 July 2002 in equipment produced after 30 June 2002 and of reversible air-conditioning/heat pump systems where the use of hydrochlorofluorocarbons shall be prohibited from 1 January 2004 in all equipment produced after 31 December 2003;
 - (v) from 1 January 2010, the use of virgin hydrochlorofluorocarbons shall be prohibited in the maintenance and servicing of refrigeration and air-conditioning equipment existing at that date; all hydrochlorofluorocarbons shall be prohibited from 1 January 2015.
- (d) for the production of foams:
 - (i) for the production of all foams except integral skin foams for use in safety applications and rigid insulating foams;
 - (ii) from 1 October 2000, for the production of integral skin foams for use in safety applications and polyethylene rigid insulating foams;
 - (iii) from 1 January 2002, for the production of extruded polystyrene rigid insulating foams,

except where used for insulated transport;
(iv) from 1 January 2003, for the production of polyurethane foams for appliances, of polyurethane flexible faced laminate foams and of polyurethane sandwich panels, except where these last two are used for insulated transport;
(v) from 1 January 2004, for the production of all foams, including polyurethane spray and block foams;
(e) as carrier gas for sterilisation substances in closed systems, in equipment produced after 31 December 1997;
(f) in all other applications.

2. By way of derogation from paragraph 1, the use of hydrochlorofluorocarbons shall be permitted:

- (a) in laboratory uses, including research and development;
- (b) as feedstock;
- (c) as a processing agent.

3. By way of derogation from paragraph 1, the use of hydrochlorofluorocarbons as fire-fighting agents in existing fire protection systems may be permitted for replacing halons in applications listed in Annex VII under the following conditions:

- halons contained in such fire protection systems shall be replaced completely,
- halons withdrawn shall be destroyed,
- 70 % of the destruction costs shall be covered by the supplier of the hydrochlorofluorocarbons,
- each year, Member States making use of this provision shall notify to the Commission the number of installations and the quantities of halons concerned.

4. The importation and placing on the market of products and equipment containing hydrochlorofluorocarbons for which a use restriction is in force under this Article shall be prohibited from the date on which the use restriction comes into force. Products and equipment shown to be manufactured before the date of that use restriction shall not be covered by this prohibition.

5. Until 31 December 2009, the use restrictions shall not apply to the use of hydrochlorofluorocarbons for the production of products for export to countries where the use of hydrochlorofluorocarbons in those products is still permitted.

Table 11: Classification of controlled substances covered by requirements under Regulation 2037/2000, Annex IV of the Directive

Group	CN code	Description
Group I	2903 41 00	Trichlorofluoromethane
	2903 42 00	Dichlorodifluoromethane
	2903 43 00	Trichlorotrifluoroethanes
	2903 44 10	Dichlorotetrafluoroethanes
	2903 44 90	Chloropentafluoroethane
Group II	2903 45 10	Chlorotrifluoromethane
	2903 45 15	Pentachlorofluoroethane
	2903 45 20	Tetrachlorodifluoroethanes
	2903 45 25	Heptachlorofluoropropanes
	2903 45 30	Hexachlorodifluoropropanes
	2903 45 35	Pentachlorotrifluoropropanes
	2903 45 40	Tetrachlorotetrafluoropropanes
	2903 45 45	Trichloropentafluoropropanes
	2903 45 50	Dichlorohexafluoropropanes
2903 45 55	Chloroheptafluoropropanes	
Group III	2903 46 10	Bromochlorodifluoromethane
	2903 46 20	Bromotrifluoromethane
	2903 46 90	Dibromotetrafluoroethanes
Group IV	2903 14 00	Carbon tetrachloride
Group V	2903 19 10	1,1,1-Trichloroethane (methylchlorofom)
Group VI	2903 39 11	Bromomethane (methyl bromide)
Group VII	2903 49 30	Hydrobromofluoromethanes, -ethanes or -propanes
Group VIII	2903 49 10	Hydrochlorofluoromethanes, -ethanes or -propanes
Group IX	ex 2903 49 80	Bromochloromethane
Mixtures	3824 71 00	Mixtures containing chlorofluorocarbons (CFCs), whether or not containing hydrochlorofluorocarbons (HCFCs), perfluorocarbons (PFCs) or hydrofluorocarbons (HFCs)
	3824 72 00	Mixtures containing bromochlorodifluoromethane, bromotrifluoromethane or dibromo-tetrafluoroethanes
	3824 73 00	Mixtures containing hydrobromofluorocarbons (HBFCs)
	3824 74 00	Mixtures containing hydrochlorofluorocarbons (HCFCs), whether or not containing perfluorocarbons (PFCs) or hydrofluorocarbons (HFCs), but not containing chlorofluorocarbons (CFCs)
	3824 75 00	Mixtures containing carbon tetrachloride
	3824 76 00	Mixtures containing 1,1,1-trichloroethane (methyl chloroform)
	3824 77 00	Mixtures containing bromomethane (methyl bromide) or bromochloromethane

Note: more detailed information can also be found in Annex I of the Regulation.

1.12 Surface Water Quality

Introduction

Since the 1970s a series of EU Directives have been adopted to achieve objectives relating to water pollution and management. These have addressed, *inter alia*, the following issues:

- setting standards or practices to control emissions of substances to water;
- setting quality objectives for water;
- setting overall management structures for water.

The Water Framework Directive (Directive 2000/60/EC⁸⁰) has comprehensively expanded the scope and the objectives of water management and water protection, both for surface waters and for groundwaters. At the same time, Directive 2000/60/EC absorbs the environmental objectives of several elements of legislation from the 1970s and 1980s and repeals the old legislation step by step (2007 and 2013).

This chapter, therefore, begins with an examination of Directive 2000/60/EC which provides the integrated management framework for other measures and sets far-reaching goals for water quality and Directive 2008/56/EC which provides the strategic framework to reach a good environmental status in marine waters. It then continues through an examination of key Directives regulating discharges to water and concludes by examining those which set water quality objectives.

Water Framework Directive

Directive 2000/60/EC:

- applies to all waters, that is lakes, rivers, transitional waters (estuaries) and coastal waters (up to one nautical mile from land) and to ground waters;
- applies to all human impacts on waters, and thus *inter alia* to all industrial activities with impact on waters;
- defines the environmental objective for surface waters in a holistic way as "good ecological status" (based on the biological, chemical and hydromorphological elements);
- sets the obligation to achieve/maintain the objective of good ecological status as a rule by 2015, complemented by a 'non-deterioration' clause, i.e. no water is allowed to deteriorate in its status; protected areas (e.g. for drinking water abstraction, bathing, nature protection, as well as areas jeopardised by Eutrophication) will be subject to additional protection;

⁸⁰ Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2000L0060:20080321:EN:PDF>

- defines the river basins as the operational entity of water management, across administrative and political boundaries, with an obligation to coordinate and cooperate within shared river basins;
- develops the operational measures step by step, from an environmental analysis of pressures and impacts in 2004, to upgrading the monitoring programmes by 2008, developing river basin management plans as a draft by 2008 and, together with the related programme of measures, in their definitive version by 2009; development of plans and programmes is followed by their subsequent implementation, with the objective of achieving the environmental objective ('good status') as a rule by 2015;
- provides for broad publication information and participation of citizens, local communities, stakeholders and NGOs;
- underpins environmental objectives by economic aspects such as water pricing reflecting cost recovery, and economic analyses.

Limited derogations from the environmental objectives may apply to certain bodies of water, if a set of conditions is met. The list of possible derogations from meeting some of the environmental objectives includes the following elements

- 'heavily modified water bodies' are designated;
- extension to the deadline for achieving good status, for reasons of technical feasibility, disproportionate costs or natural conditions;
- extension to the deadline for achieving good status, for reasons of disproportionate costs;
- less stringent environmental objectives;
- deviation from the non-deterioration principle in the case of new sustainable development activities.

In all these possible derogation cases, a set of mandatory conditions has to be complied with, if a derogation is considered, in particular that the derogation does not exclude or compromise the achievement of the environmental objectives in other bodies of water within the same river basin district, that it is consistent with the application of other Community environmental legislation and that it guarantees at least the same level of protection as the existing Community legislation.

Any possible derogations caused by new human activities – be it derogation from the non-deterioration principle or from 'good status' may only be envisaged, if

- The new source of modifications of the physical characteristics of a surface water body or alterations to the levels of ground water or where water status declines from high to good is due to 'new sustainable human development activities', and
- All practical mitigating steps are being taken.
- The reasons for the changes are of over-riding public interest and/or the benefits to the environment and society are outweighed by the benefits to the new modifications to human health, safety or to 'sustainable development', and cannot be achieved by other means due to technical or cost issues.

For projects subject to EIA under Directive 85/337/EEC, the information provided by such an assessment should be used in helping to determine if the above mentioned conditions of derogations are met. Furthermore, a joint procedure which combines the provisions of Directives 85/337/EEC and 2000/60/EC may be applied by Member States. However, note that the provisions of the Directive 2000/60/EC are distinctly more stringent than those of Directive 85/337/EEC.

All waters are to be classified according to their type. The classification system for surface waters is outlined in Annex II. This requires all surface water bodies in a River Basin District to be defined as rivers, lakes, 'transitional waters', coastal waters or artificial water bodies or heavily modified water bodies. The classification of each type of water body can be undertaken using one of two systems – A or B:

- System A is based on classification according to ecoregions (Annex XI). This map provides only very broad ecoregions across Europe. Once a water body has been assigned to an ecoregion under system A, it has to be further classified according to type based on altitude (high, mid or low), size (catchment area) and geology. Thus system A provides only a very basic framework for classification.
- System B is more flexible. It requires classification of, for example, a river or part of a river. There is no requirement to refer to ecoregions. Obligatory requirements for classification include altitude, latitude, longitude, geology and size. However, there are also a wide range of optional factors, eg flow, depth, valley shape, etc. If system B is used, the same level of discrimination must be achieved as under system A, in order to ensure that type specific reference conditions can be readily derived.

The characterization (Article 5) of the water bodies within each River Basin District should include:

- characterization according to requirements in Annex II;
- a review of human activity on the status of surface and ground waters;
- an economic analysis of water use.

The water status of each water body within a River Basin District has to be judged against reference conditions for similar water bodies which are of 'high status', taking account of the classification applied to these waters. Annex II describes the different ways to determine these reference conditions. The steps to be undertaken in determining type-specific conditions are as follows:

- Surface water bodies must be characterized into groups of water bodies with similar characters.
- For each of these groups, a type-specific reference condition must be determined.
- The key parameters to be used for the determination are the same as those used to define ecological quality and are detailed in Annex V.
- For the three key elements of ecological quality (biological, chemical and hydromorphological) it is necessary to determine the details which correspond to 'high status', according to the generalised definitions in Annex V.

- High status waters, if present, must be monitored to maintain information on the accuracy of reference conditions.
- If necessary, the reference conditions should be reviewed.

Member States must ensure a programme for monitoring water status is established ‘in order to establish a coherent and comprehensive review of water status’ in each River Basin District. Such monitoring includes volume and flow rates, as well as ecological and chemical parameters necessary to determine water status. Monitoring is required in order to determine the effectiveness of River Basin Management Plans and aid in their periodic revision. It also acts as a measure of compliance, such as in assessing whether good water status has been achieved. Monitoring is not just required after a River Basin Management Plan has become operational. The full monitoring programme must be in place at least three years prior to this. This is necessary to ensure that there is an adequate link between the programme of measures and the state of the environment. Monitoring of ecological quality (or groundwater status) provides the basis for all other actions in implementing the Directive. Monitoring locations must include, if possible, sufficient high status waters to ensure the validity of type reference conditions and cover the requirements of protected areas (or other legislation, such as the nitrates Directive). Monitoring should provide an adequate determination of ecological quality and how it is changing. Some details of appropriate locations are provided in Annex V, which focuses monitoring efforts on water bodies subject to anthropogenic pressures. This requires that Member States initially produce a list of priority waters to be monitored. These include:

- bodies at risk from point source pollution;
- bodies at risk from diffuse source pollution (representative bodies monitored);
- bodies at risk from significant hydromorphological pressure (representative bodies monitored).

Biological parameters must be monitored at all sites. Other parameters may first be subject to an investigation and inventory prior to additional monitoring. Annex V also details monitoring frequency. Routine monitoring is described as ‘surveillance’ monitoring. This indicates that biological and hydromorphological parameters should be monitored relatively infrequently (many parameters only once every three years). However, as problems occur, Member States are to provide sufficient information for a ‘reliable assessment’ of water status.

For groundwaters there is general requirement to monitor hydrology in all groundwater bodies and more specific requirements for those subject to abstraction and direct or indirect discharges. For pollution and water level information, the Directive only requires that monitoring is sufficient to detect trends. The Directive is less prescriptive than for surface waters. A programme of monitoring for protected areas shall also be established within each River Basin District. The timetable of the programme for protected areas shall be that already required in the EU legislation which establishes the protected area. Technical specifications for monitoring also follow that already required in the EU legislation which establishes the protected area.

Discharges to waters shall be controlled by one or more of the following means, as set out in other EU legislation including Directive 2008/1/EC (see Chapter 1.4), Directive

91/271/EEC (see Chapter 2.4.5) and Directive 91/676/EEC (see below):

- establishment of emission limits;
- emission controls based on best available techniques;
- use of best environmental practices for diffuse sources.

Wherever the quality objectives of the Directive require stricter conditions to be applied, Member States must ensure that these are achieved.

Within each River Basin Management Plan a programme of measures should be detailed (Article 11), to ensure that environmental quality is maintained or, where waters are below 'good status', that quality improvements are made. Compulsory measures for all waters include:

- those necessary to implement other EU legislation for the protection of water, in particular the combined approach;
- those appropriate to take account of recovery costs for water use and achieve sustainable water use;
- those necessary for heavily modified water bodies;
- those necessary to safeguard water quality intended for drinking water abstraction;
- register of water abstractions, prior authorization for abstraction and impoundment;
- prior authorization, or registration based on general binding rules or all point source discharges liable to cause pollution;
- authorizations, etc, shall be periodically reconsidered;
- prohibition of direct discharges to groundwater subject to a series of provisions for specific exemptions and ensuring that all discharges are authorized;
- co-ordination for the whole of the river basin district, across administrative and political boundaries.

Compulsory measures for water bodies which do not meet the environmental objectives of Article 4 include:

- monitoring to be reviewed and adjusted as appropriate;
- establishment of stricter environmental quality standards for pollutants if necessary;
- investigation of sources of pollution;
- review of all relevant authorizations and discharge permits.

Supplementary measures are also given and are to be implemented where they are necessary to achieve the objectives of the Directive.

The basic management unit required by the Directive is that of the River Basin District (Article 13). Each River Basin District is to produce a River Basin Management Plan. Each plan must provide the following information for each District, as detailed in Annex VII:

- Geographical and geological characteristics;
- Hydrological characteristics;
- Demographic information;
- Land-use and economic activity;
- Point sources of pollution;
- Diffuse sources of pollution;
- Water abstraction;
- Other anthropogenic influences;
- Economic information (values, prices, costs, including historical trends, investments and forecasts divided by households, industry and agriculture) for abstraction and distribution of water and collection and discharge of waste water;
- Identification of all water bodies used for abstraction;
- Register of protection areas (EC, national and local designations), covering sensitive waters (e.g. nitrates, bathing waters, etc.) or nature conservation;
- Details of monitoring regimes for ecological and chemical characteristics and for protected areas.

The plan must also contain a series of management objectives. These include:

- Measures to meet environmental quality standards for groundwater;
- Monitoring, investigation and review of authorizations in all waters not classified as “good”;
- Controls over abstraction, including a register of abstractors and ensuring that abstraction only amounts to a small proportion of available resources;
- Requirement for prior authorization for all activities that have a potentially adverse impact of water status;
- Prohibition on direct discharges to groundwaters;

Member States (Article 14) must ensure the following avenues for public consultation for the production of River Basin Management Plans and their periodic revisions:

- At least three years before a plan is to be in operation, a timetable and work programme for its production is to be made public;
- An interim overview of significant water management issues is to be made public not less than two years before the plan is operational;
- Draft copies of the plan must be available at least one year before it is in operation and the public must be given six months to comment upon it;
- All background documents must be available on request.

Case law

There have been no cases concluded in the ECJ concerning the interpretation of Directive 2000/60/EC.

Marine Strategy Framework Directive

The Marine Strategy Framework Directive 2008/56/EC⁸¹:

- applies to all marine waters,
- takes account of the transboundary effects on the quality of the marine environment of third States in the same Marine Region or Sub-Region,
- does not apply to activities the sole purpose of which is defence or national security.

‘Marine waters’ include:

- waters,
- the sea-bed and subsoil on the seaward side of the baseline from which the extent of territorial waters is measured extending to the outmost reach of the area where a Member State has and/or exercises jurisdictional rights,
- coastal waters as included within the Water Framework Directive.

Directive 2008/56/EC addresses the marine environment through ‘Marine Regions’. Article 4 specifies these as the Baltic Sea, North East Atlantic Ocean, Mediterranean Sea and Black Sea. It also allows for their sub-division into Sub-Regions and provides a list of these for the North East Atlantic Ocean and Mediterranean Sea.

For each Marine Region or Sub-Region Member States shall develop Marine Strategies (Article 5) for the waters over which they have jurisdiction. Joint Marine Strategies are not required for each Marine Region or Sub-Region (in contrast to the requirements of Directive 2000/60/EC). However, co-ordination between Member States is encouraged, including working through (and building on the work of) the regional seas Conventions (Article 6). Member States shall designate competent authorities to be responsible for implementation of the Directive (Article 7). The Marine Strategies shall include (Article 5):

- an initial assessment by 15 July 2012 of the current environmental status of the waters concerned and the environmental impact of human activities.
- determination by 15 July 2012 of good environmental status.
- establishment by 15 July 2012 of environmental targets and associated indicators.
- establishment and implementation by 15 July 2014 (except where otherwise specified in the relevant Community legislation) of a monitoring programme for assessment and regular updating of targets.
- a programme of measures developed by 2015 and in operation by 2016 designed to achieve or maintain good environmental status.

⁸¹ Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive), <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:164:0019:0040:EN:PDF>

In undertaking the initial assessment, Member States shall (Article 8) take account of assessments made on coastal waters under Directive 2000/60/EC and assessments made by the regional seas Conventions. Member States shall co-operate with neighbours in a Marine Region to take account of transboundary issues and work to develop consistent methodologies. The assessments shall include:

- an analysis of the essential features and characteristics, and current environmental status of those waters, based on an indicative lists set out in Annex III, which covers physical and chemical features, habitat types, biological features and hydro-morphology.
- an analysis of the predominant pressures and impacts (including trends), including human activity, on the environmental status of those waters based on an indicative list set out in Annex III, which covers the main cumulative and synergetic effects and takes account of assessments made under existing Community legislation.
- an economic and social analysis of the use of those waters and of the cost of degradation of the marine environment.

Following the assessment and reference to qualitative descriptors set out in Annex I Member States shall:

- in respect of each Marine Region or Sub-Region concerned, determine, for the marine waters, a set of characteristics for good environmental status(Article 9). Criteria and methodological standards to be used shall be laid down using the Committee procedure as to ensure consistency and to allow for comparison between Marine Regions or Sub-Regions of the extent to which good environmental status is being achieved.
- establish a comprehensive set of environmental targets and associated indicators for their marine waters to guide progress towards achieving good environmental status, taking account the indicative lists of pressures and impacts set out in Annex III, and characteristics set out in Annex IV(Article 10). In setting targets Member States shall take account of other relevant targets set at national, Community of international level.
- establish and implement coordinated monitoring programmes to assess environmental status on the basis of an indicative lists of elements set out in Annex III and Annex V, and by reference to the environmental targets established(Article 11). The programmes shall be compatible within Marine Regions or Sub-Regions and shall build upon relevant provisions for assessment and monitoring laid down by other Community legislation, including the Habitats Directive and the Birds Directive or under international agreements. Member States shall also work with neighbouring countries to co-ordinate monitoring programmes to ensure that methods are consistent and that transboundary issues are addressed. Specific monitoring methods can be adopted by the Committee procedure.
- notify the Commission of the environmental targets, determination of good environmental status and monitoring programmes. Article 12 requires the Commission to assess (within six months of notification) whether these elements constitute an appropriate framework to meet the requirements of Directive 2008/56/EC and may ask the Member State concerned to provide any additional information that is available and necessary.

Programmes of measures shall be drawn up by Member States by 2013 to achieve good environmental status (Article 13) and meet environmental targets. These shall take account of requirements in other EU environmental legislation. In developing the programmes of measures 'Member States shall give due consideration to sustainable development and, in particular, to the social and economic impacts of the measures envisaged'. They shall include spatial protection measures, contributing to coherent and representative networks of marine protected areas, adequately covering the diversity of the constituent ecosystems, such as areas designated under the Habitats Directive 92/43/EEC and the Birds Directive 2009/147/EC and marine protected areas as agreed by the Community or Member States resulting from international or regional agreements. Where human activity having an impact is managed at Community or international level, Member States shall inform the relevant body with a view to taking relevant measures. Also in developing the programmes of measures, Member States shall consider the implications of their programmes of measures on waters beyond their marine waters in order to minimise the risk of damage to, and if possible have a positive impact on, those waters.

Member States shall notify the Commission of the programmes of measures within three months of their establishment. Following Member State notification of programmes of measures to the Commission, it shall assess (Article 16) within six months whether they constitute an appropriate framework to meet the requirements of Directive 2008/56/EC, and may ask Member States to provide additional information. The assessments shall consider the coherence of programmes of measures within the different Marine Regions or Sub-Regions and across the Community.

A Member State may identify instances within its marine waters where the environmental targets or good environmental status cannot be achieved in every aspect through measures taken by that Member State. These can include:

- action or inaction for which the Member State concerned is not responsible;
- natural causes;
- *force majeure*;
- modifications or alterations to the physical characteristics of marine waters brought about by actions taken for reasons of overriding public interest which outweigh the negative impact on the environment, including any transboundary impact;
- natural conditions which do not allow timely improvement in the status of the marine waters concerned.

Such instances shall be communicated and justified to the Commission. In such cases Member States shall take appropriate *ad hoc* measures (integrated into the programmes of measures) aiming to continue pursuing the environmental targets, to prevent further deterioration in the status of the marine waters affected and to mitigate the adverse impact at the level of the Marine Region or Sub-Region concerned. In cases of overriding public interest Member States shall ensure that the modifications or alterations do not permanently preclude or compromise the achievement of good environmental status at the level of the Marine Region or Sub-Region concerned or in the marine waters of other Member States.

In developing and implementing the Marine Strategies, beyond the initial assessment, Member States are not required to take specific steps where there is no significant risk to the marine environment, or where the costs would be disproportionate taking account of the risks to the marine environment, and provided that there is no further deterioration. In such cases Member States shall communicate and justify their actions to the Commission.

Where a Member State identifies an issue which has an impact on environmental status of its marine waters and which cannot be tackled by national measures, or which is linked to another Community policy or international agreement, it shall inform and justify its view to the Commission (Article 15). The Commission shall respond within a period of six months, such as with appropriate recommendations for measures.

Member States are required to ensure that their Marine Strategies are kept up to date (Article 17). Every six years Member States shall review, and communicate results to the Commission and regional seas Conventions, the following:

- The initial assessment and the determination of good environmental status.
- The environmental targets.
- The monitoring programmes.
- The programmes of measures.

Member States shall ensure that all interested parties are given ‘early and effective opportunities to participate’ in the implementation of the Directive (Article 19). Member States shall publish, and make available to the public for comment, summaries of the following elements of their Marine Strategies:

- The initial assessment and the determination of good environmental status.
- The environmental targets.
- The monitoring programmes.
- The programmes of measures.

Controlling Emissions to Water

There are a number of Directives which control (or can control) emissions of substances to water. Directive 2000/60/EC includes the provision of emission controls within programmes of measures to be developed by Member States. Directive 2008/1/EC (see Chapter 1.4) also requires discharges to water to be limited based on the application of best available techniques (BAT). Further general requirements for groundwater are described in Chapter 1.13. This section, therefore, will detail two Directives (2006/11/EC and 91/676/EEC).

The Dangerous Substances Directive

Directive 2006/11/EC⁸² (originally 76/464/EEC) sets a framework for the elimination or reduction of pollution of inland, coastal and territorial waters by particularly dangerous substances. It variously set emission limits and/or water quality standards for specific substances. Quality standards will be addressed in the following section. This section will, however, provide a general introduction to Directive 2006/11/EC and describe its approach to controls on emissions. Note that the provisions of the Directive are to be replaced by the requirements of Directive 2000/60/EC and a forthcoming Directive on water quality standards (see following section).

The Directive sets standards for particular substances referred to as the 'Black List' – includes substances selected on the basis of their toxicity, persistence and bio-accumulation, eg organohalogen and organophosphorus compounds, carcinogenic substances, and mercury and cadmium compounds. List II – sometimes called the 'Grey List' – includes possibly less dangerous substances such as zinc, copper and lead compounds, cyanide and ammonia. For the purposes of the Directive any List I substance is to be treated as a List II substance unless limit values have been set for it.

Member States are to take appropriate steps to eliminate pollution by List I substances and to reduce pollution by List II substances. 'Elimination' of pollution does not necessarily mean a zero-emission since pollution is defined not by reference to the presence of a substance but to its effects. Discharges of both List I and List II substances are to be subject to prior authorization by a competent authority, but these authorizations are arrived at in different ways.

For controlling List II substances, Member States are to establish pollution reduction programmes with deadlines for implementation. All discharges liable to contain a List II substance require prior authorization with emission standards being laid down. These emission standards are to be based on quality objectives. These quality objectives must be laid down in accordance with any existing Directives. Summaries of the programmes and the results of implementation are to be communicated to the Commission which is to arrange for regular comparisons. The Commission may make proposals to ensure sufficient coordination of national programmes.

For controlling List I substances, Member States may choose between two alternative regimes. The preferred regime entails limit values which emission standards set at national level are not to exceed. These emission limits are to be fixed uniformly throughout the EU in daughter Directives. The alternative regime entails emission standards set by reference to quality objectives. The quality objectives are also to be laid down in daughter Directives. Use of the alternative regime is conditional on the Member State proving to the Commission that the quality objectives are being met in accordance with a monitoring procedure set up by the Council. The emission limits are to be laid down mainly on the basis of toxicity, persistence and bioaccumulation

⁸² Directive 2006/11/EC of the European Parliament and of the Council of 15 February 2006 on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:064:0052:0059:EN:PDF>

taking into account the best technical means available, which is to take into account the economic availability of those means.

Member States are to draw up inventories of all discharges which may contain List I substances, and supply them to the Commission at its request.

Two points need to be emphasized. First, programmes for the reduction of pollution are required for List II but not for List I substances. But, secondly, since all substances are to be treated in law as List II substances until a daughter Directive converts a substance into a List I substance, all substances, at least initially, should in theory be made the subject of pollution reduction programmes, based on quality objectives. By 1991 only seventeen substances had been put into List I (see below). All other potential List I substances remain, in law, List II substances.

List I contains certain individual substances which belong to the following families and groups of substances, selected mainly on the basis of their toxicity, persistence and bioaccumulation, with the exception of those which are biologically harmless or which are rapidly converted into substances which are biologically harmless:

- organohalogen compounds and substances which may form such compounds in the aquatic environment;
- organophosphorus compounds;
- organotin compounds;
- substances which have been proved to possess carcinogenic properties in or via the aquatic environment;
- mercury and its compounds;
- cadmium and its compounds;
- persistent mineral oils and hydrocarbons of petroleum origin;
- persistent synthetic substances which may float, remain in suspension or sink and which may interfere with any use of the waters.

List II contains substances belonging to the families and groups of substances in List I for which the emission limit values laid down by the Directives referred to in Annex IX to the water framework Directive have not been determined by those Directives, and certain individual substances and categories of substances belonging to the families and groups of substances listed below and which have a deleterious effect on the aquatic environment, which can, however, be confined to a given area and which depends on the characteristics and location of the water into which such substances are discharged. These are:

- The following metalloids and metals and their compounds:
 - Zinc;
 - Copper;
 - Nickel;
 - Chromium;
 - Lead;
 - Selenium;
 - Arsenic;
 - Antimony;
 - Molybdenum;

- Titanium;
- Tin;
- Barium;
- Beryllium;
- Boron;
- Uranium;
- Vanadium;
- Cobalt;
- Thallium;
- Tellurium;
- Silver;
- Biocides and their derivatives not appearing in List I;
- Substances which have a deleterious effect on the taste and/or smell of the products for human consumption derived from the aquatic environment and compounds liable to give rise to such substances in water;
- Toxic or persistent organic compounds of silicon, and substances which may give rise to such compounds in water, excluding those which are biologically harmless or are rapidly converted in water into harmless substances;
- Inorganic compounds of phosphorus and elemental phosphorus;
- Non-persistent mineral oils and hydrocarbons of petroleum origin;
- Cyanides;
- Fluorides;
- Substances which have an adverse effect on the oxygen balance, particularly: ammonia and nitrites.

Case law

The European Court of Justice interpreted some of the requirements of the Directive. The following two cases arising from the Netherlands concern the interpretation of 'discharge':

- C-231/97. *A.M.L. van Rooij v Dagelijks bestuur van het waterschap de Dommel*. This Case concerned the interpretation of the term 'discharge' in Directive 76/464/EEC. This case concerned a business that treated wood by a method of steam fixation of a preservative solution called 'superwolman'. It held an authorisation granted to it under the national Environment Management Law. During the wood impregnation process, steam was released which was then precipitated directly or indirectly onto nearby surface water. A local resident claimed that the steam contained substances of Annex II of the Directive 76/464/EEC (now Directive 2006/11/EC), and that it was polluting the nearby surface water. The question was whether the term discharge was to be understood as steam and if the distance of the nearby surface water was to be taken into account in the interpretation of whether it was a discharge. The Court decided that polluted steam emissions were to be understood as falling under the scope of the Directive, the distance being useful only in the determination of the predictability of the pollution and in establishing the liability of the producer.
- C-232/97, 29/09/1999. *L. Nederhoff & Zn v Dijkgraaf en hoogheemraden van het Hoogheemraadschap Rijnland*. This Case concerned the interpretation of the term 'discharge' in Directive 76/464/EEC (now Directive 2006/11/EC).

The Case arose due to the placing of wooden posts treated with creosote in water and whether these constituted a discharge. The Court ruled that they did not and that the term 'discharge' in Article 1(2)(d) of Directive 76/464/EEC must be interpreted as not including the pollution from significant sources, including multiple and diffuse sources, referred to in Article 5(1) of Directive 86/280/EEC.

The 'daughter' Directives

By the end of 1990 seven 'daughter' Directives had been agreed, relating to some 17 substances (see below). Together they include heavy metals and a large number of substances used as agricultural herbicides and pesticides. The first four Directives, relating to mercury, cadmium, and HCH, were agreed separately, while the remaining three were developed within a common framework established by Directive 86/280/EEC⁸³. They all share the following common features.

For each substance, limit values are specified for different types of processes or industrial sectors, and are to be met generally in two stages, normally three years apart. The limit values are expressed in two ways – in terms of concentration and in terms of quantity in relation to installed production capacity. The limit values in terms of quantity must be observed, while those given in terms of concentration should in principle not be exceeded. Limit values are to be reviewed every four years in the light of changes in scientific knowledge or improvements in pollution control technology. However, many of these limit values are now around 20 years old and have largely been overtaken by the need to control discharges in accordance with BAT as defined under the Directive 2008/1/EC (Chapter 1.4). It should also be noted that a forthcoming Directive establishing water quality standards pursuant to Directive 2000/60/EC will result in the repeal of Directive 2006/11/EC and all daughter Directives. As the limit values in these Directives are out-dated, and about to be repealed, and have in practice been superseded by BAT standards developed pursuant to Directive 2008/1/EC they are not detailed here. For specific requirements for controlling discharges to water from particular processes and activities, the reader is referred to the sector-specific chapters later in this Sourcebook.

The Nitrates Directive

Directive 91/676/EEC⁸⁴ seeks to reduce or prevent the pollution of water caused by the application and storage of inorganic fertilizer and manure on farmland. It is intended both to safeguard drinking water supplies, to protect groundwater in general and to prevent wider ecological damage in the form of the eutrophication of freshwater and marine waters generally.

Member States are to identify waters actually or potentially affected by pollution from nitrates. These are to include:

⁸³ Council Directive of 12 June 1986 on limit values and quality objectives for discharges of certain dangerous substances included in List I of the Annex to Directive 76/464/EEC, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1986L0280:19911223:EN:PDF>

⁸⁴ Council Directive of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1991L0676:20031120:EN:PDF>

- surface freshwaters, in particular (though not exclusively) those for the abstraction of drinking water, where nitrate concentrations do or may exceed limits set out in Directive 75/440/EEC⁸⁵ (50 mg/l);
- groundwaters actually or potentially containing more than 50mg/l nitrates;
- freshwater lakes, other freshwater bodies, estuaries, coastal waters and marine waters which are or may become eutrophic.

These criteria (set out in an Annex I to the Directive) are qualified by a number of general considerations relating to the characteristics of the water and land, the behaviour of nitrogen compounds, and the potential impact of remedial measures. By December 1993, all known areas of land which drain into waters identified in this way and contribute to pollution were to be designated by Member States as 'vulnerable zones'. The identification is to be reviewed and if necessary revised at least every four years.

Within 'vulnerable zones' legally binding measures have to be taken through Action Programmes; outside such zones, Codes of Good Practice are to be promoted on a voluntary basis.

Action Programmes relating to vulnerable zones were to be established by December 1995 and implemented by December 1999. They are to be revised at least every four years. Annex III of the Directive sets out measures that Action Programmes must contain, including:

- periods when the application of certain fertilizers is prohibited;
- limits on the quantities of fertilizers applied, taking into account certain characteristics of the vulnerable zones;
- a limit on the annual application of livestock manure per hectare to an amount containing no more than 170 kg N, or 210 kg N during the first four year action programme. Subject to a Commission Decision, higher application rates might be permitted, if those do not jeopardise achievement of the environmental objectives (i.e. nitrates concentrations <50 mg/l, and no eutrophication). On the other hand, more stringent annual application rates than 170 kg per hectare need to be ensured if this is necessary to achieve the environmental objective;
- conditions relating to the available storage capacity on farms for livestock manure;
- a code of good agricultural practice, to be established by December 1993, covering measures set out in an Annex II. (In areas other than vulnerable zones, the code of practice is to be implemented by farmers on a voluntary basis, and a training and information programme made available to them).

⁸⁵ Council Directive of 16 June 1975 concerning the quality required of surface water intended for the abstraction of drinking water in the Member States, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1975L0440:19911223:EN:PDF>

For the purpose of designating and reviewing vulnerable zones, Member States are to regularly monitor the level of nitrate pollution in surface waters and groundwaters, as well as the eutrophic state of freshwaters, estuaries and coastal waters. An Annex IV sets out reference methods of measurement to be used (but not a compliance regime).

Case law

There have been a number of cases concluded in the European Court of Justice and a number of these have clarified the interpretation of a number of elements of Directive 91/676/EEC:

- C-293/97. This was the first significant interpretation of Directive 91/676/EEC by the ECJ. This followed a challenge in the UK High Court by a group of farmers against the designation of NVZs under UK legislation. The High Court referred the questions to the ECJ. A principle challenge from the farmers concerned the designation of waters where nitrate pollution was not predominately caused by agricultural sources. The ECJ ruled that Directive 91/676/EEC required designation if the 50mg/l threshold listed in Annex I would be exceeded if no action was taken under the Directive. The Court stated 'it does not follow from the wording of the provision that Member States are required to determine precisely what proportion of the pollution is attributable to nitrates of agricultural origin or that the cause of such pollution must be exclusively agricultural'. The farmers also argued that Directive 91/676/EEC infringed the principle of proportionality, in that they alone would bear the costs of improving water quality. The Court considered that the Directive allows a flexible approach to the application of measures and that it was for national courts to ensure that the principle of proportionality was observed at that stage.
- C-69/99. The ECJ issued a judgment against the UK stating that it had interpreted Directive 91/676/EEC too narrowly. The Directive requires that Member States have to identify all surface or ground waters polluted, or at risk of being polluted, by nitrates. The UK had only designated such waters where they were used as drinking water sources. The ECJ concluded that Directive 91/676/EEC allowed no such restriction. The impact of the judgment was to stimulate a major reconsideration of nitrate vulnerable zone designation across Britain.
- C-161/00. This was a judgment against Germany. It concerned the interpretation of point 2 of Annex III to Directive 91/676/EEC - 'amount of livestock manure applied to the land'. German national law allowed for loss of nitrogen to the atmosphere to be taken into account, so that the amount of nitrogen applied to land was not the total amount of nitrogen in manure, but that amount minus what was lost to the atmosphere. The ECJ conclude that the wording in Directive 91/676/EEC was 'not without ambiguity' and also that 'the definition of 'land application' in Article 2(h) of the Directive makes no distinction between the beginning and the end of the application process'. It also noted that the 'Directive does not therefore expressly identify the moment at which the nitrogen content of the livestock manure planned to be applied should be calculated in order to ensure that the maximum permissible amounts of nitrogen to be applied to the land each year are not exceeded'. However, it

concluded that the German legislation did not comply with the obligations of Directive 91/676/EEC.

- C-258/00. This was a judgment against France for too narrow designation of waters affected by nitrates. France had argued that for certain waters eutrophication was driven by phosphorus rather than nitrogen and, therefore, designation under Directive 91/676/EEC was not necessary. The ECJ concluded that ‘notwithstanding the role that phosphorus may play in eutrophication, plant species whose growth is accelerated by nitrogen may appear in such waters, giving rise to a disturbance of the balance between the different organisms which are present there’. It also concluded that ‘taking account of the fact that the obligations arising from Article 3(1) and (2) of the Directive are intrinsically linked, a restrictive identification of waters affected by pollution or which could be so affected under Article 3(1) would result in an incomplete designation of vulnerable zones under Article 3(2)’. Finally, it concluded that ‘while it is true that the Member States have been granted a wide discretion in the identification of waters referred to in Article 3(1) [...] it nevertheless remains the case that when they carry out that identification, they are obliged to respect the objectives of the Directive, namely, the reduction of water pollution caused by nitrates from agricultural sources’.

Water Quality Requirements

Dangerous substances Directive

Directive 2006/11/EC (described above) sets the following water quality standards for those Member States which choose to apply them rather than adopt an emission limit approach.

Directive 82/176/EEC⁸⁶ on limit values and quality objectives for mercury discharges by the chlor-alkali electrolysis industry:

- The concentration of mercury in a representative sample of fish flesh chosen as an indicator must not exceed 0.3 mg/kg wet flesh;
- The total concentration of mercury in inland surface waters affected by discharges must not exceed 1 g/l as the arithmetic mean of the results obtained over a year;
- The concentration of mercury in solution in estuary waters affected by discharges must not exceed 0.5 g/l as the arithmetic mean of the results obtained over a year;
- The concentration of mercury in solution in territorial sea waters and internal coastal waters other than estuary waters affected by discharges must not exceed 0.3 mg/l as the arithmetic mean of the results obtained over a year;
- The quality of the waters must be sufficient to comply with the requirements of any other Council Directive applicable to such waters as regards the presence of mercury;

⁸⁶ Council Directive of 22 March 1982 on limit values and quality objectives for mercury discharges by the chlor-alkali electrolysis industry, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1982L0176:19911223:EN:PDF>

- The concentration of mercury in sediments or in shellfish must not increase significantly with time;
- Where several quality objectives are applied to waters in an area, the quality of the waters must be sufficient to meet each of them.

Directive 83/513/EEC⁸⁷ on limit values and quality objectives for cadmium discharges:

- The concentration of dissolved cadmium in estuary waters affected by discharges must not exceed 5 g/litre.
- The concentration of dissolved cadmium in territorial waters and in internal coastal waters other than estuary waters affected by discharges must not exceed 2.5 g/litre.
- In addition to the above requirements, cadmium concentrations must be determined by the national network and the results compared with the following concentrations:
 - In the case of inland surface waters, a total cadmium concentration of 1 g/litre;
 - In the case of estuary waters, a dissolved cadmium concentration of 1 g/litre;
 - In the case of territorial and internal coastal waters, other than estuary waters, a dissolved cadmium concentration of 0.5 g/litre.
- The concentration of cadmium in sediments and/or shellfish, if possible of the species *Mytilus edulis*, must not increase significantly with time.
- Where several quality objectives are supplied to waters in an area, the quality of the waters must be sufficient to comply with each of those objectives. The water concentrations relate to the arithmetic mean of the results obtained over one year. Directive 75/440/EEC on the quality required of surface water intended for the abstraction of drinking water in the Member States provides for a mandatory cadmium value of 5 g/litre on the basis of 95 % of the samples taken.

Directive 84/491/EEC⁸⁸ on limit values and quality objectives for discharges of hexachlorocyclohexane:

- The total HCH concentration in inland surface waters affected by discharges must not exceed 100 nanograms per litre.
- The total concentration of HCH in estuary waters and territorial sea waters must not exceed 20 nanograms per litre.
- The total concentration of HCH in sediments and/or molluscs and/or shellfish and/or fish must not increase significantly with time.
- All water concentrations relate to the arithmetic mean of the results obtained over one year.

⁸⁷ Council Directive of 26 September 1983 on limit values and quality objectives for cadmium discharges, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1983L0513:19911223:EN:PDF>

⁸⁸ Council Directive of 9 October 1984 on limit values and quality objectives for discharges of hexachlorocyclohexane, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1984L0491:19911223:EN:PDF>

Further quality standards are set by Directive 86/280/EEC and amending Directives:

- CCl₄: 12 micrograms/litre for all types of surface water;
- Para-para-DDT: 10 micrograms/litre for all types of surface water;
- Total DDT: 25 micrograms/litre for all types of surface water;
- PCP: 2 micrograms/litre for all types of surface water;
- HCB: 0.03 micrograms/litre for all types of surface water;
- HCBD: 0.1 micrograms/litre for all types of surface water;
- CHCl₃: 12 micrograms/litre for all types of surface water;
- EDC: 10 micrograms/litre for all types of surface water;
- TRI: 10 micrograms/litre for all types of surface water;
- PER: 10 micrograms/litre for all types of surface water;
- TCB: 0.4 micrograms/litre for all types of surface water.

Bathing Water Directive

Directive 2006/7/EC⁸⁹ aims to protect bathers from contamination in bathing waters. The Directive sets binding quality objectives for bacteriological quality of bathing waters at rivers, lakes and coastal waters, and requires Member States to draw up a management plan for each site to minimise risks to bathers, based on an assessment of the sources of contamination that are likely to affect it. Where bathing waters have a history of poor water quality, preventive measures should be taken to close the bathing area when such conditions are forecast. If the water quality standards are not met, remedial measures must be taken. Information on bathing water quality classification, the results of water quality monitoring and the management plan is to be made available to the public, both through displays at the site and through the media and internet. It provides for extensive public information and participation as well as for comprehensive and modern management measures.

Directive 2006/7/EC requires regular monitoring of two microbiological indicators of faecal contamination, *E. Coli* and intestinal *Enterococci*. It applies to surface waters where a large number of people are expected to bathe and establishes a method for monitoring bathing water quality during the bathing season. The classification of water quality at a bathing water is determined on the basis of a three-year trend. The classification is at four levels: poor, sufficient, good and excellent (see Table 1). Where water quality is consistently good over a three-year period the frequency of sampling may be reduced.

Directive 2006/7/EC requires the development of profiles describing the characteristics of the bathing water and identifying sources of pollution and links management action to that under Directive 2000/60/EC.

⁸⁹ Directive 2006/7/EC of the European Parliament and of the Council of 15 February 2006 concerning the management of bathing water quality and repealing Directive 76/160/EEC, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:064:0037:0051:EN:PDF>

Table 1: Bathing water standards from Directive 2006/7/EC

Parameter	Excellent quality	Good quality	Sufficient	Reference methods of analysis
Inland waters				
Intestinal enterococci (cfu/100 ml)	200 [1]	400 [1]	330 [2]	ISO 7899-1 or ISO 7899-2
Escherichia coli (cfu/100 ml)	500 [1]	1000 [1]	900 [2]	ISO 9308-3 or ISO 9308-1
Coastal and transitional waters				
Intestinal enterococci (cfu/100 ml)	100 [3]	200 [3]	185 [4]	ISO 7899-1 or ISO 7899-2
Escherichia coli (cfu/100 ml)	250 [3]	500 [3]	500 [4]	ISO 9308-3 or ISO 9308-1
Notes:				
[1] Based upon a 95-percentile evaluation.				
[2] Based upon a 90-percentile evaluation.				
[3] Based upon a 95-percentile evaluation.				
[4] Based upon a 90-percentile evaluation.				

Case law

There have been a number of cases concluded in the European Court of Justice and a number of these have clarified the interpretation of a number of elements of the earlier Bathing Water Directive 76/160/EEC:

- C-56/90. This judgement against the UK concerned its failure to comply with certain limit values at two specified bathing waters, Blackpool and Southport. The case centred on three main points. Firstly, the UK's initial classification method which had failed to identify Blackpool as a 'bathing water'. The UK government argued that the definition of bathing water within the Directive was too imprecise which had forced it to adopt a method which was based on specific numerical thresholds. The Court considered that there were a number of other factors which should have been considered in the identification process such as bathing huts and toilet facilities..
- C-92/96. This was a judgement against Spain for failing to take all necessary measures to ensure that the quality of inshore bathing waters in Spain conforms to the limit values set in accordance with Article 3 of Directive 76/160/EEC. Spain argued that drought conditions were abnormal weather conditions in the sense of the Directive. However, the Court did not consider that the conditions were sufficient abnormal and, therefore, limit values had to be complied with.
- C-307/98. This was a judgement against Belgium for excluding, without proper justification, from the scope of Directive 76/160/EEC 'numerous inland

bathing areas' and by not adopting, within 10 years following notification of the Directive, the measures needed to ensure that the quality of bathing water conforms to the limit values fixed in accordance with Article 3. The Walloon Region argued that those areas excluded had no facilities for bathers and that the areas were used very little or not at all. The Court ruled that the number of bathers was not a factor to be taken into account in identifying bathing waters. If bathing no longer occurs, it is incumbent on the Member State to prove that this is not due to failure to meet the limit values in the Directive.

- C-26/04. This Case was brought against Spain. The Commission argued that it had failed to designate three beaches on the Galician coast as bathing waters. However, the Court concluded that Directive 76/160/EEC does not expressly impose the obligation on Member States to officially designate beaches or other places as bathing areas. The Court stated that Article 1(2)(a) 'defines bathing waters as being those in which bathing is either explicitly authorised by the competent authorities of each Member State or is not prohibited and is traditionally practised by a large number of bathers. It follows from the second part of that definition that it is permissible for Member States to allow bathing in certain waters without necessarily designating them as bathing areas'. Therefore the Case was dismissed.

Quality Standards for Water Directive

Directive 2008/105/EC⁹⁰ is a daughter Directive to the Water Framework Directive 2000/60/EC. The Water Framework Directive requires that all Member States' waters should achieve 'good status' by 2015 and, to assist this, Directive 2008/105/EC was adopted to focus on specific priority substances.

The Directive sets harmonised environmental quality standards for surface waters regarding 33 'priority substances' and eight other pollutants and includes a requirement to phase out discharges, emissions and losses of 13 'priority hazardous substances' within 20 years. Priority hazardous substances are defined as 'substances or groups of substances that are toxic, persistent and liable to bio-accumulate'. The 33 priority substances include existing chemicals, plant protection products, biocides, metals (such as mercury and cadmium) and other groups like Polyaromatic Hydrocarbons (PAH) (mainly incineration by-products) and Polybrominated Biphenylethers (PBDE) (used as flame retardants).

The Directive sets two types of environmental quality standard: annual average concentrations and maximum allowable concentrations. The former are for protection against long-term and chronic effects, the latter for short-term, direct and acute ecotoxic effects. Furthermore, the environmental quality standards are differentiated for inland surface waters (rivers and lakes) and other surface waters (transitional, coastal

⁹⁰ Directive 2008/105/EC of the European Parliament and of the Council of 16 December 2008 on environmental quality standards in the field of water policy, amending and subsequently repealing Council Directives 82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC, 86/280/EEC and amending Directive 2000/60/EC of the European Parliament and of the Council, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:348:0084:0097:EN:PDF>

and territorial waters). Member States may, for specified substances, opt to apply environmental quality standards for sediments and/or biota instead of water standards. Table 2 sets out the environmental quality standards.

By 2009, Member States are required to set up an inventory of emissions, discharges and losses of pollutants for river basins on their territory. These inventories are to be published in their River Basin Management Plans developed under Directive 2000/60/EC.

The Directive allows for the fact that it may not be possible to meet environmental quality standards close to discharge points and, therefore, the concept of mixing zones is introduced. Member States may designate such mixing zones in which concentrations of the priority substances may exceed the relevant environmental quality standard if they do not affect the compliance of the rest of the surface water with the environmental quality standard. Member States need to include in their River Basin Management Plans, developed under Directive 2000/60/EC, a description of the approaches and methodologies applied to derive mixing zones and the measures taken with the aim to reduce the extent of the mixing zones in the future.

Where transboundary pollution causes a breach of the environmental quality standards, Member States shall not be in breach of the obligations of Directive 2008/105/EC provided the Member State cannot address the pollution problems and providing the transboundary co-ordination mechanisms required under Directive 2000/60/EC are established.

Many of the elements of the Directive are to be undertaken in an integrated way with Directive 2000/60/EC. These include:

- The definitions in Directive 2000/60/EC apply.
- The application of environmental quality standards is designed to meet Article 4 (environmental objectives) of Directive 2000/60/EC.
- Identification and description of mixing zones is to be done within River Basin Management Plans.
- The Inventory of emissions is to be set out in River Basin Management Plans.
- Co-ordination on transboundary pollution is to be done through mechanisms under Directive 2000/60/EC.

Table 2: Environmental quality standards set out in Directive 2008/105/EC

ANNEX I

ENVIRONMENTAL QUALITY STANDARDS FOR PRIORITY SUBSTANCES AND CERTAIN OTHER POLLUTANTS

PART A: ENVIRONMENTAL QUALITY STANDARDS (EQS)

AA: annual average;

MAC: maximum allowable concentration.

Unit: [µg/l]

(1)	(2)	(3)	(4)	(5)	(6)	(7)
No	Name of substance	CAS number (1)	AA-EQS (2) Inland surface waters (2)	AA-EQS (2) Other surface waters	MAC-EQS (3) Inland surface waters (3)	MAC-EQS (3) Other surface waters
(1)	Alachlor	1 597 2-60-8	0,3	0,3	0,7	0,7
(2)	Anthracene	120-12-7	0,1	0,1	0,4	0,4
(3)	Atrazine	1912-24-9	0,6	0,6	2,0	2,0
(4)	Benzene	71-43-2	10	8	50	50
(5)	Brominated diphenylether (2)	32534-81-9	0,0005	0,0002	not applicable	not applicable
(6)	Cadmium and its compounds (depending on water hardness classes) (2)	7440-43-9	≤ 0,08 (Class 1) 0,08 (Class 2) 0,09 (Class 3) 0,15 (Class 4) 0,25 (Class 5)	0,2	≤ 0,45 (Class 1) 0,45 (Class 2) 0,6 (Class 3) 0,9 (Class 4) 1,5 (Class 5)	≤ 0,45 (Class 1) 0,45 (Class 2) 0,6 (Class 3) 0,9 (Class 4) 1,5 (Class 5)
(6a)	Carbon-tetrachloride (2)	56-23-5	12	12	not applicable	not applicable
(7)	C10-13 Chloroalkanes	85535-84-8	0,4	0,4	1,4	1,4
(8)	Chlorfenvinphos	470-90-6	0,1	0,1	0,3	0,3
(9)	Chlorpyrifos (Chlorpyrifos-ethyl)	2921-88-2	0,03	0,03	0,1	0,1
(9a)	Cyclodiene pesticides: Aldrin (2) Dieldrin (2) Endrin (2) Isodrin (2)	309-00-2 60-57-1 72-20-8 465-73-6	Σ = 0,01	Σ = 0,005	not applicable	not applicable
(9b)	DDT total (2) (2) para-para-DDT (2)	not applicable 50-29-3	0,025 0,01	0,025 0,01	not applicable not applicable	not applicable not applicable
(10)	1,2-Dichloroethane	107-06-2	10	10	not applicable	not applicable
(11)	Dichloromethane	75-09-2	20	20	not applicable	not applicable
(12)	Di(2-ethylhexyl)-phthalate (DEHP)	117-81-7	1,3	1,3	not applicable	not applicable
(13)	Diuron	330-54-1	0,2	0,2	1,8	1,8
(14)	Endosulfan	115-29-7	0,005	0,0005	0,01	0,004
(15)	Fluoranthene	206-44-0	0,1	0,1	1	1
(16)	Hexachloro-benzene	118-74-1	0,01 (2)	0,01 (2)	0,05	0,05
(17)	Hexachloro-butadiene	87-68-3	0,1 (2)	0,1 (2)	0,6	0,6
(18)	Hexachloro-cyclohexane	608-73-1	0,02	0,002	0,04	0,02

(19)	Isoproturon	34123-59-6	0,3	0,3	1,0	1,0
(20)	Lead and its compounds	7439-92-1	7,2	7,2	not applicable	not applicable
(21)	Mercury and its compounds	7439-97-6	0,05 (¶)	0,05 (¶)	0,07	0,07
(22)	Naphthalene	91-20-3	2,4	1,2	not applicable	not applicable
(23)	Nickel and its compounds	7440-02-0	20	20	not applicable	not applicable
(24)	Nonylphenol (4-Nonylphenol)	104-40-5	0,3	0,3	2,0	2,0
(25)	Octylphenol ((4-(1,1',3,3'-tetramethylbutyl)-phenol))	140-66-9	0,1	0,01	not applicable	not applicable
(26)	Pentachloro-benzene	608-93-5	0,007	0,0007	not applicable	not applicable
(27)	Pentachloro-phenol	87-86-5	0,4	0,4	1	1
(28)	Polyaromatic hydrocarbons (PAH) (10)	not applicable				
	Benzo(a)pyrene	50-32-8	0,05	0,05	0,1	0,1
	Benzo(b)fluor-anthene	205-99-2	Σ = 0,03	Σ = 0,03	not applicable	not applicable
	Benzo(k)fluor-anthene	207-08-9				
	Benzo(g,h,i)-perylene	191-24-2	Σ = 0,002	Σ = 0,002	not applicable	not applicable
	Indeno(1,2,3-cd)-pyrene	193-39-5				
(29)	Simazine	122-34-9	1	1	4	4
(29a)	Tetrachloro-ethylene (¶)	127-18-4	10	10	not applicable	not applicable
(29b)	Trichloro-ethylene (¶)	79-01-6	10	10	not applicable	not applicable
(30)	Tributyltin compounds (Tributyltin-cation)	36643-28-4	0,0002	0,0002	0,0015	0,0015
(31)	Trichloro-benzenes	12002-48-1	0,4	0,4	not applicable	not applicable
(32)	Trichloro-methane	67-66-3	2,5	2,5	not applicable	not applicable
(33)	Trifluralin	1582-09-8	0,03	0,03	not applicable	not applicable

(1) CAS: Chemical Abstracts Service.

(2) This parameter is the EQS expressed as an annual average value (AA-EQS). Unless otherwise specified, it applies to the total concentration of all isomers.

(3) Inland surface waters encompass rivers and lakes and related artificial or heavily modified water bodies.

(4) This parameter is the EQS expressed as a maximum allowable concentration (MAC-EQS). Where the MAC-EQS are marked as 'not applicable', the AA-EQS values are considered protective against short-term pollution peaks in continuous discharges since they are significantly lower than the values derived on the basis of acute toxicity.

(5) For the group of priority substances covered by brominated diphenylethers (No 5) listed in Decision No 2455/2001/EC, an EQS is established only for congeners numbers 28, 47, 99, 100, 153 and 154.

(6) For cadmium and its compounds (No 6) the EQS values vary depending on the hardness of the water as specified in five class categories (Class 1: < 40 mg CaCO₃/l, Class 2: 40 to < 50 mg CaCO₃/l, Class 3: 50 to < 100 mg CaCO₃/l, Class 4: 100 to < 200 mg CaCO₃/l and Class 5: ≥ 200 mg CaCO₃/l).

(7) This substance is not a priority substance but one of the other pollutants for which the EQS are identical to those laid down in the legislation that applied prior to 13 January 2009.

(8) DDT total comprises the sum of the isomers 1,1,1-trichloro-2,2 bis (p-chlorophenyl) ethane (CAS number 50-29-3; EU number 200-024-3); 1,1,1-trichloro-2 (o-chlorophenyl)-2-(p-chlorophenyl) ethane (CAS number 789-02-6; EU number 212-332-5); 1,1-dichloro-2,2 bis (p-chlorophenyl) ethylene (CAS number 72-55-9; EU number 200-784-6); and 1,1-dichloro-2,2 bis (p-chlorophenyl) ethane (CAS number 72-54-8; EU number 200-783-0).

(9) If Member States do not apply EQS for biota they shall introduce stricter EQS for water in order to achieve the same level of protection as the EQS for biota set out in Article 3(2) of this Directive. They shall notify the Commission and other Member States, through the Committee referred to in Article 21 of Directive 2000/60/EC, of the reasons and basis for using this approach, the alternative EQS for water established, including the data and the methodology by which the alternative EQS were derived, and the categories of surface water to which they would apply.

(10) For the group of priority substances of polyaromatic hydrocarbons (PAH) (No 28), each individual EQS is applicable, i.e. the EQS for Benzo(a)pyrene, the EQS for the sum of Benzo(b)fluoranthene and Benzo(k)fluoranthene and the EQS for the sum of Benzo(g,h,i)perylene and Indeno(1,2,3-cd)pyrene must be met.

1.13 Soil and Groundwater Protection

Soil Protection

When compared to regulations controlling emissions to water and air, soil as a media is relatively unregulated at EU level. At present there is no comprehensive EU legislation on soil protection, though there are some specific provisions aimed at soil protection in sectoral or cross-sectoral legislation, such as that relating to waste management and environmental liability.

Installation specific requirements for land remediation and limits on emissions to land are set out under Directive 2008/1/EC on integrated pollution prevention and control (see Chapter 1.4); while other explicit requirements are included in Directive 2006/12/EC on the landfill of waste (see Chapter 2.4.3). There are also specific requirements designed to limit soil contamination resulting from the use of sewage sludge in agriculture, set out in Directive 86/278/EEC,⁹¹ a form of recovery of waste produced by urban waste water treatment plants (see Chapter 2.4.5). This Directive is intended to promote the safe use of sewage sludge in agriculture in a way that does not harm humans or the environment. It sets out under what circumstances this product's use is permitted, on what crops, and requires that use take account of environmental impact (especially on groundwater), that sludge used comply with limit values for heavy metals and that certain sampling techniques be applied to sludges and soils including keeping records of sludge produced, quantities used in agriculture, its composition and properties.

The current provisions of EU environmental legislation aimed at soil protection which are likely to be of most relevance to projects within the scope of this Sourcebook are those contained in Directive 2004/35/EC on environmental liability.⁹² This Directive imposes strict liability on a wide range of "occupational activities", including for example all installations subject to permitting under Directive 2001/18/EC, for the prevention and remediation of "land damage", which is defined as "any land contamination that creates a significant risk of human health being adversely affected as a result of the direct or indirect introduction, in, on or under land, of substances, preparations, organisms or micro-organisms". Operators of activities within the scope of the Directive have an obligation to take preventive measures whenever there is an imminent threat of land damage occurring, and remedial measures, as determined by the competent authority of the Member States concerned, if such damage does occur. Remediation of land damage implies all measures necessary to ensure that "the relevant contaminants are removed, controlled, contained or diminished so that the contaminated land, taking account of its current use or approved future use at the time of the damage, no longer poses any significant risk of adversely affecting human

⁹¹ Council Directive of 12 June 1986 on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1986L0278:20030605:EN:PDF>

⁹² Directive 2004/35/CE of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:143:0056:0075:EN:PDF>

health." Operators have to bear the cost of preventive and remedial measures, except in limited circumstances in which they can be exonerated from liability. For further details, the reader is referred to Chapter 1.3 above.

Legislation designed to protect water bodies, especially ground water, often leads to the reduction in emissions to soils and limits to contamination. This is because soil can act as the vector by which pollutants pass to water bodies, hence measures to reduce nitrate use per se also impact on soil quality. Additionally, soil itself can act as a pollutant (for example, when eroded in large quantities), therefore, the implementation of river basin management plans under Directive 2000/60/EC (see Chapter 1.12) will lead to greater regulation of soils.

Groundwater Protection

Groundwaters are protected under EU law through the Directive 2000/60/EC⁹³, with certain details set out in a specific daughter Directive on groundwater (2006/118/EC⁹⁴). Directive 2000/60/EC sets general goals that groundwaters should achieve/maintain good chemical status and good quantitative status, that deterioration of groundwater status is prohibited, that waters used for abstraction of drinking water are specifically protected, and established the management framework within which groundwater protection should take place. These are described in more detail in Chapter 1.12.

Directive 2006/118/EC requires (Article 3) Member States to assess groundwater chemical status using specified groundwater quality standards, threshold values for specified pollutants, groups of pollutants and indicators of pollution which have been identified as contributing to the characterisation of bodies or groups of bodies of groundwater as being at risk. Threshold values can be established at the national level, at the level of the river basin district or the part of the international river basin district falling within the territory of a Member State, or at the level of a body or a group of bodies of groundwater. They shall be established by 22 December 2008 and be published in the river basin management plans produced under Directive 2000/60/EC. Threshold values shall also be amended as new information on their effects becomes available.

Member States shall assess the chemical status of a body of groundwater (Article 4). A body or a group of bodies of groundwater shall be considered to be of good chemical status when:

- the relevant monitoring demonstrates that the conditions set out in of Annex V of Directive 2000/60/EC are being met; or

⁹³ Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2000L0060:20080321:EN:PDF>

⁹⁴ Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:372:0019:0031:EN:PDF>

- the values for the groundwater quality standards listed and the relevant threshold values are not exceeded at any monitoring point in that body or group of bodies of groundwater; or
- the value for a groundwater quality standard or threshold value is exceeded at one or more monitoring points but an appropriate investigation in accordance with Annex III confirms that:
 - the concentrations of pollutants exceeding the groundwater quality standards or threshold values are not considered to present a significant environmental risk, taking into account, where appropriate, the extent of the body of groundwater which is affected;
 - the other conditions for good groundwater chemical status set out in Annex V of Directive 2000/60/EC are being met;
 - (iii) for bodies of groundwater identified in accordance with Article 7(1) of Directive 2000/60/EC regarding waters used for the abstraction of drinking water, the requirements of Directive 2000/60/EC are being met;
 - the ability of the body of groundwater or of any of the bodies in the group of bodies of groundwater to support human uses has not been significantly impaired by pollution.

The groundwater quality standards currently defined at EU level under Directive 2006/118/EC are:

- Nitrates: 50 mg/l;
- Active substances in pesticides, including their relevant metabolites, degradation and reaction products: 0.1 µg/l (individual) and 0.5 µg/l (total – the sum of all individual pesticides detected and quantified in the monitoring procedure, including their relevant metabolites, degradation and reaction products).

Threshold values to be set at national / river basin level should be based on:

- the extent of interactions between groundwater and associated aquatic and dependent terrestrial ecosystems;
- the interference with actual or potential legitimate uses or functions of groundwater;
- all pollutants which characterise bodies of groundwater as being at risk;
- hydro-geological characteristics including information on background levels and water balance.

The determination of threshold values should also take account of the origins of the pollutants, their possible natural occurrence, their toxicology and dispersion tendency, their persistence and their bioaccumulation potential. Wherever elevated background levels of substances or ions or their indicators occur due to natural hydro-geological reasons, these background levels in the relevant body of groundwater shall be taken into account when establishing threshold values. The determination of threshold values should be supported by a control mechanism for the data collected, based on an evaluation of data quality, analytical considerations, and background levels for substances which may occur both naturally and as a result of human activities.

The minimum list of pollutants and their indicators for which Member States have to consider establishing threshold values include the following substances or ions or indicators which may occur both naturally and/or as a result of human activities: arsenic, cadmium, lead, mercury, ammonium, chloride and sulphate; the following man-made synthetic substances: trichloroethylene and tetrachloroethylene; and the following parameters indicative of saline or other intrusions: conductivity.

If a body of groundwater is classified as being of good chemical status, Member States shall take such measures as may be necessary to protect aquatic ecosystems, terrestrial ecosystems and human uses of groundwater dependent on the part of the body of groundwater represented by the monitoring point or points at which the value for a groundwater quality standard or the threshold value has been exceeded.

Limitation of inputs of pollutants into groundwater

Directive 2000/60/EC already prohibits as a rule any direct discharges of pollutants into groundwater (Article 11(3)j). Complementing this provision, Article 6 of Directive 2006/118/EC requires Member States to prevent or limit inputs of pollutants into groundwater through the programme of measures under the water framework Directive. These shall include ‘all measures necessary’ for any hazardous substances. For pollutants which are not considered hazardous Member States shall take all measures necessary to limit inputs into groundwater so as to ensure that such inputs do not cause deterioration or significant and sustained upward trends in the concentrations of pollutants in groundwater. Such measures shall take account, at least, of established best practice, including the Best Environmental Practice (BEP) and Best Available Techniques (BAT) specified in the relevant Community legislation, such as Directive 2008/1/EC (see Chapter 1.4).

Member States may exempt (once appropriate monitoring is established) from the measures required inputs of pollutants that are:

- the result of direct discharges authorised under Directive 2000/60/EC;
- considered by the competent authorities to be of a quantity and concentration so small as to obviate any present or future danger of deterioration in the quality of the receiving groundwater;
- the consequences of accidents or exceptional circumstances of natural cause that could not reasonably have been foreseen, avoided or mitigated;
- the result of artificial recharge or augmentation of bodies of groundwater authorised under Directive 2000/60/EC;
- in the view of the competent authorities incapable, for technical reasons, of being prevented or limited without using:
 - measures that would increase risks to human health or to the quality of the environment as a whole; or
 - disproportionately costly measures to remove quantities of pollutants from, or otherwise control their percolation in, contaminated ground or subsoil; or
 - the result of interventions in surface waters for the purposes, amongst others, of mitigating the effects of floods and droughts, and for the management of waters and waterways, including at international level.

Such interventions, including cutting, dredging, relocation and deposition of sediments in surface water, shall be conducted in accordance with general binding rules, and, where applicable, with permits and authorisations issued on the basis of such rules, developed by the Member States for that purpose, provided that such inputs do not compromise the achievement of the environmental objectives established for the water bodies under Directive 2000/60/EC.

Case Law

There have been no cases relevant to the interpretation of Directive 2006/118/EC. However, there is one case (C-416/02) concerning the relationship between the older Groundwater Directive 80/68/EEC and its relationship to the Nitrates Directive 91/676/EEC. In this case the European Commission sought a judgement against Spain for failure to carry out hydrogeological studies in an area affected by nitrate pollution around a pig farm in accordance with Articles 3(b), 5(1) and 7 of Directive 80/68/EEC. The Court, however, rejected this. It noted that the application of slurry was in accordance with good agricultural practice and that this was not 'disposal or tipping for the purposes of disposal of these substances' within the meaning of Article 5 of Directive 80/68/EEC. Also the Court stated that the system of protection of waters from pollution by livestock effluent is not based on Directive 80/68/EEC but on Directive 91/676/EEC (Nitrates Directive).

1.14 Nature Protection

Introduction

This chapter covers the two key pieces of EU legislation that relate to nature protection: Directive 2009/147/EC⁹⁵ (formerly 79/409/EEC) on the conservation of wild birds (commonly referred to as the birds Directive) and Directive 92/43/EEC⁹⁶ on the conservation of natural habitats and of wild fauna and flora (commonly referred to as the habitats Directive). The obligations under each Directive and the implications of this for project development will be examined in this section.

In addition to the above mentioned Directives, there are several related EU legislative measures that contribute to nature conservation. These include the environmental liability Directive 2004/35/EC; Directive 85/337/EC on EIA; and different Directives on water management. This chapter will not examine these instruments as they are covered in other chapters in the Sourcebook⁹⁷.

Directive 2009/147/EC provides a system of protection for all species of wild birds found in the EU. Member States are required to preserve, maintain or re-establish sufficient diversity and areas of habitats for wild birds. This is done primarily by the establishment of special protection areas (SPAs) to conserve particularly vulnerable species and through managing habitats both inside and outside protected areas. Since 1994, all SPAs form part of the Natura 2000 single ecological network, which also includes SACs designated under Directive 92/43/EEC (see below). The classification of SPAs is a matter for Member States, but is subject to supervision by the Commission, which can and has successfully initiated legal action against any Member State it considers has failed to designate SPAs areas which should have been identified and designated according to objective scientific (ornithological) criteria.

Directive 92/43/EEC aims to maintain and improve biodiversity in the EU through the conservation of natural habitats and the protection of wild fauna and flora. Member States are obligated to protect identified special areas of conservation (SACs) and establish necessary conservation measures for SACs in their territory. Lists of proposed sites of Community importance (SCI) are drawn up by Member States and submitted to the Commission for approval. Following adoption by the Commission, the list serves as a basis for formal designation by Member States of the SCIs as special areas of conservation (SACs). Member States are obliged to prevent any deterioration of sites and disturbance of species from the time they propose a SCI to its final designation as an SAC and thereafter following designation. In addition to the designation of these sites, Member States should 'endeavour' to encourage the

⁹⁵ Directive 2009/147/EC of 30 November 2009 on the conservation of wild birds (codified version), <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:020:0007:0025:EN:PDF>

⁹⁶ Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1992L0043:20070101:EN:PDF>

⁹⁷ See Chapter 1.3 on Environmental Liability; Chapter 1.1 on Environmental Impact Assessment and Chapter 1.12 on Surface Water Quality.

management of landscape features in their land-use planning and development policies to improve the ecological coherence of the Natura 2000 network (Article 10).

Implications for Project Development and Planned Activities

Article 6(3) of Directive 92/43/EEC states that any plan or project, not directly related to or necessary for the management of a site, that is ‘likely to have a significant effect’ on a designated site, either individually or cumulatively with other plans or projects, should be subject to an ‘*appropriate assessment* of its implications for the site in view of the site’s conservation obligations’. This obligation extends to SPAs designated under Directive 2009/147/EC and includes plans and projects that take place both within and outside a protected site. The planned location of a project within or near protected sites is likely to have implications for the development consent procedure and even for the possibility of obtaining such consent and it is therefore in the interest of project developers and sponsors to check the location of such sites in the territory of the intended host country⁹⁸ and to enquire with competent national authorities as to the applicable procedures for ‘appropriate assessment’. Although measures provided for in Natura 2000 contracts may have as their objective the conservation or restoration of a site, the works or developments provided may not be directly connected with or necessary for the management of that site, and thus such contracts are not systematically exempt from the assessment procedure⁹⁹.

The mechanism for environmental protection provided under Directive 92/43/EC is not triggered by the fact that a plan or project definitely has a ‘significant effect’, but rather, from the probability that such an adverse effect is possible. The extent to which a project’s impact is considered ‘significant’ is dependent on the particular environmental characteristics and conditions of the protected site and its specific conservation objectives.¹⁰⁰ Furthermore, an assessment cannot be avoided in certain categories of projects where doubts exist as to whether or not their effect on the protected site is significant. This includes ‘projects relating to installations or to the use of water’; ‘installations causing emissions’; ‘water abstraction plans and projects’ and ‘land use plans’.¹⁰¹

EU law provides provisional protection mechanisms for those sites in the ‘SAC pipeline’ which have not yet been officially designated (ie SCIs). Thus national authorities cannot approve a plan or project that adversely affects a site which *a priori* satisfies the criteria of Annex III of Directive 92/43/EEC and is likely to fall under the

⁹⁸ Links to Member States' national websites containing detailed information on all sites protected under Directives 2009/147/EC and 92/43/EEC can be found on the European Commission's Natura 2000 website at http://ec.europa.eu/environment/nature/natura2000/db_gis/index_en.htm

⁹⁹ Judgment of 4 March 2010, Case C-241/08, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:62008J0241:EN:HTML>

¹⁰⁰ Judgment of 7 September 2004, Case C-127/02, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:62002J0127:EN:HTML>

¹⁰¹ Judgment of 10 January 2006, Case C-98/03, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:62003J0098:EN:HTML>; Judgment of 20 October 2005, Case C-6/04, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:62004J0006:EN:HTML>

Natura 2000 network but has yet to be formally classified as such. The requirement to undertake an assessment does not apply to applications for authorisation formally submitted before the deadline for transposition of Directive 92/43/EEC in a Member State. For further information on the requirements under Article 6 of the Directive and their interpretation, readers may refer to the relevant Commission guidance documents¹⁰².

Article 6(3) does not specifically define any particular method for carrying out an ‘appropriate assessment’. The primary responsibility for assessing projects and plans falls on national authorities, and it is for the Member States to specify the procedure for doing so in their national legislation. This procedure may require project developers to provide information to national authorities for the purpose of assessing the likely impacts on protected sites.

Based on the conclusions of the assessment and, where appropriate, a public consultation, national authorities grant or refuse authorisation for the plan or project. National courts may be called on to assess the lawfulness of the authorisation of a particular project or plan, and to determine whether a national authority has kept within the limits of discretion set by the provisions of Article 6(3).¹⁰³ Where an assessment indicates that the plan or project threatens the integrity of the site, in principle it shall not be authorised, though Article 6(4) provides a possible exception to this rule (see below).

Suggested Procedure for Assessment

While Directive 92/43/EEC does not outline a method for carrying out an ‘appropriate assessment’, the Commission has produced methodological guidance on the provisions of Articles 6(3) and (4)¹⁰⁴ and a 2007 update on Article 6(4) clarifying the concepts of alternative solutions, imperative reasons of overriding public interest, compensatory measures, overall coherence and the opinion of the Commission¹⁰⁵. The Commission has also published on its website its opinions, where requested by Member States in accordance with Article 6(4) on proposed developments that may

¹⁰² Guidance Document on Managing Natura 2000 sites: the provisions of Article 6 of the Habitats Directive (92/42/EC), (2000), http://ec.europa.eu/environment/nature/natura2000/management/docs/art6/provision_of_art6_en.pdf

¹⁰³ Judgment of 7 September 2004, Case C-127/02, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:62002J0127:EN:HTML>

¹⁰⁴ Guidance document on the Assessment of Plans and Projects significantly affecting Natura 2000 sites (2001), http://ec.europa.eu/environment/nature/natura2000/management/docs/art6/natura_2000_assess_en.pdf

¹⁰⁵ Guidance document on Article 6(4) of the 'Habitats Directive' 92/43/EEC, Clarification of the concepts of: alternative solutions, imperative reasons of overriding public interest, compensatory measures, overall coherence, opinion of the Commission, (2007), http://ec.europa.eu/environment/nature/natura2000/management/docs/art6/guidance_art6_4_en.pdf

have a significant impact on priority species or habitats in Natura sites¹⁰⁶. The Commission's guidance is designed for use by developers, consultants, site managers and competent authorities and mirrors the approach to environmental assessments under the EIA Directive (see Chapter 1.1). Article 6 of Directive 92/43/EEC does not require a single assessment document to be produced. National competent authorities review several documents and evidence submitted by various stakeholders including project developers. The amount of information required depends on the type of project or plan in consideration and the characteristics of the site in question. Based on these documents, the competent authority then makes its decision regarding the authorisation of the proposed plan or project.

The Commission guidance document suggests the following procedure for carrying out an 'appropriate assessment' under Directive 92/43/EEC. This is not binding on Member States and it will therefore always be necessary for project developers to refer to applicable national legislation.

Stage 1: Initial screening

- Describe the project/plan and the characteristics of other projects/plans (existing or planned) of relevance and the Natura 2000 site in question.
- Identify the potential effects on the site through an examination of *inter alia* existing data on hydrogeology, key species, land-use plans, site management plans etc.
- Assess the significance of the effects of the project/plan individually and in combination with other projects/plans. This should be done in consultation with relevant national authorities and stakeholders. Key indicators may be used to assess the significance of effects. For example to assess the significance of a loss of habitat area, the percentage of the loss within the context of the amount of that habitat type in the Member State could be examined; to assess the significance of the disturbance to the habitat or a particular species, the duration or permanence of the disturbance and its distance from the site could be examined; to assess the significance of a loss in population density of a particular species the timescale for replacement could be examined; to assess the impact on water quality the relative change in key indicative chemicals and other elements could be analysed.

Depending on the outcome of this initial screening exercise, if it is concluded that there are likely to be no significant effects, the developer should complete a 'no significant effects' report which should be made available to all stakeholders. If however it is concluded that there are significant effects, the procedure described below should be followed.

¹⁰⁶DG Environment website, Management of Natura 2000 sites: Guidance, http://ec.europa.eu/environment/nature/natura2000/management/guidance_en.htm

Stage 2: Appropriate assessment by national competent authority

The national competent authority is responsible for carrying out an appropriate assessment of the proposed plan/project to consider its impact on the conservation objectives of the Natura 2000 site. Where there are adverse impacts, the competent authority is responsible for assessing options for mitigating these impacts. This assessment is based on information submitted by various stakeholders including the project developers and should include the following steps: full description of the project or plan; the site's conservation objectives; the aspects of the project that will affect the site's objectives; depending on the type of impact predicted, the likely impact of the plan or project on the site; based on these impacts, assess whether the plan or project will have an adverse effect on the conservation objectives and status of the site; where there are unavoidable adverse effects, mitigation measures to avoid such effects should be listed and evidence on how they will be implemented and monitored provided.

Stage 3: Assessment of alternative solutions by competent authority

Alternative ways to achieve the objectives of the project/plan that would avoid adverse effects on the site should be examined by the competent authority. These alternative solutions should be based on information provided by the project developers. Competent authorities should assess alternative solutions in terms of the objectives of the project/plan and their relative impact on the Natura 2000 site.

Stage 4: Assessment where no alternative solutions exist and adverse impacts remain

Where a project is deemed to be in the 'overriding public interest' and approved despite the adverse effects on the environment, compensatory measures that offset the adverse effects of the project, and maintain or enhance the overall coherence of the Natura 2000 network must be introduced. These measures are considered as an option of last resort and in order to be acceptable should: proportionately address the adversely affected habitats and species; relate to the same bio-geographic region in the Member State and be as close as possible to the affected region; provide comparable functions to those that led to the creation of the original designated site; and have clearly defined implementation, management and monitoring objectives.

Related Directives

Certain projects, particularly those related to transport infrastructure are likely to fall under both Directive 92/43/EEC and Directive 85/337/EEC on EIA. Both Directives are concerned with the environmental effects of certain public and private projects. Directive 85/337 applies to certain types of projects only (as listed in Annex I and II of the Directive) while Directive 92/43/EEC applies to all types of projects and plans (plans are not included in the EIA Directive) that are 'likely to have a significant effect' on a designated site. Annex III of the EIA Directive states that areas designated under Directive 92/43/EEC and 2009/147/EC are part of the criteria that need to be considered when screening Annex II projects, however this requirement does not trigger a mandatory EIA assessment. Member States must ensure that the impact studies of plans and projects fulfil the requirements of both Directive 92/43/EEC and

Directive 85/337/EEC. For example public consultation becomes mandatory under the EIA Directive (see Chapter 1.1 for further details), while it is optional under Directive 92/43/EEC (ie it depends on national legislation whether or not the public is to be consulted). Where projects are subject to the EIA Directive, Article 6 assessments can be integrated within the general EIA procedure. However, the ‘appropriate assessment’ required under Article 6 of Directive 92/43/EEC should be clearly distinguished within the environmental statement or reported separately.

Exceptions from the General Rule

EU nature protection measures may be subject to certain exceptions and in certain cases identified sites may be damaged or destroyed if it can be shown that the project must be carried out for ‘imperative reasons of overriding public interest, including those of social or economic nature’ in the absence of alternative solutions (Article 6(4) of Directive 92/43/EEC). The interpretation of what exactly constitutes an ‘overriding public interest’ is largely determined by national authorities. In its rulings, the ECJ has been careful to limit the interpretation of the ‘social and economic’ requirements which would justify the project. Furthermore, the wording of Article 6(4) implies that economic requirements cannot automatically be equated with to ‘imperative reasons of overriding public interest’. The ‘overriding public interest’ is generally interpreted to refer to situations where plans or projects are essential to protect the fundamental values of citizens’ lives; are fundamental policies for the State and society; carry out certain essential activities of economic or social nature; or fulfil specific obligations of public service. Where a site contains a priority habitat type or species, only considerations related to ‘human health or public safety, to beneficial consequences of primary importance for the environment or, further to an opinion from the Commission, to other imperative reasons of overriding public interest’ are legitimate grounds to derogate from protection obligations. The discretionary power of national authorities in allowing such derogations is limited in view of the fact that protection under both Directive 92/43/EEC and Directive 2009/147/EC is based on scientific considerations on the status of species and habitats.

If a project with a negative assessment is approved, it can be implemented subject to the Member State undertaking ‘all compensatory measures necessary to ensure that the overall coherence of Natura 2000 network is protected’. Compensatory measures should be independent of the project, aim to offset the negative effects of the project, be additional to existing measures implementing obligations under the Directives. What should *de facto* be compensated is the site’s structural and functional role in the overall EU network. The compensatory measures should take into account the quantity and quality of the habitats and species targeted as well as the structural and functional role played by the network in ensuring the adequate geographical distribution of the habitats and species targeted.

2 SECTOR-SPECIFIC REQUIREMENTS

2.1 ENERGY

2.1.1 *Combustion installations including thermal power stations*

Introduction

By burning fossil fuels, combustion installations generate emissions to air, water and soil, of which emissions to the air are considered to be the main environmental concerns. The most important emissions to air from the combustion of fossil fuels are SO₂, NO_x, CO, particulate matter (dust, like PM₁₀) and greenhouse gases, such as N₂O and CO₂. Other substances such as heavy metals, halide compounds, and dioxins are emitted in smaller quantities.

The emissions to air from large combustion (rated thermal input above 50MW) plants are mainly regulated by Directive 2001/80/EC¹⁰⁷ (commonly known as the Large Combustion Plant (LCP) Directive) and by Directive 2008/1/EC on IPPC (see Chapter 1.4). Best available techniques (BAT) for reducing emissions from combustion plants are described in the BAT Reference Document (BREF) for Large Combustion Plants developed pursuant to Directive 2008/1/EC. Combustion plants above 20 MW are also subject to the EU Emission Trading Scheme established by Directive 2003/87/EC (see Chapter 1.11).

The Large Combustion Plant Directive

The LCP Directive aims to tackle one of the principal causes of acid rain by limiting emissions of sulphur dioxide (SO₂) and nitrogen oxides (NO_x) from power stations and other large combustion plants such as oil refineries. It also restricts emissions of dust. The Directive also encourages combined generation of heat and power and the scope furthermore includes new gas turbines in order to regulate NO_x emissions as their use in electricity generation is growing.

Installations subject to the LCP Directive

The Directive applies to combustion plants with a thermal input of at least 50 MW, irrespective of the fuel used – where a combustion plant is ‘*any technical apparatus in which fuels are oxidised in order to use the heat thus generated*’ (Article 2(7)). It does not apply to the plants that make direct use of the product of combustion in manufacturing processes, in particular to:

- Combustion used for direct heating or drying or any other treatment of objects or materials;
- Post-combustion plants;

¹⁰⁷ Directive 2001/80/EC of the European Parliament and of the Council of 23 October 2001 on the limitation of emissions of certain pollutants into the air from large combustion plants, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2001L0080:20070101:EN:PDF>

- Facilities for the regeneration of catalytic cracking catalysts;
- Facilities for the conversion of hydrogen sulphide into sulphur;
- Reactors used in the chemical industry;
- Coke battery furnaces;
- Cowpers;
- Any technical apparatus to move a ship, vehicle or aircraft;
- Gas turbines on off-shore platforms;
- Gas turbines licensed before 27 November 2002, and already in operation no later than 27 November 2003;
- Plants powered by diesel, petrol and gas engines.

Different requirements are set for ‘new’ and ‘existing’ plants. For new plants, emissions limits to be set out in individual authorizations are defined. Existing plants can be subject to the limits for new plants, or alternatively can be subject to a national emission reduction plan, setting an overall limit for the emissions of the plants covered.

Emission limits

New plants are considered to be those for which a license was granted after 1 July 1987. Emission limit values for new plants are set either in part A (license fully required by 27 November 2002 and in operation by 27 November 2003) or in part B (others) of Annexes III to VII. The emission limit values set in part B are stricter than those in part A.

These annexes specify emission limit values for SO₂ in relation to solid fuels including biomass (Annex III), liquid fuels (Annex IV) and gas (Annex V). Emission limits are also set for NO_x (Annex VI) and dust (Annex VII). Emission limit values are shown in Tables 7-11 of this Chapter.

Member States must also ensure that, for licensed new plants, the technical and economic feasibility for providing combined generation of heat and power is examined.

Existing plants are defined as plants for which the original construction license, or the operating licence, was granted before 1 July 1987. Two routes are possible to reduce emissions from existing plants:

- All licences for the existing plants must contain conditions to comply with the emission limit values for SO₂, NO_x and dust set in part A of Annexes III to VII of the Directive;
- Alternatively, they can be subjected to a national emission reduction plan. It should be noted that the proposed values are minimum values and that Member States may adopt stricter values if they so wish. The aim is that the plan would lead to the same emission level that would have been achieved by applying the emission limit values individually to the existing plants in operation. In other words, the plan would allow some plants to exceed the limit values provided that emissions from other plants are below them.

Member States can also choose to adopt a ‘combined approach’ for the implementation of the LCP Directive for existing plants, which may consist of:

- Applying a national emission reduction plan for some plants and an emission limit value approach for others for all the compliance periods (2008-2015, 2016-2017, and 2018 onwards); or
- Adopting a national emission reduction plan for a/some compliance period(s) and complying with emission limit values for the rest of the compliance periods; or
- Mixing the two options above.

Existing plants may be exempted from compliance with the emission limit values and inclusion in national emission reduction plans under the following conditions:

- The plant operator informed the competent authority by 30 June 2004 that the plant will not be operated for more than 20,000 hours starting from 1 January 2008 and ending 31 December 2015;
- Each year the operator submits to the competent authority a record of the used and unused time allowed for the plant’s remaining operational life.

Some other derogations are foreseen in the LCP directive:

- Existing plants larger than 400MW and firing solid fuels are allowed to emit up to 800mg/Nm³ of SO₂ if they operate less than 2,000 hours per year between 2008 and 2016 and 1,500 hours per year thereafter;
- Existing plants larger than 500 MW and firing solid fuels are allowed to emit 600 mg/Nm³ of NO_x if they operate less than 2,000 hours per year between 2008 and 2016. Thereafter, these plants are allowed to emit 450 mg/Nm³ if they operate less than 1,500 hours;
- Existing coal fired plants using low-volatile fuels will be permitted to emit 1,200 mg/Nm³ of NO_x until 2018.

The competent authority may also allow for a suspension up to six months to comply with the emission limit values for a plant because of an interruption in the supply of low-sulphur fuel resulting from a serious shortage. Derogation (up to ten days except where there is an overriding need to maintain energy supplies) is also allowed when a plant that normally uses only gaseous fuel has to resort to other fuels because of the sudden interruption in the supply of gas.

All plants should discharge their waste gases in controlled fashion by means of a stack, whose height should be calculated so as to safeguard health and the environment. Where two or more separate new plants use a common stack (if this is approved by the competent authorities) they can be regarded as a single unit.

Monitoring requirements

The way emissions should be monitored is set out in Annex VIII of the LCP Directive. Operators are required to undertake continuous measurements of concentrations of SO₂, NO_x, and dust from waste gases from each combustion plant with a rated thermal input of 100 MW or more.

Discontinuous measurements (at least every 6 months) or other procedures approved by the competent authorities are allowed for:

- Emissions from combustion plants with a life span of less than 10 000 operational hours;
- SO₂ and dust from gas firing boilers and turbines;
- SO₂ from gas turbines or boilers firing oil with known sulphur content if there is no desulphurisation equipment;
- SO₂ from biomass firing boilers if the operator can prove that the SO₂ emissions cannot be higher than the prescribed emission limit values.

An operator has to inform the competent authorities about the results of all the measurements needed for compliance and of the checking of the measuring equipment.

Case law

There is no case law interpreting Directive 2001/80/EC.

Interaction with the IPPC Directive

The plants that are covered by the LCP Directive are also covered by Directive 2008/1/EC on IPPC (see Chapter 1.4). Therefore, the LCP Directive only sets minimum obligations which are not necessarily sufficient to comply with the IPPC Directive. Such compliance may involve more stringent emission limit values, emission limit values for other substances and other media, and other appropriate conditions.

Best Available Techniques for Large Combustion Plants

The BREF for Large Combustion Plants covers combustion installations with a rated thermal input exceeding 50 MW. These include the power generation industry and those industries where 'conventional' fuels are used – namely coal, lignite, biomass, peat, liquid and gaseous fuels (including hydrogen and biogas). Incineration of waste is not covered, but co-incineration of waste and recovered fuel in large combustion plants is addressed. The BREF covers also upstream and downstream activities that are directly associated to the combustion process.

The BATs for reducing emissions from large combustion plants, allowing the removal of dust (including partly heavy metals), SO₂, NO_x, HCl, HF and other pollutants and preventing water and soil contamination, are summarised below.

Unloading, storage and handling of fuel and additives

Some BATs can prevent releases from the unloading, storage and handling of fuels and additives (e.g. lime, limestone, ammonia, etc.). These are:

Reducing particulate matter:

- the use of loading and unloading equipment that minimises the height of fuel drop to the stockpile, to reduce the generation of fugitive dust (solid fuels);
- in countries where freezing does not occur, using water spray systems to reduce the formation of fugitive dust from solid fuel storage (solid fuels);
- placing transfer conveyors in safe, open areas aboveground so that damage from vehicles and other equipment can be prevented (solid fuels);
- using enclosed conveyors with well designed, robust extraction and filtration equipment on conveyor transfer points to prevent the emission of dust (solid fuels);
- rationalising transport systems to minimise the generation and transport of dust on site (solid fuels);
- the use of good design and construction practices and adequate maintenance (all fuels);
- storage of lime or limestone in silos with well designed, robust extraction and filtration equipment (all fuels).

Reducing water contamination:

- having storage on sealed surfaces with drainage, drain collection and water treatment for settling out (solid fuels);
- the use of liquid fuel storage systems that are contained in impervious bunds that have a capacity capable of containing 75 % of the maximum capacity of all tanks or at least the maximum volume of the largest tank. Tank contents should be displayed and associated alarms used and automatic control systems can be applied to prevent the overfilling of storage tanks (solid fuels);
- pipelines placed in safe, open areas aboveground so that leaks can be detected quickly and damage from vehicles and other equipment can be prevented. For non-accessible pipes, double walled type pipes with automatic control of the spacing can be applied (liquid and gaseous fuels);
- collecting surface run-off (rainwater) from fuel storage areas that washes fuel away and treating this collected stream (settling out or waste water treatment plant) before discharge (solid fuels).

Preventing fire:

- surveying storage areas for solid fuels with automatic systems, to detect fires, caused by self-ignition and to identify risk points (solid fuels).

Reducing fugitive emissions:

- using fuel gas leak detection systems and alarms (liquid and gaseous fuels).

Efficient use of natural resources

- using expansion turbines to recover the energy content of the pressurised fuel gases (natural gas delivered via pressure pipelines) (liquid and gaseous fuels);

- preheating the fuel gas by using waste heat from the boiler or gas turbine (liquid and gaseous fuels).

Reducing health and safety risk regarding ammonia

- for handling and storage of pure liquified ammonia: pressure reservoirs for pure liquified ammonia $>100 \text{ m}^3$ should be constructed as double wall and should be located subterraneously; reservoirs of 100 m^3 and smaller should be manufactured including annealing processes (all fuels);
- from a safety point of view, the use of an ammonia-water solution is less risky than the storage and handling of pure liquified ammonia (all fuels).

Fuel pre-treatment

Fuel pre-treatment of solid fuel implies blending and mixing in order to ensure stable combustion conditions and to reduce peak emissions. To reduce the amount of water in peat and biomass, drying of fuel is also considered to be part of BAT.

For liquid fuels, the use of pre-treatment devices, such as diesel oil cleaning units used in gas turbines and engines, are BAT. Heavy fuel oil (HFO) treatment comprises devices such as electrical or steam coil type heaters, de-emulsifier dosing systems, etc.

Thermal efficiency

One way to reduce the emission of CO_2 per unit of energy generated is the optimisation of the energy utilisation and the energy generating process, i.e. increasing thermal efficiency.

Cogeneration (CHP) is considered as the most effective option to reduce the overall amount of CO_2 released and is relevant for any new build power plant whenever the local heat demand is high enough to warrant the construction of the more expensive cogeneration plant instead of the simpler heat or electricity only plant. Other techniques can be applied to improve efficiency, like pulverised combustion (PC), dry bottom boiler (DBB), wet bottom boiler (WBB), fluidised bed combustion (FBC) and pressurised fluidised bed combustion (PFBC) for coal and lignite fired combustion plants. In the case of peat and biomass fired combustion plants, grate-firing, spreader-stoker, fluidised bed combustion (FBC), circulating fluidised bed combustion (CFBC), bubbling fluidised bed combustion (BFBC) can be used.

Heat and Recovery Steam Generators (HRSG) can be used for gas-fired combustion plants.

No specific thermal efficiency values instead were concluded when using liquid fuels in boilers and engines

The BAT conclusion to increase efficiency and the BAT associated levels for solid and gaseous fuels are summarised in the tables 1-3 below.

supplementary firing (HRSG) for electricity generation only			
Combined cycle without supplementary firing (HRSG) in CHP mode	<38	<35	75 – 85
Combined cycle with supplementary firing in CHP mode	<40	<35	75 – 85
Notes: HRSG Heat and Recovery Steam Generators CHP Combined Heat and Power			

Source: Based on EC (2005)

Particulate matter

Particulate matter (dust) emitted during the combustion of solid or liquid fuels arises almost entirely from their mineral fraction. By combustion of liquid fuels, poor combustion conditions lead to the formation of soot. Combustion of natural gas is not a significant source of dust emissions.

For dedusting off-gases from new and existing combustion plants, BAT is considered to be the use of an electrostatic precipitator (ESP) or a fabric filter (FF). Cyclones and mechanical collectors alone are not BAT, but they can be used as a pre-cleaning stage in the flue-gas path.

For combustion plants over 100 MW_{th}, and especially over 300 MW_{th}, Flue-Gas Desulfurisation (FGD) techniques, which are considered BAT for desulphurisation, also reduce particulate matter. The emission levels of particulate matter associated to BAT are shown in the table 4 below.

Table 4: BAT for the reduction of particulate emissions from some combustion plants

Capacity (MW _{th})	Dust emission level (mg/Nm ³)						BAT to reach these levels
	Coal and lignite		Biomass and peat		Liquid fuels for boilers		
	New plants	Existing plants	New plants	Existing plants	New plants	Existing plants	
50 – 100	5 – 20*	5 – 30*	5 – 20	5 – 30	5 – 20*	5 – 30*	ESP or FF
100 – 300	5 – 20*	5 – 25*	5 – 20	5 – 20	5 – 20*	5 – 25*	ESP or FF in combination FGD (wet, sd or dsi) for PC ESP or FF for FBC
>300	5 – 10*	5 – 20*	5 – 20	5 – 20	5 – 10*	5 – 20*	

Notes:

ESP: Electrostatic precipitator

FF: Fabric filter

PC Pulverised Combustion,

FGD(wet): Wet flue-gas desulphurisation

FGD (dsi): dry sorbent injection

FGD(sd): semi dry

FBC: Fluidised bed combustion

* Some split views appeared in these values

Source: Based on EC (2005)

Heavy metals

Most of the heavy metals emitted by combustion plants (As, Cd, Cr, Cu, Hg, Ni, Pb, Se, V, Zn) are normally released as compounds (e.g. oxides, chlorides) in association with particulates. Therefore, BAT to reduce the emissions of heavy metals is generally the application of high performance dedusting devices such as ESPs or FFs.

Hg and Se are partly present in the vapour phase. Mercury has a high vapour pressure at the typical control device operating temperatures, and its collection by particulate matter control devices, is highly variable. For ESPs or FFs operated in combination with FGD techniques, such as wet limestone scrubbers, spray dryer scrubbers or dry sorbent injection, an average removal rate of Hg is 75 %. The removal rate is higher if a high dust Selective Catalytic Reduction (SCR) is added.

SO₂ emissions

Emissions of sulphur oxides mainly result from the presence of sulphur in the fuel. Natural gas is generally considered free from sulphur. Desulphurisation of other industrial gases though may in some cases be necessary.

In general, for solid and liquid-fuel-fired combustion plants, the use of low sulphur fuel and/or desulphurisation is considered to be BAT. However, the use of low sulphur fuel for plants over 100 MW_{th} often needs to be complemented with other measures.

Other techniques that are considered to be BAT are mainly the spray dry scrubber desulphurisation and the wet scrubber. The latter though is not considered as BAT for plants with a capacity of less than 100 MW_{th}, due to its high costs. Dry FGD techniques, such as dry sorbent injection, are used mainly for plants with a thermal capacity of less than 300 MW_{th}.

SO₂ emission levels associated to BAT are shown in the table 5 below.

Table 5: BAT for the reduction of SO₂ emissions from some combustion plants

Capacity (MW _{th})	SO ₂ emission level (mg/Nm ³)						BAT to reach these levels
	Coal and lignite		Peat		Liquid fuels for boilers		
	New plants	Existing plants	New plants	Existing plants	New plants	Existing plants	
50 – 100	200 – 400* 150 – 400* (FBC)	200 – 400* 150 – 400* (FBC)	200 – 300	200 – 300	100 – 350*	100 – 350*	Low sulphur fuel or/and FGD (dsi) or FGD (sds) or FGD (wet) (depending on the plant size). Seawater scrubbing. Combined techniques for
100 – 300	100 – 200	100 – 250*	200 – 300 150 – 250 (FBC)	200 – 300 150 -300 (FBC)	100 – 200*	100 – 250*	
>300	20 – 150*	20 – 200* 100 – 200*	50 – 150	50 – 200	50 – 150*	50 – 200*	

	100 – 200 (CFBC/PFBC)	(CFBC/PFBC)	50 – 200 (FBC)				the reduction of NO _x and SO ₂ . Limestone injection (FBC).
Notes: FBC: Fluidised bed combustion CFBC: Circulating fluidised bed combustion PFBC: Pressurised fluidised bed combustion FGD(wet): Wet flue-gas desulphurisation FGD(sds): Flue-gas desulphurisation by using a spray dryer FGD(dsi): Flue-gas desulphurisation by dry sorbent injection * Some split views appeared in these values							

Source: Based on EC (2005)

Nitrogen Oxides (NO_x) emissions

For pulverised coal combustion plants, the reduction of NO_x emissions by primary and secondary measures, such as SCR, is BAT, where the reduction rate of the SCR system ranges between 80 and 95 %. For small solid fuel-fired plants without high load variations and with a stable fuel quality, the Selective Non Catalytic Reduction (SNCR) of NO_x technique is also regarded as BAT.

For pulverised lignite and peat-fired combustion plants, the combination of different primary measures is considered as BAT. This means, for instance, the use of advanced low NO_x burners in combination with other primary measures such as flue-gas recirculation, staged combustion (air-staging), reburning, etc.

In Fluidised Bed Combustion (FBC) boilers burning solid fuel, BAT is the reduction of NO_x emissions achieved by air distribution or by flue-gas recirculation. There is a small difference in the NO_x emissions from Bubbling Fluidised Bed Combustion (BFBC) and Circulating Fluidised Bed Combustion (CFBC).

The BAT conclusion for the reduction of NO_x emissions and the associated emission levels for various fuels are summarised in the tables 6-7 below.

Table 6: BAT for the reduction of NO_x from coal-and lignite-fired combustion plants

Capacity (MW _{th})	Combustion technique	NO _x emission level associated with BAT (mg/Nm ³)			BAT options to reach these levels
		New plants	Existing plants	Fuel	
50 – 100	Grate-firing	200 – 300*	200 – 300*	Coal and lignite	Pm and/or SNCR
	PC	90 – 300*	90 – 300*	Coal	Combination of Pm and SNCR or SCR
	CFBC and PFBC	200 – 300	200 – 300	Coal and lignite	Combination of Pm
	PC	200 –	200 – 450*	Lignite	

		450			
100 – 300	PC	90* – 200	90 – 200*	Coal	Combination of Pm in combination with SCR or combined techniques
	PC	100 – 200	100 – 200*	Lignite	Combination of Pm
	BFBC, CFBC and PFBC	100 – 200	100 – 200*	Coal and Lignite	Combination of Pm together with SNCR
>300	PC	90 – 150	90 – 200	Coal	Combination of Pm in combination with SCR or combined techniques
	PC	50 – 200*	50 – 200*	Lignite	Combination of Pm
	BFBC, CFBC and PFBC	50 – 150	50 – 200	Coal and Lignite	Combination of Pm
Notes:					
PC: Pulverised combustion					
BFBC: Bubbling Fluidised Bed Combustion					
CFBC: Circulating fluidised bed combustion					
PFBC: Pressurised fluidised bed combustion					
Pm: Primary measures to reduce NO _x					
SCR: Selective catalytic reduction of NO _x					
SNCR: Selective non catalytic reduction of NO _x					
The use of anthracite hard coal may lead to higher emission levels of NO _x because of the high combustion temperatures					
* Some split views appeared in these values					

Source: Based on EC (2005)

Table 7: BAT for the reduction of NO_x from peat, biomass and liquid fuel-fired combustion plants

Capacity (MW _{th})	NO _x -emission level (mg/Nm ³)				BAT to reach these levels
	Biomass and Peat		Liquid fuels		
	New plants	Existing plants	New plants	Existing plants	
50 – 100	150 – 250	150 – 300	150 – 300*	150 – 450	Combination of Pm SNCR/ SCR or combined techniques
100 – 300	150 – 200	150 – 250	50 – 150*	50 – 200*	
>300	50 – 150	50 – 200	50 – 100*	50 – 150*	
Notes:					
Pm: Primary measures to reduce NO _x					
SCR: Selective catalytic reduction of NO _x					
* Some split views appeared in these values					

Source: Based on EC (2005)

For new gas turbines, dry low NO_x premix burners (DLN) are BAT. For existing gas turbines, water and steam injection or conversion to the DLN technique is BAT. For gas-fired stationary engine plants, the lean-burn approach is BAT.

For most gas turbines and gas engines, SCR is also considered to be BAT. Retrofitting of an SCR system to a Combined Cycle Gas Turbine (CCGT) is technically feasible but is not economically justified for existing plants.

NO_x emission levels associated to BATs for gas-fired combustion plants are shown in the table 8 below.

Table 8: BAT for the reduction of NO_x and CO emissions from gas-fired combustion plants

Plant type	Emission level associated with BAT (mg/Nm ³)		O ₂ level (%)	BAT options to reach these levels
	NO _x	CO		
Gas turbines				
New gas turbines	20 – 50	5 – 100	15	Dry low NO _x premix burners or SCR
DLN for existing gas turbines	20 – 75	5 – 100	15	Dry low NO _x premix burners as retrofitting packages if available
Existing gas turbines	50 – 90*	30 – 100	15	Water and steam injection or SCR
Gas engines				
New gas engines	20 – 75*	30 – 100*	15	Lean-burn concept or SCR and oxidation catalyst for CO
New gas engine with HRSG in CHP mode	20 – 75*	30 – 100*	15	Lean-burn concept or SCR and oxidation catalyst for CO
Existing gas engines	20 – 100*	30 – 100	15	Low NO _x tuned
Gas-fired boilers				
New gas-fired boilers	50 – 100*	30 – 100	3	Low NO _x burners or SCR or SNCR
Existing gas-fired boiler	50 – 100*	30 – 100	3	
CCGT				
New CCGT without supplementary firing (HRSG)	20 – 50	5 – 100	15	Dry low NO _x premix burners or SCR
Existing CCGT without supplementary firing (HRSG)	20 – 90*	5 – 100	15	Dry low NO _x premix burners or water and steam injection or SCR
New CCGT with supplementary firing	20 – 50	30 – 100	Plant spec.	Dry low NO _x premix burners and low NO _x burners for the boiler part or SCR or SNCR
Existing CCGT with supplementary firing	20 – 90*	30 – 100	Plant spec.	Dry low NO _x premix burners or water and steam injection and low NO _x burners for the boiler part or SCR or SNCR
Notes: SCR: Selective catalytic reduction of NO _x SNCR: Selective non catalytic reduction of NO _x DLN: dry low NO _x HRSG: heat recovery steam generator				

CHP: Cogeneration CCGT: combined cycle gas turbine * Some split views appeared on these values
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Source: Based on EC (2005)

Carbon monoxide (CO) emissions

BAT for the minimisation of CO emissions, which appears in the intermediate product of the combustion process, is complete combustion, which goes along with good furnace design, the use of high performance monitoring and process control techniques, and maintenance of the combustion system.

Water contamination

Large combustion plants are also a significant source of water discharge (cooling and waste water) into rivers, lakes and the marine environment.

Any surface run-off (rainwater) from the storage areas that washes fuel particles away should be collected and treated (settling out) before being discharged. Oil separation wells are BAT to avoid any environmental damage from small amounts of oil contaminated washing water.

The BAT conclusion for wet scrubbing desulphurisation is related to the application of a waste water treatment plant. The waste water treatment plant consists of different chemical treatments to remove heavy metals and to decrease the amount of solid matter from entering the water. It includes an adjustment of the pH level, the precipitation of heavy metals and removal of the solid matter.

Waste and residues

Utilisation and re-use is, therefore, the best available option for combustion residues and by-products. There huge variety of utilisation possibilities for different by-products could not be covered in the BREF.

The end-product of the wet scrubbing technique is gypsum, which is a commercial product for the plant in most EU countries. It can be sold and used instead of natural gypsum (especially in the plasterboard industry).

Co-combustion of waste and recovered fuel

In general the BATs mentioned above for the removal of pollutants as well as techniques to prevent water and soil contamination are considered as BAT for the co-combustion of secondary fuel. A higher input of pollutants into the firing system can be balanced within certain limits by adaptation of the flue-gas cleaning system or by limitation of the percentage of secondary fuel that can be co-combusted.

Regarding the impact of co-combustion to the quality of the residues, the main BAT issue is maintaining the quality of gypsum, ashes, slag and other residues and by-products at the same level as those occurring without the co-combustion of secondary fuel for the purpose of recycling. If co-combustion leads to significant (extra) disposal

volumes of by-products or residues or extra contamination by metals (e.g. Cd, Cr, Pb) or dioxins, additional measures need to be taken to avoid this.

Emission Trading

Combustion installations with a rated thermal input exceeding 20 MW (except hazardous or municipal waste installations) are also subjected to the ETS under Directive 2003/87/EC (see Chapter 1.11). Operators of such plants (as well as of other installations, listed in an Annex) have to hold greenhouse gas (GHG) emission permits and are allowed to emit these gases up to a fixed allowance. The number of allowances is determined by Member States and allocated within a National Allocation Plan (NAP).

The Directive allows for pooling, which effectively allows a number of activities to be included in a bubble to allow them to buy and sell allowances as a group, which could include all the operations of a single company, or even sector, to trade as one.

Operators of installations are required to document all data for the installation's emissions from all sources. They are also required to operate an effective data management system and retain such information for a period of at least ten years. This data have to be submitted, verified, and then used by the competent authority to ensure sufficient number of allowances have been surrendered by the operator in respect of that same installation.

Revision of the BREF

The BREF is scheduled for revision. However, no draft conclusions concerning BAT have yet emerged.

2.1.2 Pipelines for carrying gas, steam, hot water, oil or chemicals

Introduction

Pipelines for carrying gas, steam, hot water, oil or chemicals are covered by the requirements of EIA Directive 85/337/EEC¹⁰⁸ but not by any other relevant EU environmental legislation. Pipelines transporting hazardous substances are excluded from the major accident prevention requirements of Directive 96/82/EC (Seveso II) and are only dealt with as part of the establishments covered this Seveso II Directive. A Strategic Environmental Assessment (SEA) under Directive 2001/42/EC would also be required for any public authority plans and programmes that set the framework for future development consent for those pipelines that are listed in Annex I and Annex II of the EIA Directive or requiring an Appropriate Assessment according to the Habitats Directive 92/43/EEC.

EIA

An EIA is always required for pipelines for the transport of gas, oil or chemicals with a diameter of more than 800 mm and a length of more than 40 km (Annex I projects). An EIA might be required for all other oil and gas pipeline installations as well as industrial installations carrying gas, steam or hot water (Annex II projects). For these Annex II projects Member States are required to determine on a case-by-case basis and/or through thresholds or criteria, set by the Member State in question, whether the project is subject to an EIA or not.

Further details about this screening procedure, as well as a description of the EIA process, can be found in Chapter 1.1.

Environmental Liability

Directive 2004/35/EC¹⁰⁹ covers damage to species and natural habitats protected at EU level under the Directive 79/409/EEC and Directive 92/43/EEC, damage to waters covered by the Directive 2000/60/EC and land contamination which causes significant risk of harming human health.

This Directive applies to environmental damage caused by any of the occupational activities listed in Annex III, and to any imminent threat of such damage occurring by reason of any of those activities. It also applies to other activities not listed in Annex III if they cause damage to protected species and natural habitats or poses an imminent threat of such damage occurring by reason of any of those activities,

¹⁰⁸ Council Directive of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1985L0337:20030625:EN:PDF>

¹⁰⁹ Directive 2004/35/CE of the European Parliament and of the Council of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2004L0035:20060501:EN:PDF>

whenever the operator has been at fault or negligent. None of the activities listed in Annex III are relevant for this chapter. Hence any environmental damage from the transport of chemicals, gas, steam, hot water and oil would be covered under the environmental liability Directive under the regime for activities not listed in Annex III.

2.1.3 Transmission of electrical energy by overhead cables

Introduction

Transmission of electrical energy by overhead cables is covered by the requirements of the EIA Directive 85/337/EEC¹¹⁰ but not by any other EU environmental legislation. A Strategic Environmental Assessment (SEA) would also be required under Directive 2001/42/EC for any public authority plans and programmes that set the framework for future development consent for these electrical cables that are covered by Annex I or Annex II in the EIA Directive or requiring an Appropriate Assessment according to the Habitats Directive 92/43/EEC.

EIA

An EIA is always required for the construction of overhead electrical power lines with a voltage of 220 kV or more and a length of more than 15 km (Annex I projects). An EIA might be required for all other overhead electrical power lines (Annex II projects). For these Annex II projects Member States are required to determine on a case-by-case basis and/or thresholds or criteria, set by the Member State in question, whether the project is subject to an EIA or not.

Further details about this screening procedure, as well as a description of the EIA process and its relationship with the SEA Directive, can be found in Chapter 1.1.

¹¹⁰ Council Directive of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1985L0337:20030625:EN:PDF>

2.1.4 Installations for hydroelectric energy production

Introduction

Installations for hydroelectric energy production are subject to the provisions of Directive 85/337/EEC¹¹¹ on environmental impact assessment.

In addition, EU legislation that relates to nature protection may also be relevant to hydroelectric installations, in particular Directive 2009/147/EC (formerly 79/409/EEC)¹¹² on the conservation of wild birds (commonly referred to as the Birds Directive) and Directive 92/43/EEC¹¹³ on the conservation of natural habitats (commonly referred to as the Habitats Directive).

Furthermore, there are a number of provisions under Directive 2000/60/EC¹¹⁴ (the Water Framework Directive) that impact hydroelectric installations.

Obligations with respect to Environmental Impact Assessment

Installations for hydroelectric energy production are listed under Annex II of the EIA Directive. Member States have some discretion regarding Annex II projects and consequently an EIA may or may not be undertaken as part of the consent procedure for the planned development.

Projects listed in Annex II must be subject to screening in order to evaluate whether they are likely to have significant environmental effects, and hence requiring an EIA. The screening is made through:

- a case-by-case examination of projects; or
- thresholds and criteria set by any of the Member States; or
- a combination of both.

Further details about this screening procedure as well as a description of the EIA process can be found in chapter 1.1.

¹¹¹ Council Directive of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1985L0337:20030625:EN:PDF>

¹¹² Directive 2009/147/EC of 30 November 2009 of the European Parliament and of the Council on the conservation of wild birds (codified version), <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:020:0007:0025:EN:PDF>

¹¹³ Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1992L0043:20070101:EN:PDF>

¹¹⁴ Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2000L0060:20080321:EN:PDF>

Obligations with respect to nature conservation

Directive 2009/147/EC provides a system of protection for all species of wild birds found in Europe, while Directive 92/43/EEC aims to maintain and improve biodiversity in the EU through the conservation of natural habitats and the protection of wild fauna and flora.

When proposing a new hydropower scheme, the developer must determine if the installation is located within, or is likely to have a ‘significant’ effect on the integrity of a designated, proposed, or candidate ‘Natura 2000’ site (Special Areas of Conservation (SAC) and/or Special Protection Areas (SPA), as designated under Directive 92/43/EEC and Directive 2009/147/EC, respectively). If a significant effect is likely, the ‘competent authorities’ are required to carry out an ‘appropriate assessment’ under Directive 92/43/EEC. The assessment aims at determining if these effects will be (a) significant; and (b) adverse (this includes indirect effects from outside the site). Further details are provided in Chapter 1.14.

Obligations with respect to Water Management

Directive 2000/60/EC (Water Framework Directive) was introduced with the aim of coordinating water environment policy and regulation across Europe. The Directive applies to surface waters, that is lakes, rivers, transitional waters (estuaries) and coastal waters (up to one nautical mile from land) and to groundwater.

The environmental objectives are set out in Article 4 of Directive 2000/60/EC and require Member States to:

- prevent deterioration of ecological quality and pollution of surface waters and restore polluted waters, in order to achieve good water status in all surface waters by 31 December 2015;
- prevent deterioration of groundwater quality, restore polluted groundwater, and ensure a balance between abstraction and recharge of groundwater, in order to achieve good groundwater status in all groundwater by 31 December 2010;
- comply with all standards and objectives relating to Protected Areas by 31 December 2010, unless otherwise specified in the Community, national or local legislation under which the individual Protected Areas have been established.

The key criterion for judging performance is the achievement of ‘good ecological status’.

Hydropower generation represents a water use that results in physical alteration. For new hydropower schemes that will either downgrade the ecological status or cause it to drop below good it may be possible to apply derogations listed under Article 4(7).

The list of derogations from meeting some of the environmental objectives includes situations where:

- heavily modified water bodies are designated;
- technical feasibility to achieve objectives requires an extension to the deadline;
- cost implications to achieve objectives requires an extension to the deadline;
- natural conditions require additional time to meet the objectives.

Member States are also allowed to fail to meet the requirements of the Directive when this is due to new modifications of the physical characteristics of a surface water body or alterations to the levels of groundwater or where water status declines from high to good due to ‘new sustainable human development activities’. In such cases the following conditions must be met:

- to take all practical mitigating steps;
- the reasons for the changes are of overriding public interest and/or the benefits to the environment and society are outweighed by the benefits to the new modifications to human health, safety or to ‘sustainable development’;
- the benefits cannot be achieved by other means due to technical or cost issues.

For projects falling under the scope of the Directive 85/337/EEC, the information provided by the EIA should be used in helping to determine if the above mentioned conditions for derogation are met. Furthermore, a joint procedure which combines the provisions of Directive 85/337/EEC and those of the Directive 2000/60/EC may be applied by Member States.

For projects which do not fall under the scope of Directive 85/337/EEC, a specific water assessment procedure implemented by each Member State in accordance with its national legislation should determine if these conditions are met.

The provisions which allow derogation from the objectives laid down in Directive 2000/60/EC cannot however be used as an exemption from fulfilling the legal requirements of other Directives. For instance, a new development that would cause deterioration of the status of a water body and that fails to achieve the objectives for a Natura 2000 site would have to fulfil the requirements of both Directive 2000/60/EC and Directive 92/43/EEC, i.e.:

- the relevant conditions set out in Article 4(7) of Directive 2000/60/EC for allowing deterioration of status would have to be met to the extent that it is a water body; and
- the conditions set out in Article 6 of Directive 92/43/EEC for allowing a failure to achieve a Natura 2000 site conservation objectives.

The crucial issues under Directive 2000/60/EC in respect to hydroelectric installations are river continuity, the level of residual flow and surge limitation. But the actual effects of this Directive on hydropower highly depend on national implementation. The Directive allows national legislators relatively broad room in the process of transposition, to allow the national peculiarities of water use and the relevant economic issues to be taken into consideration.

In conclusion, new hydropower projects are compatible with Directive 2000/60/EC as long as external effects – e.g. on the water environment – are taken into account properly by the use of the Article 4(7) test. A policy paper was developed through a collaborative programme involving the European Commission, all the EU Member States and several stakeholders. The paper provides guidance on the exemptions of Article 4(7) and represents an informal consensus among the various parties¹¹⁵. By the end of 2008 the Commission intends to prepare a more ‘comprehensive guidance document’.

As for existing schemes, this will either reclassify the water body as heavily modified or establish a lesser objective. In order for a derogation to apply, the social and economic benefits must be shown to outweigh any negative impact on the ecology. The proposal must also demonstrate that it will be the best environmental option. For hydropower schemes this must consider both the best use of the available water resource for hydropower and also whether alternative means for generating electricity by a renewable resource would be more appropriate. The scheme will also have to adopt best practice to mitigate its impact on the ecology of the water body.

¹¹⁵ <http://www.espo.be/downloads/archive/ae0362be-40c7-4de6-bc9e-3880b975fed6.doc>

2.1.5 Installations for energy production from wind power (wind farms)

Introduction

Wind farm developments are subject to the EIA provisions of Directive 85/337/EEC¹¹⁶. In addition, EU legislation relating to nature protection may also have implications for wind farms, in particular Directive 2009/147/EC (formerly 79/409/EEC)¹¹⁷ on the conservation of wild birds (commonly referred to as the Birds Directive) and Directive 92/43/EEC¹¹⁸ on the conservation of natural habitats and of wild fauna and flora (commonly referred to as the Habitats Directive).

This chapter will examine the provisions of the EU legislation that needs to be taken into account in the development of wind power infrastructure projects. However, several provisions at national and local level also need to be considered, mainly concerning spatial planning and noise regulations. Also, international guidelines apply for wind farms developed in non-EU countries.

Obligations with respect to Environmental Impact Assessment

Wind farms are listed under Annex II of Directive 85/337/EEC as ‘installations for the harnessing of wind power for energy production (wind farms)’. Member States have some discretion regarding Annex II projects and consequently an EIA may or may not have to be undertaken as part of the consent procedure for the planned development.

Projects listed in Annex II must be subject to screening in order to evaluate whether they are likely to have significant environmental effects, and hence requiring an EIA. The screening is made through:

- a case-by-case examination of projects; or
- thresholds and criteria set by any of the Member States; or
- a combination of both

Most of the Member States are using a combination of both thresholds and the case-by-case approach for screening Annex II projects. But each Member State utilizes different criteria, generally stated in the codifying legislation, to determine whether a wind farm project is subject to EIA. Usually this includes estimating noise, shadow effects of wind turbines, and visual impact, but the amount of work needed generally varies according to the countries and the size of the project.

¹¹⁶ Council Directive of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1985L0337:20030625:EN:PDF>

¹¹⁷ Directive 2009/147/EC of 30 November 2009 of the European Parliament and of the Council on the conservation of wild birds (codified version), <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:020:0007:0025:EN:PDF>

¹¹⁸ Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1992L0043:20070101:EN:PDF>

Several of the Member States appear to have implemented their own ‘rules’ with regards to the types of wind projects which require EIA. For example, many countries simply require that any wind farm larger than a certain number of turbines (ranging from 2 to 20) or generating capacity (ranging from 1 to 10 MW) falls under the provisions of an EIA, whereas other Member States apply a financial threshold.

Furthermore, the EIA Directive does not distinguish between onshore and offshore wind energy projects. But additional requirements usually apply for offshore wind farms which are linked with maritime laws and authorisation of farm-to-shore cable for connection to the grid. An EIA is generally required by all countries.

Further details about the screening procedure as well as a description of the EIA process can be found in Chapter 1.1.

Obligations with respect to nature conservation

Directive 2009/147/EC (formerly 79/409/EEC) provides a system of protection for all species of wild birds found in Europe, while Directive 92/43/EEC aims to maintain and improve biodiversity in the EU through the conservation of natural habitats and the protection of wild fauna and flora.

In case a proposed wind farm site is located within, or would be likely to significantly impact, a designated, proposed, or candidate ‘Natura 2000’ Site (Special Areas of Conservation (SAC) and/or Special Protection Areas (SPA), as designated under Directive 92/43/EEC and Directive 2009/147/EC, respectively), it is required that an ‘appropriate assessment’ be carried out under Directive 92/43/EEC. The assessment aims at ensuring that wind farm development does not cause adverse effects on the integrity of these sites (this includes indirect effects from outside the site). Further details are provided in Chapter 1.14.

In general it is recommended that in order to minimise the potential for adverse effects on birds, including the risk of collisions, wind farm developers assess known bird migration routes, local flight paths, foraging areas, and coastal and inland wetland sites and upland sites of high ornithological importance, particularly those supporting large populations of migratory waterfowl. Developers should also take into account the potential sensitivities of ridges and valleys, and of cliff and headland locations where large numbers of birds may concentrate.

2.1.6 Crude-oil refineries

Introduction

Crude-oil refineries are subject to the EIA provisions of the Directive 85/337/EEC¹¹⁹. In addition, mineral oil and gas refineries are subject to the permitting requirements of Directive 2008/1/EC¹²⁰ (IPPC Directive), under Section 1.2 of Annex I of that Directive.

Directive 2001/80/EC¹²¹ on the limitation of emissions of certain pollutants into the air from large combustion plants (commonly referred to as the Large Combustion Plant Directive) applies to combustion plants with a rated thermal input equal to or greater than 50 MW. Plants covered include petroleum refineries. The LCP Directive applies without prejudice to the requirements of Directive 2008/1/EC, meaning that any IPPC requirements which are additional to those of Directive 2001/80/EC take precedence, notably the requirement for emission limit values (ELVs) to be set on the basis of the application of best available techniques (BAT).

In addition, refineries have to comply with air quality mandatory standards which are established in Directive 2008/50/EC¹²² (see Chapter 1.11). These are to be taken account of in setting emission limit values in permits issued to installations regulated by Directive 2008/1/EC.

Refineries are also included under Directive 2003/87/EC establishing the EU Emission Trading Scheme (EU ETS). Refineries are defined as ‘mineral oil refineries’ in Annex 1 of that Directive. Directive 2003/87/EC also includes any combustion installation over 20 MW which could cover generation plants in the refinery sector. Member States were obliged to develop National Allocation Plans (NAPs) specifying the total amount of CO₂ allowances (European Union Allowances – EUAs) that they have allocated to the refinery sector and how they have been allocated. The EU ETS introduced rigorous monitoring, reporting and verification under the Commission’s Monitoring and Reporting Guidelines. According to these guidelines refinery installations in Group C (installations emitting more than 500ktCO₂ per year) should meet the top-tier (most accurate) monitoring specifications. Installations emitting less

¹¹⁹ Council Directive of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1985L0337:20030625:EN:PDF>

¹²⁰ Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:024:0008:0029:EN:PDF>

¹²¹ Directive 2001/80/EC of the European Parliament and of the Council of 23 October 2001 on the limitation of emissions of certain pollutants into the air from large combustion plants, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2001L0080:20070101:EN:PDF>

¹²² Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:152:0001:0044:EN:PDF>

than 500ktCO₂ per year should also aim to meet top-tier requirements, unless it is not technically feasible to do so or it would lead to unreasonable costs.

Furthermore, under Directive 92/43/EEC on the conservation of natural habitats (commonly referred to as the Habitats Directive), existing plants (including refineries) have to ensure that there is 'no deterioration' in the surrounding environment, whereas new plants have to demonstrate that there are 'no adverse effects' from their operations.

This chapter will examine the provisions of Directive 85/337/EEC on EIA and of Directive 2008/1/EC on IPPC that apply to crude-oil refineries and will outline the procedures to be followed. Furthermore, this chapter will outline the relevant BREF note developed to assist in the implementation of Directive 2008/1/EC.

Obligations with respect to Environmental Impact Assessment

The development of crude-oil refineries (excluding undertakings manufacturing only lubricants from crude oil) is listed under Annex I of Directive 85/337/EEC and consequently an EIA is mandatory and must always be undertaken as part of the consent procedure for the planned development.

When planning to develop a crude-oil refinery, developers are required to submit a certain minimal amount of information concerning the project and its effects to the competent authorities in the Member State. In regards to the development of crude-oil refineries, the main considerations are likely to be the scale of development, emissions to air, discharges to water, the risk of accident and the arrangements for transporting. Any authorities with relevant information are required to make this available to the developer on request.

Further details about the EIA process can be found in Chapter 1.1.

Obligations with respect to Integrated Pollution Prevention and Control

Mineral oil and gas refineries are subject to Directive 2008/1/EC (commonly referred to as the IPPC Directive), under Section 1.2 of Annex I of that Directive. As a result, refineries must be made subject to authorisation through permitting.

Information generated with respect to any other legislation, including Directive 85/337/EEC on EIA, may be included as part of an IPPC application. Further details about the IPPC authorisation procedure can be found in Chapter 1.4.

All permits falling under the provisions of Directive 2008/1/EC must be based on the concept of BAT, which is defined in Article 2 of that Directive.

Best Available Techniques for Oil Refineries

The BREF note for the Mineral Oil and Gas Refinery Industry¹²³, describing BAT for this sector, is most relevant for the permitting of new process units in existing refineries or the update and renewal of permits for existing facilities.

There is no specific crude oil refining ‘process’. The complexity of a refinery means that they are all slightly different and this in turn gives rise to individual solutions and thus unique configurations. When determining BAT for crude oil refining, it is necessary to look at each unit operation individually and select BAT for that operation. Nevertheless, a number of environmental technologies can be used in most refineries and a certain generalisation can be made when discussing the topic.

Generic (whole refinery) BAT

BAT for Good Housekeeping and Environmental Management

Techniques to consider when examining BAT for general refinery management include environmental management tools such as the development of an Environmental Management System (EMS), scheduling of maintenance, training and safety management. These are techniques for continuous improvement of environmental performance which often prevent emissions.

A good EMS would require implementing a monitoring system that allows adequate processing and emissions control. Some elements of a monitoring system could include:

- continuous monitoring of pollutants for high volume flows with a high variability in pollutant concentrations;
- periodic monitoring or the use of emission relevant parameters for flows with a low variability;
- regular calibration of measurement equipment; and
- periodic verification of measurement by simultaneous comparative measurements.

Emissions to Air

The overall reduction of emissions to air is achieved in practice by a combined effort on the performance of the ‘processes/activities’ (e.g. improved SRU efficiency, application of low NO_x techniques) and on the performance of the ‘integrated/whole’ installation (e.g. energy efficiency, fuel management, sulphur balance). However, there is no consensus on a range of emission values under the bubble concept which could be associated with BAT.

BAT is to:

¹²³ Available at: <http://eippcb.jrc.ec.europa.eu/pages/FActivities.htm>

- improve the energy efficiency (reduction of all air pollutants generated by combustion) by enhancing heat integration and recovery throughout the refinery, applying energy conservation techniques and optimising the energy production/consumption;
- use clean RFG and, if necessary, to supply the rest of the refinery energy demand, liquid fuel combined with control and abatement techniques or other fuel gases such as natural gas or liquefied petroleum gas LPG;
- reduce sulphur dioxide emissions by:
 - quantifying the sulphur emissions from various refinery sources to identify the main emitters in each specific case. This quantification is an element of the sulphur balance;
 - using BAT applicable to SO₂ emission reduction in the energy system, catcrackers and cokers;
 - efficient operation of the sulphur recovery unit; and
 - reducing SO₂ emissions from typically small contributors when they become a significant part of the total emission and if cost-effective (e.g. flaring, gases from vacuum ejector gas burnt in furnaces).
- reduce nitrogen oxides emissions by:
 - quantifying the NO_x emission sources in order to identify the main emitters (e.g. furnaces and boilers, the FCC regenerators and gas turbines) in each specific case; and
 - using BAT applicable to NO_x reduction in the energy system and catcracker.
- reduce particulate emission by:
 - quantifying the particulate emission sources (especially furnaces and boilers, the FCC regenerators and cokers) in order to identify the main emitters in each specific case;
 - minimising the particulate emissions from solids handling situations (catalyst loading/unloading, coke handling, sludge transport) by applying good housekeeping and control techniques; and
 - using BAT applicable to particulate reduction in the energy system, catcrackers and cokers.
- reduce volatile organic carbons emissions by:
 - quantifying VOC emission sources (e.g. by DIAL) in order to identify the main emitters in each specific case;
 - executing LDAR campaigns or equivalent. A good LDAR includes the determination of the type of measurement, frequency, type of components to be checked, type of compound lines, what leaks should be repaired and how fast the action should be taken;
 - using a maintenance drain-out system;
 - selecting and using low-leakage valves such as graphite-packed valves or equivalent (especially important for control valves) for lines containing product with a high vapour pressure;
 - using low leak pumps (e.g. seal-less designs, double seals, with gas seals or good mechanical seals) on product lines carrying fluid with a high vapour pressure;
 - minimising flanges (easier to apply in the design stage), installing sealing rings on leaking flanges and use of high integrity sealing materials (fire safe) in flanges (very important for heat exchangers);
 - blinding, plugging or capping open-ended vent and drain valves;

- routing relief valves with high potential VOC emissions to flare;
- routing compressor vents with high potential for VOC emissions back to process and when not possible (e.g. vent compressor distance pieces) to refinery flare for destruction;
- using totally closed loop in all routine samplers that potentially may generate VOC emissions minimising flaring; e.g. covering separators, basins and inlet bays and by routing off-gases in the WWTP. Implementation of some of those techniques may compromise efficient operation of WWTP or cause safety concerns if they are not properly designed and managed. For these reasons, this technique may have technical problems when retrofitted. Consider as part of an odour abatement programme; and
- using BAT applicable to VOC reduction in storage and handling.

Discharges to Water

BAT for Reduction of Discharges to Water is to:

- Apply a water management scheme (as part of the EMS) aimed at reducing:
 - the volume of water used in the refinery by:
 - water stream integration options including water optimisation studies;
 - re-using as much as possible the cleaned waste water; and
 - applying techniques to reduce waste water generated within each specific process/activity.
 - the contamination of water by:
 - segregation of contaminated, low-contaminated or non-contaminated water streams and, where possible, drainage systems. This entails the complete system of fresh water supply, rainwater, ballast water, sanitary water, process water, boiler feed water, cooling water, groundwater as well as effluent collection, storage and the various (primary, secondary and tertiary) waste water treatment systems. Many of those waters end up in a single waste water treatment where they may be mixed after they have been appropriately (pre)treated. In existing installations, this segregation may be very costly and may require space for implementation;
 - segregation of “once-through” cooling water from process effluent until after this has been treated;
 - good housekeeping in operation and maintenance of existing facilities (as part of the EMS);
 - spill prevention and control; and
 - applying techniques to reduce contamination of waste water within each specific process/activity.
- Achieve the following water parameters in the WWTP effluent:
 - by a suitable combination of:

- a three-step waste water treatment plant consisting of gravity separation, advanced physical separation (e.g. FFU) and biotreater;
- a nitrification/denitrification process;
- ensure design of WWTP includes sufficient capacity to prevent toxic shock loads to the biotreater e.g. by the use of a buffer tank, diversion tank, oversized reactor, etc.;
- good process practices and housekeeping to prevent contamination of the waste water (see Table 12); and
- combination of waste water from several processes with comparable qualities for pre-treatment (e.g. treatment of sour water from primary distillation unit, catalytic cracker, coking and from other sour water sources by stripping).

Table 12: Water parameters in the WWTP effluent

Parameters	Concentration (mg/l) (monthly average)	Load (g/tonne crude oil or feedstocks processed) (yearly averages)
Total hydrocarbon content	0.05 – 1.5	0.01 – 0.75
Biochemical oxygen demand (5 day ATU @ 20 °C)	2 – 20	0.5 – 11
Chemical oxygen demand (2 hour)	30 – 125	3 – 70
Ammoniacal nitrogen (as N) 0.25 - 10 0.1 - 6	0.25 – 10	0.1 – 6
Total nitrogen 1.5 - 25 0.5 - 15	1.5 – 25	0.5 – 15
Suspended solids (dried @ 105 °C)	2 – 50	1 – 25
Total metals (As, Cd, Co, Cr, Cu, Hg, Ni, Pb, V, Zn)	<0.1 - 4	

Solid Waste Management

BAT for Solid Waste Management is to:

- implement a solid waste management system (as part of the EMS). This includes:
 - annual reporting of waste quantities;
 - implementing a plan with measures for waste reduction including recycling and/or recovery;

- operating the WWTP so as to maximise performance, with the minimum of sludge production;
 - implementing good housekeeping activities; and
 - applying BAT determined on forthcoming waste BREF.
- minimise oil spills and exclude oil spills that contaminate the soil (as part of the good housekeeping activities). This includes, among other things:
 - implementing a plan to exclude leakage from pipework and tanks (part of the EMS). This plan may include inspection, corrosion monitoring, leak detection instruments, double bottoms etc.;
 - performing a risk analysis to rank in order of significance cases where an accidental leak may occur (elements to consider are the product in the tanks/pipes, the age of the equipment, the nature of the soil and groundwater that would be affected). Prioritise areas where impermeable floors are needed most. Produce a multiyear master plan to programme necessary steps; and
 - designing new installations with the minimum of underground piping. In existing installations, include underground pipes in risk assessment process referred to above.
 - apply techniques to reduce solid waste generated within each specific process/activity.

In addition to the above mentioned generic BATs, the BREF also covers the various processes and activities, which are unit-specific-BAT applicable to the particular case. BATs are provided for the following processes/activities:

- Alkylation
- Base Oil Production
- Bitumen Production
- Catalytic Cracking
- Catalytic Reforming
- Coking Processes
- Cooling Systems
- Desalting
- Energy Systems
- Etherification
- Gas Separation Processes
- Hydrogen consuming Processes
- Hydrogen Production
- Integrated Refinery Management
- Isomerisation
- Polymerisation
- Primary Distillation Units
- Product Treatments
- Storage and Handling of refinery materials
- Visbreaking
- Waste Gas Treatments.

2.1.7 Installations for the gasification or liquefaction of coal or bituminous shale

Introduction

This chapter addresses installations for the gasification and liquefaction of coal or bituminous shale. Such installations are covered by the provisions of Directive 85/337/EEC¹²⁴ on EIA. In addition, installations for coal gasification or liquefaction are subject to Directive 2008/1/EC¹²⁵ on IPPC. Consequently, reference should be made to the applicable provisions of the BREF on Large Combustion Plants and the BREF on Mineral Oil and Gas Refineries.

Furthermore, a number of provisions of Directive 2000/60/EC¹²⁶ apply to this activity. Also, several provisions of Directive 2004/35/EC¹²⁷ on environmental liability need to be taken into account.

Obligations with respect to Environmental Impact Assessment

Installations for the gasification or liquefaction of 500 tonnes or more of coal or bituminous shale per day are listed under Annex I of Directive 85/337/EEC in its amended form and consequently an EIA is mandatory and must always be undertaken as part of the consent procedure for the planned development.

Obligations with respect to Integrated Pollution Prevention and Control

Installations for coal gasification or liquefaction¹²⁸ are also subject to Directive 2008/1/EC, under Section 1.4 of Annex I of the Directive. As a result, such installations must be made subject to authorisation through permitting.

Information generated in respect of any other legislation, including Directive 85/337/EEC on EIA, may be included as part of an IPPC application. Further details about the IPPC authorisation procedure can be found in Chapter 1.4.

All permits falling under the provisions of Directive 2008/1/EC must be based on the concept of BAT, which is defined in Article 2 of the Directive.

¹²⁴ Council Directive of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1985L0337:20030625:EN:PDF>

¹²⁵ Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:024:0008:0029:EN:PDF>

¹²⁶ Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2000L0060:20080321:EN:PDF>

¹²⁷ Directive 2004/35/CE of the European Parliament and of the Council of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2004L0035:20060501:EN:PDF>

¹²⁸ The gasification and liquefaction of feed stocks other than coal, such as shale, is not subject to IPPC.

Best Available Techniques for Coal Gasification and Liquefaction

For the main environmental issues and impact of the gasification and liquefaction of coal or bituminous shale reference should be made to the applicable provisions of the BREF on Large Combustion Plants¹²⁹ (see its section 4 on coal), and the BREF on Mineral Oil and Gas Refineries¹³⁰ (section 14 addresses gasification).

Directive 2001/80/EC

Implications of the Directive 2001/80/EC¹³¹ on the limitation of emissions of certain pollutants into the air from large combustion plants (commonly referred to as the Large Combustion Plants Directive) may need to be considered. Provisions of this Directive would apply if the proposed combustion plant utilising gas had a net thermal input of 50 MW or more. The Directive applies without prejudice to Directive 2008/1/EC, meaning that any IPPC requirements which are additional to those of Directive 2001/80/EC take precedence, notably the requirement for emission limit values (ELVs) to be set on the basis of the application of BAT.

Obligations with respect to water management

The amount of water required to operate a coal liquefaction plant is significant and is used mainly for process water, boiler feed water and cooling water. Another focus of environmental concerns is on the contaminants in discharged water. In addition, coal gasification can contaminate ground water. Therefore, a number of provisions under the Directive 2000/60/EC (commonly referred to as the Water Framework Directive) apply to this activity.

Directive 2000/60/EC was introduced with the aim of coordinating water environment policy and regulation across Europe. The Directive applies to surface waters, that is lakes, rivers, transitional waters (estuaries) and coastal waters (up to one nautical mile from land) and to ground waters.

The environmental objectives are set out in Article 4 of the Directive and require Member States to:

- prevent deterioration of ecological quality and pollution of surface waters and restore polluted waters, in order to achieve good water status in all surface waters by 31 December 2015;

¹²⁹ Integrated Pollution Prevention and Control (IPPC), Reference Document on Best Available Techniques for Large Combustion Plants, July 2006, <http://eippcb.jrc.es/reference/lcp.html>

¹³⁰ Integrated Pollution Prevention and Control (IPPC), Reference Document on Best Available Techniques for Mineral Oil and Gas Refineries, February 2003, <http://eippcb.jrc.es/reference/ref.html>

¹³¹ Directive 2001/80/EC of the European Parliament and of the Council of 23 October 2001 on the limitation of emissions of certain pollutants into the air from large combustion plants, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2001L0080:20070101:EN:PDF>

- prevent deterioration of groundwater quality, restore polluted groundwater, and ensure a balance between abstraction and recharge of groundwater, in order to achieve good groundwater status in all ground waters by 31 December 2010; and
- comply with all standards and objectives relating to Protected Areas by 31 December 2010, unless otherwise specified in the Community, national or local legislation under which the individual Protected Areas have been established.

The key criterion for judging performance is the achievement of ‘good ecological status’.

The list of derogations from meeting some of the environmental objectives includes situations where:

- heavily modified water bodies are designated;
- technical feasibility to achieve objectives requires an extension to the deadline;
- cost implications to achieve objectives requires an extension to the deadline; and
- natural conditions require additional time to meet the objectives.

Member States are also allowed to fail to meet the requirements of the Directive when this is due to new modifications of the physical characteristics of a surface water body or alterations to the levels of ground water or where water status declines from high to good due to ‘new sustainable human development activities’. In such cases the following conditions must be met:

- all practical mitigating steps should be taken;
- the reasons for the changes are of over-riding public interest and/or the benefits to the environment and society are outweighed by the benefits to the new modifications to human health, safety or to ‘sustainable development’; and
- the benefits cannot be achieved by other means due to technical or cost issues.

For projects falling under the scope of the Directive 85/337/EC on EIA, the information provided by such an assessment should be used in helping to determine if the above mentioned conditions for derogation are met. Furthermore, a joint procedure which combines the provisions of Directive 85/337/EC and Directive 2000/60/EC may be applied by Member States.

In conclusion, the activity of gasification and liquefaction of coal or bituminous shale is compatible with Directive 2000/60/EC as long as external effects – e.g. on the water environment – are taken into account properly by the use of the Article 4(7) test. As for ongoing activities, this will either reclassify the water body as heavily modified or establish a lesser objective. In order for a derogation to apply, the social and economic benefits must be shown to outweigh any negative impact on the environment. The proposal must also demonstrate that it will be the best environmental option.

2.2 PRODUCTION AND PROCESSING OF METALS

2.2.1 Ferrous metal processing (with a production capacity exceeding 20 tonnes per day)

Introduction

Ferrous metal foundries are regulated under the Directive 2008/1/EC¹³², further details of which are given in Chapter 1.4. This chapter describes the conclusions on BAT operating conditions described in the 2001 BREF on ferrous metal processing¹³³. The BREF covers the different industrial sub-sectors of the Ferrous Metals Processing sector: Hot and Cold Forming; Continuous Coating; Batch Galvanizing.

Hot and Cold Forming

This part of the ferrous metal processing sector includes manufacturing methods such as hot rolling, cold rolling and drawing of steel. The BREF describes the main environmental issues of hot rolling are emissions to air, especially NO_x and SO_x; the energy consumption of furnaces; (fugitive) dust emissions from product handling, rolling or mechanical surface treatment; oil- and solid-containing effluents and oil-containing wastes. Emissions to water from hot rolling basically comprise oil- and solid-containing effluents.

The key findings in the BREF regarding BAT for individual process steps and different environmental issues of hot rolling are summarized in Table 1 as set out in the BREF. All emission figures are expressed as daily mean values. Emissions to air are based on standard conditions of 273 K, 101.3 kPa and dry gas. Discharges to water are indicated as daily mean value of a flow-rate-related 24-hour composite sample or a flow-rate-related composite sample over the actual operating time (for plants not operated in three shifts).

Table 1: Key findings regarding BAT and associated emission/consumption levels for hot rolling

Best Available Techniques / Split views on BAT	BAT-associated emission and consumption levels/ Split views on associated levels
Storing and handling of raw materials and auxiliaries	

¹³² Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:024:0008:0029:EN:PDF>

¹³³ A full copy of the BREF is available at: <http://eippcb.jrc.ec.europa.eu/pages/FActivities.htm>

<ul style="list-style-type: none"> Collection of spillages and leakages by suitable measures, e.g. safety pits and drainage. 	
<ul style="list-style-type: none"> Separation of oil from the contaminated drainage water and reuse of recovered oil. 	
<ul style="list-style-type: none"> Treatment of separated water in the water treatment plant. 	
Machine scarfing	
<ul style="list-style-type: none"> Enclosures for machine scarfing and dust abatement with fabric filters. 	split view on dust level: < 5 mg/Nm ³ < 20 mg/Nm ³
<ul style="list-style-type: none"> Electrostatic precipitator, where fabric filters cannot be operated because of very wet fume. 	split view on dust level: < 10 mg/Nm ³ 20 - 50 mg/Nm ³
<ul style="list-style-type: none"> Separate collection of scale/swarf from scarfing. 	
Grinding	
<ul style="list-style-type: none"> Enclosures for machine grinding and dedicated booths, equipped with collection hoods for manual grinding and dust abatement by fabric filters. 	split view on dust level: < 5 mg/Nm ³ < 20 mg/Nm ³
All surface rectification processes	
<ul style="list-style-type: none"> Treatment and reuse of water from all surface rectification processes (separation of solids). 	
<ul style="list-style-type: none"> Internal recycling or sale for recycling of scale, swarf and dust. 	
Re-heating and heat treatment furnaces	
<ul style="list-style-type: none"> General measures, e.g. regarding furnace design or operation & maintenance. 	
<ul style="list-style-type: none"> Avoiding excess air and heat loss during charging by operational measures (minimum door opening necessary for charging) or structural means (installation of multi-segmented doors for tighter closure). 	
<ul style="list-style-type: none"> Careful choice of fuel and implementation of furnace automation/control to optimise the firing conditions. - for natural gas - for all other gases and gas mixtures - for fuel oil (< 1 % S) 	SO ₂ levels: < 100 mg/Nm ³ < 400 mg/Nm ³ up to 1700 mg/Nm ³
Split view:	
<ul style="list-style-type: none"> limitation of sulphur content in fuel to < 1 % is BAT lower S limit or additional SO₂ reduction measures is BAT 	
<ul style="list-style-type: none"> Recovery of heat in the waste gas by feedstock pre-heating Recovery of heat in the waste gas by regenerative or recuperative burner systems Recovery of heat in the waste gas by waste heat boiler or evaporative skid cooling (where there is a need for steam) 	Energy savings 25 - 50 % and NO _x reductions potentials of up to 50 % (depending on system).
<ul style="list-style-type: none"> Second generation low-NO_x burners 	NO _x 250 - 400 mg/Nm ³ (3% O ₂) without air pre-heating reported NO _x reduction potential of about 65 % compared to conventional.
<ul style="list-style-type: none"> Limiting the air pre-heating temperature. Trade-off energy saving vs. NO_x emission: Advantages of reduced energy consumption and reductions in SO₂, CO₂ and CO have to be weighed against the disadvantage of potentially increased emissions of NO_x 	

Split view: <ul style="list-style-type: none"> SCR and SNCR are BAT Not enough information to decide whether or not SCR/SNCR are BAT 	Achieved levels ² : SCR: NO _x < 320 mg/Nm ³ SNCR: NO _x < 205 mg/Nm ³ , ammonia slip 5 mg/Nm ³
<ul style="list-style-type: none"> Reduction of heat loss in intermediate products; by minimizing the storage time and by insulating the slabs/blooms (heat conservation box or thermal covers) depending on production layout. Change of logistic and intermediate storage to allow for a maximum rate of hot charging, direct charging or direct rolling (the maximum rate depends on production schemes and product quality). 	
<ul style="list-style-type: none"> For new plants, near-net-shape casting and thin slab casting, as far as the product to be rolled can be produced by this technique. 	
Descaling	
<ul style="list-style-type: none"> Material tracking to reduce water and energy consumption. 	
Transport of rolled stock	
<ul style="list-style-type: none"> Reduce unwanted energy loss by coil boxes or coil recovery furnaces and heat shields for transfer bars 	
Finishing train	
<ul style="list-style-type: none"> Water sprays followed by waste water treatment in which the solids (iron oxides) are separated and collected for reuse of iron content. 	
<ul style="list-style-type: none"> Exhaust systems with treatment of extracted air by fabric filters and recycling of collected dust. 	split view on dust level: < 5 mg/Nm ³ < 20 mg/Nm ³
Levelling and welding	
<ul style="list-style-type: none"> Suction hoods and subsequent abatement by fabric filters 	split view on dust level: < 5 mg/Nm ³ < 20 mg/Nm ³
Cooling (machines etc.)	
<ul style="list-style-type: none"> Separate cooling water systems operating in closed loops 	
Waste water treatment/ scale- and oil-containing process water	
<ul style="list-style-type: none"> Operating closed loops with recirculating rates of > 95 % 	
<ul style="list-style-type: none"> Reduction of emissions by using a suitable combination of treatment techniques (described in detail in Chapters A.4.1.12.2 and D.10.1). 	SS: < 20 mg/l Oil: < 5 mg/l (1) Fe: < 10 mg/l Crtot: < 0.2 mg/l (2) Ni: < 0.2 mg/l (2) Zn: < 2 mg/l
<ul style="list-style-type: none"> Recirculation of mill scale collected in water treatment to the metallurgical process Oily waste/sludge collected should be de-watered to allow for thermal utilisation or safe disposal. 	
Prevention of hydrocarbon contamination	

<ul style="list-style-type: none"> • Preventive periodic checks and preventive maintenance of seals, gaskets, pumps and pipelines. • Use of bearings and bearing seals of modern design for work- and back-up rolls, installation of leakage indicators in the lubricant lines (e.g. at hydrostatic bearings). • Collection and treatment of contaminated drainage water at the various consumers (hydraulic aggregates), separation and use of oil fraction, e.g. thermal utilisation by blast furnace injection. Further processing of the separated water either in the water treatment plant or in dressing plants with ultra filtration or vacuum evaporator. 	Reduction in oil consumption by 50-70 %.
Roll shops	
<ul style="list-style-type: none"> • Use of water-based degreasing as far as technically acceptable for the degree of cleanliness required. • If organic solvents have to be used, preference is to be given to non-chlorinated solvents. • Collection of grease removed from roll trunnions and proper disposal, such as by incineration. • Treatment of grinding sludge by magnetic separation for recovery of metal particles and recirculation into the steelmaking process. • Disposal of oil and grease-containing residues from grinding wheels, e.g. by incineration. • Deposition of mineral residues from grinding wheels and of worn grinding wheels in landfills. • Treatment of cooling liquids and cutting emulsions for oil/water separation. Proper disposal of oily residues, e.g. by incineration. • Treatment of waste water effluents from cooling and degreasing as well as from emulsion separation in the hot rolling mill water treatment plant. • Recycling of steel and iron turnings into the steelmaking process. 	
<p>¹ These are emission levels reported for the one existing SCR plant (walking beam furnace) and the one existing SNCR plant (walking beam furnace). ² oil based on random measurements 2 0.5 mg/l for plants using stainless steel</p>	

Cold Rolling

In cold rolling, the properties of hot rolled strip products are changed by compression between rollers without previous heating of the input. The BREF describes the main environmental issues of cold rolling are: acidic wastes and waste water; degreaser fume, acidic and oil mist emissions to air; oil-containing wastes and waste water; dust, e.g. from descaling and decoiling; NOx from mixed acid pickling and combustion gases from furnace firing.

The key findings in the BREF regarding BAT for individual process steps and different environmental issues of cold rolling are summarized in Table 2 as set out in the BREF. All emission figures are expressed as daily mean values. Emissions to air are based on standard conditions of 273 K, 101.3 kPa and dry gas. Discharges to water are indicated as daily mean value of a flow-rate-related 24-hour composite

sample or a flow-rate-related composite sample over the actual operating time (for plants not operated in three shifts).

Table 2: Key findings regarding BAT and associated emission/consumption levels for cold rolling

Best Available Techniques / Split views on BAT	BAT-associated emission and consumption levels/ Split views on associated levels
Decoiling	
<ul style="list-style-type: none"> Water curtains followed by waste water treatment in which the solids are separated and collected for reuse of iron content. Exhaust systems with treatment of extracted air by fabric filters and recycling of collected dust. 	split view on dust level: < 5 mg/Nm ³ < 20 mg/Nm ³
Pickling	
<p>General measures to reduce acid consumption and waste acid generation should be applied as far as possible, especially the following techniques:</p> <ul style="list-style-type: none"> Prevention of steel corrosion by appropriate storage and handling, cooling etc. Reduction of load on pickling step by mechanical pre-descaling in a closed unit, with an extraction system and fabric filters. Use of electrolytic pre-pickling. Use of modern, optimised pickling facilities (spray or turbulence pickling instead of dip pickling). Mechanical filtration and recirculation for lifetime extension of pickling baths. Side-stream ion-exchange or electro-dialysis (for mixed acid) or other method for free acid reclamation (described in Chapter D.6.9) for bath regeneration. 	
HCl pickling	
<ul style="list-style-type: none"> Reuse of spent HCl. or Regeneration of the acid by spray roasting or fluidised bed (or equivalent process) with recirculation of the regenerate; air scrubbing system as described in Chapter 4 for the regeneration plant; reuse of Fe₂O₃ by-product. 	Dust 20 -50 mg/Nm ³ HCl 2 – 30 mg/Nm ³ SO ₂ 50 - 100 mg/Nm ³ CO 150 mg/Nm ³ CO ₂ 180000 mg/Nm ³ NO ₂ 300 – 370 mg/Nm ³
<ul style="list-style-type: none"> Totally enclosed equipment or equipment fitted with hoods and scrubbing of extracted air. 	Dust 10 - 20 mg/Nm ³ HCl 2 – 30 mg/Nm ³
H ₂ SO ₄ Pickling	
<ul style="list-style-type: none"> Recovery of the free acid by crystallisation; air scrubbing devices for recovery plant. 	H ₂ SO ₄ 5 - 10 mg/Nm ³ SO ₂ 8 – 20 mg/Nm ³
<ul style="list-style-type: none"> Totally enclosed equipment or equipment fitted with hoods and scrubbing of extracted air. 	H ₂ SO ₄ 1 - 2 mg/Nm ³ SO ₂ 8 - 20 mg/Nm ³
Mixed acid pickling	
<ul style="list-style-type: none"> Free acid reclamation (by side-stream ion exchange or dialysis) or acid regeneration - by spray roasting: - or by evaporation process: 	Dust < 10 mg/Nm ³ HF < 2 mg/Nm ³ NO ₂ < 200 mg/Nm ³ HF < 2 mg/Nm ³ NO ₂ < 100 mg/Nm ³

<ul style="list-style-type: none"> • Enclosed equipment/hoods and scrubbing, and additionally: • Scrubbing with H₂O₂, urea etc. • or NO_x suppression by adding H₂O₂ or urea to the pickling bath • or SCR. 	for all: NO _x 200 - 650 mg/Nm ³ HF 2 - 7 mg/Nm ³
<ul style="list-style-type: none"> • Alternative: use of nitric acid-free pickling plus enclosed equipment or equipment fitted with hoods and scrubbing. 	
Heating of acids	
<ul style="list-style-type: none"> • Indirect heating by heat exchangers or, if steam for heat exchangers has to be produced first, by submerged combustion. • Not using direct injection of steam. 	
Minimization of waste water	
<ul style="list-style-type: none"> • Cascade rinsing systems with internal re-use of overflow (e.g. in pickling baths or scrubbing). • Careful tuning and managing of the 'pickling-acid regeneration-rinsing' system. 	
Waste water treatment	
<ul style="list-style-type: none"> • Treatment by neutralisation, flocculation, etc., where acidic water blow-down from the system cannot be avoided. 	SS: < 20 mg/l Oil: < 5 mg/l 1 Fe: < 10 mg/l Crtot: < 0.2 mg/l 2 Ni: < 0.2 mg/l 2 Zn: < 2 mg/l
Emulsion systems	
<ul style="list-style-type: none"> • Prevention of contamination by regular checking of seals, pipework etc. and leakage control. • Continuous monitoring of emulsion quality. • Operation of emulsion circuits with cleaning and reuse of emulsion to extend lifetime. • Treatment of spent emulsion to reduce oil content, e.g. by ultrafiltration or electrolytic splitting. 	
Rolling and tempering	
<ul style="list-style-type: none"> • Exhaust system with treatment of extracted air by mist eliminators (droplet separator). 	Hydrocarbons: 5 - 15 mg/Nm ³ .
Degreasing	
<ul style="list-style-type: none"> • Degreasing circuit with cleaning and reuse of the degreaser solution. Appropriate measures for cleaning are mechanical methods and membrane filtration as described in chapter A.4. • Treatment of spent degreasing solution by electrolytic emulsion splitting or ultrafiltration to reduce the oil content; reuse of separated oil fraction; treatment (neutralisation etc.) of separated water fraction prior to discharge. • Extraction system for degreasing fume and scrubbing. 	
Annealing furnaces	
<ul style="list-style-type: none"> • For continuous furnaces, low NO_x burners. 	NO _x 250-400 mg/Nm ³ without air pre-heating, 3 % O ₂ . Reduction rates of 60 % for NO _x and 87 % for CO
<ul style="list-style-type: none"> • Combustion air pre-heating by regenerative or recuperative burners or • Pre-heating of stock by waste gas. 	
Finishing/Oiling	

<ul style="list-style-type: none"> Extraction hoods followed by mist eliminators and/or electrostatic precipitators or Electrostatic oiling. 	
Levelling and welding	
<ul style="list-style-type: none"> Extraction hoods with dust abatement by fabric filters. 	split view on dust level: < 5 mg/Nm ³ < 20 mg/Nm ³
Cooling (machines etc.)	
<ul style="list-style-type: none"> Separate cooling water systems operating in closed loops. 	
Roll shops	
Refer to BATs listed above for roll shops in hot rolling.	
Metallic by-products	
<ul style="list-style-type: none"> Collection of scrap from cutting, heads and tails and recirculation into the metallurgical process. 	
¹ oil based on random measurements ² for stainless steel < 0.5 mg/l	

Wire Drawing

Wire drawing is a process in which wire rods/wires are reduced in size by drawing them through cone-shaped openings of a smaller cross section. The BREF describes the main environmental aspects of wire drawing are: air emissions from pickling, acidic wastes and waste water; fugitive soap dust (dry drawing), spent lubricant and effluents (wet drawing), combustion gas from furnaces and emissions and lead-containing wastes from lead baths.

The key findings from the BREF regarding BAT for individual process steps and different environmental issues of wire drawing are summarized in Table 3 as set out in the BREF. All emission figures are expressed as daily mean values. Emissions to air are based on standard conditions of 273 K, 101.3 kPa and dry gas. Discharges to water are indicated as daily mean value of a flow-rate-related 24-hour composite sample or a flow-rate-related composite sample over the actual operating time (for plants not operated in three shifts).

Table 3: Key findings regarding BAT and associated emission/consumption levels for wire drawing

Best Available Techniques	BAT-associated emission and consumption levels
Batch pickling	
<ul style="list-style-type: none"> Close monitoring of bath parameters: temperature and concentration. Operating within the limits given in Part D/Chapter D.6.1 ‘Open Pickling Bath Operation’. For of pickling baths with high vapour emission, e.g. heated or concentrated HCl-bath: installation of lateral extraction and possibly treating of the extraction air for both new and existing installations. 	HCl 2 – 30 mg/Nm ³ .
Pickling	

<ul style="list-style-type: none"> • Cascade Pickling (capacity >15 000 tonne wire rod per year) or • Reclamation of free acid fraction and reuse in pickling plant. • External regeneration of spent acid. • Recycling of spent acid as secondary raw material. • Non-acid descaling, e.g shot blasting, if quality requirements allow it. • Counter current cascade rinsing. 	
Dry drawing	
<ul style="list-style-type: none"> • Enclosing the drawing machine (and connecting to a filter or similar device when necessary), for all new machines with drawing speed ≥ 4 m/s. 	
Wet drawing	
<ul style="list-style-type: none"> • Cleaning and reuse of drawing lubricant. • Treatment of spent lubricant to reduce oil content in the discharge and/or to reduce waste volume, e.g. by chemical breaking, electrolytic emulsion splitting or ultrafiltration. • Treatment of discharge water fraction. 	
Dry and wet drawing	
<ul style="list-style-type: none"> • Closed cooling-water loops. • Not using once-through cooling water systems. 	
Batch annealing furnaces, continuous annealing furnaces for stainless steel and furnaces used in oil hardening and tempering	
<ul style="list-style-type: none"> • Burning of the protective gas purge. 	
Continuous annealing of low carbon wire and patenting,	
<ul style="list-style-type: none"> • Good housekeeping measures, as described in chapter A.4.3.7 for the lead bath. • Separate storage of Pb-containing wastes, protected from rain and wind. • Recycling of Pb-containing wastes in non-ferrous metals industry • Closed loop operation of quench bath. 	Pb < 5 mg/Nm ³ , CO < 100 mg/Nm ³ TOC < 50 mg/Nm ³ .
Oil-hardening lines	
<ul style="list-style-type: none"> • Evacuation of the oil mist from quench baths and removal of the oil mists, when appropriate. 	

Continuous Hot Dip Coating

In the hot dip coating process, steel sheet or wire is continuously passed through molten metal. The BREF describes the main environmental issues concerning this sub-sector are acidic air emissions, wastes and waste water; air emissions and energy consumption of furnaces, zinc-containing residues, oil- and chrome-containing waste waters.

The key findings in the BREF regarding BAT for individual process steps and different environmental issues of continuous hot dip galvanizing are summarized in Table 4 as set out in the BREF. All emission figures are expressed as daily mean values. Emissions to air are based on standard conditions of 273 K, 101.3 kPa and dry gas. Discharges to water are indicated as daily mean value of a flow-rate related 24-hour composite sample or a flow-rate-related composite sample over the actual operating time (for plants not operated in three shifts).

Table 4: Key findings regarding BAT and associated emission/consumption levels for continuous hot dip galvanizing

Best Available Techniques	BAT-associated emission and consumption levels
Pickling	
See above for Cold rolling Mills.	
Degreasing	
<ul style="list-style-type: none"> • Cascade degreasing. • Cleaning and recirculation of degreasing solution; appropriate measures for cleaning are mechanical methods and membrane filtration. • Treatment of spent degreasing solution by electrolytic emulsion splitting or ultrafiltration to reduce the oil content; reutilisation of separated oil fraction, e.g. thermally; treatment (neutralisation etc.) of the separated water fraction. • Covered tanks with extraction and cleaning of extracted air by scrubber or demister. • Use of squeeze rolls to minimize drag-out. 	
Heat treatment furnaces	
<ul style="list-style-type: none"> • Low-NOx burners. • Air pre-heating by regenerative or recuperative burners. • Pre-heating of strip. • Steam production to recover heat from waste gas. 	NOx 250 400 mg/Nm ³ (3% O ₂) without air pre-heating CO 100 - 200 mg/Nm ³
Hot dipping	
<ul style="list-style-type: none"> • Separate collection and recycling in the non-ferrous metals industry for zinc-containing residues, dross or hard zinc. 	
Galvannealing	
<ul style="list-style-type: none"> • Low-NOx burners. • Regenerative or recuperative burner systems. 	NOx 250-400 mg/Nm ³ (3% O ₂) without air pre-heating
Oiling	
<ul style="list-style-type: none"> • Covering the strip oiling machine or • Electrostatic oiling. 	
Phosphating and passivation/chromating	
<ul style="list-style-type: none"> • Covered process baths. • Cleaning and reuse of phosphating solution. • Cleaning and reuse of passivation solution. • Use of squeeze rolls. • Collection of skinpass/temper solution and treatment in waste water treatment plant. 	
Cooling (machines etc.)	
<ul style="list-style-type: none"> • Separate cooling water systems operating in closed loops. 	
Waste water	

<ul style="list-style-type: none"> Waste water treatment by a combination of sedimentation, filtration and/or flotation/ precipitation/flocculation. Techniques described in Chapter 4 or equally efficient combinations of individual treatment measures (also described in part D). For existing continuous water treatment plants which only achieve Zn < 4 mg/l, switch to batch treatment. 	SS: < 20 mg/l Fe: < 10 mg/l Zn: < 2 mg/l Ni: < 0.2 mg/l Crtot: < 0.2 mg/l Pb: < 0.5 mg/l Sn: < 2 mg/l
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Aluminizing of Sheet

Most BAT are the same as for hot dip galvanising. However, the BREF states that there is no need for a waste water treatment plant as only cooling water is discharged. BAT for heating is gas firing.

Lead-Tin Coating of Sheet

The BAT for lead-tin coating of sheet are set out in Table 5 as set out in the BREF.

Table 5: Key findings regarding BAT and associated emission/consumption levels for continuous lead-tin coating of sheet

Best Available Techniques	BAT-associated emission and consumption levels
Pickling	
Enclosed tanks and venting to a wet scrubber, treatment of waste water from the scrubber and pickling tank.	HCl < 30 mg/Nm ³ (1)
Nickel plating	
<ul style="list-style-type: none"> Enclosed process, ventilated to a wet scrubber. 	
Hot dipping	
<ul style="list-style-type: none"> Air knives to control coating thickness. 	
Passivation	
<ul style="list-style-type: none"> A no-rinse system and hence no rinse waters. 	
Oiling	
<ul style="list-style-type: none"> Electrostatic oiling machine. 	
Waste water	
<ul style="list-style-type: none"> Waste water treatment by neutralising with sodium hydroxide solution, flocculation/precipitation. Filter cake de-watering and disposed to landfill. 	
1 daily mean values, standard conditions of 273 K, 101.3 Pa and dry gas	

Coating of Wire

The key findings in the BREF regarding BAT for individual process steps and different environmental issues of wire coating are summarized in Table 6 as set out in the BREF. All emission figures are expressed as daily mean values. Emissions to air are based on standard conditions of 273 K, 101.3 kPa and dry gas. Discharges to water are indicated as daily mean value of a flow-rate-related 24-hour composite sample or a flow-rate-related composite sample over the actual operating time (for plants not operated in three shifts).

Table 6: Key findings regarding BAT and associated emission/consumption levels for wire coating

Best Available Techniques	BAT-associated emission and consumption levels
Pickling	
<ul style="list-style-type: none"> Enclosed equipment or equipment fitted with hoods and scrubbing of extracted air. Cascade pickling for new installations above a capacity of 15 000 tonne/year per line. Recovery of free acid fraction. External regeneration of spent acid for all installations. Reuse of spent acid as secondary raw material. 	HCl 2 - 30 mg/Nm ³ .
Water consumption	
<ul style="list-style-type: none"> Cascaded rinsing, possibly in combination with other methods to minimize water consumption, for all new and all large installations (> 15 000 tonne/year). 	
Waste water	
<ul style="list-style-type: none"> Waste water treatment by physico-chemical treatment (neutralisation, flocculation, etc.). 	SS: < 20 mg/l Fe: < 10 mg/l Zn: < 2 mg/l Ni: < 0.2 mg/l Crtot: < 0.2 mg/l Pb: < 0.5 mg/l Sn: < 2 mg/l
Fluxing	
<ul style="list-style-type: none"> Good housekeeping with special focus on reducing iron carry-over and bath maintenance. Regeneration of flux baths on site (side-stream iron removal). External reutilisation of spent flux solution. 	
Hot dipping	
<ul style="list-style-type: none"> Good housekeeping measures. 	Dust < 10 mg/Nm ³ Zinc < 5 mg/Nm ³
Zn-containing wastes	
<ul style="list-style-type: none"> Separate storage and protection from rain and wind, and reuse in the non-ferrous metals industry. 	
Cooling water (after the zinc bath)	
<ul style="list-style-type: none"> Closed loop or reuse of this relatively pure water as makeup water for other applications. 	

Batch Galvanizing

Hot dip galvanizing is a corrosion protection process in which iron and steel fabrications are protected from corrosion by coating them with zinc. The BREF describes the main environmental issues for batch galvanizing are emissions to air (HCl from pickling, and dust and gaseous compounds from the kettle); spent process solutions (degreasing solutions, pickling baths and flux baths), oily wastes (e.g. from cleaning of degreasing baths) and zinc-containing residues (filter dust, zinc ash, hard zinc).

The key findings in the BREF regarding BAT for individual process steps and different environmental issues of batch galvanizing are summarized in Table 7 as set out in the BREF. All emission figures are expressed as daily mean values. Emissions

to air are based on standard conditions of 273 K, 101.3 kPa and dry gas. Discharges to water are indicated as daily mean value of a flow-rate-related 24-hour composite sample or a flow-rate-related composite sample over the actual operating time (for plants not operated in three shifts).

Table 7: Key findings regarding BAT and associated emission/consumption levels for batch galvanizing

Best Available Techniques	BAT-associated emission and consumption
Degreasing	
<ul style="list-style-type: none"> • Installation of a degreasing step, unless items are totally grease free. • Optimum bath operation to enhance efficiency, e.g. by agitation. • Cleaning degreasing solutions to extend lifespan (by skimming, centrifuge, etc.) and recirculation, reutilization of oily sludge or • Biological degreasing' with in situ cleaning (grease and oil removal from degreaser solution) by bacteria. 	
Pickling + stripping:	
<ul style="list-style-type: none"> • Separate pickling and stripping unless a downstream process for the recovery of values from “mixed” liquors is installed on site or is available through a specialist external contractor. • Reuse of spent stripping liquor (external or internal e.g. to recover fluxing agent). In case of combined pickling and stripping: • Recovery of values from “mixed” liquors, e.g. use for flux production, recovery of acid for re-use in the galvanizing industry or for other inorganic chemicals 	
HCl pickling	
<ul style="list-style-type: none"> • Close monitoring of baths parameters: temperature and concentration. • If heated or higher concentrated HCl-baths are used: installation of extraction unit and treatment of extracted air (e.g. by scrubbing). • Special attention to actual pickling effect of bath and use of pickling inhibitors to avoid over-pickling. • Recovery of free acid fraction from spent pickle liquor or external regeneration of pickling liquor. • Zn removal from acid. • Use of spent pickle liquor for flux production. • Not using spent pickle liquor for neutralisation • Not using spent pickling liquor for emulsion splitting 	HCl 2 – 30 mg/Nm ³
Rinsing	
<ul style="list-style-type: none"> • Good drainage between pre-treatment tanks. • Implementation of rinsing after degreasing and after pickling. • Static rinsing or rinsing cascades. • Reuse of rinse water to replenish preceding process baths. Waste water-free operation (in exceptional cases where waste water is generated, waste water treatment is required). 	
Fluxing	
<ul style="list-style-type: none"> • Control of bath parameters and the optimised amount of flux used are also important to reduce emission further down the process line. • For flux baths: internal and external flux bath regeneration. 	
Hot dipping	

<ul style="list-style-type: none"> • Capture of emissions from dipping by enclosure of the pot or by lip extraction and dust abatement by fabric filters or wet scrubbers. • Internal or external reuse of dust, e.g. for flux production. The recovery system should ensure that dioxins, which may occasionally be present at low concentration due to upset conditions in the plant, do not build up as the dusts are recycled. 	Dust < 5 mg/Nm ³
Zn-containing wastes	
<ul style="list-style-type: none"> • Separate storage and protection from rain and wind, and reuse of contained values in the non-ferrous or other sectors. 	

Revision of the BREF

The BREF is scheduled for revision. However, no draft conclusions concerning BAT have yet emerged.

2.2.2 Installations for the production of non-ferrous crude metals

Introduction

Installations for the production of non-ferrous crude metals are regulated under the Directive 2008/1/EC¹³⁴, further details of which are given in Chapter 1.4. This chapter describes the conclusions on BAT operating conditions described in the 2001 non-ferrous metal processes BREF¹³⁵. A revision of the BREF is ongoing and although a first version of a draft BREF has been published, it is still at too early stage to be discussed here.

To deal with the complex area of the production of non-ferrous metals, the non-ferrous metal processes BREF covers the production of the metals from both primary and secondary raw materials together in one document and deals with the metals in 10 groups (mining and ore treatment at the mine site are not covered in the BREF):

- Copper (including Sn and Be) and its Alloys;
- Aluminium;
- Zinc, Lead and Cadmium, (+ Sb, Bi, In, Ge, Ga, As, Se, Te);
- Precious Metals;
- Mercury;
- Refractory Metals;
- Ferro Alloys;
- Alkali and Alkaline Earth Metals;
- Nickel and Cobalt;
- Carbon and Graphite.

Environmental Issues for the Industry

The sector covers a wide range of different process types including a range of metals. There is general concern over the potential emission and discharge of pollutants to air and water, production of waste and energy consumption. The BREF summarises the main issues for the production processes for each of the groups of metals as follows:

- “For the production of copper: SO₂, dust, metal compounds, organic compounds, wastewater (metal compounds), residues such as furnace linings, sludge, filter dust and slag. Dioxin formation during treatment of secondary copper materials is also an issue;
- For the production of aluminium: fluorides (incl. HF), dust, metal compounds, SO₂, COS, PAH, VOCs, green house gases (PFCs and CO₂), dioxins

¹³⁴ Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:024:0008:0029:EN:PDF>

¹³⁵ The BREF can be obtained at: <http://eippcb.jrc.ec.europa.eu/pages/FActivities.htm>

- (secondary), chlorides and HCl. Residues such as bauxite residue, Spent Pot Lining, filter dust and salt slag and wastewater (oil and ammonia);
- For the production of lead, zinc and cadmium: dust, metal compounds, VOCs (including dioxins), odours, SO₂, other acid gases, wastewater (metal compounds), residues such as sludge, the iron rich residues, filter dust and slag;
 - For the production of precious metals: VOCs, dust, metal compounds, dioxins, odours, NO_x, other acid gases such as chlorine and SO₂. Residues such as sludge, filter dust and slag and wastewater (metal compounds and organic compounds);
 - For the production of mercury: mercury vapour, dust, metal compounds, odours, SO₂, other acid gases, wastewater (metal compounds), residues such as sludge, filter dust and slag;
 - For the production of refractory metals, hardmetal powder and metal carbides: dust, solid hardmetal and metal compounds, wastewater (metal compounds), residues such as filter dust, sludge and slag. Process chemicals such as hydrogen fluoride (HF) are used for processing tantalum and niobium and are highly toxic. This needs to be taken into account in the handling and storage of these materials;
 - For the production of ferro-alloys: dust, metal compounds, CO, CO₂, SO₂, energy recovery, wastewater (metal compounds), residues such as filter dust, sludge and slag;
 - For the production of alkali and alkaline earth metals: chlorine, HCl, dioxin, SF₆, dust, metal compounds, CO₂, SO₂, wastewater (metal compounds), residues such as sludge, aluminate, filter dust and slag;
 - For the production of nickel and cobalt: VOCs, CO, dust, metal compounds, odours, SO₂, chlorine and other acid gases, wastewater (metal compounds and organic compounds), residues such as sludge, filter dust and slag;
 - For the production of carbon and graphite: PAHs, hydrocarbons, dust, odours, SO₂, wastewater prevention, residues such as filter dust”.

Key BAT Conclusions

The key conclusions on BAT in the non-ferrous metal processes BREF are summarised below.

Up-stream Activities

The BREF sets out general BAT recommendations concerning process management, supervision and the control of the process and abatement systems. This includes staff training, considering the environmental implications of new processes and materials, process design, using an audit trail for decision-making, adequate planning, good maintenance and monitoring. The BREF sets out detailed BAT for raw material storage and handling, such as adequate covering, use of closed drums and hoppers and appropriate drainage.

Process control

The BREF states that “process control techniques that are designed to measure and maintain optimum parameters such as temperature, pressure, gas components and

other critical process parameters, etc, are considered to be BAT”. These include effective sampling, good mixing of feed materials to achieve optimum efficiency and detailed monitoring of a range of different process operations such as furnace conditions, gas components, vibration (to detect blockages), current and voltage of electrolytic processes and emissions. This requires staff to be adequately trained in these activities.

Gas collection and abatement

The BREF sets out BAT for gas collection and abatement. Collection systems should be sealed to reduce leakage and maintain pressure. The BREF describes a range of options available. Fabric filters with modern wear resistant fabrics can collect dust and associated metals. The BREF states that “for sticky or abrasive dusts, wet electrostatic precipitators or scrubbers can be effective provided that they are properly designed for the application. Gas treatment for the smelting or incineration stage should include a sulphur dioxide removal stage and/or after-burning if this is considered necessary to avoid local, regional or long-range air quality problems or if dioxins may be present”.

Prevention and the destruction of dioxins

The BREF sets out the following techniques (which may be used in combination) to prevent and destroy dioxins which may be produced in many non-ferrous metal processes:

- “Quality control of scrap inputs depending on the process used. The use of the correct feed material for the particular furnace or process. Selection and sorting to prevent the addition of material that is contaminated with organic matter or precursors can reduce the potential for dioxin formation.
- The use of correctly designed and operated afterburners and rapid quenching of the hot gases to $< 250^{\circ}\text{C}$.
- The use of optimum combustion conditions. The use of oxygen injection in the upper part of a furnace to ensure complete combustion of furnace gases if necessary to achieve this.
- Absorption onto activated carbon in a fixed bed or moving bed reactor or by injection into the gas stream, and removal as filter dust.
- Very high efficiency dust removal for example, ceramic filters, high efficiency fabric filters or the gas cleaning train prior to a sulphuric acid plant.
- The use of a catalytic oxidation stage or fabric filters that incorporate a catalytic coating.
- The treatment of collected dusts in high temperature furnaces to destroy dioxins and to recover metals”.

The BREF states that the emission concentrations of dioxins “that are associated with the above techniques range from <0.1 to 0.5 ng/Nm^3 TEQ depending on the feed, the smelting or melting process and the techniques or combination of techniques that are used for dioxin removal”.

Metallurgical Processes

The BREF sets out conclusions on BAT with regard to selected processes. In most cases the BREF states that “the type of furnace has only a minor effect on BAT, provided that the furnace has been designed for the raw materials used and energy recovery is used where practicable”. However, there are exceptions. The BREF states that the “use of multiple point feeding of alumina to centre worked prebake cells is BAT for primary aluminium, as was the use of sealed furnaces in the production of some ferro-alloys to allow collection of high calorific value gas”. Also “for primary copper the reverberatory furnace is not considered to be BAT”. The BREF states that the other major influences are the blending of the raw materials, process control, management and the collection of fume. The BREF sets out a hierarchy in the choice of a new or changed process as:

- “Thermal or mechanical pre-treatment of secondary material to minimise organic contamination of the feed.
- The use of sealed furnaces or other process units to prevent fugitive emissions, allow heat recovery and allow the collection of process gases for other use (e.g. CO as a fuel and SO₂ as sulphuric acid) or for abatement.
- The use of semi-sealed furnaces where sealed furnaces are not available.
- The minimisation of material transfers between processes.
- Where such transfers are unavoidable, the use of launders in preference to ladles for molten materials.
- In some cases the restriction of techniques to those that avoid molten material transfers may prevent the recovery of some secondary materials that would then enter the waste stream. In these cases the use of secondary or tertiary fume collection is appropriate so that these materials can be recovered.
- Hooding and ductwork design to capture fume arising from hot metal, matte or slag transfers and tapping.
- Furnace or reactor enclosures may be required to prevent release of fume losses into the atmosphere.
- Where primary extraction and enclosure are likely to be ineffective, then the furnace can be fully closed and ventilation air drawn off by extraction fans to a suitable treatment and discharge system.
- The maximum use of the energy content of sulphidic concentrates”.

Emissions to Air

The BREF states that emissions to air arise from the storage, handling, pre-treatment, pyro-metallurgical and hydrometallurgical stages and transfer of materials is particularly important. Also the significance of fugitive emissions in many processes is very high. The BREF states environmental impacts can be reduced by following a hierarchy of gas collection techniques from material storage and handling, reactors or furnaces and from material transfer points and that potential fugitive emissions must be considered at all stages of process design and development. The BREF identified the hierarchy of gas collection from all of the process stages as:

- “Process optimisation and minimisation of emissions;
- Sealed reactors and furnaces;

- Targeted fume collection”.

The BREF states that “roofline collection of fume is very energy consuming and should be a last resort”.

Associated emissions to air are given in Table 1. The values are given as daily averages based on continuous monitoring during the operating period. In cases where continuous monitoring is not practicable the value is the average over the sampling period. Standard conditions are used: 273 K, 101.3 kPa, measured oxygen content and dry gas with no dilution of the gases.

The BREF states that sulphur capture is an important requirement when sulphidic ores or concentrates are roasted or smelted.

Table 1: Emissions to air associated with the use of BAT

Abatement Technique	Associated Range	Comment
Fabric filter	Dust 1 - 5 mg/Nm ³ Metals - dependent on dust composition	Depends on characteristics of dust.
Carbon or Bio filter	Total organic C < 20 mg/Nm ³	Phenol < 0.1 mg/Nm ³
Afterburner (including temperature quench for dioxin removal)	Total organic C < 5 - 15 mg/Nm ³ Dioxin < 0.1 - 0.5 ng/Nm ³ TEQ PAH (OSPAR 11) < 200 µgC/Nm ³ HCN < 2 mg/Nm ³	Designed for gas volume. Other techniques are available to reduce dioxins further by carbon/lime injection, catalytic reactors/filters.
Optimised combustion conditions	Total organic C < 5 - 50 mg/Nm ³	
Wet EP Ceramic filter	Dust < 5 mg/Nm ³	Depends on characteristics e.g. dust, moisture or high temperature
Wet or semi-dry alkaline scrubber	SO ₂ < 50 - 200 mg/Nm ³ Tar < 10 mg/Nm ³ Chlorine < 2 mg/Nm ³	
Alumina scrubber	Dust 1 - 5 mg/Nm ³ Hydrocarbon < 2 mg/Nm ³ PAH (OSPAR 11) < 200 µgC/Nm ³	
Chlorine recovery	Chlorine < 5 mg/Nm ³ .	Chlorine is re-used. Possible accidental fugitive releases.
Oxidising scrubber	NO _x < 100 mg/Nm ³	From use of nitric acid - recovery followed by removal of traces.
Low NO _x burner.	< 100 mg/Nm ³	Higher values are associated with oxygen enrichment to reduce energy use. In these cases gas volume and mass emission are reduced.
Oxy-fuel burner.	< 100 - 300 mg/Nm ³	
Sulphuric acid plant	> 99.7% conversion (double contact)	Including mercury scrubber using Boliden/Norzink process or thiosulphate scrubber Hg < 1 ppm in acid produced
	> 99.1% conversion (single contact)	
Cooler, EP, lime/carbon adsorption and fabric filter	PAH (OSPAR 11) < 200 µgC/Nm ³ Hydrocarbons (volatile) < 20 mgC/Nm ³ Hydrocarbons (condensed) < 2 mgC/Nm ³	
<p>Note. Collected emissions only. Associated emissions are given as daily averages based on continuous monitoring during the operating period and standard conditions of 273 K, 101.3 kPa, measured oxygen content and dry gas without dilution of the gases with air. In cases where continuous monitoring is not practicable the value will be the average over the sampling period. For the abatement system used, the characteristics of the gas and dust will be taken into account in the design of the system and the correct operating temperature used. For some components, the variation in raw gas concentration during batch processes may affect the performance of the abatement system.</p>		

Emissions to Water

The BREF notes that emissions to water arise from a number of sources and a variety of minimisation and treatment options are applicable depending on the source and the components present. Wastewater treatment systems can maximise the removal of metals using sedimentation and possibly filtration. The reagents used for precipitation may be hydroxide, sulphide or a combination of both, depending on the mix of metals present. It is also practicable in many cases to re-use treated water. Table 2 sets out examples of emission levels associated with the use of BAT.

Table 2: Example of emissions to water associated with the use of BAT

	Main components [mg/l]					
	Cu	Pb	As	Ni	Cd	Zn
Process water	<0.1	<0.05	<0.01	<0.1	<0.05	<0.15
Note: The associated emissions to water are based on a qualified random sample or a 24-hour composite sample. The extent of wastewater treatment depends on the source and the metals contained in the wastewater.						

Process Residues

Process residues are produced at various stages of the process and are highly dependent on the constituents of the raw materials. The BREF states that filter dusts can be recycled within the same plant or used for the recovery of other metals at other non-ferrous metal installations. Residues and slags can be treated to recover valuable metals and render the residues suitable for other uses e.g. as construction material. Some components can be converted into saleable products. Residues from water treatment may contain valuable metals and can be recycled in some cases.

Toxic Compounds

Where metals have toxic compounds that may be emitted from the processes, these need to be reduced.

Energy Recovery

The BREF states that energy recovery before or after abatement is applicable in the majority of cases but local circumstances are important, for example, where there is no outlet for the recovered energy. The BAT conclusions for energy recovery are:

- “Production of steam and electricity from the heat raised in waste heat boilers;
- The use of the heat of reaction to smelt or roast concentrates or melt scrap metals in a converter;
- The use of hot process gases to dry feed materials;
- Pre-heating of a furnace charge using the energy content of furnace gases or hot gases from another source;
- The use of recuperative burners or the pre-heating of combustion air.
- The use as a fuel gas of CO produced;
- The heating of leach liquors from hot process gases or liquors;
- The use of plastic contents in some raw materials as a fuel, provided that good quality plastic cannot be recovered and VOCs and dioxins are not emitted;
- The use of low-mass refractories where practicable”

Revision of the BREF

The BREF is scheduled for revision. It is at too early a stage to provide details of draft conclusions concerning BAT.

2.2.3 Installations for surface treatment of metals (and plastic materials) using an electrolytic or chemical process

Introduction

This chapter addresses installations defined under Annex 1 of Directive 2008/1/EC¹³⁶ (see Chapter 1.4) as: ‘Installations for the surface treatment of metals and plastics using an electrolytic or chemical process where the volume of the treatment vats exceeds 30 m³’. This chapter sets out BAT as described in the 2006 BREF on surface treatment of metals¹³⁷. The BREF does not deal with:

- hardening (with the exception of hydrogen de-embrittlement).
- other physical surface treatments such as vapour deposition of metals.
- hot-dip galvanising and the bulk pickling of iron and steels.
- surface treatment processes with solvents (see Chapter 2.11.1).
- electropainting (electrophoretic painting).

The BREF states that the main environmental impacts relate to energy and water consumption, the consumption of raw materials, emissions to surface and groundwaters, solid and liquid wastes and the site condition on cessation of activities. Water consumption is an important issue. The main pollutants of concern for water discharge are metals, cyanides and surfactants which may have low biodegradability and accumulative effects, e.g. NPE and PFOS. The BREF considers that the sector is not a major source of air emissions, but some may be locally important such as NO_x, HCl, HF and acid particulates.

Techniques to consider in determining BAT

The BREF highlights a wide range of issues to be considered in determining BAT in this sector. These are presented in 18 thematic headings:

- 1. Environmental management tools.** Use of environmental management systems is essential for minimising environmental impacts.
- 2. Installation design, construction and operation.** Measures can be applied to prevent and control unplanned releases.
- 3. General operational issues.** Techniques to protect the materials to be treated reduce the amount of processing required and, therefore, resulting consumptions and emissions.

¹³⁶ Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:024:0008:0029:EN:PDF>

¹³⁷ The BREF can be found at: <http://eippcb.jrc.ec.europa.eu/pages/FActivities.htm>

4. Utility inputs and their management. Techniques to optimise electricity consumption and energy and/or water used in cooling.

5. and 6. Drag-out reduction and control. In the use of rinsing techniques and drag-out recovery the retention of materials in the processes and using rinsing techniques to recover the drag-out reduce raw material and water consumption and reduce discharge of pollutants.

7. Other ways to optimise raw material usage. Avoiding poor process control which can lead to overdosing which increases material consumption and discharges.

8. Electrode techniques. The BREF states that “in some electrolytic processes, the metal anode operates at a higher efficiency than deposition, leading to metal build-up and increased losses, which in turn increase waste and quality problems”.

9. Substitution. Substitution for less hazardous for chemicals and processes.

10. Process solution maintenance. Techniques to remove contaminants that build up in solutions by drag-in or by breakdown of raw materials, etc.

11. Process metals recovery. Techniques to be used in conjunction with drag-out controls to recover metals.

12. Post-treatment activities. These include drying and de-embrittlement.

13. Continuous coil – large scale steel coil. Techniques which apply to large scale treatment of steel coils.

14. Printed circuit boards. Techniques specific to printed circuit board manufacture.

15. Air emission abatement. There are in-process and end-of-pipe techniques.

16. Waste water emission abatement. Techniques to reduce the generation of water pollutants and treatment techniques to avoid or reduce discharges.

17. Waste management. The minimisation of waste is dealt with by drag-out control and solution maintenance techniques.

18. Noise management. Good practice and/or engineered techniques reduce impacts.

BAT Conclusions

Generic BAT

In describing BAT, the BREF on surface treatment of metals firstly begins by describing generic BAT and then continues with BAT specific to individual activities.

The BREF states that it is BAT to implement environmental and other management systems, including “benchmarking consumptions and emissions (over time against internal and external data), optimising processes and minimising reworking”. To

protect the environment it is BAT to use “simple risk management to design, construct and operate an installation, together with techniques on emissions from storage when storing and using process chemicals and raw materials”. This aids in reducing impacts on site decommissioning.

BAT is to “minimise electrical losses in the supply system as well as to reduce heat losses from heated processes”. For cooling, it is BAT to “minimise water usage by using evaporation and/or closed loop systems, and to design and operate systems to prevent the formation and transmission of legionella”.

It is also BAT to “minimise material losses by retaining raw materials in process vats and at the same time minimise water use by controlling the drag-in and drag-out of process solutions, as well as rinsing stages, such as by jiggling and barrelling workpieces to enable rapid draining, preventing overdosing of process solutions and using eco rinse tanks and multiple rinsing with counter-current flows, especially with the return of rinse-water to the process vat”. The BREF considers that this can be enhanced by using techniques to recover materials from the rinsing stages. It states that the reference value for water usage using a combination of these techniques is 3 - 20 litres/m² of substrate surface/rinse stage.

The BREF states that BAT for precious metals, hexavalent chromium and cadmium requires the rinse flow for a specific process in a line to be reduced until the materials loop is closed. The BREF states that “this is not ‘zero discharge’, which applies to a whole process line or installation: this can be achieved in specific cases but is not generally BAT”.

The BREF states that further techniques to aid recycling and recovery are “to identify potential waste streams for segregation and treatment, to re-use materials such as aluminium hydroxide suspension externally, and to recover externally certain acids and metals”. BAT includes “prevention, separation of the waste water flow types, maximising internal recycling (by treating according to the use requirements) and applying adequate treatment for each final flow. This includes techniques such as chemical treatment, oil separation, sedimentation and/or filtration”.

Table 1 sets out values from the BREF that are achieved for a sample of surface treatment of metals installations each using several BAT. However, the BREF states that “the results do need interpretation through detailed consideration of the BREF itself”.

Table 1 : Emission levels associated with some plants using a range of BAT*

	Jig, barrel, small scale coil and other processes other than large scale steel coil		Large scale steel coil coating	
All values are mg/l	Discharges to public sewer (PS) or surface water (SW)	Additional determinands only applicable for surface water (SW) discharges	Tin or ECCS	Zn or Zn-Ni
Ag	0.1 – 0.5			
Al		1 – 10		
Cd	0.10 – 0.2			

CN free	0.01 – 0.2			
CrVI	0.1 – 0.2		0.001 – 0.2	
Cr total	0.1 – 2.0		0.03 – 1.0	
Cu	0.2 – 2.0			
F		10 – 20		
Fe		0.1 – 5	2 – 10	
Ni	0.2 – 2.0			
Phosphate as P		0.5 – 10		
Pb	0.05 – 0.5			
Sn	0.2 – 2.0		0.03 – 1.0	
Zn	0.2 – 2.0		0.02 – 0.2	0.2 – 2.2
COD		100 – 500	120 – 200	
Total Hydrocarbons		1 – 5		
VOX		0.1 – 0.5		
Suspended Solids		5 – 30	4 – 40 (surface waters only)	
*These values are for daily composites unfiltered prior to analysis and taken after treatment and before any kind of dilution, such as by cooling water, other process waters or receiving waters				

The BREF states that it is BAT to prevent fugitive emissions to air from some processes by extraction and treatment. It is also BAT to control noise by good practice techniques, e.g. “closing bay doors, minimising deliveries and adjusting delivery times, or if necessary, by specific engineered solutions”.

Specific BAT

The BREF states that it is BAT to use less hazardous substances. It is BAT to substitute EDTA for biodegradable alternatives or to use alternative techniques. The BREF states that “where EDTA has to be used, it is BAT to minimise its loss and treat any remaining in waste waters. For PFOS, it is BAT to minimise its use by controlling additions, minimising fumes to be controlled by techniques including floating surface insulation sections: however, occupational health may be an important factor. It can be phased out in anodising and there are alternative processes to hexavalent chromium and alkali cyanide-free zinc plating”.

The BREF states that “it is not possible to replace cyanide in all applications, but cyanide degreasing is not BAT. The BAT substitutes for zinc cyanide are acid or alkali cyanide free zinc, and for cyanide copper, acid or pyrophosphate options, with some exceptions”.

The BREF states that “Hexavalent chromium cannot be replaced in hard chromium plating. BAT for decorative plating is trivalent chromium or alternative processes such as tin-cobalt, however, at an installation level there may be specification reasons such as wear resistance or colour that require hexavalent chromium processing. Where hexavalent chromium plating is used, it is BAT to reduce air emissions by

techniques including covering the solution or vat and achieving closed loop for hexavalent chromium, and in new or rebuilt lines in certain situations, by enclosing the line. It was not currently possible to formulate a BAT for chromium passivation, although it is BAT to replace hexavalent chromium systems in phospho-chromium finishes with non-hexavalent chromium systems”.

The BREF states that “for degreasing, it is BAT to liaise with customers to minimise the grease or oil applied, and/or to remove excess oil by physical techniques. It is BAT to replace solvent degreasing by other techniques, usually water-based, except where these techniques can damage the substrate. In aqueous degreasing systems, it is BAT to reduce the amount of chemicals and energy used by using long-life systems with solution maintenance or regeneration”.

The BREF states that it is BAT to “increase process solution life, as well as preserving quality, by monitoring and maintaining solutions within established limits”. For pickling on a large scale, “it is BAT to extend the life of the acid by techniques including electrolysis”. The acids may also be recovered externally.

The BREF also sets out specific BAT for anodising, including recovering the heat from sealing baths. It states that “it is also BAT to recover caustic etch where there is high consumption, there are no interfering additives and the surface can meet specifications. It is not BAT to close rinse-water cycles using deionised water, because of the cross-media impacts of the regenerations”.

The BREF states that “for large scale continuous steel coil, in addition to the other relevant BAT, it is BAT to:

- use real time process controls to optimise processes;
- replace worn motors by energy efficient motors;
- use squeeze rollers to prevent process solution drag-in and drag-out;
- switch the polarity of the electrodes at regular intervals in electrolytic degreasing and electrolytic pickling;
- minimise oil use by using covered electrostatic oilers;
- optimise the anode-cathode gap for electrolytic processes;
- optimise conductor roll performance by polishing;
- use edge polishers to remove metal build-up on the edge of the strip;
- use edge masks to prevent excess metal build-up, and to prevent overthrow when plating one side only”.

The BREF states that for printed circuit boards manufacture “in addition to the other relevant BAT, it is BAT to:

- use squeeze rollers to prevent process solution drag-out and drag-in;
- use low environmental impact techniques for inner layer bonding steps;
- for dry resist: reduce drag-out, optimise the concentration and spraying of the developer and separate the developed resist from the waste water;
- for etching: optimise the etchant chemical concentrations regularly, and for ammonia etching, regenerate the etching solution and recover the copper”.

Revision of the BREF

The BREF is scheduled for revision. However, no draft conclusions concerning BAT have yet emerged.

2.3 CHEMICAL INDUSTRY

2.3.1 Chemical installations for the production of fertilizers

Chemical Installations for the production of fertilisers are covered by Directive 2008/1/EC¹³⁸ on IPPC, Directive 96/82/EC¹³⁹ on risk prevention and management (commonly known as the 'Seveso II' Directive) and the EIA Directive 85/337/EC as amended by 97/11/EC and 2003/35/EC¹⁴⁰. The generic requirements concerning the EIA Directive can be found in Chapter 1.1, those for the IPPC are addressed in Chapter 1.4 and those for risk prevention and management are addressed in Chapter 1.5.

Chemical installations are regulated by the EIA, IPPC, and Seveso Directives. It is important to be aware of the differences that exist between the project classification systems, scope and thresholds in each of the Directives. While the EIA Directive covers projects in a number of different sectors, the IPPC Directive has its focus on pollution control and sustainable use of natural resources in relation to industrial installations. The Seveso Directive focuses on the control of dangerous substances within a site.¹⁴¹

Requirements with respect to risk prevention

Directive 96/82/EC applies to establishments where dangerous substances are present in quantities equal to, or in excess of, the quantities listed in its Annex I. It sets the following requirements on establishments dealing with following fertilizers.

Ammonium Nitrate: Fertilisers Capable of Self-sustaining Decomposition

These are ammonium nitrate-based compound/composite fertilisers (compound/composite fertilisers containing ammonium nitrate with phosphate and/or potash) in which the nitrogen content as a result of ammonium nitrate is:

- between 15.75 % (15.75 % nitrogen content by weight as a result of ammonium nitrate corresponds to 45 % ammonium nitrate) and 24.5 % (24.5 % nitrogen content by weight as a result of ammonium nitrate corresponds to 70 % ammonium nitrate) by weight, and either with not more than 0.4 % total combustible/organic materials or which fulfil the requirements of Annex II of Directive 80/876/EEC,

¹³⁸ Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:024:0008:0029:EN:PDF>

¹³⁹ Council Directive 96/82/EC of 9 December 1996 on the control of major-accident hazards involving dangerous substances, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1996L0082:20031231:EN:PDF>

¹⁴⁰ Council Directive of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1985L0337:20030625:EN:PDF>

¹⁴¹ European Commission(2008), *Interpretation of definitions of certain project categories of Annex I and II of the EIA Directive*, 2008-022, 2008

- 15.75 % (15.75 % nitrogen content by weight as a result of ammonium nitrate corresponds to 45 % ammonium nitrate)) by weight or less and unrestricted combustible materials, and which are capable of self-sustaining decomposition according to the UN Trough Test¹⁴².

The qualifying quantity for a “notification” (Article 6) and a “major-accident prevention policy document” (Article 7) for these ammonium nitrates is 5000 tonnes. The qualifying quantity for a “safety report” (Article 9), which also triggers the requirement for “emergency plans” (Article 11), is 10 000 tonnes. A “major-accident prevention policy document” is not required in cases where a “safety report” has to be produced.

Ammonium nitrate: Fertiliser grade

These are straight ammonium nitrate-based fertilisers and ammonium nitrate-based compound/composite fertilisers in which the nitrogen content as a result of ammonium nitrate is:

- more than 24.5 % by weight, except for mixtures of ammonium nitrate with dolomite, limestone and/or calcium carbonate with a purity of at least 90 %,
- more than 15.75 % by weight for mixtures of ammonium nitrate and ammonium sulphate,
- more than 28 % (28 % nitrogen content by weight as a result of ammonium nitrate corresponds to 80 % ammonium nitrate) by weight for mixtures of ammonium nitrate with dolomite, limestone and/or calcium carbonate with a purity of at least 90 %, and which fulfil the requirements of Annex II of Directive 80/876/EEC.

The qualifying quantity for a “notification” (Article 6) and a “major-accident prevention policy document” (Article 7) for these ammonium nitrates is 1250 tonnes. The qualifying quantity for a “safety report” (Article 9), which also triggers the requirement for “emergency plans” (Article 11), is 5000 tonnes. A “major-accident prevention policy document” is not required in cases where a “safety report” has to be produced.

Ammonium Nitrate: Technical Grade

These are ammonium nitrate and preparations of ammonium nitrate in which the nitrogen content as a result of the ammonium nitrate is:

- between 24.5 % and 28 % by weight, and which contain not more than 0,4 % combustible substances,
- more than 28 % by weight, and which contain not more than 0.2 % combustible substances,
- aqueous ammonium nitrate solutions in which the concentration of ammonium nitrate is more than 80 % by weight.

¹⁴² See United Nations Recommendations on the Transport of Dangerous Goods: Manual of Tests and Criteria, Part III, subsection 38.2

The qualifying quantity for a “notification” (Article 6) and a “major-accident prevention policy document” (Article 7) for these ammonium nitrates is 350 tonnes. The qualifying quantity for a “safety report” (Article 9), which also triggers the requirement for “emergency plans” (Article 11), is 2500 tonnes. A “major-accident prevention policy document” is not required in cases where a “safety report” has to be produced.

Ammonium Nitrate (10/50): ‘off-specs’ Material and Fertilisers not Fulfilling the Detonation Test

These are material rejected during the manufacturing process and ammonium nitrate and preparations of ammonium nitrate, straight ammonium nitrate-based fertilisers and ammonium nitrate-based compound/composite fertilisers (fertilizer grade and technical grade), that are being or have been returned from the final user to a manufacturer, temporary storage or reprocessing plant for reworking, recycling or treatment for safe use, because they no longer comply with the above specifications of ammonium nitrates of fertilizer or technical grade. It also applies to the first indent of above ammonium nitrate fertilisers, which are capable of self-sustaining decomposition as well as to ammonium nitrates of fertilizer grade, which do not fulfil the requirements of Annex II of Directive 80/876/EEC¹⁴³.

The qualifying quantity for a “notification” (Article 6) and a “major-accident prevention policy document” (Article 7) for these ammonium nitrates is 10 tonnes. The qualifying quantity for a “safety report” (Article 9), which also triggers the requirement for “emergency plans” (Article 11), is 50 tonnes. A “major-accident prevention policy document” is not required in cases where a “safety report” has to be produced.

Potassium Nitrate: Composite Potassium Nitrate Based Fertilisers Composed of Potassium Nitrate in Prilled/Granular Form

The qualifying quantity for a “notification” (Article 6) and a “major-accident prevention policy document” (Article 7) for these potassium nitrates is 5000 tonnes. The qualifying quantity for a “safety report” (Article 9), which also triggers the requirement for “emergency plans” (Article 11), is 10 000 tonnes. A “major-accident prevention policy document” is not required in cases where a “safety report” has to be produced.

Potassium Nitrate: Composite Potassium Nitrate Based Fertilisers Composed of Potassium Nitrate in Crystalline Form

The qualifying quantity for a “notification” (Article 6) and a “major-accident prevention policy document” (Article 7) for these potassium nitrates is 1250 tonnes. The qualifying quantity for a “safety report” (Article 9), which also triggers the requirement for “emergency plans” (Article 11), is 5000 tonnes. A “major-accident

¹⁴³ Council Directive 80/876/EEC of 15 July 1980 on the approximation of the laws of the Member States relating to straight ammonium nitrate fertilizers of high nitrogen content, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31980L0876:EN:HTML>

prevention policy document” is not required in cases where a “safety report” has to be produced.

Obligations with respect to Integrated Pollution Prevention and Control

Chemical installations for the production of phosphorous-, nitrogen- or potassium-based fertilisers (simple or compound fertilisers) are covered by the IPPC Directive, and a relevant BREF has been developed pursuant to this Directive.

Scope of the BREF

Although the main use of ammonia, nitric acid, sulphuric acid and phosphoric acid is the downstream production of fertilisers, the scope of the BREF for the production of large volume inorganic chemicals¹⁴⁴ is not restricted to the manufacture of fertiliser grade products. The approach is much wider, including the production of synthesis gas for the production of ammonia and the production of sulphuric acid based on SO₂ gases from various processes, e.g. SO₂ gases from non-ferrous metals production or regeneration of spent acids. Hence sources used for the production of fertilisers, such as ammonia, will not be covered by the Sourcebook. Instead the specific BATs are described only for those compounds that are actually used as fertilisers.

Generic BAT

BAT is to carry out regular energy audits for the whole production site, to monitor key performance parameters and to establish and to maintain mass balances for nitrogen, P₂O₅, steam, water and CO₂. Minimisation of energy losses is carried out by generally avoiding steam pressure reduction without using the energy or by adjusting the whole steam system in order to minimise the generation of excess steam. Excess thermal energy should be used on-site or offsite and, if local factors prevent that, as a last option, steam might be used for generating only electrical power. BAT is to improve the environmental performance of the production site by a combination of recycling or re-routing mass streams, efficiently sharing equipment, increasing heat integration, preheating of combustion air, maintaining heat exchanger efficiency, reducing waste water volumes and loads by recycling condensates, process and scrubbing waters, applying advanced process control systems and by maintenance.

Specific BAT

NPK fertilisers

When defining compound fertilisers, the large number of N/P/K (nitrogen/phosphorous/potassium) – ratios and the numerous processes applied in their production must be taken into account. Product types are PK, NP (e.g DAP), NK and NPK. These products might contain:

- nitrogen, expressed as % of N, in ureic, ammoniacal and/or nitrate forms

¹⁴⁴ Available at: http://ec.europa.eu/environment/ippc/brefs/lvic_bref_0907.pdf

- phosphorus, usually expressed as % of P₂O₅, in forms soluble in water and/or neutral ammonia citrate and/or mineral acids
- potassium, usually expressed as % of K₂O, in forms soluble in water
- secondary nutrients, as calcium (CaO), magnesium (MgO), sodium (Na₂O) and/or sulphur (SO₃)
- microelements (zinc, copper, boron, etc.)
- other elements.

The demand for NPK fertilisers in various compositions results basically in two plant types: production by the mixed acid route and production by the nitrophosphate route.

Section 7.2 of the BREF contains applied processes and techniques for the production of NPK fertilisers. These compound fertilisers can be produced in four, basically different, ways:

- production by the mixed acid route, without phosphate rock digestion
- production by the mixed acid route, with phosphate rock digestion
- production by the nitrophosphate route (ODDA process)
- mechanical blending or compactation of single or multi-nutrient components
NPK

These processes are described in detail in the BREF, Section 7.2. Section 7.3 covers the reported emission levels to air and water and energy and water consumption levels in the production of NPK fertilisers. Section 7.4 deals with the techniques to consider in the determination of BAT.

BAT for NPK fertilisers is summarised in chapter 7.5, applying the common BAT of Section 1.5.

For rock grinding BAT is to reduce dust emissions, e.g. by application of fabric filters or ceramic filters and to achieve dust emission levels of 2.5 – 10 mg/Nm₃ (see Section 10.4.2).

For preventing dispersion of phosphate rock dust, BAT is to use covered conveyor belts, indoor storage, and frequently cleaning/sweeping the plant grounds and the quay (see Section 5.4.8).

To improve environmental performance of the finishing section, BAT is to use one or a combination of the following techniques:

- apply plate bank product cooling (see Section 7.4.5);
- recycling of warm air (see Section 7.4.6);
- select proper size of screens and mills, e.g. roller or chain mills (see Section 7.4.7);
- apply surge hoppers for granulation recycle control (see Section 7.4.7); or
- apply online product size distribution measurements for granulation recycle control (see Section 7.4.7).

To minimise the NO_x load in exhaust gases from phosphate rock digestion, BAT is to use one or a combination of:

- accurate temperature control (see Sections 7.4.1);
- proper rock/acid ratio (see Sections 7.4.1);
- phosphate rock selection (see Sections 5.4;.9 and 5.4.10); or
- by controlling other relevant process parameters.

In reducing emissions to air from phosphate rock digestion, sand washing and CNTH filtration, BAT is to apply, e.g. multistage scrubbing, and to achieve emission levels given in Table 7.14 (see Section 7.4.9).

In reducing emission levels to air from neutralisation, granulation, drying, coating and Cooling, BAT is to apply the following techniques and to achieve the emission levels or removal efficiencies given in Table 7.14:

- dust removal, such as cyclones and/or fabric filters (see Sections 7.4.6 and 7.4.10);
- wet scrubbing, e.g. combined scrubbing (see Section 7.4.10);

For minimising waste water volumes, BAT is to recycle washing and rinsing waters and scrubbing liquors into the process, e.g. by using residual heat for waste water evaporation (see Sections 7.4.10 and 7.4.11).

BAT for the treatment of remaining waste water volumes is done according to Section 7.4.12.

	Parameter	Level	Removal efficiency in %
		mg/Nm ³	
Phosphate rock digestion, sand washing, CNTH filtration	NO _x as NO ₂	100 – 425	
	Fluoride as HF	0.3 – 5	
Neutralisation, granulation, drying, coating, cooling	NH ₃	5 – 30 ^x	
	Fluoride as HF	1 – 5 ^{xx}	
	Dust	10 – 25	>80
	HCl	4 – 23	
^x the lower part of the range is achieved with nitric acid as the scrubbing medium, the upper part of the range is achieved with other acids as the scrubbing medium. Depending on the actual NPK grade produced (e.g. DAP), even by applying multistage scrubbing, higher emission levels might be expected ^{xx} in the case of DAP production with multistage scrubbing with H ₃ PO ₄ , levels of up to 10 mg/Nm ³ might be expected			

Table 7.14: Emission levels to air associated with the application of BAT

Urea and Urea Ammonium Nitrate

The take up in use of urea as a fertiliser at first was rather slow but it has since become the most used solid nitrogen fertiliser in the world, mainly because of its use

for flooded rice. The biggest demand for urea is now in Asia. Urea is also used as a raw material for the manufacture of melamine and for various urea/formaldehyde resins/adhesives and as cattle feed supplement, where it is an inexpensive source of nitrogen for the build-up of protein.

Applied processes and techniques for the production are described in Section 8.2. Section 8.3 covers the wide range of reported emission and consumption levels to in the production of urea. Section 8.4 deals with the techniques to consider in the determination of BAT.

BAT for urea and urea ammonium nitrate is summarised in chapter 8.5, applying the common BAT of Section 1.5.

BAT is to improve environmental performance of the finishing section by one or a combination of the following techniques:

- apply plate bank product cooling (see Section 7.4.5);
- redirecting urea fines to the concentrated urea solution;
- select proper size of screens and mills, e.g. roller or chain mills;
- apply surge hoppers for granulation recycle control; or
- apply product size distribution measurement and control.

To optimise the total energy consumption for urea production, BAT is to apply one or a combination of the following techniques:

- for existing stripping installations, continue applying stripping technology;
- for new installations, applying total recycling stripping processes (see Sections 8.4.2, 8.4.3 and 8.4.4);
- for existing conventional total recycling installations, only in the case of a substantial urea plant capacity increase, upgrading to stripping technology (see Section 8.4.7);
- increase heat integration of stripping plants (see Section 8.4.8); or
- applying combined condensation and reaction technology (see Section 8.4.9).

BAT is to treat all exhaust gases from the wet sections by scrubbing, taking into account the lower explosion limit and to recycle the resulting ammonia solutions to the process (e.g. see Section 8.4.5).

BAT is to reduce ammonia and dust emissions from prilling or granulation and to achieve ammonia emission levels of 3 – 35 mg/Nm₃, e.g. by scrubbing or optimising the operation conditions of prilling towers, and to re-use scrubber liquids on-site (see Section 7.4.11). If the scrubbing liquid can be re-used, then preferably by acidic scrubbing, if not, by water scrubbing. In optimising the emission levels to the values mentioned above, it is assumed that dust emission levels of 15 – 55 mg/Nm₃ are achieved, even, with water scrubbing.

Where process water with or without treatment is not re-used, BAT is to treat process water, e.g. by desorption and hydrolysis and to achieve the levels given in Table 8.20. If in existing plants the levels cannot be achieved, it is BAT to apply subsequent biological waste water treatment.

		NH ₃	Urea	
After process water treatment	New plants	1	1	ppm w/w
	Existing plants	<10	<5	

Table 8.20: BAT levels for the treatment of process water from urea production

BAT for production of urea is to monitor key performance parameters according to Section 8.4.13.

Ammonium Nitrate and Cadmium Ammonium Nitrate

Ammonium nitrate (AN) is used extensively as a nitrogenous fertiliser. The main marketable products are: hot solution of ammonium nitrate, ammonium nitrate containing 33.5 – 34.5 % nitrogen and calcium ammonium nitrate containing less than 28 % nitrogen. The world production of AN solution (ANS) is estimated to be 40 – 45 Mtonnes per year.

Calcium ammonium nitrate (CAN) is obtained from AN solution by mixing with dolomite, limestone or calcium carbonate and represents Western Europe's most applied fertiliser product. Plants for the production of AN and CAN generally produce from a few hundred tonnes per day up to 3600 tonnes per day.

Applied processes and techniques for the production are described in Section 9.2. Section 9.3 covers reported emission and consumption levels to in the production of these compounds. Section 9.4 deals with the techniques to consider in the determination of BAT.

BAT for ammonium nitrate and cadmium ammonium nitrate is summarised in chapter 9.5, applying the common BAT of Section 1.5.

BAT is to optimise the neutralisation/evaporation stage by a combination of the following techniques:

- using the heat of reaction to preheat the HNO₃ and/or to vapourise NH₃ (see Section 9.4.1);
- operating the neutralisation at an elevated pressure and exporting steam (see Sections 9.4.1);
- using the generated steam for evaporation of water from ANS (see Section 9.4.3);
- recovering residual heat for chilling process water (see Section 9.4.2);
- using the generated steam for the treatment of process condensates; or
- using the heat of the reaction for additional water evaporation;

BAT is to effectively and reliably control pH, flow and temperature.

BAT is to improve environmental performance of the finishing section by one or a combination of the following techniques:

- apply plate bank product cooling (see Section 7.4.5);

- recycling of warm air (see Sections 7.4.6 and 9.4.5);
- select proper size of screens and mills, e.g. roller or chain mills (see Section 7.4.7);
- apply surge hoppers for granulation recycle control (see Section 7.4.7); or
- apply product size distribution measurement and control (see Section 7.4.7).

BAT is to reduce dust emissions from dolomite grinding to levels <10 mg/Nm₃ by applying, e.g. fabric filters.

Because of an insufficient data basis, no conclusions could be drawn for emissions to air from neutralisation, evaporation, granulation, prilling, drying, cooling and conditioning.

BAT is to recycle process water on-site or offsite and to treat the remaining waste water in a biological treatment plant or using any other technique achieving an equivalent removal efficiency.

Superphosphates

Superphosphates, i.e. single superphosphate (SSP) and triple superphosphate (TSP), account for one quarter of the world's phosphate fertiliser production. Superphosphates are defined by the percentage of phosphorus as P₂O₅ and are used as straight fertilisers (marketable products), but are also a feedstock for multinutrient fertilisers.

Applied processes and techniques for the production are described in Section 10.2. Section 10.3 covers reported emission and consumption levels to in the production of these compounds. Section 10.4 deals with the techniques to consider in the determination of BAT.

BAT for superphosphates are summarised in chapter 10.5 applying the common BAT of Section 1.5.

BAT is to reduce dust emissions from rock grinding by application of, e.g. fabric filters or ceramic filters and to achieve dust emission levels of 2.5 – 10 mg/Nm₃ (see Section 10.4.2).

BAT is to prevent dispersion of phosphate rock dust by using covered conveyor belts, indoor storage, and frequently cleaning/sweeping the plant grounds and the quay (see Section 5.4.8).

To improve environmental performance of the finishing section, BAT is to use one or a combination of the following techniques:

- apply plate bank product cooling (see Section 7.4.5);
- recycling of warm air (see Section 7.4.6);
- select proper size of screens and mills, e.g. roller or chain mills;
- apply surge hoppers for granulation recycle control; or
- apply online product size distribution measurement for granulation recycle control.

BAT is to reduce fluoride emissions by application of scrubbers with suitable scrubbing liquids and to achieve fluoride emission levels of 0.5 – 5 mg/Nm³ expressed as HF (see Section 10.4.3).

BAT is to reduce waste water volumes by recycling of scrubbing liquids, where, besides the manufacture of SSP or TSP, acidulated phosphate rock (PAPR) is also produced.

BAT for production of SSP/TSP and multipurpose production is to reduce emissions to air from neutralisation, granulation, drying, coating, cooling by applying the following techniques and to achieve the emission levels or removal efficiencies given in Table 10.7.

- cyclones and/or fabric filters (see Sections 7.4.6 and 7.4.10)
- wet scrubbing, e.g. combined scrubbing (see Section 7.4.10).

	Parameter	Level	Removal efficiency in %
		mg/Nm ³	
Neutralisation, granulation, drying, coating, cooling	NH ₃	5 – 30 ^x	
	Fluoride as HF	1 – 5 ^{xx}	
	Dust	10 – 25	> 80
	HCl	4 – 23	
^x the lower part of the range is achieved with nitric acid as the scrubbing medium, the upper part of the range is achieved with other acids as the scrubbing medium. Depending on the actual NPK grade produced (e.g. DAP), even by applying multistage scrubbing, higher emission levels might be expected ^{xx} in the case of DAP production with multistage scrubbing with H ₃ PO ₄ , levels of up to 10 mg/Nm ³ might be expected			

Table 10.7: Emission levels to air associated with the application of BAT

EIA

The project category ‘integrated chemical installations’ is divided into 6 sub-categories, including the production of phosphorous-, nitrogen- or potassium-based fertilizers (simple or compound fertilizers), which are the same as those listed in Annex I(4) of the IPPC Directive.

Integrated chemical installations covers those installations for the manufacture on an industrial scale of substances using chemical conversion processes, in which several units are juxtaposed and are functionally linked to one another.

The list of basic organic and inorganic chemicals in the IPPC Directive’s Annex I could be used as a nonexhaustive list for the purposes of the EIA Directive as well.

The first guidance on ‘integrated’, ‘juxtaposed and functionally linked’ was provided by ECJ case-law (case C-133/94, Commission v Belgium), where the European Court of Justice ruled that ‘whether a chemical installation is integrated does not depend

upon its processing capacity or on the type of chemical substance processed in it but on the existence of interlinked production units constituting in terms of their operation a single production unit'¹⁴⁵.

¹⁴⁵ European Commission(2008), *Interpretation of definitions of certain project categories of Annex I and II of the EIA Directive*, 2008-022, 2008

2.3.2 Chemical installations for the production of pesticides

Chemical installations for the production of pesticides are covered by Directive 85/337/EEC¹⁴⁶ on EIA and Directive 2008/1/EC¹⁴⁷ on IPPC, as well as by the risk prevention and management requirements of Directive 96/82/EC.

Chemical installations are regulated by the EIA, IPPC, and Seveso Directives. It is important to be aware of the differences that exist between the project classification systems, scope and thresholds in each of the Directives. While the EIA Directive covers projects in a number of different sectors, the IPPC Directive has its focus on pollution control and sustainable use of natural resources in relation to industrial installations. The Seveso Directive focuses on the control of dangerous substances within a site.¹⁴⁸

Obligations with respect to Environmental Impact Assessment

An EIA might be required for the production of pesticides (Annex II projects). For these Annex II projects Member States are required to determine through a case-by-case and/or thresholds or criteria, set by the Member State in question, whether the project is subject to an EIA or not. Further details about this screening procedure as well as a description of the EIA process can be found in Chapter 1.1.

Obligations with respect to Integrated Pollution Prevention and Control

The chemical installations for the production of basic plant health products and of biocides are covered by the IPPC Directive. The generic requirements concerning the implementation of IPPC are addressed in Chapter 1.4. There exists no specific BREF for this sector.

Obligations with respect to risk prevention and management

Many pesticides and biocides would qualify as hazardous substances under the provisions of Directive 96/82/EC¹⁴⁹, and to this extent the installations for their production would be subject to its requirements for the prevention of industrial accident risks. (see Chapter 1.5)

¹⁴⁶ Council Directive of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1985L0337:20030625:EN:PDF>

¹⁴⁷ Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:024:0008:0029:EN:PDF>

¹⁴⁸ European Commission(2008), *Interpretation of definitions of certain project categories of Annex I and II of the EIA Directive*, 2008-022, 2008

¹⁴⁹ Council Directive 96/82/EC of 9 December 1996 on the control of major-accident hazards involving dangerous substances, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1996L0082:20031231:EN:PDF>

2.4 WASTE MANAGEMENT

2.4.1 Disposal or recovery of hazardous waste, other than through incineration

Introduction

Directive 91/689/EEC¹⁵⁰ establishes more stringent controls for hazardous waste within a general framework laid down by Directive 2006/12/EC¹⁵¹ (formerly 75/442/EEC). This framework aims to control both hazardous and non hazardous wastes, including the planning and regulation of waste management activities.

Both Directive 91/689/EEC and Directive 2006/12/EC will be repealed by Directive 2008/98/EC¹⁵² on waste on 12 December 2010. Directive 2008/98/EC is intended to bring together key provisions on the management of waste, providing a clearer baseline and streamlined legislative approach at EU level. Whilst the majority of requirements for hazardous waste management are retained, some derogations will be provided from the mixing ban placed on the landfilling of hazardous waste with other materials (see below).

Directive 2008/1/EC¹⁵³ applies to installations for the disposal or recovery of hazardous waste, as defined in Annexes II A (all disposal operations) and II B (recovery operations R1, R5, R6, R8 and R9) to Directive 2006/12/EC and in Directive 75/439/EEC¹⁵⁴, with a capacity exceeding 10 tonnes per day.

The incineration of hazardous waste is covered in Chapter 2.4.2 of this Sourcebook, together with that of municipal waste. Installations for the incineration of hazardous waste are subject both to the provisions of Directive 2008/1/EC and to those of Directive 2000/76/EC. Directive 2008/1/EC, however, applies only to hazardous waste incinerators with a capacity exceeding 10 tonnes per day.

¹⁵⁰Council Directive of 12 December 1991 on hazardous waste, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1991L0689:20060224:EN:PDF>

¹⁵¹ Directive 2006/12/EC of the European Parliament and of the Council of 5 April 2006 on waste, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:114:0009:0021:EN:PDF>

¹⁵² Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:312:0003:0030:EN:PDF>

¹⁵³ Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:024:0008:0029:EN:PDF>

¹⁵⁴ Council Directive of 16 June 1975 on the disposal of waste oils, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1975L0439:20051228:EN:PDF>

Definition of hazardous waste

Directive 91/689/EEC required a list of hazardous waste to be drawn up by the Commission, by reference to three annexes which list categories or generic types of hazardous waste according to: their nature or the activity which generated them (Annex I); constituents (Annex II); and properties which render wastes hazardous (Annex III). The list is to 'take into account the origin and composition of the waste and, where necessary, limit values of concentration'.

The current list of hazardous waste is laid down in Decision 2000/532/EC, as amended. The 290 entries classified as hazardous waste on the list are each considered to display one or more of the properties included in Annex III of Directive 91/689. At least one of a list of certain other properties must also apply to wastes under the categories of H3 to H8, H10 and H11 of that Annex for them to be considered hazardous. Wastes which are not listed under the Decision but which nevertheless satisfy any of the Annex III properties are also considered to be hazardous. Inclusion in the list does not mean that a material is waste in all circumstances, with the definition set out in Directive 2006/12/EC being the determining factor. Member States are to notify the Commission of other waste they consider to display hazardous properties for review and possible inclusion in the list. Decisions 2001/118/EC, 2001/119/EC and 2001/573/EC amend Decision 2000/532/EC on the basis of further notifications by Member States.

Directive 2008/98/EC, which enters into force on 12 December 2010, will alter definitions and specifications as to how waste is defined, with potential impacts on the management of hazardous waste. The hazardous properties of waste are listed in Annex III of the Directive (explosive, oxidising, highly flammable, flammable, irritant, harmful, toxic, carcinogenic, corrosive, infectious, toxic for reproduction, mutagenic, waste which releases toxic gases in contact with water, air or acid, sensitising, ecotoxic, and waste capable after disposal of yielding another substance which possesses any of the hazardous characteristics).

Mixing of wastes

As a general rule, establishments and undertakings which dispose of, recover, collect or transport hazardous waste must not mix different categories of hazardous waste or mix it with non-hazardous waste. Where technically and economically feasible and necessary to comply with the general duty of Directive 2006/12/EC to recover or dispose of waste safely, hazardous waste mixed with other waste, substances or materials must be separated. Mixing is permitted only where this general duty is met and where it has the purpose of improving safety during disposal or recovery, and has been specifically authorized pursuant to Directive 2006/12/EC.

Directive 2008/98/EC, which enters into force on 12 December 2010, will provide some derogations from the mixing ban placed on the landfilling of hazardous waste with other materials provided that: activities are permitted; the environment and human health are protected; and mixing operations conform to best-available techniques.

Permits

Under Directive 2006/12/EC all waste disposal and recovery operations are subject to prior authorisation delivered by the competent national authorities. While establishments or undertakings which carry out their own waste disposal may in principle be exempted from this general requirement by national law, this exemption may not be applied in the case of hazardous waste disposal according to Directive 91/689/EC. The permitting exemption for establishments or undertakings which recover waste may be applied to hazardous waste recovery only if the Member State adopts general rules listing the type and quantity of waste and laying down specific conditions for recovery, and if the general safety duty of Directive 2006/12/EC is met. In such cases, recovery operators must be registered with the competent authorities.

Inspections and records

Producers of hazardous waste must be made subject to periodic inspections by the competent authorities, and inspections concerning collection and transport operations must cover particularly the origin and destination of hazardous waste. Producers and transporters of hazardous waste must keep detailed records, which are to be preserved for at least three years and one year respectively. Documentary evidence of management operations must be supplied to the competent authorities or a previous holder on request. Hazardous waste must be recorded and identified on every site where it is tipped and must be properly packaged and labelled in accordance with Community and international standards in the course of collection, transport and temporary storage.

Obligations with respect to Integrated Pollution Prevention and Control

Disposal and recovery operations of hazardous waste are subject to the permitting requirements of Directive 2008/1/EC under the conditions specified above. Accordingly, the permit must prescribe the use of BAT as defined in the Directive. Although there is no specific BREF for the disposal or recovery of hazardous waste, a 'general' BREF does exist for 'Waste Treatments Industries'¹⁵⁵, which is discussed below in Chapter 2.4.4.

In this BREF on Waste Treatment Industries, some BATs have been identified as being particularly related to hazardous waste. These are summarised below for ease of reference:

Waste IN

BAT for hazardous waste is to:

- implement an acceptance procedure containing at least the following items:

¹⁵⁵ Available at: http://ec.europa.eu/environment/ippc/brefs/wt_bref_0806.pdf

- a visual inspection of the waste in to check compliance with the description received during the pre-acceptance procedure. For some liquid and hazardous waste, this BAT is not applicable;
- implement different sampling procedures for all different incoming waste vessels delivered in bulk and/or containers. These sampling procedures may be based on a risk approach. Elements to consider include the type of waste (e.g. hazardous or non-hazardous) and the knowledge of the customer (e.g. waste producer);
- have a reception facility that has a laboratory to analyse all the samples at the speed required by BAT. This typically requires having a robust quality assurance system, quality control methods and maintaining suitable records for storing the results of the analyses. Particularly for hazardous wastes, this often means that the laboratory needs to be on-site.

Management systems

BAT for hazardous waste is to:

- have and apply mixing/blending rules that are designed to restrict the types of wastes that can be mixed/blended together in order to avoid increasing pollution emission of down-stream waste treatments. These rules need to consider the type of waste (e.g. hazardous, non hazardous) and the waste treatment to be applied, as well as the following steps that will be carried out to the waste OUT.

Specific industry BAT

A number of the specific BAT provisions are also to be highlighted in terms of their relevance (or otherwise) to hazardous waste. These can be summarised as follows:

Preparation of waste to be used as fuel

For the preparation of waste fuel from hazardous waste, BAT is to:

- use activated carbon treatment for low contaminated water and thermal treatment for highly polluted water. (A definition of thermal treatment in this context is provided elsewhere in the BREF);
- ensure correct follow-up of the rules concerning electrostatic and flammability hazards for safety reasons.

For the preparation of solid waste fuel from hazardous waste, BAT is to:

- consider hazards related to emissions and flammability in case a drying or heating operation is required;
- consider carrying out the mixing and blending operations in closed areas with appropriate atmosphere control systems;
- use bags filters for the abatement of particulates.

For the preparation of liquid waste fuels from hazardous waste, BAT is to:

- use heat-exchange units external to the vessel if heating of the liquid fuel is necessary;

- adapt the suspended solid content to ensure the homogeneity of the liquid fuel.

Case law

No cases specifically concerning the interpretation of the Directive on hazardous waste have been concluded by the ECJ.

2.4.2 Incineration of waste (including municipal waste)

Introduction

This chapter addresses installations for the incineration of waste, including municipal waste and hazardous waste. These are activities covered in Annex I of Directive 2008/1/EC and also by Directive 2000/76/EC.

Directive 2008/1/EC applies to installations for the incineration of municipal waste (defined as ‘household waste and similar commercial, industrial and institutional wastes’) with a capacity exceeding 3 tonnes per hour, and to hazardous waste incinerators with a capacity exceeding 10 tonnes per day.

On 21 December 2007 the Commission adopted a Proposal for a Directive on industrial emissions¹⁵⁶. This proposal represents an attempt to recast seven existing Directives related to industrial emissions into one single clear and coherent piece of legislation. The recast includes the IPPC Directive (2008/1/EC), as well as the waste incineration Directive (2000/76/EC), the large combustion plants Directive (2001/80/EC), three Directives on titanium dioxide (78/176/EEC, 82/883/EEC and 92/112/EEC) and the VOC Solvents Directive (1999/13/EC). At the time of writing the proposal was still going through the EU decision-making process.

Directive 2000/76/EC

The aim of Directive 2000/76/EC is to prevent or limit negative effects on the environment and risks to human health from the incineration and co-incineration of waste. The Directive applies to the incineration of most types of waste at most incineration and co-incineration plants, with the following exceptions:

- plants treating only the following types of wastes:
 - vegetable waste from agriculture and forestry;
 - vegetable waste from the food processing industry, provided there is heat recovery;
 - fibrous vegetable waste from virgin pulp production and from production of paper from pulp, if co-incinerated with heat recovery at the place of production;
 - wood waste except wood waste which may contain halogenated organic compounds or heavy metals as a result of treatment with wood preservatives or coating (e.g. wood waste originating from construction and demolition waste);
 - cork waste;
 - radioactive waste;
 - animal carcasses as regulated by Directive 90/667/EEC;

¹⁵⁶ Proposal for a Directive of the European Parliament and of the Council on industrial emissions (integrated pollution prevention and control) (Recast) (COM(2007) 844 final), 21.12.07, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2007:0844:FIN:EN:PDF>

- waste resulting from the exploration for and exploitation of oil and gas resources from off-shore installations and incinerated on board the installation
- experimental plants used for research, development and testing in order to improve the incineration process and which treat less than 50 tonnes of waste per year..

A co-incineration plant is defined as a plant whose main purpose is the generation of energy or production of material products, where waste is used as a regular or additional fuel. The emission limit values or standards contained in the Directive and outlined below have applied to new plants since 28 December 2002 and to existing plants since 28 December 2005. The Directive is based on the premise that the emissions from the waste fraction must not be higher compared to separate incineration of waste. As well as emissions released into the air, the Directive also controls releases to soil and water.

The handling operations preceding incineration are subject to the following stricter requirements in the case of hazardous waste. The operator of the incineration or co-incineration plant is required to take all the necessary precautions concerning the delivery and reception of waste in order to prevent or limit as far as practicable negative effects on the environment and human health. Prior to accepting hazardous waste at the incineration or co-incineration plant, the operator is required to have available information about the waste and to also follow specific reception procedures. Furthermore the operator must determine the mass of each category of waste according to the EU waste list before accepting the waste.

The operating requirements laid down in the Directive are as follows:

- for incineration (not co-incineration) the Total Organic Carbon (TOC) content of slag and bottom ashes must be less than 3% or their loss on ignition must be less than 5% of the dry weight of the material;
- incineration and co-incineration plants must be operated in such a way that the gas from the combustion has a minimum temperature of 850 °C for two seconds even under the most unfavourable conditions;
- in case the hazardous waste to be incinerated or co-incinerated has a content of more than 1% of halogenated organic substances (expressed as chlorine), the temperature has to be raised to 1100 °C;
- incineration and co-incineration plants must have and operate an automatic system to prevent waste feed in certain circumstances;
- any heat generated by the incineration or the co-incineration process must be recovered as far as practicable
- infectious clinical waste must be placed straight into the furnace; and
- the management of the incineration or co-incineration plant must be controlled by a 'natural person'.

The Directive sets emission limit values (ELVs) for many atmospheric pollutants from incinerators (Annex V) and for co-incineration (Annex II), with special provisions for cement kilns co-incinerating waste (Annex II.1), for combustion plants co-incinerating waste (Annex II.2) and for industrial sectors not covered under II.1 or II.2 co-incinerating waste (Annex II.3). Annex V provides the daily and half-hourly

average emission limit values for total dust, gaseous and organic substances, hydrogen chloride, hydrogen fluoride, sulphur dioxide and the sum of nitrogen monoxide and nitrogen dioxide. The ELVs for the nitrogen oxides are either 200 mg/m³ or 400 mg/m³ depending on the nominal capacity of the incineration plant (over or under 6 tonnes per hour). Exemptions to the ELVs for NO_x may be authorised by the competent authority in specific circumstances (until 1 January 2010, depending on the conditions) as well as for dust. Annex V also sets out the average values (within defined sample periods) for cadmium, thalium, mercury, antimony, arsenic, lead, chromium, cobalt, copper, manganese, nickel, vanadium and the total concentration of dioxin and furans. The concentrations of carbon monoxide in the combustion gas are also restricted. The emission limit value for dioxins and furans is set at 0.1ng/m³ to be sampled over a period of 6-8 hours. For calculating the total concentration of dioxins and furans, the Directive uses the international toxic equivalent scheme (I-TEQ), which does not include dioxin-like polychlorinated biphenyls (PCBs). Annex II covers largely the same substances as Annex V but the ELVs and the provisions are different. As with incinerators there are exemptions to the emission limit values for NO_x (until 1 January 2008 or 1 January 2007, depending on the condition) and for dust (1 January 2008). The ELVs are more stringent for incinerators than co-incinerators. However, if in a co-incineration plant more than 40% of the resulting heat release comes from hazardous waste the ELVs set out in Annex V will apply. In the case of co-incineration of untreated mixed municipal waste, the limit values will be determined according to Annex V, and Annex II will not apply.

Annex II includes a 'mixing rule' which should be applied whenever a specific total emission limit value has not been set out in a table within the Annex. This mixing rule and its explanation is reproduced below.

DETERMINATION OF AIR EMISSION LIMIT VALUES FOR THE CO-INCINERATION OF WASTE

The following formula (mixing rule) is to be applied whenever a specific total emission limit value 'C' has not been set out in a table in this Annex.

The limit value for each relevant pollutant and carbon monoxide in the exhaust gas resulting from the co-incineration of waste shall be calculated as follows:

$$\frac{V_{waste} \times C_{waste} + V_{proc} \times C_{proc}}{V_{waste} + V_{proc}} = C$$

- V_{waste} : exhaust gas volume resulting from the incineration of waste only determined from the waste with the lowest calorific value specified in the permit and standardised at the conditions given by this Directive.
- If the resulting heat release from the incineration of hazardous waste amounts to less than 10 % of the total heat released in the plant, V_{waste} must be calculated from a (notional) quantity of waste that, being incinerated, would equal 10 % heat release, the total heat release being fixed.
- C_{waste} : emission limit values set for incineration plants in Annex V for the relevant pollutants and carbon monoxide.
- V_{proc} : exhaust gas volume resulting from the plant process including the combustion of the authorised fuels normally used in the plant (wastes excluded) determined on the basis of oxygen contents at which the emissions must be standardised as laid down in Community or national regulations. In the absence of regulations for this kind of plant, the real oxygen content in the exhaust gas without being thinned by addition of air unnecessary for the process must be used. The standardisation at the other conditions is given in this Directive.
- C_{proc} : emission limit values as laid down in the tables of this annex for certain industrial sectors or in case of the absence of such a table or such values, emission limit values of the relevant pollutants and carbon monoxide in the flue gas of plants which comply with the national laws, regulations and administrative provisions for such plants while burning the normally authorised fuels (wastes excluded). In the absence of these measures the emission limit values laid down in the permit are used. In the absence of such permit values the real mass concentrations are used.
- C: total emission limit values and oxygen content as laid down in the tables of this annex for certain industrial sectors and certain pollutants or in case of the absence of such a table or such values total emission limit values for CO and the relevant pollutants replacing the emission limit values as laid down in specific Annexes of this Directive. The total oxygen content to replace the oxygen content for the standardisation is calculated on the basis of the content above respecting the partial volumes.

Member States may lay down rules governing the exemptions provided for in this Annex.

The Directive requires waste water from the cleaning of exhaust gases discharged from an incineration or co-incineration plant to be limited as far as practicable, at least in accordance with the ELVs set out in Annex IV. Annex IV provides ELVs for total suspended solids, mercury, cadmium, thallium, arsenic, lead, chromium, copper, nickel, zinc, and the total concentration of dioxins and furans. The competent authority may authorise exemptions for total suspended solids.

Compliance with the emission limit values laid down by this Directive is to be regarded as a necessary but not sufficient condition for compliance with the requirements of Directive 2008/1/EC. Directive 2008/1/EC does not impose ELVs for specific pollutants itself, but requires the permitting authorities to do so on the basis of BAT (best available techniques). Therefore if the BAT allows compliance with stricter ELVs than those in Directive 2000/76/EC, the permitting authorities are, in principle, obliged to require them in the IPPC permit.

The relevant Annexes to the Directive are reproduced at the end of this Chapter.

Case law

Two European Court of Justice cases have helped to interpret the definitions within Directive 2000/76/EC. The first judgment (case C-317/07, 2008) concluded that: the definition of 'waste' in Article 3(1) does not cover gaseous substances; the definition

of ‘incineration plant’ in Article 3(4) relates to any technical unit and equipment in which waste is thermally treated, on condition that the substances resulting from the use of the thermal treatment process are subsequently incinerated, and that the presence of an incineration line is not necessary for such classification; and that a gas plant whose objective is to obtain products in gaseous form (e.g. purified gas) by thermally treating waste must be classified as a ‘co-incineration plant’, whereas a power plant which uses a purified gas obtained by the co-incineration of waste as an additional fuel does not fall within the scope of the Directive.

The judgment in the second case (case C-251/07, 2008) concluded that: where a co-generation plant comprises a number of boilers, each boiler and its associated equipment is to be regarded as constituting a separate plant; and that it is on the basis of its main purpose that a plant is to be classified as an ‘incineration plant’ or a ‘co-incineration plant’, and that the competent authorities must identify that purpose based on an assessment including the volume of energy generated or material products produced by the plant in relation to the quantity of waste incinerated and the stability and continuity of energy or material production.

Directive 2008/98/EC

Directive 2008/98/EC on waste, which enters into force on 12 December 2010, enables certain forms of incineration to be classed as recovery (rather than disposal), provided they meet certain energy efficiency standards described in Annex II of the Directive (reproduced below).

(*) This includes incineration facilities dedicated to the processing of municipal solid waste only where their energy efficiency is equal to or above:
— 0,60 for installations in operation and permitted in accordance with applicable Community legislation before 1 January 2009,
— 0,65 for installations permitted after 31 December 2008,
using the following formula:
Energy efficiency = $(E_p - (E_f + E_i)) / (0,97 \times (E_w + E_f))$
In which:
E_p means annual energy produced as heat or electricity. It is calculated with energy in the form of electricity being multiplied by 2,6 and heat produced for commercial use multiplied by 1,1 (GJ/year)
E_f means annual energy input to the system from fuels contributing to the production of steam (GJ/year)
E_w means annual energy contained in the treated waste calculated using the net calorific value of the waste (GJ/year)
E_i means annual energy imported excluding E_w and E_f (GJ/year)
0,97 is a factor accounting for energy losses due to bottom ash and radiation.
This formula shall be applied in accordance with the reference document on Best Available Techniques for waste incineration.

BAT under Directive 2008/1/EC

The BREF on Waste Incineration developed to assist in implementation of IPPC deals only with the dedicated incineration of waste and not with other situations where waste is thermally treated, e.g. co-incineration processes such as cement kilns and large combustion plants. The emissions to air from large combustion plants (rated thermal input above 50MW) are also regulated by Directive 2001/80/EC and by the Directive 2008/1/EC. BAT for reducing emissions from combustion plants are also presented in the BREF for Large Combustion Plants (see Chapter 2.1.1). The 2001 BREF for the Cement and Lime Manufacturing Industries is also relevant. It is however important to note that the BREF is currently in the final stages of review, with revisions, inter alia, to the BAT associated emission levels. This has not yet been formally adopted and, therefore, inclusion of its conclusions will need to be taken account in the next revision of this handbook. (For more detail on the Cement and Lime BREF see Chapter 2.3.1.)

The Waste Incineration BREF points out that approaches vary greatly, but that the incineration sector may approximately be divided into the following main sub-sectors:

- ***Mixed municipal waste incineration.*** Treating typically mixed and largely untreated household and domestic wastes but may sometimes including certain industrial and commercial wastes (industrial and commercial wastes are also separately incinerated in dedicated industrial or commercial non-hazardous waste incinerators).
- ***Pretreated municipal or other pretreated waste incineration.*** Installations that treat wastes that have been selectively collected, pretreated, or prepared in some way, such that the characteristics of the waste differ from mixed waste. Specifically prepared refuse derived fuel incinerators fall in this sub-sector.
- ***Hazardous waste incineration.*** This includes incineration on industrial sites and incineration at merchant plants (that usually receive a very wide variety of wastes).
- ***Sewage sludge incineration.*** In some locations sewage sludges are incinerated separately from other wastes in dedicated installations, in others such waste is combined with other wastes (e.g. municipal wastes) for its incineration.
- ***Clinical waste incineration.*** Dedicated installations for the treatment of clinical wastes, typically those arising at hospitals and other healthcare institutions, exist as centralised facilities or on the site of individual hospital etc. In some cases certain clinical wastes are treated in other installations, for example with mixed municipal or hazardous wastes.

The generic BAT are intended to apply to the whole sector (ie waste incineration, waste gasification and waste pyrolysis of whatever type of waste). Other BAT are given that apply to sub-sectors dealing primarily with specific waste streams. It is therefore anticipated that a specific installation would apply a combination of the generic and waste specific BAT, and that installations treating mixtures of waste, or wastes not specifically mentioned, would apply the generic BAT plus a suitable selection of the waste specific BAT.

Generic BAT

For each waste incineration installation, the combination of the generic BAT and the waste type specific BAT listed in the following section are taken to represent a starting point for determining appropriate local techniques and conditions. The practical aim is therefore the local optimisation in the circumstances of the installation, taking account of this BAT guidance, and other local factors.

The following paragraphs summarise what is considered to be the general BAT for waste incineration.

Suitability of installation design

A fundamental BAT stresses the importance of the selecting an installation design that is suited to the characteristics of the waste received at the installation in terms of both its physical and chemical characteristics. This BAT is fundamental to ensuring the installation may treat the waste received with a minimum of process disturbances – which themselves may give rise to additional environmental impacts. To this end there is also a BAT about the minimisation of planned and unplanned shutdowns.

Waste input

BAT includes establishing and maintaining quality controls over the waste input. This aims to ensure that the waste characteristics remain suited to the design of the receiving installation. Such quality control procedures are compatible with the application of an environmental management system, which is also considered BAT.

Storage of incoming wastes

There are several BAT regarding the conditions and management of the storage of incoming wastes prior to their treatment, so that this does not give rise to pollution and odour releases. Some specific techniques and conditions of storage are noted. A risk based approach that takes into account the properties of the waste concerned is considered BAT.

Pre-treatment of incoming wastes

Some installation designs have a demonstrated ability to very efficiently treat highly heterogeneous wastes (e.g. mixed municipal solid waste). There are also a number of risks and cross-media effects associated with pretreatment. As a result, the BREF concludes that it is BAT to pretreat incoming wastes to the degree required to meet the design specification for the receiving installation. It is also noted that to treat wastes beyond this requires balanced consideration of (possibly limited) benefits, operational factors and cross-media effects.

Design and operation of the combustion stage

The design and operation of the combustion stage is identified as an important aspect for preventing primary pollution, and it is therefore highly relevant to achieving the aims of Directive 2008/1/EC. It is noted in the BAT chapter that flow modelling at the design stage may assist in ensuring that certain key design decisions are well informed. In operation, it is considered BAT to use various techniques, such as the control of air supply and distribution, in order to control combustion. The BAT regarding the selection of a design that suits the waste received is of particular relevance here.

In general the use of the combustion operating conditions specified in Article 6 of Directive 2000/76/EC are considered to be compatible with BAT. However the TWG noted, that the use of conditions in excess of these (e.g. higher temperatures) could result in an overall deterioration in environmental performance, and that there were several examples of hazardous waste installations that had demonstrated an overall

improvement in environmental performance when using lower operational temperatures than the 1100 °C specified in WID for certain hazardous wastes. The general BAT conclusion was that the combustion conditions (e.g. temperature) should be sufficient to achieve the destruction of the waste but, in order to limit potential cross-media impacts, generally not significantly in excess of those conditions. The provision of auxiliary burner(s) for achieving and maintaining operational conditions is considered to be BAT when waste is being burned.

Gasification and pyrolysis

When gasification or pyrolysis is used, in order to prevent the generation of waste by disposal of the reaction products of these techniques, it is BAT either, to recover the energy value from the products using a combustion stage, or to supply them for use. The BAT associated emission levels for releases to air from the combustion stage of such installations are the same as those established for incineration installations.

Recovery of the energy value of waste

The recovery of the energy value of the waste is a key environmental issue for the sector, presenting an area where the sector may make a significant positive contribution. Several BAT cover this aspect, dealing with:

- specific techniques that are considered to be BAT;
- the heat transfer efficiencies expected of boilers;
- the use of CHP, district heating, industrial steam supply and electricity production;
- the recovery efficiencies that may be anticipated.

CHP and steam/heat supply

With CHP and steam/heat supply generally offering the greatest opportunity for increasing energy recovery rates, policies affecting the availability of suitable customers for steam/heat generally play a far greater role in determining the efficiency achievable at an installation than the detail of its design. For mainly policy and economic reasons, electricity generation and supply is often the energy recovery option selected at individual installations. Options for CHP, district heating and industrial steam supply are only well exploited in a few European Member States – generally those that have high heat prices and/or that have adopted particular policies. The supply of energy for the operation of cooling systems and desalination plants is something that is done, but is in general poorly exploited – such an option may be of particular interest in warmer climate zones, and in general expands the options for the supply of waste derived energy.

Flue-gas treatments

The flue-gas treatments applied at waste incineration installations have been developed over many years in order to meet stringent regulatory standards and are now highly technically advanced. Their design and operation are critical to ensure that all emissions to air are well controlled. The BAT that are included:

- cover the process of selection of FGT systems;
- describe several specific techniques which are considered to be BAT;
- describe the performance levels that are anticipated from the application of BAT.

The performance ranges agreed by the wider TWG resulted in some split views. These were mainly from one Member State and the Environmental NGO, who believed that lower emission values than the ranges agreed by the remainder of the TWG could also be considered to be BAT.

Table 1: Operational emission level ranges associated with the use of BAT for releases to air (in mg/Nm³ or as stated)

Substance(s)	Table 5.2: Operational emission level ranges associated with the use of BAT (see notes below) for releases to air (in mg/Nm ³ or as stated)			Comments
	Non-continuous samples	% hour average	24 hour average	
Total dust		1 – 20 (see split view 2)	1 – 5	In general the use of fabric filters give the lower levels within these emission ranges. Effective maintenance of dust control systems is very important. Energy use can increase as lower emission averages are sought. Controlling dust levels generally reduces metal emissions too.
Hydrogen chloride (HCl)		1 – 50	1 – 8	Waste control, blending and mixing can reduce fluctuations in raw gas concentrations that can lead to elevated short-term emissions.
Hydrogen fluoride (HF)		<2 (see split view 2)	<1	Wet FGT systems generally have the highest absorption capacity and deliver the lowest emission levels for these substances, but are generally more expensive. See Table 5.3 for consideration of criteria for selection between the main FGT systems, including cross-media impacts.
Sulphur dioxide (SO ₂)		1 – 150 (see split view 2)	1 – 40 (see split view 2)	Waste and combustion control techniques coupled with SCR generally result in operation within these emission ranges. The use of SCR imposes an additional energy demand and costs. In general at larger installations the use of SCR results in less significant additional cost per tonne of waste treated. High N waste may result in increased raw gas NO _x concentrations.
Nitrogen monoxide (NO) and nitrogen dioxide (NO ₂), expressed as nitrogen dioxide for installations using SCR		40 – 300 (see split view 2)	40 – 100 (see split view 2)	Waste and combustion control techniques with SNCR generally result in operation within these emission ranges. 24 hour averages below this range generally require SCR although levels below 70mg/Nm ³ have been achieved using SNCR e.g. where raw NO _x is low and/or at high reagent dose rates) Where high SNCR reagent dosing rates are used, the resulting NH ₃ slip can be controlled using wet FGT with appropriate measures to deal with the resultant ammoniacal waste water. High N waste may result in increased raw gas NO _x concentrations. (See also note 8 below in respect of small installations).
Nitrogen monoxide (NO) and nitrogen dioxide (NO ₂) expressed as nitrogen dioxide for installations not using SCR		30 – 350	120 – 180	Techniques that improve combustion conditions reduce emissions of these substances. Emission concentrations are generally not influenced greatly by FGT. CO levels may be higher during start-up and shut down, and with new boilers that have not yet established their normal operational fouling level
Gaseous and vaporous organic substances, expressed as TOC		1 – 20	1 – 10	Adsorption using carbon based reagents is generally required to achieve these emission levels with many wastes - as metallic Hg is more difficult to control than ionic Hg. The precise abatement performance and technique required will depend on the levels and distribution of Hg in the waste. Some waste streams have very highly variable Hg concentrations – waste pretreatment may be required in such cases to prevent peak overloading of FGC system capacity. Continuous monitoring of Hg is <u>not</u> required by Directive 2000/76/EC but has been carried out in some MSs
Carbon monoxide (CO)		5 – 100	5 – 30	See comments for Hg. The lower volatility of these metals than Hg means that dust and other metal control methods are more effective at controlling these substances than Hg.
Mercury and its compounds (as Hg)	<0.05 (see split view 2)	0.001 – 0.03	0.001 – 0.02	Techniques that control dust levels generally also control these metals
Total cadmium and thallium (and their compounds expressed as the metals)	0.005 - 0.05 (see split view 2)			Combustion techniques destroy PCDD/F in the waste. Specific design and temperature controls reduce <i>de-novo</i> synthesis. In addition to such measures, abatement techniques using carbon based absorbents reduce final emissions to within this emission range. Increased dosing rates for carbon absorbent may give emissions to air as low as 0.001 but result in increased consumption and residues.
Other metals	0.005 - 0.5			
Dioxins and furans (ng TEQ/Nm ³)	0.01 – 0.1 (see split view 2)			

Table 2: Operational emission level ranges associated with the use of BAT for release to air from waste incinerators

Substances not included in Directive 2000/76/EC on waste incineration:				
Ammonia (NH ₃)	<10	1 – 10	<10 (see split view 1)	Effective control of NO _x abatement systems, including reagent dosing contributes to reducing NH ₃ emissions. Wet scrubbers absorb NH ₃ and transfer it to the waste water stream.
Benz(a)pyrene	For these substances there was insufficient data to draw a firm BAT conclusion on emission levels. However, the data provided in Chapter 3 indicates that their emission levels are generally low. PCBs, PAHs and benz(a)pyrene can be controlled using the techniques applied for PCDD/F. N ₂ O levels are determined by combustion technique and optimisation, and SNCR optimisation where urea is used.			Techniques that control PCDD/F also control Benz(a)pyrene, PCBs and PAHs
PCBs				
PAHs				
Nitrous oxide (N ₂ O)				Effective oxidative combustion and control of NO _x abatement systems contribute to reducing N ₂ O emissions. The higher levels may be seen with fluidised beds operated at lower temperatures e.g. below ~900 °C
NOTES:				
1. The ranges given in this table are the levels of operational performance that may generally be expected as a result of the application of BAT – they are not legally binding emission limit values (ELVs)				
2. ∑ other metals = sum of Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V and their compounds expressed as the metals				
3. Non-continuous measurements are averaged over a sampling period of between 30 minutes and 8 hours. Sampling periods are generally in the order of 4 – 8 hours for such measurements.				
4. Data is standardised at 11 % Oxygen, dry gas, 273K and 101.3kPa				
5. Dioxin and furans are calculated using the equivalence factors as in EC/2000/76				
6. When comparing performance against these ranges, in all cases the following should be taken into account: the confidence value associated with determinations carried out; that the relative error of such determinations increases as measured concentrations decrease towards lower detection levels				
7. The operational data supporting the above-mentioned BAT ranges were obtained according to the currently accepted codes of good monitoring practice requiring measurement equipment with instrumental scales of 0 – 3 times the WID ELV. For parameters with an emission profile of a very low baseline combined with short period peak emissions, specific attention has to be paid to the instrumental scale. For example changing the instrumental scale for the measurement of CO from 3-times the WID ELV to a 10-times higher value, has been reported in some cases, to increase the reported values of the measurement by a factor of 2 – 3. This should be taken into account when interpreting this table.				
8. One MS reported that technical difficulties have been experienced in some cases when retrofitting SNCR abatement systems to existing small MSW incineration installations, and that the cost effectiveness (i.e. NO _x reduction per unit cost) of NO _x abatement (e.g. SNCR) is lower at small MSWIs (i.e. those MSWIs of capacity <6 tonnes of waste/hour).				
SPLIT VIEWS:				
1. BAT 35 : Based upon their knowledge of the performance of existing installations a few Member States and the Environmental NGO expressed the split view that the 24 hour NH ₃ emission range associated with the use of BAT should be <5 mg/Nm ³ (in the place of <10 mg/ Nm ³)				
2. BAT 35 : One Member State and the Environmental NGO expressed split views regarding the BAT ranges in table 5.2 (air). These split views were based upon their knowledge of the performance of a number of existing installations, and their interpretation of data provided by the TWG and also of that included in this BREF document (e.g. in Chapter 3). The final outcome of the TWG meeting was the ranges shown in Table 5.2, but with the following split views recorded: total dust 1/2hr average 1 - 10 mg/Nm ³ ; NO _x (as NO ₂) using SCR 1/2hr average 30 - 200 and 24hr average 30 - 100 mg/Nm ³ ; Hg and its compounds (as Hg) non-continuous 0.001 - 0.03 mg/Nm ³ ; Total Cd + Ti non-continuous 0.005 - 0.03mg/Nm ³ ; Dioxins and furans non-continuous 0.01 - 0.05 ng TEQ/Nm ³ . Based on the same rationale, the Environmental NGO also registered the following split views: HF 1/2hr average <1 mg/Nm ³ ; SO ₂ 1/2hr average 1 – 50 mg/Nm ³ and 24hr average 1 – 25 mg/Nm ³ .				

Table 5.2 Operational emission level ranges associated with the use of BAT for releases to air from waste incinerators

Table 3: An example assessment of some IPPC relevant criteria that may be taken into account when selecting between wet/semi-wet/dry FGT options

Criteria	Wet FGT (W)	Semi-wet FGT (SW)	Dry lime FGT (DL)	Dry sodium bicarbonate FGT (DS)	Comments
Air emissions performance	+	0	-	0	<ul style="list-style-type: none"> in respect of HCl, HF, NH₃ & SO₂ wet systems generally give the lowest emission levels to air each of the systems are usually combined with additional dust and PCDD/F control equipment DL systems may reach similar emission levels as DS & SW but only with increased reagent dosing rates and associated increased residue production.
Residue production	+	0	-	0	<ul style="list-style-type: none"> residue production per tonne waste is generally higher with DL systems and lower with W systems with greater concentration of pollutants in residues from W systems material recovery from residues is possible with W systems following treatment of scrubber effluent, and with DS systems
Water consumption	-	0	+	+	<ul style="list-style-type: none"> water consumption is generally higher with W systems Dry systems use little or no water
Effluent production	-	+	+	+	<ul style="list-style-type: none"> the effluents produced (if not evaporated) by W systems require treatment and usually discharge – where a suitable receptor for the salty treated effluent can be found (e.g. marine environments) the discharge itself may not be a significant disadvantage ammonia removal from effluent may be complex
Energy consumption	-	0	0	0	<ul style="list-style-type: none"> energy consumption higher with W systems due to pump demand – and is further increased where (as is common) combined with other FGT components e.g. for dust removal
Reagent consumption	+	0	-	0	<ul style="list-style-type: none"> generally lowest reagent consumption with W systems generally highest reagent consumption with DL – but may be reduced with reagent re-circulation SW, and DL & DS systems can benefit from use of raw gas acid monitoring (see 4.4.3.9)
Ability to cope with inlet variations of pollutant	+	0	-	0	<ul style="list-style-type: none"> W systems are most capable of dealing with wide ranging and fast changing inlet concentrations of HCl, HF and SO₂. DL systems generally offer less flexibility – although this may be improved with the use of raw gas acid monitoring (see 4.4.3.9)
Plume visibility	-	0	+	+	<ul style="list-style-type: none"> plume visibility is generally higher with wet systems (unless special measures used) dry systems generally have the lowest plume visibility
Process complexity	- (highest)	0 (medium)	+	+	<ul style="list-style-type: none"> W systems themselves are quite simple but other process components are required to provide an all round FGT system, including a waste water treatment plant etc.
Costs - capital	Generally higher	medium	Generally lower	Generally lower	<ul style="list-style-type: none"> additional cost for wet system arises from the additional costs for complementary FGT and auxiliary components – most significant at smaller plants
Costs – operational	medium	Generally lower	medium	Generally lower	<ul style="list-style-type: none"> there is an additional operational cost of ETP for W systems – most significant at smaller plants higher residue disposal costs where more residues are produced, and more reagent consumed. W systems generally produce lowest amounts of reagents and therefore may have lower reagent disposal costs. op. costs include consumables, disposal and maintenance costs. Op. costs depend very much on local prices for consumables and residue disposal.
<p>Note: + means that the use of the technique generally offers an advantage in respect of the assessment criteria considered 0 means that the use of the technique generally offers no significant advantage or disadvantage in respect of the assessment criteria considered - means that the use of the technique generally offers a disadvantage in respect of the assessment criteria considered</p>					

Table 5.3: An example assessment of some IPPC relevant criteria that may be taken into account when selecting between wet/semi-wet/dry FGT options

Waste water control

The BAT regarding waste water control include:

- the in-process recirculation of certain effluents
- the separation of drainage for certain effluents
- the use of on-site effluent treatment for wet scrubber effluents
- BAT associated performance levels for emissions from scrubber effluent treatment
- the use of specific techniques.

The performance ranges agreed by the wider TWG resulted in some split views from one Member State and the Environmental NGO, who believed that lower emission values than the ranges given could also be considered to be BAT.

Table 4: BAT associated operational emission levels for discharges of waste water effluent treatment plants receiving FGT scrubber effluent

Parameter	BAT range in mg/l (unless stated)	Sampling and data information
Total suspended solids as defined by Directive 91/271/EEC	10 – 30 (95 %) 10 – 45 (100 %)	• based on spot daily or 24 hour flow proportional sample
Chemical oxygen demand	50 – 250	• based on spot daily, or 24 hour flow proportional sample
pH	pH 6.5 – pH 11	• continuous measurement
Hg and its compounds, expressed as Hg	0.001 – 0.03 (see split view 1)	<ul style="list-style-type: none"> • based on monthly measurements of a flow proportional representative sample of the discharge over a period of 24 hours with one measurement per year exceeding the values given, or no more than 5 % where more than 20 samples are assessed per year • There have been some positive experiences with continuous monitoring of Hg • Total Cr levels below 0.2 mg/l provide for control of Chromium VI • Sb, Mn, V and Sn are not included in Directive 2000/76
Cd and its compounds, expressed as Cd	0.01 – 0.05 (see split view 1&2)	
Tl and its compounds, expressed as Tl	0.01 – 0.05 (see split view 2)	
As and its compounds, expressed as As	0.01 – 0.15 (see split view 1)	
Pb and its compounds, expressed as Pb	0.01 – 0.1	
Cr and its compounds, expressed as Cr	0.01 – 0.5 (see split view 2)	
Cu and its compounds, expressed as Cu	0.01 – 0.5 (see split view 2)	
Ni and its compounds, expressed as Ni	0.01 – 0.5 (see split view 2)	
Zn and its compounds, expressed as Zn	0.01 – 1.0 (see split view 2)	
Sb and its compounds, expressed as Sb	0.005 – 0.85 (see split view 1)	
Co and its compounds, expressed as Co	0.005 – 0.05	
Mn and its compounds, expressed as Mn	0.02 – 0.2	
V and its compounds, expressed as V	0.03 – 0.5 (see split view 1)	
Sn and its compounds, expressed as Sn	0.02 – 0.5	
PCDD/F (TEQ)	0.01 – 0.1 ng TEQ/l (see split view 1&2)	
<p>NOTE:</p> <ol style="list-style-type: none"> 1. Values are expressed in mass concentrations for unfiltered samples 2. Values relate to the discharge of treated scrubber effluents without dilution 3. BAT ranges are not the same as ELVs – see comments in introduction to Chapter 5 4. pH is one important parameter for waste water treatment process control 5. Confidence levels decrease as measured concentrations decrease towards lower detection levels <p>SPLIT VIEWS:</p> <p>1 BAT 48: One Member State and the Environmental NGO expressed split views regarding the BAT ranges in table 5.4 (water). These split views were based upon their knowledge of the performance of a number of existing installations, and their interpretation of data provided by the TWG and also of that included in this BREF document (e.g. in Chapter 3). The final outcome of the TWG meeting was the ranges shown in Table 5.4, but with the following split views recorded: Hg 0.001 - 0.01 mg/l; Cd 0.001 - 0.05 mg/l; As 0.003 - 0.05 mg/l; Sb 0.005 - 0.1 mg/l; V 0.01 - 0.1 mg/l; PCDD/F <0.01 - 0.1 ng TEQ/l.</p> <p>2 BAT 48: Based on the same rationale, the Environmental NGO also registered the following split views: Cd 0.001 - 0.02 mg/l; Tl 0.001 – 0.03 mg/l; Cr 0.003 – 0.02 mg/l; Cu 0.003 – 0.3 mg/l; Ni 0.003 – 0.2 mg/l.; Zn 0.01 – 0.05 mg/l; PCDD/F <0.01 ng TEQ/l.</p>		

Table 5.4: BAT associated operational emission levels for discharges of waste water from effluent treatment plant receiving FGT scrubber effluent

Residue management

BAT regarding residue management include:

- a bottom ash burnout TOC level of below 3 %, with typical values falling between 1 and 2 %
- a list of techniques, which when suitably combined may attain these burnout levels
- the separate management of bottom ash from fly ash and a requirement to assess each stream produced
- the extraction of ferrous and non-ferrous metals from ash for their recovery (where present in ash to sufficient degree to make this viable)
- the treatment of bottom ashes and other residues using certain techniques - to the extent required for them to meet the acceptance criteria at the receiving recovery or disposal site.

Specific industry BAT

In addition to the generic BAT outlined above, more specific BAT are identified for those sub-sectors of the industry treating mainly the following wastes:

- municipal wastes
- pretreated or selected municipal wastes
- hazardous wastes
- sewage sludge
- clinical waste.

The specific BAT provide, where it has been possible, more detailed BAT conclusions. These conclusions deal with the following waste stream specific issues:

- in-coming waste management, storage and pretreatment
- combustion techniques
- energy recovery performance

Compared with incineration, the degree of demonstration (in terms of overall throughput and operational hours) of pyrolysis and gasification on the main European waste streams is low, and operational difficulties are reported at some installations. However, as both gasification and pyrolysis are applied in the sector, according to the BREF definition they cannot be considered to be emerging techniques, and for that reason they are included in the BREF chapter on the determination of BAT.

ANNEX II

DETERMINATION OF AIR EMISSION LIMIT VALUES FOR THE CO-INCINERATION OF WASTE

The following formula (mixing rule) is to be applied whenever a specific total emission limit value 'C' has not been set out in a table in this Annex.

The limit value for each relevant pollutant and carbon monoxide in the exhaust gas resulting from the co-incineration of waste shall be calculated as follows:

$$\frac{V_{waste} \times C_{waste} + V_{proc} \times C_{proc}}{V_{waste} + V_{proc}} = C$$

V_{waste} : exhaust gas volume resulting from the incineration of waste only determined from the waste with the lowest calorific value specified in the permit and standardised at the conditions given by this Directive.

If the resulting heat release from the incineration of hazardous waste amounts to less than 10 % of the total heat released in the plant, V_{waste} must be calculated from a (notional) quantity of waste that, being incinerated, would equal 10 % heat release, the total heat release being fixed.

C_{waste} : emission limit values set for incineration plants in Annex V for the relevant pollutants and carbon monoxide.

V_{proc} : exhaust gas volume resulting from the plant process including the combustion of the authorised fuels normally used in the plant (wastes excluded) determined on the basis of oxygen contents at which the emissions must be standardised as laid down in Community or national regulations. In the absence of regulations for this kind of plant, the real oxygen content in the exhaust gas without being thinned by addition of air unnecessary for the process must be used. The standardisation at the other conditions is given in this Directive.

C_{proc} : emission limit values as laid down in the tables of this annex for certain industrial sectors or in case of the absence of such a table or such values, emission limit values of the relevant pollutants and carbon monoxide in the flue gas of plants which comply with the national laws, regulations and administrative provisions for such plants while burning the normally authorised fuels (wastes excluded). In the absence of these measures the emission limit values laid down in the permit are used. In the absence of such permit values the real mass concentrations are used.

C: total emission limit values and oxygen content as laid down in the tables of this annex for certain industrial sectors and certain pollutants or in case of the absence of such a table or such values total emission limit values for CO and the relevant pollutants replacing the emission limit values as laid down in specific Annexes of this Directive. The total oxygen content to replace the oxygen content for the standardisation is calculated on the basis of the content above respecting the partial volumes.

Member States may lay down rules governing the exemptions provided for in this Annex.

II.1. Special provisions for cement kilns co-incinerating waste

Daily average values (for continuous measurements) Sample periods and other measurement requirements as in Article 7. All values in mg/m³ (Dioxins and furans ng/m³). Half-hourly average values shall only be needed in view of calculating the daily average values.

The results of the measurements made to verify compliance with the emission limit values shall be standardised at the following conditions: Temperature 273 K, pressure 101,3 kPa, 10 % oxygen, dry gas.

II.1.1. C — total emission limit values

Pollutant	C
Total dust	30
HCl	10
HF	1
NO _x for existing plants	800
NO _x for new plants	500 ⁽¹⁾

Pollutant	C
Cd + Tl	0,05
Hg	0,05
Sb + As + Pb + Cr + Co + Cu + Mn + Ni + V	0,5
Dioxins and furans	0,1

(f) For the implementation of the NO_x emission limit values, cement kilns which are in operation and have a permit in accordance with existing Community legislation and which start co-incinerating waste after the date mentioned in Article 20(3) are not to be regarded as new plants.

Until 1 January 2008, exemptions for NO_x may be authorised by the competent authorities for existing wet process cement kilns or cement kilns which burn less than three tonnes of waste per hour, provided that the permit foresees a total emission limit value for NO_x of not more than 1200 mg/m³.

Until 1 January 2008, exemptions for dust may be authorised by the competent authority for cement kilns which burn less than three tonnes of waste per hour, provided that the permit foresees a total emission limit value of not more than 50 mg/m³.

II.1.2. C — total emission limit values for SO₂ and TOC

Pollutant	C
SO ₂	50
TOC	10

Exemptions may be authorised by the competent authority in cases where TOC and SO₂ do not result from the incineration of waste.

II.1.3. Emission limit value for CO

Emission limit values for CO can be set by the competent authority.

II.2. Special provisions for combustion plants co-incinerating waste

II.2.1. Daily average values

Without prejudice to Directive 88/609/EEC and in the case where, for large combustion plants, more stringent emission limit values are set according to future Community legislation, the latter shall replace, for the plants and pollutants concerned, the emission limit values as laid down in the following tables (C_{proc}). In that case, the following tables shall be adapted to these more stringent emission limit values in accordance with the procedure laid down in Article 17 without delay.

Half-hourly average values shall only be needed in view of calculating the daily average values.

C_{proc}:

C_{proc} for solid fuels expressed in mg/Nm³ (O₂ content 6 %):

Pollutants	< 50 MWth	50-100 MWth	100 to 300 MWth	> 300 MWth
SO ₂ general case		850	850 to 200 (linear decrease from 100 to 300 MWth)	200
indigenous fuels		or rate of desulphurisation ≥90 %	or rate of desulphurisation ≥92 %	or rate of desulphurisation ≥95 %
NO _x		400	300	200
Dust	50	50	30	30

Until 1 January 2007 and without prejudice to relevant Community legislation, the emission limit value for NO_x does not apply to plants only co-incinerating hazardous waste.

Until 1 January 2008, exemptions for NO_x and SO₂ may be authorised by the competent authorities for existing co-incineration plants between 100 and 300 MWth using fluidised bed technology and burning solid fuels provided that the permit foresees a C_{proc} value of not more than 350 mg/Nm³ for NO_x and not more than 850 to 400 mg/Nm³ (linear decrease from 100 to 300 MWth) for SO₂.

C_{proc} for biomass expressed in mg/Nm³ (O₂ content 6 %):

'Biomass' means: products consisting of any whole or part of a vegetable matter from agriculture or forestry, which can be used for the purpose of recovering its energy content as well as wastes listed in Article 2(2)(a)(i) to (v).

Pollutants	< 50 MWth	50 to 100 MWth	100 to 300 MWth	> 300 MWth
SO ₂		200	200	200
NO _x		350	300	300
Dust	50	50	30	30

Until 1 January 2008, exemptions for NO_x may be authorised by the competent authorities for existing co-incineration plants between 100 and 300 MWth using fluidised bed technology and burning biomass provided that the permit foresees a C_{proc} value of not more than 350 mg/Nm³.

C_{proc} for liquid fuels expressed in mg/Nm³ (O₂ content 3 %):

Pollutants	< 50 MWth	50 to 100 MWth	100 to 300 MWth	> 300 MWth
SO ₂		850	850 to 200 (linear decrease from 100 to 300 MWth)	200
NO _x		400	300	200
Dust	50	50	30	30

II.2.2. C — total emission limit values

C expressed in mg/Nm³ (O₂ content 6 %). All average values over the sample period of a minimum of 30 minutes and a maximum of 8 hours:

Pollutant	C
Cd + Tl	0,05
Hg	0,05
Sb + As + Pb + Cr + Co + Cu + Mn + Ni + V	0,5

C expressed in ng/Nm³ (O₂ content 6 %). All average values measured over the sample period of a minimum of 6 hours and a maximum of 8 hours:

Pollutant	C
Dioxins and furans	0,1

II.3. Special provisions for industrial sectors not covered under II.1 or II.2 co-incinerating waste

II.3.1. C — total emission limit values:

C expressed in ng/Nm³. All average values measured over the sample period of a minimum of 6 hours and a maximum of 8 hours:

Pollutant	C
Dioxins and furans	0,1

C expressed in mg/Nm³. All average values over the sample period of a minimum of 30 minutes and a maximum of 8 hours:

Pollutant	C
Cd + Tl	0,05
Hg	0,05

ANNEX III

Measurement techniques

1. Measurements for the determination of concentrations of air and water polluting substances have to be carried out representatively.
2. Sampling and analysis of all pollutants including dioxins and furans as well as reference measurement methods to calibrate automated measurement systems shall be carried out as given by CEN-standards. If CEN standards are not available, ISO standards, national or international standards which will ensure the provision of data of an equivalent scientific quality shall apply.
3. At the daily emission limit value level, the values of the 95 % confidence intervals of a single measured result shall not exceed the following percentages of the emission limit values:

Carbon monoxide:	10 %
Sulphur dioxide:	20 %
Nitrogen dioxide:	20 %
Total dust:	30 %
Total organic carbon:	30 %
Hydrogen chloride:	40 %
Hydrogen fluoride:	40 %.

ANNEX IV

Emission limit values for discharges of waste water from the cleaning of exhaust gases

Polluting substances	Emission limit values expressed in mass concentrations for unfiltered samples	
	95 % 30 mg/l	100 % 45 mg/l
1. Total suspended solids as defined by Directive 91/271/EEC		
2. Mercury and its compounds, expressed as mercury (Hg)	0,03 mg/l	
3. Cadmium and its compounds, expressed as cadmium (Cd)	0,05 mg/l	
4. Thallium and its compounds, expressed as thallium (Tl)	0,05 mg/l	
5. Arsenic and its compounds, expressed as arsenic (As)	0,15 mg/l	
6. Lead and its compounds, expressed as lead (Pb)	0,2 mg/l	
7. Chromium and its compounds, expressed as chromium (Cr)	0,5 mg/l	
8. Copper and its compounds, expressed as copper (Cu)	0,5 mg/l	
9. Nickel and its compounds, expressed as nickel (Ni)	0,5 mg/l	
10. Zinc and its compounds, expressed as zinc (Zn)	1,5 mg/l	
11. Dioxins and furans, defined as the sum of the individual dioxins and furans evaluated in accordance with Annex I	0,3 mg/l	

Until 1 January 2008, exemptions for total suspended solids may be authorised by the competent authority for existing incineration plants provided the permit foresees that 80 % of the measured values do not exceed 30 mg/l and none of them exceed 45 mg/l.

ANNEX V

AIR EMISSION LIMIT VALUES

(a) Daily average values

Total dust	10 mg/m ³
Gaseous and vaporous organic substances, expressed as total organic carbon	10 mg/m ³
Hydrogen chloride (HCl)	10 mg/m ³
Hydrogen fluoride (HF)	1 mg/m ³
Sulphur dioxide (SO ₂)	50 mg/m ³
Nitrogen monoxide (NO) and nitrogen dioxide (NO ₂), expressed as nitrogen dioxide for existing incineration plants with a nominal capacity exceeding 6 tonnes per hour or new incineration plants	200 mg/m ³ (*)
Nitrogen monoxide (NO) and nitrogen dioxide (NO ₂), expressed as nitrogen dioxide for existing incineration plants with a nominal capacity of 6 tonnes per hour or less	400 mg/m ³ (*)

(*) Until 1 January 2007 and without prejudice to relevant (Community) legislation the emission limit value for NO_x does not apply to plants only incinerating hazardous waste.

Exemptions for NO_x may be authorised by the competent authority for existing incineration plants:

- with a nominal capacity of 6 tonnes per hour, provided that the permit foresees the daily average values do not exceed 500 mg/m³ and this until 1 January 2008,
- with a nominal capacity of >6 tonnes per hour but equal or less than 16 tonnes per hour, provided the permit foresees the daily average values do not exceed 400 mg/m³ and this until 1 January 2010,
- with a nominal capacity of >16 tonnes per hour but <25 tonnes per hour and which do not produce water discharges, provided that the permit foresees the daily average values do not exceed 400 mg/m³ and this until 1 January 2008.

Until 1 January 2008, exemptions for dust may be authorised by the competent authority for existing incinerating plants, provided that the permit foresees the daily average values do not exceed 20 mg/m³.

(b) Half-hourly average values

	(100 %) A	(97 %) B
Total dust	30 mg/m ³	10 mg/m ³
Gaseous and vaporous organic substances, expressed as total organic carbon	20 mg/m ³	10 mg/m ³
Hydrogen chloride (HCl)	60 mg/m ³	10 mg/m ³
Hydrogen fluoride (HF)	4 mg/m ³	2 mg/m ³
Sulphur dioxide (SO ₂)	200 mg/m ³	50 mg/m ³
Nitrogen monoxide (NO) and nitrogen dioxide (NO ₂), expressed as nitrogen dioxide for existing incineration plants with a nominal capacity exceeding 6 tonnes per hour or new incineration plants	400 mg/m ³ (*)	200 mg/m ³ (*)

(*) Until 1 January 2007 and without prejudice to relevant Community legislation the emission limit value for NO_x does not apply to plants only incinerating hazardous waste.

Until 1 January 2010, exemptions for NO_x may be authorised by the competent authority for existing incineration plants with a nominal capacity between 6 and 16 tonnes per hour, provided the half-hourly average value does not exceed 600 mg/m³ for column A or 400 mg/m³ for column B.

(c) All average values over the sample period of a minimum of 30 minutes and a maximum of 8 hours

Cadmium and its compounds, expressed as cadmium (Cd)		
Thallium and its compounds, expressed as thallium (Tl)	total 0,05 mg/m ³	total 0,1 mg/m ³ (*)
Mercury and its compounds, expressed as mercury (Hg)	0,05 mg/m ³	0,1 mg/m ³ (*)
Antimony and its compounds, expressed as antimony (Sb)		
Arsenic and its compounds, expressed as arsenic (As)		
Lead and its compounds, expressed as lead (Pb)		
Chromium and its compounds, expressed as chromium (Cr)		
Cobalt and its compounds, expressed as cobalt (Co)	total 0,5 mg/m ³	total 1 mg/m ³ (*)
Copper and its compounds, expressed as copper (Cu)		
Manganese and its compounds, expressed as manganese (Mn)		
Nickel and its compounds, expressed as nickel (Ni)		
Vanadium and its compounds, expressed as vanadium (V)		

(*) Until 1 January 2007 average values for existing plants for which the permit to operate has been granted before 31 December 1996, and which incinerate hazardous waste only.

These average values cover also gaseous and the vapour forms of the relevant heavy metal emissions as well as their compounds.

(d) Average values shall be measured over a sample period of a minimum of 6 hours and a maximum of 8 hours. The emission limit value refers to the total concentration of dioxins and furans calculated using the concept of toxic equivalence in accordance with Annex I.

Dioxins and furans	0,1 ng/m ³
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(e) The following emission limit values of carbon monoxide (CO) concentrations shall not be exceeded in the combustion gases (excluding the start-up and shut-down phase):

- 50 milligrams/m³ of combustion gas determined as daily average value;
- 150 milligrams/m³ of combustion gas of at least 95 % of all measurements determined as 10-minute average values or 100 mg/m³ of combustion gas of all measurements determined as half-hourly average values taken in any 24-hour period.

Exemptions may be authorised by the competent authority for incineration plants using fluidised bed technology, provided that the permit foresees an emission limit value for carbon monoxide (CO) of not more than 100 mg/m³ as an hourly average value.

(f) Member States may lay down rules governing the exemptions provided for in this Annex.

ANNEX VI

Formula to calculate the emission concentration at the standard percentage oxygen concentration

$$E_s = \frac{21 - O_s}{21 - O_M} \times E_M$$

E_s = calculated emission concentration at the standard percentage oxygen concentration

E_M = measured emission concentration

O_s = standard oxygen concentration

O_M = measured oxygen concentration

2.4.3 Landfilling of waste

Introduction

The regulation of landfilling in Europe is designed with two aims in mind, firstly to minimise the levels of contamination associated with the landfilling of waste and secondly to reduce the level of landfilling as part of a broader policy to minimise waste disposal. The latter is intended to push waste management activities up the waste hierarchy ie promoting the recovery and recycling of waste and to specifically reduce the biodegradable waste sent to landfill in turn reducing levels of methane (a powerful greenhouse gas) production. Requirements pertaining to the landfilling of waste are also included within Directives 2008/1/EC, 85/337/EEC, 96/82/EC and 91/689/EEC (see Chapter 2.4.1 for details on the disposal of hazardous waste). Requirements for landfilling activities are, however, dominated by the provisions of Directive 1999/31/EC¹⁵⁷ (known as the landfill Directive) aimed at reducing the landfilling of waste and ensuring the proper licensing, monitoring and aftercare of facilities. In addition Directives 2002/96/EC¹⁵⁸, 2006/66/EC¹⁵⁹, 2000/53/EC¹⁶⁰ and 94/62/EC¹⁶¹ also require that specific waste streams be diverted from landfill to be recovered or recycled.

Directive 1999/31/EC

Directive 1999/31/EC¹ on the landfill of waste has three aims:

- to tackle emissions of methane by limiting the amount of biodegradable waste going to landfill;
- encourage the prevention, recycling and recovery of waste by limiting its final disposal through landfill including requiring charges levied by operators to reflect the continuing costs of landfill, including clean up and aftercare; and
- safeguard the health of people and the environment by reducing emissions to air, land and water by setting limit values for emissions and ensuring the

¹⁵⁷ Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1999L0031:20031120:EN:PDF>

¹⁵⁸ Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2000L0053:20050701:EN:PDF>

¹⁵⁹ Directive 2006/66/EC of the European Parliament and of the Council of 6 September 2006 on batteries and accumulators and waste batteries and accumulators and repealing Directive 91/157/EEC, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2006L0066:20080320:EN:PDF>

¹⁶⁰ Directive 2000/53/EC of the European Parliament and of the Council of 18 September 2000 on end-of life vehicles, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2000L0053:20050701:EN:PDF>

¹⁶¹ European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1994L0062:20050405:EN:PDF>

proper licensing, monitoring and aftercare of new and existing landfill sites across all Member States.

For operators of landfills the Directive has various implications including:

- the need to comply with landfill requirements to protect the environment and health and the implications of this for engineering and location;
- the need to be aware of substances banned from landfills;
- that monitoring and compliance needs are rigorous during the life of the plant and also for after care;
- the liability and cost implications of the above;
- issues pertaining to the acceptance of biodegradable wastes, the associated production of landfill gas ie methane and the health, safety and environmental consequences of this; and
- managing landfills in an environmentally sound manner with a reduced proportion of biodegradable wastes which can often act as a binding agent reducing litter and dust production.

Requirements of the Directive

Within the Directive a landfill is defined as ‘*a waste disposal site for the deposit of the waste onto or into land (i.e. underground)*’. Under the Directive there are three distinct classes of landfill and all landfills must be classified as:

- **Hazardous**, ie any waste covered by Directive 91/689/EEC on hazardous wastes (see Chapter 2.4.1);
- **Non hazardous**, ie wastes not covered by Directive 91/689/EEC, according to Directive 1999/31/EC these may include: municipal waste; non-hazardous waste of any other origin that fulfils the criteria for the acceptance of waste at landfill for non-hazardous waste; and stable, non-reactive hazardous wastes (e.g. solidified, vitrified), with leaching behaviour equivalent to those of the non-hazardous wastes - these hazardous wastes shall not be deposited in cells destined for biodegradable non-hazardous waste; and
- **Inert**, defined as waste that does not undergo any significant physical, chemical or biological transformations. Inert waste will not dissolve, burn or otherwise physically or chemically react, biodegrade or adversely affect other matter with which it comes into contact in a way likely to give rise to environmental pollution or harm human health. The total leachability and pollutant content of the waste and the ecotoxicity of the leachate must be insignificant, and in particular not endanger the quality of surface water and/or groundwater.

It is no longer acceptable to mix these different types of waste in one landfill, known as co-disposal, except in very limited circumstances. In order to establish exactly how to determine what waste should be landfilled under which conditions the Decision 2003/33/EC on acceptance criteria² sets out a decision tree to provide some support. This can be used in conjunction with the acceptance criteria set out in Annex B of this Chapter to establish the landfilling approach appropriate for a particular waste stream.

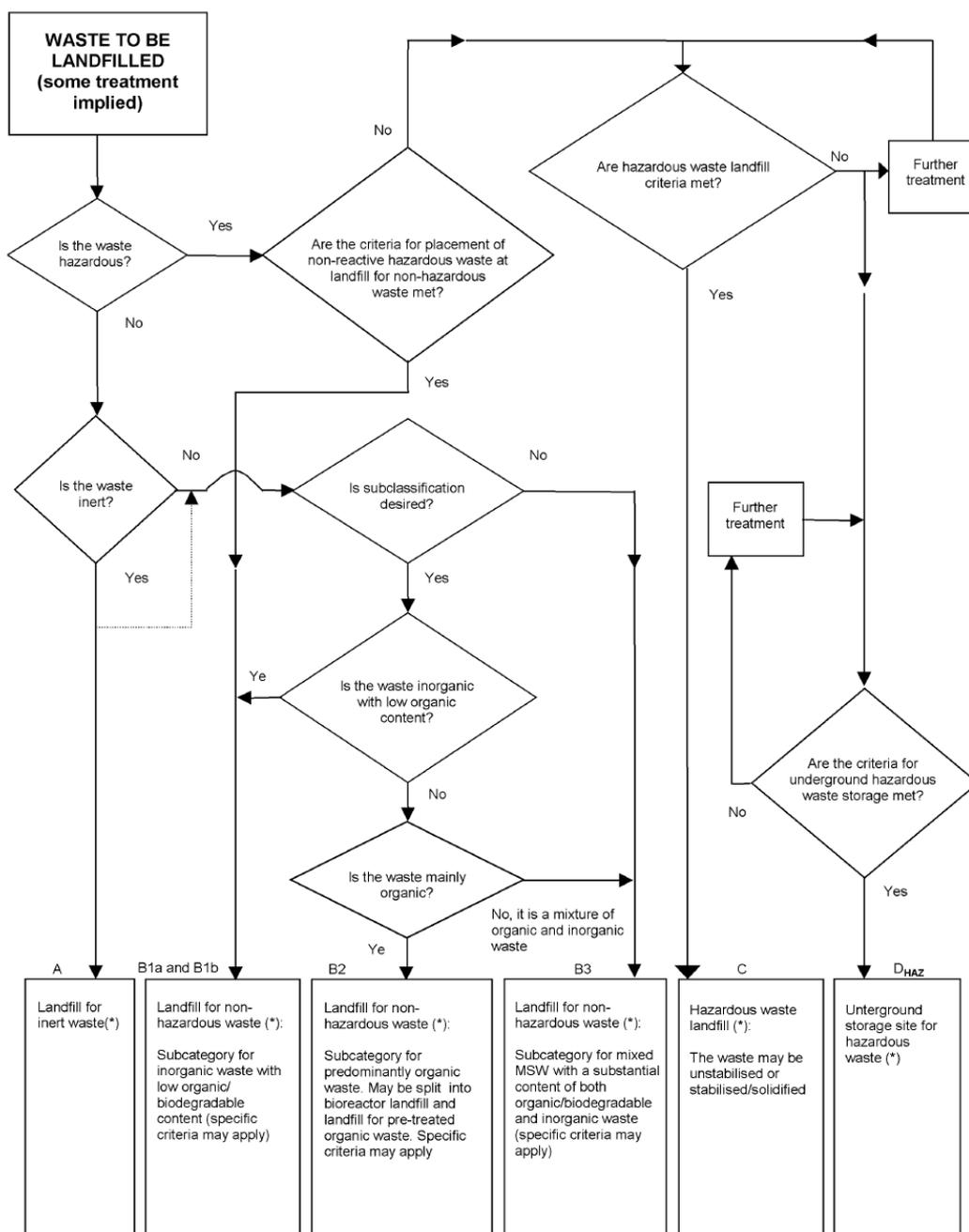
The Directive sets out a list of wastes that must not be accepted for landfilling, these are:

- liquid waste with the exception of sewage sludge;
- waste which is explosive, corrosive, oxidising, highly flammable or flammable;
- infectious clinical waste from either medical or veterinary sources;
- whole tyres (from 2003) and shredded tyres (from 2006), except large tyres and bicycle tyres; and
- any other waste which does not fulfil the acceptance criteria set out in the Directive and presented in Annex B.

Specific activities are excluded from the scope of the Directive:

- the spreading of sewage or dredging sludges on soil for fertilisation
- the deposit of non hazardous dredging sludges alongside waterways or in surface waters.
- the use of suitable inert waste for construction or restoration of landfills
- the deposit of unpolluted soil and inert waste from mineral extraction or quarrying. In addition, Member States may exempt the deposit of other non hazardous waste arising from these activities;
- Member States may exempt landfills for non hazardous or inert waste below a certain capacity serving islands or isolated settlements, as defined in Article 2 of the Directive; and
- Member states may exempt underground storage from certain provisions of the Directive.

Figure 1 : This diagram sets out the decisions necessary in order to determine to which type of landfill a specific type of waste should be sent – taken from the Decision 2003/33/EC on acceptance criteria



(*) In principle, underground storage is also possible for inert and non-hazardous waste.

Under the Directive all waste must be treated before it is landfilled, unless it is defined as inert. Treatment is defined as ‘physical, thermal, chemical or biological processes, including sorting, that change the characteristics of the waste in order to reduce its volume or hazardous nature, facilitate its handling or enhance recovery.’ While treatment is essential it is, however, prohibited to dilute or mix waste in order to meet waste acceptance criteria (see Annex B for details of these criteria).

Directive 1999/31/EC, and its supporting Decision on the acceptance criteria for landfills, set out detailed specifications as to what can be landfilled at either hazardous, non hazardous and inert sites. This includes numerous limit values for different types of waste and specific testing protocols both for establishing the nature of waste and also ensuring appropriate management of landfills. The acceptance criteria and monitoring needs for the different categories of landfill are contained, in Annexes B and C of this chapter¹⁶²; these are legally set out in Decision 2003/33/EC and Annex III of the landfill Directive.

Acceptance criteria are complemented by specific procedures that must be followed before waste can be accepted for landfilling. These are:

- Documentation must be provided to demonstrate that waste can be accepted at a landfill site based on the conditions set within its permit.
- Upon receipt of waste documentation concerning the waste must be checked, a visual inspection must be conducted upon the waste, as appropriate conformity with the description provided should be documentation verified and a register of the quantify and characteristics of the waste must be kept (including details of origin, date of delivery, identity of producer or collector for municipal waste and for hazardous waste the location of the site).
- The operator of the landfill must provide written acknowledgement of the receipt of each delivery of waste.
- If waste is not accepted at a landfill the operator must notify immediately the competent authority of this.

In addition to criteria and procedures setting out the nature of waste to be accepted at a landfill there are also broader requirements that will limit the location, design and broader operating of the site. All landfills must be compliant with these broader requirements which are set out in Annex I of the Directive and presented in Annex A of this chapter. The requirements include provisions relating to the approximate location of the landfill, control of water movement and leachate, protection of soils and water and provisions to control landfill gas.

The provisions set out in Annex A and B of this chapter, along with provisions on monitoring (see Annex C to this chapter), are intended to ensure that throughout the life of a landfill environmental impacts are minimised and waste is appropriately disposed of.

Permitting

The Directive lays down specific requirements for the application for and issuing of permits. Without an appropriately approved permit landfilling operations can not be conducted. In each Member State there will be set procedures for permit application,

¹⁶² It should be noted that in relation to the acceptance criteria Member States are permitted to set up to three times higher limit values for some parameters, ie less strict standards, provided that a case-by-case risk assessment is carried out which shows that this would pose no additional environmental impact or risk. Member States may also introduce more stringent measures than those set out in the Decision (provided that they are compatible with the Treaty and are notified to the Commission), as well as limit values for materials that are not included in the Decision.

however, in line with the Directive applications as a minimum must contain the following:

- the identity of the applicant and, in some cases, of the operator;
- a description of the types and total quantity of waste to be deposited;
- the capacity of the disposal site;
- a description of the site;
- the proposed methods for pollution prevention and abatement;
- the proposed operation, monitoring and control plan;
- the plan for closure and aftercare procedures;
- the applicant's financial security;
- an impact assessment study, where required on the assessment of the effects on the environment.

Under the Directive a permit can only be issued if:

- The project complies with all the requirements of the Directive including compliance with the requirements on environmental protection set out in Annex I of the Directive and Annex A of this chapter.
- The management of the landfill will be in the hands of a technically competent manager and professional and technical development and training of operators and staff is provided.
- The landfill will be operated in a way that prevents accidents and limits their consequences.
- That adequate provision is made, by way of financial guarantee or equivalent, to ensure that obligations under the Directive, including aftercare provisions, are completed.

The competent authority, ie the regulatory body in a given Member State charged with permitting, will issue an installation with a permit if it deems that a development is appropriate and in line with broader waste management objectives and plans. The permit sets out the specific conditions with which a particular landfill must comply including: the permitted activities; quantities of waste to be disposed of; nature of waste (ie class of the landfill); the operating procedures; details of the required monitoring and reporting regime; contingency plans and provisional requirements for closure and aftercare. Prior to the commencement of disposal operations the competent authority must inspect the proposed facility to ensure it is in compliance with the permit conditions. While reporting requirements will be set within the permit it should be noted that, as a minimum, annual reporting will be required. This should set out the types and quantities of waste disposed of as well as the results of any monitoring. Additionally, if any 'significant adverse environmental effects' are noted as a result of monitoring the operator of the landfill must inform the competent authority and undertake any corrective action needed at their own expense.

Closure and Aftercare

Central to achieving the objectives of Directive 1999/31/EC are requirements relating to the after care of the site. A landfill can only be formally considered as closed once the competent authority has conducted a site visit, has assessed all reports submitted

to them in relation to the site and has formally approved the closure. However, closure of a site does not reduce the responsibility of the operator for the landfill and they remain accountable for the site's maintenance, monitoring and control for as long as may be required by the competent authority. During this after care period the operator must inform the authorities of any significant adverse environmental effects revealed by the monitoring procedures. Importantly the requirements upon the operator to provide adequate financial security remain as long as maintenance and after care operations are ongoing.

Reducing Waste to Landfill

There are two measures set out in Directive 1999/31/EC that are explicitly intended to aid the diversion of waste away from this method of disposal. The first is that the estimated costs of setting up, operating, closure and aftercare of the site for at least 30 years must be reflected in the price charged by the operator for accepting waste for landfill. This measure is aimed at ensuring that the true cost of landfill is reflected in its price to the waste producer, so that it is not treated as a cheap and easy option.

Additionally, the Directive specifically aims to reduce the proportion of biodegradable waste disposed of in landfills leading to a reduction in methane emissions. As such Member States were required to draw up national strategies for reducing the amount of biodegradable waste going into landfill. These must ensure that the following targets are achieved by means of recycling, composting, biogas production or materials/energy recovery. Reduction of biodegradable municipal waste going to landfill must take place as follows:

- a reduction to 75 per cent of 1995 levels by 2006;
- a reduction to 50 per cent of 1995 levels by 2009; and
- a reduction to 35 per cent of 1995 levels by 2016.

Those Member States putting more than 80 per cent of their municipal waste into landfill in 1995 were permitted to postpone attainment of the above targets by up to 4 years.

IPPC, EIA and industrial risk prevention

Landfills meeting certain requirements are explicitly covered by Directive 2008/1/EC¹⁶³ on IPPC, meaning that they must be managed in line with the provisions of that Directive (see Chapter 1.4) to ensure that they are designed to prevent, or where that is not practicable, to reduce emissions in the air, water and land in order to achieve a high level of protection of the environment as a whole. Landfilling activities covered by Directive 2008/1/EC are:

¹⁶³ Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:024:0008:0029:EN:PDF>

- Installations for the disposal of non-hazardous waste, with a capacity exceeding 50 tonnes per day;
- Landfills receiving more than 10 tonnes per day or with a total capacity exceeding 25 000 tonnes, excluding landfills of inert waste.

While there is a BREF setting out best available techniques (BAT) in relation to the treatment of wastes there is, however, no BREF setting BAT for landfills. Importantly, Article 1(2) of the landfill Directive states that technical requirements under Directive 2008/1/EC will be deemed to be fulfilled if the requirements of the landfill Directive are complied with.

Unsurprisingly given their nature landfills are also covered by Directive 85/337/EEC on EIA. Under Annex I of this Directive it is specified that ‘waste disposal installations for ... landfill of hazardous wastes’ must be subject to an EIA before commencement. Additionally all other landfills may be subject to an EIA as part of the classification by the inclusion in Annex II of the Directive all waste disposal activities other than those covered in Annex I. For details of how an EIA should be conducted in line with the Directive see Chapter 1.1.

The requirements of Directive 96/82/EC on the control of major accident hazards applies to waste landfill sites containing dangerous substances (defined in Annex I of the Directive) in particular those used in connection with the chemical and thermal processing of materials (see Chapter 1.5 for details).

Annex A: Extract from Annex I of Directive 1999/31/EC: GENERAL REQUIREMENTS FOR ALL CLASSES OF LANDFILLS

1. Location

- 1.1. The location of a landfill must take into consideration requirements relating to:
- (a) the distances from the boundary of the site to residential and recreation areas, waterways, water bodies and other agricultural or urban sites;
 - (b) the existence of groundwater, coastal water or nature protection zones in the area;
 - (c) the geological and hydrogeological conditions in the area;
 - (d) the risk of flooding, subsidence, landslides or avalanches on the site;
 - (e) the protection of the nature or cultural patrimony in the area.
- 1.2. The landfill can be authorised only if the characteristics of the site with respect to the abovementioned requirements, or the corrective measures to be taken, indicate that the landfill does not pose a serious environmental risk.

2. Water control and leachate management

Appropriate measures shall be taken, with respect to the characteristics of the landfill and the meteorological conditions, in order to:

- control water from precipitations entering into the landfill body,
- prevent surface water and/or groundwater from entering into the landfilled waste,
- collect contaminated water and leachate. If an assessment based on consideration of the location of the landfill and the waste to be accepted shows that the landfill poses no potential hazard to the environment, the competent authority may decide that this provision does not apply,
- treat contaminated water and leachate collected from the landfill to the appropriate standard required for their discharge.

The above provisions may not apply to landfills for inert waste.

3. Protection of soil and water

3.1. A landfill must be situated and designed so as to meet the necessary conditions for preventing pollution of the soil, groundwater or surface water and ensuring efficient collection of leachate as and when required according to Section 2. Protection of soil, groundwater and surface water is to be achieved by the combination of a geological barrier and a bottom liner during the operational/active phase and by the combination of a geological barrier and a bottom liner during the operational/active phase and by the combination of a geological barrier and a top liner during the passive phase/post closure.

3.2. The geological barrier is determined by geological and hydrogeological conditions below and in the vicinity of a landfill site providing sufficient attenuation capacity to prevent a potential risk to soil and groundwater.

The landfill base and sides shall consist of a mineral layer which satisfies permeability and thickness requirements with a combined effect in terms of protection of soil, groundwater and surface water at least equivalent to the one resulting from the following requirements:

- landfill for hazardous waste: K greater than or equal to $1,0 \times 10^{-9}$ m/s; thickness greater than or equal to 5 m,
- landfill for non-hazardous waste: K greater than or equal to $1,0 \times 10^{-9}$ m/s; thickness greater than or equal to 1 m,
- landfill for inert waste: K greater than or equal to $1,0 \times 10^{-7}$ m/s; thickness greater than or equal to 5 m.

Where the geological barrier does not naturally meet the above conditions it can be completed artificially and reinforced by other means giving equivalent protection. An artificially established geological barrier should be no less than 0,5 metres thick.

3.3. In addition to the geological barrier described above a leachate collection and sealing system must be added in accordance with the following principles so as to ensure that leachate accumulation at the base of the landfill is kept to a minimum:

Leachate collection and bottom sealing

Leachate collection and bottom sealing

Landfill category	non hazardous	hazardous
Artificial sealing liner	required	required
Drainage layer $\geq 0,5$ m	required	required

Member States may set general or specific requirements for inert waste landfills and for the characteristics of the abovementioned technical means.

If the competent authority after a consideration of the potential hazards to the environment finds that the prevention of leachate formation is necessary, a surface sealing may be prescribed. Recommendations for the surface sealing are as follows:

Landfill category	non hazardous	hazardous
Gas drainage layer	required	not required
Artificial sealing liner	not required	required
Impermeable mineral layer	required	required
Drainage layer $> 0,5$ m	required	required
Top soil cover > 1 m	required	required.

3.4. If, on the basis of an assessment of environmental risks taking into account, in particular, Directive 80/68/EEC¹⁶⁴, the competent authority has decided, in accordance with Section 2 ("Water control and leachate management"), that collection and treatment of leachate is not necessary or it has been established that the landfill poses no potential hazard to soil, groundwater or surface water, the requirements in paragraphs 3.2 and 3.3 above may be reduced accordingly. In the case of landfills for inert waste these requirements may be adapted by national legislation.

3.5. The method to be used for the determination of the permeability coefficient for landfills, in the field and for the whole extension of the site, is to be developed and approved by the Committee set up under Article 17 of this Directive.

4. Gas control

4.1. Appropriate measures shall be taken in order to control the accumulation and migration of landfill gas (Annex III).

¹⁶⁴ Council Directive of 17 December 1979 on the protection of groundwater against pollution caused by certain dangerous substances, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1980L0068:19911223:EN:PDF>

4.2. Landfill gas shall be collected from all landfills receiving biodegradable waste and the landfill gas must be treated and used. If the gas collected cannot be used to produce energy, it must be flared.

4.3. The collection, treatment and use of landfill gas under paragraph 4.2 shall be carried on in a manner which minimises damage to or deterioration of the environment and risk to human health.

5. Nuisances and hazards

Measures shall be taken to minimise nuisances and hazards arising from the landfill through:

- emissions of odours and dust,
- wind-blown materials,
- noise and traffic,
- birds, vermin and insects,
- formation and aerosols,
- fires.

The landfill shall be equipped so that dirt originating from the site is not dispersed onto public roads and the surrounding land.

6. Stability

The emplacement of waste on the site shall take place in such a way as to ensure stability of the mass of waste and associated structures, particularly in respect of avoidance of slippages. Where an artificial barrier is established it must be ascertained that the geological substratum, considering the morphology of the landfill, is sufficiently stable to prevent settlement that may cause damage to the barrier.

7. Barriers

The landfill shall be secured to prevent free access to the site. The gates shall be locked outside operating hours. The system of control and access to each facility should contain a programme of measures to detect and discourage illegal dumping in the facility.

Annex B: Waste Acceptance Criteria — Extracts from Council Decision 2003/33/EC establishing criteria and procedures for the acceptance of waste at landfills

Within the Directive 1999/31/EC there are different categories of landfills dealing with inert, non hazardous and hazardous wastes. The Directive requires that these different categories of waste should not be mixed. The three different types of landfill have criteria setting out the types of waste to be accepted and the level of emissions permitted based on the risks posed. These criteria are set out in detail within Decision 2003/33/EC and summary of the requirements are set out below by landfill category.

Landfilling of Inert Waste

Wastes in the Table below are assumed to fulfil the criteria as set out in the definition of inert waste Directive 1999/31/EC on the landfill of wastes. The wastes can be admitted without testing at a landfill for inert waste. However, in order for this to apply waste must be a single stream (from only one source) of a single waste type. Different wastes contained in the list maybe accepted together, provided they are from the same source.

If contamination is suspected (either from visual inspection or from knowledge of the origin of the waste) testing should be applied or the waste refused. If the listed wastes are contaminated or contain other material or substances such as metals, asbestos, plastics, chemicals, etc. to an extent which increases the risk associated with the waste sufficiently to justify their disposal in other classes of landfills, they may not be accepted in a landfill for inert waste.

If there is a doubt that the waste fulfils the definition of inert waste or about the lack of contamination of the waste, testing must be applied in line with procedures set out within the Decision.

EWG code	Description	Restrictions
1011 03	Waste glass-based fibrous materials	Only without organic binders
1501 07	Glass packagingGlas	
1701 01	Concrete	Selected C & D waste only (*)
1701 02	Bricks	Selected C & D waste only (*)
1701 03	Tiles and ceramics	Selected C & D waste only (*)
1701 07	Mixtures of concrete, bricks, tiles and ceramics	Selected C & D waste only (*)
1702 02	Glass	
1705 04	Soil and stones	Excluding topsoil, peat; excluding soil and stones from contaminated sites
1912 05	Glass	
2001 02	Glass	Separately collected glass only
2002 02	Soil and stones	Only from garden and parks waste; Excluding top soil, peat

(*) Selected construction and demolition waste (C & D waste); with low contents of other types of materials (like metals, plastic, soil, organics, wood, rubber, etc). The origin of the waste must be known.

- No C & D waste from constructions, polluted with inorganic or organic dangerous substances, e.g. because of production processes in the construction, soil pollution, storage and usage of pesticides or other dangerous substances, etc., unless it is made clear that the demolished construction was not significantly polluted.
- No C & D waste from constructions, treated, covered or painted with materials, containing dangerous substances in significant amounts.

In addition to specifying the types of waste applicable limit values are also applied. For inert waste these are as follows.

Leachate

Component	L/S = 2 l/kg	L/S = 10 l/kg	C ₀ (percolation test)
	mg/kg dry substance	mg/kg dry substance	mg/l
As	0,1	0,5	0,06
Ba	7	20	4
Cd	0,03	0,04	0,02
Cr total	0,2	0,5	0,1

Cu	0,9	2	0,6
Hg	0,003	0,01	0,002
Mo	0,3	0,5	0,2
Ni	0,2	0,4	0,12
Pb	0,2	0,5	0,15
Sb	0,02	0,06	0,1
Se	0,06	0,1	0,04
Zn	2	4	1,2
Chloride	550	800	460
Fluoride	4	10	2,5
Sulphate	560 (*)	1 000 (*)	1 500
Phenol index	0,5	1	0,3
DOC (**)	240	500	160
TDS (***)	2 500	4 000	—

(*) If the waste does not meet these values for sulphate, it may still be considered as complying with the acceptance criteria if the leaching does not exceed either of the following values: 1 500 mg/l as CO at L/S = 0,1 l/kg and 6 000 mg/kg at L/S = 10 l/kg. It will be necessary to use a percolation test to determine the limit value at L/S = 0,1 l/kg under initial equilibrium conditions, whereas the value at L/S = 10 l/kg may be determined either by a batch leaching test or by a percolation test under conditions approaching local equilibrium.

(**) If the waste does not meet these values for DOC at its own pH value, it may alternatively be tested at L/S = 10 l/kg and a pH between 7,5 and 8,0. The waste may be considered as complying with the acceptance criteria for DOC, if the result of this determination does not exceed 500 mg/kg. (A draft method based on prEN 14429 is available).

(***) The values for total dissolved solids (TDS) can be used alternatively to the values for sulphate and chloride.

Total content of organic parameters

Parameter	Value mg/kg
TOC (total organic carbon)	30 000 (*)
BTEX (benzene, toluene, ethylbenzene and xylenes)	6
PCBs (polychlorinated biphenyls, 7 congeners)	1
Mineral oil (C10 to C40)	500
PAHs (polycyclic aromatic hydrocarbons)	Member States to set limit value

(*) In the case of soils, a higher limit value may be admitted by the competent authority, provided the DOC value of 500 mg/kg is achieved at L/S = 10 l/kg, either at the soil's own pH or at a pH value between 7,5 and 8,0.

Landfilling of Non Hazardous Wastes

Certain wastes can be accepted into non hazardous landfills without the need for testing. Municipal waste (defined as waste from households, as well as other waste which, because of its nature or composition, is similar to waste from household) that is classified as non hazardous, separately collected non hazardous fractions of household wastes and the same non hazardous materials from other origins can be admitted without testing. However, in line with Directive 1999/31/EC wastes may not be admitted if they have not been subject to prior treatment or if they are contaminated to an extent which increases the risk associated with the waste sufficiently to justify their disposal in other facilities.

The following limit values are set for non hazardous wastes.

Components	L/S = 2 l/kg	L/S = 10 l/kg	C ₀ (percolation test)
	mg/kg dry substance	mg/kg dry substance	mg/l
As	0,4	2	0,3
Ba	30	100	20
Cd	0,6	1	0,3
Cr total	4	10	2,5
Cu	25	50	30
Hg	0,05	0,2	0,03
Mo	5	10	3,5
Ni	5	10	3
Pb	5	10	3
Sb	0,2	0,7	0,15
Se	0,3	0,5	0,2
Zn	25	50	15
Chloride	10 000	15 000	8 500

Fluoride	60	150	40
Sulphate	10 000	20 000	7 000
DOC (*)	380	800	250
TDS (**)	40 000	60 000	—

(*) If the waste does not meet these values for DOC at its own pH, it may alternatively be tested at L/S = 10 l/kg and a pH of 7,5-8,0. The waste may be considered as complying with the acceptance criteria for DOC, if the result of this determination does not exceed 800 mg/kg (A draft method based on prEN 14429 is available).

(**) The values for TDS can be used alternatively to the values for sulphate and chloride.

As set out in Directive 1999/31/EC stable non reactive hazardous wastes can be accepted to non hazardous landfills. Stable and non reactive is taken to mean that the leaching behaviour of the waste will not change adversely in the long-term, under landfill design conditions or foreseeable accidents:

- in the waste alone (for example, by biodegradation),
- under the impact of long-term ambient conditions (for example, water, air, temperature, mechanical constraints),
- by the impact of other wastes (including waste products such as leachate and gas).

Leaching limit values and other criteria are set for this category of waste to ensure that risk is minimised. These are set out below.

Leaching limit values

Components	L/S = 2 l/kg	L/S = 10 l/kg	C ₀ (percolation test)
	mg/kg dry substance	mg/kg dry substance	mg/l
As	0,4	2	0,3
Ba	30	100	20
Cd	0,6	1	0,3
Cr total	4	10	2,5

Cu	25	50	30
Hg	0,05	0,2	0,03
Mo	5	10	3,5
Ni	5	10	3
Pb	5	10	3
Sb	0,2	0,7	0,15
Se	0,3	0,5	0,2
Zn	25	50	15
Chloride	10 000	15 000	8 500
Fluoride	60	150	40
Sulphate	10 000	20 000	7 000
DOC (*)	380	800	250
TDS (**)	40 000	60 000	—

(*) If the waste does not meet these values for DOC at its own pH, it may alternatively be tested at L/S = 10 l/kg and a pH of 7,5-8,0. The waste may be considered as complying with the acceptance criteria for DOC, if the result of this determination does not exceed 800 mg/kg (A draft method based on prEN 14429 is available).

(**) The values for TDS can be used alternatively to the values for sulphate and chloride.

Other requirements

Parameter	Value
TOC (total organic carbon)	5 % (*)
pH	Minimum 6
ANC (acid neutralisation capacity)	Must be evaluated

(*) If this value is not achieved, a higher limit value may be admitted by the competent authority, provided that the DOC value of 800 mg/kg is achieved at L/S = 10 l/kg, either at the material's own pH or at a pH value between 7,5 and 8,0.

In addition Member State may also set specific criteria to ensure sufficient stability and bearing capacity.

Asbestos may be landfilled as non hazardous waste so long as the following specific requirements are fulfilled:

- the waste contains no other hazardous substances than bound asbestos, including fibres bound by a binding agent or packed in plastic,
- the landfill accepts only construction material containing asbestos and other suitable asbestos waste. These wastes may also be landfilled in a separate cell of a landfill for non-hazardous waste, if the cell is sufficiently self-contained,
- in order to avoid dispersion of fibres, the zone of deposit is covered daily and before each compacting operation with appropriate material and, if the waste is not packed, it is regularly sprinkled,
- a final top cover is put on the landfill/cell in order to avoid the dispersion of fibres,

- no works are carried out on the landfill/cell that could lead to a release of fibres (e.g. drilling of holes),
- after closure a plan is kept of the location of the landfill/cell indicating that asbestos wastes have been deposited,
- appropriate measures are taken to limit the possible uses of the land after closure of the landfill in order to avoid human contact with the waste.

Landfilling of Hazardous Waste

For wastes to be accepted as hazardous waste ie rather than considered to be in need to specialist underground storage, leachate limits and other criteria apply.

Leachate limit values

Components	L/S = 2 l/kg	L/S = 10 l/kg	C ₀ (percolation test)
	mg/kg dry substance	mg/kg dry substance	mg/l
As	6	25	3
Ba	100	300	60
Cd	3	5	1,7
Cr total	25	70	15
Cu	50	100	60
Hg	0,5	2	0,3
Mo	20	30	10
Ni	20	40	12
Pb	25	50	15

Sb	2	5	1
Se	4	7	3
Zn	90	200	60
Chloride	17 000	25 000	15 000
Fluoride	200	500	120
Sulphate	25 000	50 000	17 000
DOC (*)	480	1 000	320
TDS (**)	70 000	100 000	—

(*) If the waste does not meet these values for DOC at its own pH, it may alternatively be tested at L/S = 10 l/kg and a pH of 7,5-8,0. The waste may be considered as complying with the acceptance criteria for DOC, if the result of this determination does not exceed 1 000 mg/kg. (A draft method based on prEN 14429 is available.)

(**) The values for TDS can be used alternatively to the values for sulphate and chloride.

Other limits

Parameter	Value
LOI (*)	10 %
TOC (*)	6 % (**)
ANC (acid neutralisation capacity)	Must be evaluated

(*) Either LOI or TOC must be used.

(**) If this value is not achieved, a higher limit value may be admitted by the competent authority, provided that the DOC value of 1 000 mg/kg is achieved at L/S = 10 l/kg, either at the material's own pH or at a pH value between 7,5 and 8,0.

Annex C: Control and Monitoring Procedures in Operation and After-Care Phases for landfills, extracted from Annex III of Directive 1999/31/EC

1. Introduction

The purpose of this Annex is to provide the minimum procedures for monitoring to be carried out to check:

- that waste has been accepted to disposal in accordance with the criteria set for the category of landfill in question,
- that the processes within the landfill proceed as desired,
- that the environmental protection systems are functioning fully as intended,
- that the permit conditions for the landfill are fulfilled.

2. Meteorological data

Under their reporting obligation (Article 15), Member States should supply data on the collection method for meteorological data. It is up to Member States to decide how the data should be collected (in situ, national meteorological network, etc.).

Should Member States decide that water balances are an effective tool for evaluating whether leachate is building up in the landfill body or whether the site is leaking, it is recommended that the following data are collected from monitoring at the landfill or from the nearest meteorological station, as long as required by the competent authority in accordance with Article 13(c) of this Directive:

	Operation phase	After-care phase
1.1. Volume of precipitation	daily	daily, added to monthly values
1.2. Temperature (min., max., 14.00 h CET)	daily	monthly average
1.3. Direction and force of prevailing wind	daily	not required
1.4. Evaporation (lysimeter) ⁽¹⁾	daily	daily, added to monthly values
1.5. Atmospheric humidity (14.00 h CET)	daily	monthly average

⁽¹⁾ Or through other suitable methods.

3. Emission data: water, leachate and gas control

- Sampling of leachate and surface water if present must be collected at representative points. Sampling and measuring (volume and composition) of leachate must be performed separately at each point at which leachate is discharged from the site. Reference: general guidelines on sampling technology, ISO 5667-2 (1991).
- Monitoring of surface water if present shall be carried out at not less than two points, one upstream from the landfill and one downstream.
- Gas monitoring must be representative for each section of the landfill. The frequency of sampling and analysis is listed in the following table.
- For leachate and water, a sample, representative of the average composition, shall be taken for monitoring.
- The frequency of sampling could be adapted on the basis of the morphology of the landfill waste (in tumulus, buried, etc). This has to be specified in the permit.

	Operating phase	After-care phase ⁽³⁾
2.1. Leachate volume	monthly ⁽¹⁾ ⁽³⁾	every six months
2.2. Leachate composition ⁽²⁾	quarterly ⁽³⁾	every six months
2.3. Volume and composition of surface water ⁽⁷⁾	quarterly ⁽³⁾	every six months
2.4. Potential gas emissions and atmospheric pressure ⁽⁴⁾ (CH ₄ , CO ₂ , O ₂ , H ₂ S, H ₂ etc.)	monthly ⁽³⁾ ⁽⁵⁾	every six months ⁽⁶⁾

⁽¹⁾ The frequency of sampling could be adapted on the basis of the morphology of the landfill waste (in tumulus, buried, etc.). This has to be specified in the permit.

⁽²⁾ The parameters to be measured and the substances to be analysed vary according to the composition of the waste deposited; they must be laid down in the permit document and reflect the leaching characteristics of the wastes.

⁽³⁾ If the evaluation of data indicates that longer intervals are equally effective, they may be adapted. For leachates, conductivity must always be measured at least once a year.

⁽⁴⁾ These measurements are related mainly to the content of organic material in the waste.

⁽⁵⁾ CH₄, CO₂, O₂, regularly, other gases as required, according to the composition of the waste deposited, with a view to reflecting its leaching properties.

⁽⁶⁾ Efficiency of the gas extraction system must be checked regularly.

⁽⁷⁾ On the basis of the characteristics of the landfill site, the competent authority may determine that these measurements are not required, and will report accordingly in the way laid down in Article 15 of the Directive.

2.1 and 2.2 apply only where leachate collection takes place (see Annex I(2)).

4. Protection of groundwater

A. Sampling

The measurements must be such as to provide information on groundwater likely to be affected by the discharging of waste, with at least one measuring point in the groundwater inflow region and two in the outflow region. This number can be increased on the basis of a specific hydrogeological survey and the need for an early identification of accidental leachate release in the groundwater.

Sampling must be carried out in at least three locations before the filling operations in order to establish reference values for future sampling. Reference: Sampling Groundwaters, ISO 5667, Part 11, 1993.

B. Monitoring

The parameters to be analysed in the samples taken must be derived from the expected composition of the leachate and the groundwater quality in the area. In selecting the parameters for analysis account should be taken of mobility in the groundwater zone. Parameters could include indicator parameters in order to ensure an early recognition of change in water quality.

	Operation phase	After-care phase
Level of groundwater	every six months ⁽¹⁾	every six months ⁽¹⁾
Groundwater composition	site-specific frequency ⁽²⁾ ⁽³⁾	site-specific frequency ⁽²⁾ ⁽³⁾

⁽¹⁾ If there are fluctuating groundwater levels, the frequency must be increased.

⁽²⁾ The frequency must be based on possibility for remedial actions between two samplings if a trigger level is reached, i.e. the frequency must be determined on the basis of knowledge and the evaluation of the velocity of groundwater flow.

⁽³⁾ When a trigger level is reached (see C), verification is necessary by repeating the sampling. When the level has been confirmed, a contingency plan (laid down in the permit) must be followed.

C. Trigger levels

Significant adverse environmental effects, as referred to in Articles 12 and 13 of this Directive, should be considered to have occurred in the case of groundwater, when an analysis of a groundwater sample shows a significant change in water quality. A trigger level must be determined taking account of the specific hydrogeological formations in the location of the landfill and groundwater quality. The trigger level must be laid down in the permit whenever possible.

The observations must be evaluated by means of control charts with established control rules and levels for each downgradient well. The control levels must be determined from local variations in groundwater quality.

5. Topography of the site: data on the landfill body

	Operating phase	After-care phase
5.1. Structure and composition of landfill body ⁽¹⁾	yearly	
5.2. Settling behaviour of the level of the landfill body	yearly	yearly reading

⁽¹⁾ Data for the status plan of the concerned landfill: surface occupied by waste, volume and composition of waste, methods of depositing, time and duration of depositing, calculation of the remaining capacity still available at the landfill.

(1) Recommended parameters: ph, TOC, phenols, heavy metals, fluoride, AS, oil/hydrocarbons

Annex D: Testing of Wastes – Set out in Council Decision 2003/33/EC establishing criteria and procedures for the acceptance of waste at landfills

Decision 2003/33/EC sets out specific requirements and standards to be abided by in order to test wastes and ensure their appropriate landfilling ie to establish levels of contaminants and assess whether they can be landfilled in an inert, non hazardous or hazardous facility. These requirements are set out in the box below.

Sampling and testing for basic characterisation and compliance testing shall be carried out by independent and qualified persons and institutions. Laboratories shall have proven experience in waste testing and analysis and an efficient quality assurance system.

Member States may decide that:

1. the sampling may be carried out by producers of waste or operators under the condition that sufficient supervision of independent and qualified persons or institutions ensures that the objectives set out in this Decision are achieved;
2. the testing of the waste may be carried out by producers of waste or operators if they have set up an appropriate quality assurance system including periodic independent checking.

As long as a CEN standard is not available as formal EN, Member States will use either national standards or procedures or the draft CEN standard, when it has reached the prEN stage.

The following methods shall be used.

Sampling

For the sampling of waste — for basic characterisation, compliance testing and on-site verification testing — a sampling plan shall be developed according to part 1 of the sampling standard currently developed by CEN.

General waste properties

EN 13137	Determination of TOC in waste, sludge and sediments
prEN 14346	Calculation of dry matter by determination of dry residue or water content

Leaching tests

prEN 14405	Leaching behaviour test - Up-flow percolation test (Up-flow percolation test for inorganic constituents)
EN 12457/1-4	Leaching — Compliance test for leaching of granular waste materials and sludges: part 1: L/S = 2 l/kg, particle size < 4 mm part 2: L/S = 10 l/kg, particle size < 4 mm part 3: L/S = 2 and 8 l/kg, particle size < 4 mm part 4: L/S = 10 l/kg, particle size < 10 mm

Digestion of raw waste

EN 13657	Digestion for subsequent determination of aqua regia soluble portion of elements (partial digestion of the solid waste prior to elementary analysis, leaving the silicate matrix intact)
EN 13656	Microwave-assisted digestion with hydrofluoric (HF), nitric (HNO ₃) and hydrochloric (HCl) acid mixture for subsequent determination of elements (total digestion of the solid waste prior to elementary analysis)

Analysis

ENV 12506	Analysis of eluates — Determination of pH, As, Ba, Cd, Cl, Co, Cr, CrVI, Cu, Mo, Ni, NO ₂ , Pb, total S, SO ₄ , V and Zn (analysis of inorganic constituents of solid waste and/or its eluate; major, minor and trace elements)
ENV 13370	Analysis of eluates — Determination of ammonium, AOX, conductivity, Hg, phenol index, TOC, easily liberatable CN, F (analysis of inorganic constituents of solid waste and/or its eluate (anions))
prEN 14039	Determination of hydrocarbon content in the range of C10 to C40 by gas chromatography

This list will be amended when more CEN standards are available.

For tests and analyses, for which CEN methods are not (yet) available, the methods used must be approved by the competent authorities.

2.4.4 Other waste disposal and recovery operations

Obligations with respect to Integrated Pollution Prevention and Control

Directive 2008/1/EC applies to installations for the disposal of non-hazardous waste as defined in Annexes II A and II B to Directive 2006/12/EC – specifically the following:

- D8 - Biological treatment not specified elsewhere in Annex II of 96/350/EC which results in final compounds or mixtures which are discarded by means of some of the disposal operations (numbered D1 to D12)
- D9 - Physico-chemical treatment not specified elsewhere in Annex II of 96/350/EC which results in final compounds or mixtures which are discarded by means of some of the disposal operation (numbered D1 to D12) (e.g. evaporation, drying, calcination, etc.)

General BAT for Waste Treatment Industries under the IPPC Directive

A 'general' BREF has been produced for 'Waste Treatment Industries', covering the following recovery (R) and disposal (D) operations, as defined in Annexes II A and II B to Directive 2006/12/EC:

- R1 - Use of waste principally as a fuel or other means to generate energy
- R2 - Solvent reclamation/regeneration
- R5 - Recycling/reclamation of other inorganic materials (excluding metals and metal compounds covered in other recovery treatments (namely R4))
- R6 - Regeneration of acids or bases
- R7 - Recovery of components used for pollution abatement
- R8 - Recovery of components from catalysts
- R9 - Oil re-refining or other uses of oil
- R12 - Exchange of wastes for submission to some recovery operations (numbered R1 to R11)
- R13 - Storage of wastes pending some recovery operations (numbered R1 to R12) (excluding temporary storage, pending collection, on the site where it is produced)
- D8 - Biological treatment not specified elsewhere in Annex II of 96/350/EC which results in final compounds or mixtures which are discarded by means of some of the disposal operations (numbered D1 to D12)
- D9 - Physico-chemical treatment not specified elsewhere in Annex II of 96/350/EC which results in final compounds or mixtures which are discarded by means of some of the disposal operation (numbered D1 to D12) (e.g. evaporation, drying, calcination, etc.)
- D13 - Blending or mixing prior to submission to some disposal operations (numbered D1 to D12)
- D14 - Repacking prior to submission to some disposal operations (numbered D1 to D13)
- D15 - Storage pending any of the disposal operations (numbered D1 to D14) (excluding temporary storage, pending collection, on the site where it is produced)

Some 940 techniques were considered in the determination of BAT, structured into eight groups of techniques as indicated in Table 1

Table 1

Type of waste treatment	Number of techniques applied to:				TOTAL
	waste treatment, prevention and management	air emissions	waste water	solid residues	
Common techniques	296	26	16	31	369
Biological treatments	41	58	3	4	106
Physico-chemical treatments	133	17	4	6	160
Recovery of materials	44	44	19	7	114
Preparation of waste fuel	39	16	0	0	55
Air abatement treatments		57			57
Waste water treatments			52		52
Residue management				27	27
TOTAL	553	218	94	75	940

The BAT presented in the BREF document relate to the most relevant environmental issues and typically relate to emissions from normal operation. In some situations, BAT conclusions on emissions from incidents and (major) accidents are also reported.

Some of the general conclusions from the BAT chapter of the BREF are as follows:

- BAT conclusions for the waste treatment sector are set out at two levels. One level deals with generic BAT conclusions (ie those that are generally applicable to the whole sector) and the other contains more specific BAT conclusions for the various types of specific processes and activities identified in the scope. The BAT for any specific type of waste treatment installation are therefore a combination of these two levels of BAT. In some cases, other BREF documents can give guidance and then form part of the list of documents that need to be considered when analysing a specific installation. As an example, BAT for re-refining waste oil contains the BAT elements numbered from 1 to 64 plus 95 to 104 in the table below. On top of that, it may be considered that other BREF documents related to the issue may give extra guidance. Another example is that BAT for liquid waste fuels from hazardous waste contain the BAT elements from 1 to 64, 117 to 121 and 129 to 130.
- Some of the BATs are based on concrete techniques or technologies.
- In the determination of BAT in this sector, some associated emission levels following the use of BAT have been identified. These relate to emissions of volatile organic compounds and particulate matter to air, and water parameters such as chemical oxygen demand, biological oxygen demand and heavy metals. Moreover, emissions to air of odour and ammonia have been identified for mechanical biological treatment and emissions to water of hydrocarbons and phenols have been identified for waste oil treatment.

The generic BAT from the BREF on Waste Treatment Industries are reproduced below.

Environmental management

BAT is to:

1. implement and adhere to an Environmental management system (EMS) that incorporates (as appropriate):
 - a. definition by top management of an environmental policy for the installation
 - b. planning and establishing the necessary procedures
 - c. implementation of the procedures
 - d. checking performance and taking corrective action
 - e. review by top management.

Three further complementary features are also mentioned:

- f. examination and validation of the management system and audit procedure by an accredited certification body or external EMS verifier
- g. preparation and publication (and possibly external validation) of a regular environmental statement
- h. implementation and adherence to an internationally accepted voluntary system such as EMAS or EN ISO 14001:1996.

Other potential features of the EMS should also be considered specifically for this industry sector:

- i. considering the environmental impact from the eventual decommissioning of the unit at the stage of designing a new plant
 - j. considering the development of cleaner technologies
 - k. where practicable, sectoral benchmarking on a regular basis, including energy efficiency and energy conservation activities, choice of input materials, emissions to air, discharges to water, consumption of water and generation of waste.
2. ensure that full details of the activities carried out on-site are provided. This could include: descriptions of the waste treatment methods and procedures; diagrams of the main plant items with environmental relevance; the chemical reactions and their reaction kinetics/energy balance; the control system philosophy and how the control system incorporates the environmental monitoring information; how protection is provided during abnormal operating conditions; an instruction manual; an operational diary; an annual survey of the activities carried out and the waste treated.
 3. put in place a good housekeeping procedure which also covers the maintenance procedure, and an adequate training programme, covering the preventive actions that workers need to take on health and safety issues and environmental risks
 4. try to maintain a close relationship with the waste producer/holder so that the customers' sites implement measures to produce the quality of waste necessary for the waste treatment process to be carried out
 5. have sufficient staff available and on duty with the requisite qualifications (having undergone specific job training and further education) at all times

Waste IN

BAT is to:

6. have a concrete knowledge of the waste IN, taking into account the waste OUT, the treatment to be carried out, the type of waste, the origin of the waste, the procedure under consideration (see BAT number 7 and 8) and the risk (related to waste OUT and the treatment)
7. implement a pre-acceptance procedure containing at least the following items:
 - a. tests for the incoming waste with respect to the planned treatment

- b. ensuring that all necessary information is received on the nature of the process(es) producing the waste, including the variability of the process
 - c. a system for providing and analysing a representative sample(s) of the waste from the production process producing such waste from the current holder
 - d. a system for carefully verifying, if not dealing directly with the waste producer, the information received at the pre-acceptance stage
 - e. making sure that the waste code according to the European Waste List (EWL) is provided
 - f. identifying the appropriate treatment for each waste to be received at the installation by identifying a suitable treatment method for each new waste enquiry and having a clear methodology in place to assess the treatment of waste, that considers the physico-chemical properties of the individual waste and the specifications for the treated waste.
8. implement an acceptance procedure containing at least the following items:
- a. a clear and specified system to allow the operator to accept wastes at the receiving plant only if a defined treatment method and disposal/recovery route for the output of the treatment is determined (see pre-acceptance in BAT number 7). The necessary storage, treatment capacity and dispatch conditions (e.g. acceptance criteria of the output by the other installation) must also be guaranteed
 - b. measures in place to fully document and deal with acceptable wastes arriving at the site, such as a pre-booking system
 - c. clear and unambiguous criteria for the rejection of wastes and the reporting of all non conformances
 - d. a system for identifying the maximum capacity limit of waste that can be stored at the facility (related to BAT number 10.b, 10.c, 27 and 24.f)
 - e. visually inspect the waste IN to check compliance with the description received during the pre-acceptance procedure. *NB For some liquid and hazardous waste, this BAT is not applicable.*
9. implement different sampling procedures for all different incoming waste vessels delivered in bulk and/or containers. These sample procedures may contain the following items:
- a. sampling procedures based on a risk approach, which may consider the type of waste (e.g. hazardous or non-hazardous) and the knowledge of the customer (e.g. waste producer)
 - b. check on the relevant physico-chemical parameters, which are related to the knowledge of the waste needed in each case (see BAT number 6)
 - c. registration of all waste materials
 - d. have different sampling procedures for bulk (liquid and solids), large and small containers and laboratory smalls. The number of samples taken should increase with the number of containers. In extreme situations, small containers must all be checked against the accompanying paperwork. The procedure should contain a system for recording the number of samples and degree of consolidation
 - e. details of the sampling of wastes in drums within designated storage, e.g. the timescale after receipt
 - f. sample prior to acceptance
 - g. maintenance of a record at the installation of the sampling regime for each load, along with a record of the justification for the selection of each option
 - h. a system for determining and recording: a suitable location for the sampling points; the capacity of the vessel sampled (in the case of drums, the total number of drums should be recorded); the number of samples and degree of consolidation; the operating conditions at the time of sampling.
 - i. a system to ensure that the waste samples are analysed
 - j. in the case of cold ambient temperatures, temporary storage may be needed in order to allow sampling after defrosting. This may affect the applicability of some of the above items in this BAT.
10. have a reception facility covering at least the following issues:

- a. have a laboratory to analyse all the samples at the speed required by BAT. Typically this requires having a robust quality assurance system, quality control methods and maintaining suitable records for storing the analyses results. Particularly for hazardous wastes, this often means that the laboratory needs to be on-site
- b. have a dedicated quarantine waste storage area as well as written procedures to manage non-accepted waste. This enables, for example, damaged, corroded or unlabelled drums to be temporarily stored safely
- c. have a clear procedure dealing with wastes where inspection and/or analysis prove that they do not fulfil the acceptance criteria of the plant or do not fit with the waste description received during the pre-acceptance procedure. The procedure should include all measures as required by the permit or national/international legislation to inform competent authorities, to safely store the delivery for any transition period or to reject the waste and send it back to the waste producer or to any other authorised destination
- d. move waste to the storage area only after acceptance of the waste (related to BAT number 8)
- e. mark the inspection, unloading and sampling areas on a site plan
- f. have a sealed drainage system (related to BAT number 63)
- g. a system to ensure that the installation personnel involved in the sampling, checking and analysis procedures are suitably qualified and adequately trained, and that the training is updated on a regular basis (related to BAT number 5)
- h. the application of a waste tracking system unique identifier (label/code) to each container at this stage. The identifier will contain at least the date of arrival on-site and the waste code (related to BAT number 9 and 12).

Waste OUT

BAT is to:

- 11. analyse the waste OUT according to the relevant parameters important for the receiving facility (e.g. landfill, incinerator)

Management systems

BAT is to:

- 12. have a system in place that guarantees that waste treatment can be traced. Different procedures may be needed to take into account the physico-chemical properties of the waste (e.g. liquid, solid), type of treatment process (e.g. continuous, batch) as well as the changes that may occur to the physico-chemical properties of the wastes when the treatment is carried out. A good traceability system contains the following items:
 - a. documenting the treatments by flow charts and mass balances (this is related to BAT number 2.a)
 - b. carrying out data traceability through several operational steps (e.g. pre-acceptance/acceptance/storage/treatment/dispatch). Records can be made and kept updated on an ongoing basis to reflect deliveries, on-site treatment and dispatches. Records are typically held for a minimum of six months after the waste has been dispatched
 - c. recording and referencing the information on waste characteristics and the source of the waste stream, so that it is available at all times, including giving the waste a reference number that can be obtainable at any time in the process
 - d. having a computer database/series of databases, which are regularly backed up, to operate as waste inventory/stock control system including various information on the waste
 - e. only moving drums and other mobile containers between different locations (or loaded for removal off site) under instructions from the appropriate manager, ensuring that the waste tracking system is amended to record these changes

13. have and apply mixing/blending rules aimed at restricting the types of wastes that can be mixed/blended together in order to avoid increasing pollution emission of down-stream waste treatments. These rules need to consider the type of waste (e.g. hazardous, nonhazardous), waste treatment to be applied as well as the subsequent steps that will be carried out to the waste OUT
14. have a segregation and compatibility procedure in place (related to BAT number 13 and 24.c), including:
 - a. keeping records of the testing, including any reaction giving rise to safety parameters (increase in temperature, generation of gases or raising of pressure); a record of the operating parameters (viscosity change and separation or precipitation of solids) and any other relevant parameters, such as generation of odours
 - b. packing containers of chemicals into separate drums based on their hazard classification. Chemicals which are incompatible (e.g. oxidisers and flammable liquids) should not be stored in the same drum
15. have an approach for improving waste treatment efficiency. This typically includes identifying suitable indicators to report waste treatment efficiency and a monitoring programme (related to BAT number 1)
16. produce a structured accident management plan
17. have and properly use an incident diary (related to BAT number 1 and to quality management system)
18. have a noise and vibration management plan in place as part of the EMS (related to BAT number 1). For some waste treatment installations, noise and vibration may not be an environmental problem
19. consider any future decommissioning at the design stage. For existing installations and where decommissioning problems are identified, put a programme to minimise these problems in place (related to BAT number 1.i).

Utilities and raw material management

BAT is to:

20. provide a breakdown of the energy consumption and generation (including exporting) by the type of source (i.e. electricity, gas, liquid conventional fuels, solid conventional fuels and waste) (related to BAT number 1.k). This involves:
 - a. reporting the energy consumption information in terms of delivered energy
 - b. reporting the energy exported from the installation
 - c. providing energy flow information (for example, diagrams or energy balances) showing how the energy is used throughout the process.
21. continuously increase the energy efficiency of the installation, by:
 - a. developing an energy efficiency plan
 - b. using techniques that reduce energy consumption and thereby reduce direct (heat and emissions from on-site generation) and indirect (emissions from a remote power station) emissions
 - c. defining and calculating the specific energy consumption of the activity (or activities), setting key performance indicators on an annual basis (e.g. MWh/tonne of waste processed) (related to BAT number 1.k and 20).
22. carry out an internal benchmarking (e.g. on an annual basis) of raw materials consumption (related to BAT number 1.k). Some applicability limitations have been identified and are expanded on in the BREF

23. explore the options for the use of waste as a raw material for the treatment of other wastes. If waste is used to treat other wastes, to have a system in place to guarantee that the waste supply is available. If this cannot be guaranteed, a secondary treatment or other raw materials should be in place in order to avoid any unnecessary waiting treatment time

Storage and handling

BAT is to:

24. apply the following techniques related to storage:
- a. locating storage areas:
 - away from watercourses and sensitive perimeters, and
 - in such a way so as to eliminate or minimise the double handling of wastes within the installation
 - b. ensuring that the storage area drainage infrastructure can contain all possible contaminated run-off and that drainage from incompatible wastes cannot come into contact with each other
 - c. using a dedicated area/store which is equipped with all necessary measures related to the specific risk of the wastes for sorting and repackaging laboratory smalls or similar waste. These wastes are sorted according to their hazard classification, with due consideration for any potential incompatibility problems and then repackaged. After that, they are removed to the appropriate storage area
 - d. handling odorous materials in fully enclosed or suitably abated vessels and storing them in enclosed buildings connected to abatement
 - e. ensuring that all connections between the vessels are capable of being closed via valves. Overflow pipes need to be directed to a contained drainage system (i.e. the relevant bunded area or another vessel)
 - f. having measures available to prevent the building up of sludges higher than a certain level and the emergence of foams that may affect such measures in liquid tanks, e.g. by regularly controlling the tanks, sucking out the sludges for appropriate further treatment and using anti-foaming agents
 - g. equipping tanks and vessels with suitable abatement systems when volatile emissions may be generated, together with level meters and alarms. These systems need to be sufficiently robust (able to work if sludge and foam is present) and regularly maintained
 - h. storing organic waste liquid with a low flashpoint under a nitrogen atmosphere to keep it inertised. Each storage tank is put in a waterproof retention area. Gas effluents are collected and treated.
25. separately bund the liquid decanting and storage areas using bunds which are impermeable and resistant to the stored materials
26. apply the following techniques concerning tank and process pipework labelling:
- a. clearly labelling all vessels with regard to their contents and capacity, and applying an unique identifier. Tanks need to have an appropriately labelled system depending on their use and contents
 - b. ensuring that the label differentiates between waste water and process water, combustible liquid and combustible vapour and the direction of flow (i.e. in or outflow)
 - c. keeping records for all tanks, detailing the unique identifier; capacity; its construction, including materials; maintenance schedules and inspection results; fittings; and the waste types which may be stored/treated in the vessel, including flashpoint limits.
27. take measures to avoid problems that may be generated from the storage/accumulation of waste. This may conflict with BAT number 23 when waste is used as a reactant
28. apply the following techniques when handling waste:

- a. having systems and procedures in place to ensure that wastes are transferred to the appropriate storage safely
 - b. having in place a management system for the loading and unloading of waste in the installation, which also takes into consideration any risks that these activities may incur
 - c. ensuring that a qualified person attends the waste holder site to check the laboratory samples, the old original waste, waste from an unclear origin or undefined waste (especially if drummed), to classify the substances accordingly and to package into specific containers
 - d. ensuring that damaged hoses, valves and connections are not used
 - e. collecting the exhaust gas from vessels and tanks when handling liquid waste
 - f. unloading solids and sludge in closed areas which are fitted with extractive vent systems linked to abatement equipment when the handled waste can potentially generate emission to air (e.g. odours, dust, VOCs)
 - g. using a system to ensure the bulking of different batches only takes place with compatibility testing (related to BAT number 13, 14 and 30).
29. ensure that the bulking/mixing to or from packaged waste only takes place under instruction and supervision and is carried out by trained personnel. For certain types of wastes, such a bulking/mixing needs to be carried out under local exhaust ventilation
30. ensure that chemical incompatibilities guide the segregation required during storage (related to BAT number 14)
31. apply the following techniques when containerised wastes are handled:
- a. storing of containerised wastes under cover. This can also be applied to any container that is held in storage pending sampling and emptying. Some exceptions on the applicability of this technique related to containers or waste not affected by ambient conditions (e.g. sunlight, temperature, water) have been identified. Covered areas need to have adequate provision for ventilation
 - b. maintaining the availability and access to storage areas for containers holding substances that are known to be sensitive to heat, light and water, under cover and protected from heat and direct sunlight.

Other common techniques not mentioned above

BAT is to:

32. perform crushing, shredding and sieving operations in areas fitted with extractive vent systems linked to abatement equipment when handling materials that can generate emission to air (e.g. odours, dust, VOCs)
33. perform crushing/shredding operations under full encapsulation and under an inert atmosphere for drums/containers containing flammable or highly volatile substances. This will avoid ignition. The inert atmosphere is to be abated
34. perform washing processes considering:
- a. identifying the washed components that may be present in the items to be washed (e.g. solvents)
 - b. transferring washings to appropriate storage and then treating them in the same way as the waste from which they were derived
 - c. using treated waste water from the WT plant for washing instead of fresh water. The resultant waste water can then be treated in the WWTP or re-used in the installation.

Air emission treatments

To prevent or control the emissions mainly of dust, odours and VOC and some inorganic compounds, BAT is to:

35. restrict the use of open topped tanks, vessels and pits by:
 - a. not allowing direct venting or discharges to air by linking all the vents to suitable abatement systems when storing materials that can generate emissions to the air (e.g. odours, dust, VOCs)
 - b. keeping the waste or raw materials under cover or in waterproof packaging (related to BAT number 31.a)
 - c. connecting the head space above the settlement tanks (e.g. where oil treatment is a pretreatment process within a chemical treatment plant) to the overall site exhaust and scrubber units
36. use an enclosed system with extraction, or under depression, to a suitable abatement plant. This technique is especially relevant to processes which involve the transfer of volatile liquids, including during tanker charging/discharging
37. apply a suitably sized extraction system which can cover the holding tanks, pretreatment areas, storage tanks, mixing/reaction tanks and the filter press areas, or to have in place a separate system to treat the vent gases from specific tanks (for example, activated carbon filters from tanks holding waste contaminated with solvents)
38. correctly operate and maintain the abatement equipment, including the handling and treatment/disposal of spent scrubber media
39. have a scrubber system in place for the major inorganic gaseous releases from those unit operations which have a point discharge for process emissions. Install a secondary scrubber unit to certain pretreatment systems if the discharge is incompatible, or too concentrated for the main scrubbers
40. have leak detection and repair procedures in place in installations a) handling a large number of piping components and storage and b) compounds that may leak easily and create an environmental problem (e.g. fugitive emissions, soil contamination). This may be seen as an element of the EMS (see BAT number 1)
41. reduce air emission to the following levels by using a suitable combination of preventive and/or abatement techniques. The techniques mentioned above in the BAT 'Air emission treatments' section (BAT numbers 35 – 41) also contribute to achieve these values:

Air parameter	Emission levels associated to the use of BAT (mg/Nm ³)
VOC	7 – 20 ¹
PM	5 – 20
¹ For low VOC loads, the higher end of the range can be extended to 50	

Waste water management

BAT is to:

42. reduce the water use and the contamination of water by:
 - a. applying site waterproofing and storage retention methods
 - b. carrying out regular checks of the tanks and pits especially when they are underground
 - c. applying separated water drainage according to the pollution load (roof water, road water, process water)
 - d. applying a security collection basin
 - e. performing regular water audits, with the aim of reducing water consumption and preventing water contamination
 - f. segregating process water from rainwater (related to BAT number 46).

43. have procedures in place to ensure that the effluent specification is suitable for the on-site effluent treatment system or discharge
44. avoid the effluent by-passing the treatment plant systems
45. have in place and operate an enclosure system whereby rainwater falling on the processing areas is collected along with tanker washings, occasional spillages, drum washings, etc. and returned to the processing plant or collected in a combined interceptor
46. segregate the water collecting systems for potentially more contaminated waters from less contaminated water
47. have a full concrete base in the whole treatment area, that falls to internal site drainage systems which lead to storage tanks or to interceptors that can collect rainwater and any spillage. Interceptors with an overflow to sewer usually need automatic monitoring systems, such as pH checks, which can shut down the overflow (related to BAT number 63)
48. collect the rainwater in a special basin for checking, treatment if contaminated and further use
49. maximise the re-use of treated waste waters and use of rainwater in the installation
50. conduct daily checks on the effluent management system and to maintain a log of all checks carried out, by having a system for monitoring the effluent discharge and sludge quality in place
51. firstly identify waste waters that may contain hazardous compounds (e.g. absorbable organically bound halogens (AOX); cyanides; sulphides; aromatic compounds; benzene or hydrocarbons (dissolved, emulsified or undissolved); and metals, such as mercury, cadmium, lead, copper, nickel, chromium, arsenic and zinc). Secondly, segregate the previously identified waste water streams on-site and thirdly, specifically treat waste water on-site or off-site.
52. ultimately after the application of BAT number 42, select and carry out the appropriate treatment technique for each type of waste water
53. implement measures to increase the reliability with which the required control and abatement performance can be carried out (for example, optimising the precipitation of metals)
54. identify the main chemical constituents of the treated effluent (including the make-up of the COD) and to then make an informed assessment of the fate of these chemicals in the environment (see Section 4.7.1 and their applicability restrictions identified)
55. only discharge the waste water from its storage after the conclusion of all the treatment measures and a subsequent final inspection
56. achieve the following water emission values before discharge by applying a suitable combination of techniques. The techniques mentioned above in this section on 'waste water management' (BAT number 42 – 55) can contribute to reach these values.

Water parameter	Emission values associated with the use of BAT (ppm)
COD	20 – 120
BOD	2 – 20
Heavy metals (Cr, Cu, Ni, Pb, Zn)	0.1 – 1
Highly toxic heavy metals:	
As	<0.1
Hg	0.01 – 0.05
Cd	<0.1 – 0.2
Cr(VI)	<0.1 – 0.4

Management of the process generated residues

BAT is to:

57. have a residue management plan as part of the EMS including:
 - a. basic housekeeping techniques (related to BAT number 3)
 - b. internal benchmarking techniques (related to BAT numbers 1.k and 22).
58. maximise the use of re-usable packaging (drums, containers, IBCs, palletes, etc.)
59. re-use drums when they are in a good working state. In other cases, they are to be sent for appropriate treatment
60. keep a monitoring inventory of the waste on-site by using records of the amount of wastes received on-site and records of the wastes processed (related to BAT number 27)
61. re-use the waste from one activity/treatment possibly as a feedstock for another (related to BAT number 23)

Soil contamination

To prevent soil contamination, BAT is to:

62. provide and then maintain the surfaces of operational areas, including applying measures to prevent or quickly clear away leaks and spillages, and ensuring that maintenance of drainage systems and other subsurface structures is carried out
63. utilise an impermeable base and internal site drainage
64. reduce the installation site and minimise the use of underground vessels and pipework (related to BAT number 10.f, 25, and 40)

Emission limit values

The generic BAT also make some suggestions for the limit values for certain pollutants which can be associated with the use of BAT. These are presented in the tables below.

Air emission treatments

Table 2

Air parameter	Emission levels associated to the use of BAT (mg/Nm ³)
VOC	7 – 20 ¹
PM	5 – 20

¹ For low VOC loads, the higher end of the range can be extended to 50

Waste water management

Table 3

Water parameter	Emission values associated with the use of BAT (ppm)
COD	20 – 120
BOD	2 – 20
Heavy metals (Cr, Cu, Ni, Pb, Zn)	0.1 – 1
Highly toxic heavy metals:	
As	<0.1
Hg	0.01 – 0.05
Cd	<0.1 – 0.2
Cr(VI)	<0.1 – 0.4

BAT for specific types of waste treatments

In addition to the generic BAT described above, the BREF on Waste Treatment Industries also suggests BAT for specific methods of waste treatment. Table 4 provides an overview of these BAT conclusions.

Table 4: BAT for specific types of waste treatments

Category	Identified BAT elements on
Biological treatments	<ol style="list-style-type: none"> the storage and handling in biological systems waste types and separation processes techniques for anaerobic digestion reducing the air emissions of dust, nitrogen oxides, sulphur oxides, carbon monoxide, hydrogen sulphide and volatile organic compounds when using biogas as fuel the techniques for mechanical biological treatments reducing the emissions of odour, ammonia, nitrous oxide and mercury from mechanical biological treatments reducing the emissions to water of total nitrogen, ammonia, nitrate and nitrite

Category	Identified BAT elements on
Physico-chemical treatments of waste waters	<ul style="list-style-type: none"> 8. the techniques in physico-chemical reactors 9. additional waste water parameters needing to be identified 10. neutralisation process 11. the precipitation of the metals 12. the break-up of emulsions 13. oxidation/reduction 14. waste waters containing cyanides 15. waste waters containing chromium (VI) compounds 16. waste waters containing nitrites 17. waste waters containing ammonia 18. air abatement during filtration and dewatering processes 19. flocculation and evaporation 20. cleaning of sieving processes
Physico-chemical treatment of solid wastes	<ul style="list-style-type: none"> 21. the insolubilisation of amphoteric metals 22. the leachability of inorganic compounds 23. restricting the acceptance of wastes to be treated by solidification/immobilisation 24. enclosed systems 25. abatement systems in charging and unloading 26. solid wastes to be landfilled
Physico-chemical treatment of contaminated soil	<ul style="list-style-type: none"> 27. the control of excavations 28. determining the suitability of the process to be applied 29. collecting and controlling equipment 30. the efficiency achieved during the processes
Re-refining of waste oils	<ul style="list-style-type: none"> 31. controlling of incoming materials 32. checking chlorinated solvents and polychlorinated biphenyls 33. condensation for the gas phase of the flash distillation units 34. abatement during the loading and unloading of vehicles 35. different abatements when chlorinated species are present 36. thermal oxidation 37. vacuum systems 38. using the residues from vacuum distillation or thin film evaporators 39. highly efficient re-refining processes of waste oil 40. waste water emission values for hydrocarbon and phenols
Regeneration of waste solvents	<ul style="list-style-type: none"> 41. controlling of incoming materials 42. evaporating the residue
Regeneration of waste catalysts	<ul style="list-style-type: none"> 43. using bag filters 44. using sulphur oxide abatement systems
Regeneration of waste activated carbons	<ul style="list-style-type: none"> 45. quality control procedures 46. the origin of the waste activated carbons 47. using a kiln for the treatment of industrial carbons 48. using an afterburner for the regeneration of industrial carbons 49. using an afterburner for the regeneration of potable water and food grade active carbons 50. using a flue-gas treatment train 51. scrubbing systems 52. waste water treatment plants
Preparation of waste to be used as fuel	<ul style="list-style-type: none"> 53. transferring the knowledge of the waste fuel composition prepared 54. quality assurance systems 55. manufacturing different type of waste fuels 56. waste water treatments 57. safety aspects
Preparation of solid waste fuels from non-hazardous waste	<ul style="list-style-type: none"> 58. visually inspecting the incoming wastes 59. using magnetic ferrous and non ferrous metal separators 60. using near-infrared techniques 61. the preparation of the waste fuel at the correct size
Preparation of solid waste fuels from hazardous waste	<ul style="list-style-type: none"> 62. drying or heating operations 63. mixing and blending operations 64. the abatement of particulates

Category	Identified BAT elements on
Preparation of liquid waste fuels from hazardous waste	65. using heat-exchange units external to the vessel 66. the homogeneity of the liquid fuel

These BAT for specific methods of waste treatment also make some suggestions for the limit values for certain pollutants which can be associated with the use of the BAT in question. These are presented in the tables below.

Mechanical biological treatments

Table 5

Parameter	Treated exhaust gas
Odour (ouE/m ³)	<500 – 6000
NH ₃ (mg/Nm ³)	<1 – 20
For VOC and PM, see the generic BAT 41 The TWG recognised that N ₂ O (see Section 4.6.10) and Hg also needed to be added to this table, however not enough data were provided to validate values on these issues.	

Recovery of materials from waste

The following values are suggested for the discharged waste water from the re-refining unit:

Table 6

Waste water parameter	Concentration (ppm)
Hydrocarbons	<0.01 – 5
Phenols	0.15 – 0.45
For other water parameters, refer to BAT number 56 in the Generic BAT section	

Disposal of waste oils

A general duty is placed on Member States by Directive 75/439/EEC¹⁶⁵ to ensure that the collection and disposal of waste oils causes no avoidable damage to man and the environment. The definition of ‘waste oils’ is not restricted to lubricating oils, but by including the words ‘used oils’ it excludes wastes from oil refineries, for example. Member States are required to give priority to regeneration (producing base oils) ‘where technical, economic and organisational constraints so allow’. Burning of waste oils which cannot be regenerated is to be carried out under environmentally acceptable conditions as set out in the Directive with the proviso that it is technically, economically and organisationally feasible. Waste oils that are neither regenerated nor burnt must be safely destroyed or their dumping controlled.

The following are to be prohibited:

- discharge of waste oils to any water and drainage systems;
- any deposit and/or discharge harmful to the soil;

¹⁶⁵ Council Directive of 16 June 1975 on the disposal of waste oils, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1975L0439:20051228:EN:PDF>

- any uncontrolled discharge of residues from processing;
- any processing of waste oils causing air pollution which exceeds the level prescribed by existing provisions.

Where the above aims cannot otherwise be achieved, Member States are to ensure that one or more undertakings carry out the collection and/or disposal of waste oils in assigned zones. Holders of waste oils who cannot comply with the above prohibitions must place the oils at the disposal of these undertakings.

Indemnities may be granted to these collection and disposal undertakings as a reciprocal concession for the obligations imposed on them. These indemnities must not exceed annual uncovered costs and must not cause any significant distortion to competition or give rise to artificial patterns of trade in the products. The indemnities may be financed by a charge on waste oils or on products which, after use, are transformed into waste oils. The 'polluter pays principle' is to apply.

Any undertaking *disposing* of waste oil must obtain a permit from the competent authority. The permit may be subject to conditions. The undertakings must supply certain information to the competent authority on request and must be periodically inspected. Any undertaking *collecting* waste oils must be registered and adequately supervised; a system of permits may be required. Undertakings *regenerating or burning* waste oils may be granted a permit only when the competent authority is satisfied that all appropriate preventive measures have been taken. In the case of regeneration plants, Member States are required to ensure that their operation will cause no avoidable damage to the environment by requiring that the risks from residues are reduced to the minimum and that such residues are disposed of as required by the Directive 91/689/EEC on hazardous waste (see Chapter 2.4.1).

Member States must also take the following measures where waste oils are burnt: plants with a capacity of more than 3 MW must observe emission limits set in the amending Directive (these include limits for heavy metals, chlorine and fluorine, but sulphur dioxide and smoke limits are to be set by each Member State); plants under 3 MW must be subject to 'adequate control'. The Commission must be informed of the measures taken for both regeneration and combustion plants. There are further provisions to ensure that PCB/PCTs do not cause hazards. A limit of 50 ppm is laid down for the content of PCB/PCTs in regenerated waste oil.

Directive 75/439/EEC will be repealed by Directive 2008/98/EC on waste as of 12 December 2010. The new Directive is intended to bring together key provisions on the management of waste, providing a clearer baseline and a streamlined legislative approach at EU level. The treatment of waste oils is integrated into provisions on the management of specific hazardous waste streams. Essentially, Member States will need to take the necessary measures to ensure that: waste oils are collected separately, where technically feasible; that they are treated in accordance with the waste hierarchy and without endangering human health or the environment; and that where technically feasible and economically viable, waste oils of different characteristics are not mixed and waste oils are not mixed with other kinds of waste or substances, if such mixing impedes their treatment. The priority given in Directive 75/439/EEC to regeneration of waste oils is no longer felt to be justified, and regeneration will therefore no longer be given priority over other recovery options.

End-of-life vehicles

Directive 2000/53/EC¹⁶⁶ applies to cars and light commercial vehicles, i.e. vehicles designated as M1 and N1 under the EC vehicle classification system. Member States should encourage vehicle manufacturers and their component suppliers to limit the use of hazardous substances, design and produce vehicles so as to facilitate their dismantling and the reuse and recovery of materials and components, and to use recycled materials so as to encourage the development of this market.

Member States must ensure that systems are in place to collect End-of-life vehicles (ELVs), that there are enough collection facilities available, and that all ELVs are transferred to authorised treatment facilities. When an ELV has been transferred to such a facility, a certificate of destruction is to be issued to the last holder/owner. With regards to treatment, undertakings wishing to treat ELVs must obtain a permit to do so or be registered with the relevant competent authority. Annex I sets out minimum technical standards for the sites where ELVs are to be stored and treated. Minimum technical standards are also set out for the treatment of an ELV, eg the removal of batteries and oils, and the promotion of recycling by removing catalysts, metallic and plastic components, tyres and glass. Specific targets are set with regards to reuse and recovery:

- by 1 January 2006 on average at least 85% by weight of all ELVs is to be reused and recovered and at least 80% is to be reused and recycled. For cars produced before 1 January 1980, however, Member States are allowed to apply lower targets of 75 and 70% respectively;
- by 1 January 2015, the equivalent figures should be at least 95% and 85% respectively.

The Commission established component and material coding standards to facilitate reuse and recovery by the adoption of Decision 2003/138/EC. This requires Member States to take the necessary measures, working with manufacturers, to use the relevant ISO coding standards for plastics and rubber as set out in the Annex to the Decision. Member States must also ensure that producers supply dismantling information for each type of new vehicle within six months of that vehicle being put on the market.

Batteries and accumulators

Directive 2006/66/EC¹⁶⁷ sets mandatory recycling targets for all batteries; requires the establishment of collection schemes; and places a ban on the final disposal of industrial and automotive batteries and accumulators in landfills or by incineration (although residues of any batteries and accumulators that have undergone both

¹⁶⁶ Directive 2000/53/EC of the European Parliament and of the Council of 18 September 2000 on end-of life vehicles, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2000L0053:20050701:EN:PDF>

¹⁶⁷ Directive 2006/66/EC of the European Parliament and of the Council of 6 September 2006 on batteries and accumulators and waste batteries and accumulators and repealing Directive 91/157/EEC, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2006L0066:20080320:EN:PDF>

treatment and recycling in accordance with the Directive may be disposed of in landfills or by incineration).

Annex III of the Directive details the treatment and recycling requirements for batteries and accumulators covered by the Directive:

- treatment shall, as a minimum, include removal of all fluids and acids
- treatment and any storage at treatment facilities shall take place in sites with impermeable surfaces and suitable weatherproof covering or in suitable containers
- recycling processes shall achieve the following minimum recycling efficiencies:
 - a. recycling of 65% by average weight of lead-acid batteries and accumulators, including recycling of the lead content to the highest degree that is technically feasible while avoiding excessive costs;
 - b. recycling of 75% by average weight of nickel-cadmium batteries and accumulators, including recycling of the cadmium content to the highest degree that is technically feasible while avoiding excessive costs; and
 - c. recycling of 50% by average weight of other waste batteries and accumulators.

Packaging waste

Directive 94/62/EC¹⁶⁸ is concerned with all products made of any material which is used for the ‘containment, protection, handling, delivery and presentation of goods’. It covers the three main types of packaging: sales or primary packaging, which is normally acquired by the purchaser or consumer; grouping or secondary packaging, which is generally removed by the distributor or retailer at or near the point of sale; and tertiary packaging, which may be designed to facilitate bulk handling as well as transport.

Member States are required to establish return, collection and recovery systems to provide for: (a) the return and/or collection of used packaging and/or packaging waste from the consumer, other final user, or from the waste stream in order to channel it to the most appropriate waste management alternatives’; and (b) ‘the reuse or recovery including recycling of the packaging and/or packaging waste collected’.

Directive 2004/12/EC, which amended Directive 94/62/EC, set recovery targets for 31 December 2008: 60% as a minimum by weight of packaging waste shall be recovered or incinerated at waste incineration plants with energy recovery; between 55% as a minimum and 80% as a maximum by weight of packaging waste shall be recycled; and minimum recycling targets for materials contained in packaging waste shall be attained by weight for glass (60%); for paper and board (60%); for metals (50%); for plastics (22.5%); and for wood (15%). Derogations were included for Greece, Portugal and Ireland, but they are nevertheless required to achieve a minimum 25% recovery target.

¹⁶⁸ European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1994L0062:20050405:EN:PDF>

Waste electrical and electronic equipment and restriction of hazardous substances in electrical/electronic equipment

Directive 2002/96/EC¹⁶⁹ sets targets for recovery, requires collection systems to be set up, and encourages the design and production of electrical and electronic equipment (EEE) to take future reuse, recycling and recovery into account. It applies to EEE falling into categories set out in Annexes 1A (which lists the categories) and 1B (which gives examples of the 10 categories). The Directive is mainly focused on waste electrical and electronic equipment (WEEE) from private households, although the definition of this also includes waste from commercial, industrial, institutional and other sources, which because of its nature and quantity is similar to that from private households. The categories of WEEE, and the associated target rates for recovery of WEEE, to be attained by 31 December 2006, are summarised in the table below.

¹⁶⁹ Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2002L0096:20080321:EN:PDF>

<i>Category (according to Annex IA)</i>	<i>Examples include (according to Annex IB)</i>	<i>Targets for recovery</i>
Category 1: large household Appliances; Category 10: Automatic dispensers	Refrigerators, freezers, electric stoves, washing machines, microwaves. Dispensers for hot drinks, cans, money.	Minimum 80% by an average weight per appliance; and Minimum 75% by an average weight per appliance, for component, material and substance reuse and recycling
Category 3: IT and telecommunications equipment Category 4: Consumer equipment	Centralised data processing, main frames, printer units, PCs and laptops including mouse, screen and keyboard, copying equipment, calculators. Radios, televisions, video cameras, hi-fis, video recorders.	Minimum 75% by an average weight per appliance; and Minimum 65% by an average weight per appliance, for component, material and substance reuse and recycling
Category 2: Small household appliances Category 5: Lighting equipment Category 6: Electrical and electronic tools (excluding large-scale stationary industrial tools) Category 7: Toys, leisure and sports equipment. Category 9: Monitoring and control instruments	Vacuum cleaners, irons, toasters, fryers, electric knives. Luminaires for fluorescent lamps (except in households), straight and compact fluorescent lamps. Drills, saws, sewing machines, tools for welding, soldering, tools for mowing or other garden activities. Electric trains or car racing sets, video games, hand held consoles, coin slot machines. Smoke detector, heating regulators, thermostats.	Minimum 70% by an average weight per appliance; Minimum 50% by an average weight per appliance, for component, material and substance reuse and recycling; and For gas discharge lamps the rate of component, material and substance reuse and recycling shall reach a minimum of 80% by weight of the lamps

Note: For category 8: Medical devices (with the exception of all implanted and infected products), no recovery targets are established for this period.

31 December 2006 was set as the deadline by which the target to separately collect at least an average of 4 kg per inhabitant per year should be achieved for private households. The Commission is to propose a new mandatory target by 31 December 2008. This will include targets for products in category 8 of Annex IA for which there were no targets established for 2006.

Producers, or third parties acting on their behalf, are to set up systems for the treatment of WEEE using the best available treatment, recovery and recycling techniques. The systems may be collective or individual. As a minimum, treatment is to include the removal of all fluids, plus a selective treatment for materials and components of WEEE, as outlined in Annex II, for example the removal of batteries and components containing mercury. The Directive sets out technical requirements for the treatment and storage of WEEE (Annex III). Any establishment or undertaking carrying out treatment operations must obtain a permit from the Member State's competent authority. Member States may establish minimum quality standards for the treatment of WEEE.

Directive 2002/96/EC is complemented by Directive 2002/95/EC¹⁷⁰, on the restriction of the use of hazardous substances (RoHS) in EEE. Directive 2002/95/EC placed a ban on the use of the following hazardous substances in new EEE placed on the market after 1 July 2006: lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE). It applies to EEE outlined in categories 1-7 and 10 of Annex 1A of Directive 2002/96/EC (see above). In addition, it will apply to electric light bulbs and luminaries in households. In accordance with the EU waste hierarchy, which states a preference for reuse over recycling, the ban will not apply to spare parts for the repair, or to the reuse, of electrical and electronic equipment placed on the market before 1 July 2006. There are also exemptions for a number of applications, as listed in the Annex to the Directive. However, Decision 2005/618/EC amended the Directive to allow certain maximum concentrations of hazardous substances as follows: 0.1% by weight of lead, mercury, hexavalent chromium, polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE) in homogeneous materials; and 0.01% by weight of cadmium in homogeneous materials.

In December 2008 the European Commission adopted a proposal to ‘recast’ (i.e. consolidate and add new provisions to) Directives 2002/96/EC and 2002/95/EC.

The proposal to recast the WEEE Directive (2002/96/EC) includes amendments to core waste definitions adopted within Directive 2008/98/EC¹⁷¹ on waste. Importantly, it also proposes revising targets for the collection and treatment of WEEE, from the current 4kg of WEEE per inhabitant per year (which has proved problematic to implement) to a minimum collection rate of 65% of WEEE applied to producers. New targets for the recovery, preparation for reuse, and recycling of WEEE are proposed for 2011: for WEEE in categories 1 and 10, 85% to be recovered and 80% prepared for reuse and recycled; for WEEE in categories 3 and 4, 80% to be recovered and 70% prepared for reuse and recycled; for WEEE in categories 2, 5, 6, 7, 8 and 9, 75% to be recovered and 55% to be prepared for re-use and recycled; and for gas discharge lamps, 85% to be prepared for re-use and recycled.

The proposal to recast the RoHS Directive (2002/95/EC) would extend its scope to include the currently excluded product categories of medical devices and control and monitoring instruments. This would improve the harmonisation of the RoHS and WEEE Directives. The proposal would also clarify the issue of whether the non-exhaustive list of categories (set out in Annex IB of the WEEE Directive) is applicable to the RoHS Directive, by moving the list from the WEEE Directive to the RoHS Directive (renamed Annex II).

¹⁷⁰ Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2002L0095:20080321:EN:PDF>

¹⁷¹ Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:312:0003:0030:EN:PDF>

2.4.5 Urban waste water treatment plants

Introduction

This chapter addresses waste water treatment plants which treat waste water arising from 'urban' sources. This includes waste water from domestic sewage, drainage and from industry, where this is discharged into a sewer. It does not address waste water treatment requirements for individual industrial activities as these are highly specific to those industries.

Under EU law the main provisions relating to the regulation of such processes is the Urban Waste Water Treatment Directive (91/271/EEC)¹⁷². This Directive seeks to reduce the pollution of freshwater, estuarial and coastal waters by domestic sewage, industrial waste water and rainwater run-off. It sets minimum standards, and timetables for their achievement, for the collection, treatment and discharge of urban waste water. It introduces controls over the disposal of sewage sludge, and requires the ending of sewage sludge dumping at sea.

Requirements of Directive 91/271/EEC

Collection of waste water

All towns and villages ('agglomerations') with a population equivalent (p.e.) greater than 2000 are required to have collecting (sewerage) systems by the end of 1998, 2000 and 2005 respectively, depending on their size and the characteristics of the affected waters.

Treatment levels

Treatment levels and deadlines are staged, depending on the size of the agglomeration and the characteristics of the affected waters.

Towns in the catchment of so-called 'sensitive areas' (largely areas suffering from eutrophication or in danger to become eutrophic) and greater than 10,000 p.e. had to provide for waste water treatment including nutrient removal ('tertiary treatment', or 'more stringent treatment'; Annex I, table 2) by 31.12.1998.

Towns outside the catchment of sensitive areas and greater than 15,000 p.e. had to provide for 'secondary treatment' (Annex I, table 1) by 31.12.2000.

Towns and villages between 2.000 and 15.000 p.e. had to provide for 'secondary treatment' (Annex I, table 1) by 31.12.2005.

¹⁷² Council Directive of 21 May 1991 concerning urban waste water treatment, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1991L0271:20031120:EN:PDF>

For the new 12 Member States which joined the EU in 2004 and 2007, specific transition periods are set out in the Accession Treaties. They are staged between 2008 and 2015, and in the case of Romania's smaller agglomerations until 2018.

Smaller town and villages below 2,000 p.e. but equipped with a collecting system had to provide appropriate treatment by 31.12.2005; appropriate treatment is the level of treatment allowing to meet environmental quality standards in the affected waters.

Designating sensitive and less sensitive areas

Against the staged environmental objectives for 'sensitive areas' and 'normal areas', waters have to be assessed whether they are sensitive or not. Binding criteria for such assessment are set out in Annex II and have to be applied by Member States in assessing their waters. Member States have the options of either designating individual sensitive areas and regularly reassessing these, or applying the more stringent approach of Annex I, table 2, to their whole territory.

Directive 91/271/EEC provides for limited derogation options from the rule of secondary treatment as minimum level, in so-called 'less sensitive areas', however subject to comprehensive studies and agreement by the Commission. Since 1991, such a derogation has been issued by the Commission for only one single treatment plant.

Emission limits

Annex I of the Directive sets emission limit values or minimum percentage reductions that systems of waste treatment must meet, and sets out reference methods for monitoring and evaluating the results. Table 1 sets the emission limit values for secondary treatment, table 2 for tertiary (more stringent) treatment including nutrient removal (nitrogen and/or phosphorus).

Table 1: Requirements for discharges from urban waste water treatment plants subject to Articles 4 and 5 of the Directive. The values for concentration or for the percentage of reduction shall apply.

Parameters	Concentration	Minimum percentage of reduction ⁽¹⁾	Reference method of measurement
Biochemical oxygen demand (BOD5 at 20 °C) without nitrification ⁽²⁾	25 mg/l O ₂	70-90 40 under Article 4 (2)	Homogenized, unfiltered, undecanted sample. Determination of dissolved oxygen before and after five-day incubation at 20 °C ± 1 °C, in complete darkness. Addition of a nitrification inhibitor
Chemical oxygen demand (COD)	125 mg/l O ₂	75	Homogenized, unfiltered, undecanted sample Potassium dichromate
Total suspended solids	35 mg/l ⁽³⁾ 35 under Article 4 (2) (more than 10 000 p.e.) 60 under Article 4 (2) (2 000-10 000 p.e.)	90 ⁽³⁾ 90 under Article 4 (2) (more than 10 000 p.e.) 70 under Article 4 (2) (2 000-10 000 p.e.)	— Filtering of a representative sample through a 0,45 µm filter membrane. Drying at 105 °C and weighing — Centrifuging of a representative sample (for at least five mins with mean acceleration of 2 800 to 3 200 g), drying at 105 °C and weighing

⁽¹⁾ Reduction in relation to the load of the influent.

⁽²⁾ The parameter can be replaced by another parameter: total organic carbon (TOC) or total oxygen demand (TOD) if a relationship can be established between BOD5 and the substitute parameter.

⁽³⁾ This requirement is optional.

Table 2: Requirements for discharges from urban waste water treatment plants to sensitive areas which are subject to eutrophication as identified in Annex IIA(a). One or both parameters may be applied depending on the local situation. The values for concentration or for the percentage of reduction shall apply.

Parameters	Concentration	Minimum percentage of reduction (%)	Reference method of measurement
Total phosphorus	► C1 2 mg/l (10 000 — 100 000 p.e.) ◀ 1 mg/l (more than 100 000 p.e.)	80	Molecular absorption spectrophotometry
Total nitrogen (%)	15 mg/l (10 000-100 000p.e.) (2) 10 mg/l (more than 100 000 p.e.) (3)	70-80	Molecular absorption spectrophotometry

(1) Reduction in relation to the load of the influent.

(2) Total nitrogen means the sum of total Kjeldahl nitrogen (organic and ammoniacal nitrogen) nitrate-nitrogen and nitrite-nitrogen.

(3) These values for concentration are annual means as referred to in Annex I, paragraph D.4(c). However, the requirements for nitrogen may be checked using daily averages when it is proved, in accordance with Annex I, paragraph D.1, that the same level of protection is obtained. In this case, the daily average must not exceed 20 mg/l of total nitrogen for all the samples when the temperature from the effluent in the biological reactor is superior or equal to 12 °C. The conditions concerning temperature could be replaced by a limitation on the time of operation to take account of regional climatic conditions.

Member States have the option to comply with these emission limit values:

- either by complying with the set maximum concentrations in the effluent,
- or by complying with the set minimum pollution elimination rates.

Further, for the catchment of sensitive areas, they have the option:

- either to comply treatment plant by treatment plant with the emission limit values,
- or to prove that all the treatments plants together in that catchment reach an pollution elimination rate of 75% for nitrogen and for phosphorus.

Sludge disposal

Directive 91/271/EEC requires that the disposal of sewage sludge arising from waste water treatment was to be subject to regulation by the end of 1998. The dumping of sludge at sea, or in other surface waters, had to be 'phased out' by the same date.

Disposal of sewage sludge is also regulated by Directive 86/278/EEC¹⁷³ which aims to encourage the use of sewage sludge in agriculture and to regulate its use in such a way as to prevent harmful effects on soil, vegetation, animals and man. It prohibits

¹⁷³ Council Directive of 12 June 1986 on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1986L0278:20030605:EN:PDF>

the use of untreated sludge on agricultural land unless it is injected or incorporated into the soil. It restricts the application of sludge and access of animals to areas where sludge has been applied.

Industrial waste water

As regards industrial waste water, discharges into collecting systems and treatment plants had to be subject to prior regulation and/or specific authorization by the end of 1993, and subject to forms of pre-treatment specified in an Annex. These include the provision that the resulting sludge can be disposed of safely in an environmentally acceptable manner. Bio-degradable industrial waste water from specified sectors of the food and drink industry which is discharged direct to receiving waters is also to be subject to prior regulation/authorization by the end of 2000.

Programmes

Programmes for the implementation of the Directive, which need to be updated every two years if appropriate, had to be established by Member States by the end of 1993 in accordance with Decision 93/481/EC. These programmes basically gave an overview over the foreseen construction of collecting systems and treatment plants. As for the 12 new Member States which joined the EU in 2004 and 2007 respectively, these programmes operationally have to reflect the transition periods set out in the Accession Treaties.

Case Law

There have been a large number of cases concluded in the ECJ concerning Directive 91/271/EEC. However, these address various failures of implementation rather than interpretation. One case relates to interpretation of the Directive with respect to its interaction with the Waste Framework Directive 75/442/EEC. In Case C-252/05, the ECJ held that sewage that has escaped from sewers should be classified as waste within the scope of the Waste Framework Directive 75/442/EEC. In this judgment the ECJ also stated that the sewage need nevertheless not be classed as waste if national law contains explicit provisions on the management of such escaped sewage providing an equal level of environmental protection to that guaranteed by the Directive 75/442/EEC.

2.5 EXTRACTIVE INDUSTRY

2.5.1 *Extraction of petroleum and natural gas*

Introduction

This chapter addresses the extraction of petroleum and natural gas. This area is not covered by Directive 2008/1/EC and so does not have a BREF referring to BAT. It is however affected by the provisions of Directive 85/337/EEC¹⁷⁴.

In addition, EU legislation that relates to nature protection may also apply to these installations, in particular Directive 2009/147/EC (formerly 79/409/EEC)¹⁷⁵ on the conservation of wild birds (commonly referred to as the Birds Directive) and Directive 92/43/EEC¹⁷⁶ on the conservation of natural habitats and of wild fauna and flora (commonly referred to as the Habitats Directive).

The drilling of a well for the extraction of petroleum and natural gas can risk contamination of groundwater by leakage of the chemical substances used for drilling muds, as well as by oil spills. Therefore, a number of provisions on water management of Directive 2000/60/EC¹⁷⁷ also apply to this activity. Furthermore, several provisions under the Directive 2004/35/EC on environmental liability with regard to the prevention and remedying of environmental damage need to be taken into account.

Obligations with respect to Environmental Impact Assessment

Directive 85/337/EEC lists two classes of project to which the Directive applies: Annex I Projects for which environmental impact assessment (EIA) is mandatory; and Annex II projects for which EIA is discretionary. In the original 1985 Directive oil and gas development were Annex II projects. The 1997 amending Directive made oil and gas developments Annex I Projects.

The extraction of petroleum and natural gas for commercial purposes, where the amount extracted exceeds 500 tonnes/day in the case of petroleum and 500,000m³/day in the case of gas, is listed under Annex I of Directive 85/337/EEC and consequently

¹⁷⁴ Council Directive of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1985L0337:20030625:EN:PDF>

¹⁷⁵ Directive 2009/147/EC of 30 November 2009 of the European Parliament and of the Council on the conservation of wild birds (codified version), <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:020:0007:0025:EN:PDF>

¹⁷⁶ Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1992L0043:20070101:EN:PDF>

¹⁷⁷ Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2000L0060:20080321:EN:PDF>

an EIA is mandatory and must always be undertaken as part of the consent procedure for the planned development.

In addition, surface industrial installations for the extraction of coal, petroleum, natural gas and ores, as well as bituminous shale are listed under Annex II of the Directive. These projects must be subjected to screening in order to evaluate whether they are likely to have significant environmental effects, and hence require an EIA.

Obligations with respect to nature conservation

Directive 2009/147/EC (formerly 79/409/EEC) provides a system of protection for all species of wild birds found in Europe, while Directive 92/43/EEC aims to maintain and improve biodiversity in the EU through the conservation of natural habitats and the protection of wild fauna and flora.

One of the main problems of the offshore petroleum industry is that it affects the marine environment. Therefore, when extracting petroleum or natural gas, the developer must determine if the installation is located within, or is likely to have a 'significant' effect on the integrity of, a designated, proposed, or candidate Natura 2000 site (Special Areas of Conservation (SAC) and/or Special Protection Areas (SPA), as designated under Directive 92/43/EEC and Directive 2009/147/EC, respectively). If a significant effect is likely, the 'competent authorities' are required to carry out an 'appropriate assessment' under Directive 92/43/EEC. The assessment aims to determine if these effects will be (a) significant; and (b) adverse (this includes indirect effects from outside the site). Further details are provided in Chapter 1.14.

Obligations with respect to water management

Directive 2000/60/EC (commonly referred to as the Water Framework Directive) was introduced with the aim of coordinating water environment policy and regulation across Europe. The Directive as amended applies to surface waters, that is lakes, rivers, transitional waters (estuaries) and coastal waters (up to one nautical mile from land) and to ground waters.

The environmental objectives are set out in Article 4 of the Directive 2000/60/EC and require Member States to:

- prevent deterioration of ecological quality and pollution of surface waters and restore polluted waters, in order to achieve good water status in all surface waters by 31 December 2015;
- prevent deterioration of groundwater quality, restore polluted groundwater, and ensure a balance between abstraction and recharge of groundwater, in order to achieve good groundwater status in all ground waters by 31 December 2010; and
- comply with all standards and objectives relating to Protected Areas by 31 December 2010, unless otherwise specified in the Community, national or local legislation under which the individual Protected Areas have been established.

The key criterion for judging performance is the achievement of 'good ecological status'.

Drilling of a well for the extraction of petroleum and natural gas can potentially contaminate groundwater by leakage of the chemical substances used for drilling muds or by oil spills.

The list of derogations from meeting some of the environmental objectives includes situations where:

- heavily modified water bodies are designated;
- technical feasibility to achieve objectives requires an extension to the deadline;
- cost implications to achieve objectives requires an extension to the deadline; and
- natural conditions require additional time to meet the objectives.

Member States are also allowed to fail to meet the requirements of the Directive when this is due to new modifications of the physical characteristics of a surface water body or alterations to the levels of groundwater or where water status declines from high to good due to 'new sustainable human development activities'. In such cases the following conditions must be met:

- all practical mitigating steps should be taken;
- the reasons for the changes are of overriding public interest and/or the benefits to the environment and society are outweighed by the benefits to the new modifications to human health, safety or to 'sustainable development'; and
- the benefits cannot be achieved by other means due to technical or cost issues.

For projects falling under the scope of Directive 85/337/EEC, the information provided by such an assessment should be used in helping to determine if the above-mentioned conditions for derogation are met. Furthermore, a joint procedure which combines the provisions of Directive 85/337/EEC and those of Directive 2000/60/EC may be applied by Member States.

For projects which do not fall under the scope of Directive 85/337/EEC, a specific water assessment procedure implemented by each Member State in accordance with its national legislation should determine if the conditions for derogation are met.

The provisions which allow derogation from Directive 2000/60/EC objectives cannot however be used as an exemption from fulfilling the legal requirements of other Directives. For instance, a new development that would cause deterioration of status of a water body and that fails to achieve the objectives for a Natura 2000 site would have to fulfil both Directive 2000/60/EC and Directive 92/43/EEC, i.e.:

- The relevant conditions set out in Article 4(7) of Directive 2000/60/EC for allowing deterioration of status would have to be met to the extent that it is a water body.
- The conditions set out in Article 6 of Directive 92/43/EEC for allowing a failure to achieve a Natura 2000 site's conservation objectives.

In conclusion, the activity of extraction of petroleum and natural gas is compatible with Directive 2000/60/EC as long as external effects – e.g. on the water environment – are taken into account properly by the use of the Article 4(7) test. As for ongoing

activities, this will either reclassify the water body as heavily modified or establish a lesser objective. In order for a derogation to apply, the social and economic benefits must be shown to outweigh any negative impact on the environment. The proposal must also demonstrate that it will be the best environmental option.

2.5.2 Mining, quarries and peat extraction

Introduction

Mining and quarrying for minerals and peat extraction represent major industrial and potentially highly polluting activities. As such they are specifically covered by provisions under Directive 85/337/EEC¹⁷⁸ on environmental impact assessment. Major accidents involving the mining sector/extractive industries have led to their inclusion within the scope of Directive 96/82/EC¹⁷⁹ on the control of major accident hazards. This is complemented by measures specific to extractive industries focused on the management of their wastes, as accumulated mine wastes have been implicated in various disasters. The latter category includes the mining waste Directive and a BREF focusing upon BAT for the management of tailings and waste rock in mining activities.

Obligations with respect to Environmental Impact Assessment

Extractive industries are covered by both Annex I and Annex II of Directive 85/337/EEC. In accordance with Article 4 of the Directive projects listed in Annex I 'shall be made subject' to an EIA in line with the provisions of the Directive (see Chapter 1.1 for the requirements of an EIA). Extractive industries covered by this clause are:

- Installations for the extraction of asbestos and for the processing and transformation of asbestos and products containing asbestos: for asbestos-cement products, with an annual production of more than 20 000 tonnes of finished products, for friction material, with an annual production of more than 50 tonnes of finished products, and for other uses of asbestos, utilization of more than 200 tonnes per year (Annex I, Paragraph 5); and
- Quarries and open-cast mining where the surface of the site exceeds 25 hectares, or peat extraction, where the surface of the site exceeds 150 hectares (Annex I, Paragraph 19)

Extractive industry projects covered by Annex II of Directive 85/337/EEC are:

- Quarries, open-cast mining and peat extraction (projects not included in Annex I) (Annex II, Paragraph 2a); and
- Underground mining (Annex II, Paragraph 2b).

For Annex II projects Member States must determine, either on a case by case basis and/or if specific thresholds or criteria are met, whether an EIA is required.

¹⁷⁸ Council Directive of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1985L0337:20030625:EN:PDF>

¹⁷⁹ Council Directive 96/82/EC of 9 December 1996 on the control of major-accident hazards involving dangerous substances, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1996L0082:20031231:EN:PDF>

Obligations with respect to risk prevention and management

Directive 96/82/EC (see Chapter 1.5 for further details) was amended by Directive 2003/105/EC extending its coverage to ‘the exploitation (exploration, extraction and processing) of minerals in mines, quarries, or by means of boreholes, with the exception of chemical and thermal processing operations and storage related to those operations which involve dangerous substances’. Annex I of the Directive defines what should be considered to be a dangerous substance.

Management of waste from extractive industries

Directive 2006/21/EC¹⁸⁰ on the management of waste from extractive industries (commonly known as the mining waste Directive) outlines provisions for the management of waste explicitly from the ‘prospecting, extraction, treatment and storage of mineral resources and the working of quarries’ (excluding offshore activities), requiring them to be ‘managed without endangering human health and without using processes and methods which could harm the environment’ in particular ‘water, air, soil, fauna and flora and landscape’. The Directive is intended to reduce the environmental impact of mining, reduce the hazardousness of the waste generated, encourage the prioritisation of recovery and recycling, and allow the minimisation of the quantities of waste for disposal.

Under the Directive operators of waste management facilities are required to develop waste management plans, ‘major accident prevention policies’ and provide a ‘financial guarantee’ covering both operation and after-closure phases. Details of permitting, inspection, monitoring and closure requirements are also outlined.

In terms of scope, facilities conducting the prospecting, extraction, treatment and storage of mineral resources and working quarries would be regulated under this measure. The main focus, however, is upon activities falling within ‘Category A’ and defined as follows:

- where a failure or incorrect operation could give rise to major accident, based upon a risk assessment;
- when the waste facility is dealing with waste classified as hazardous; and
- when the waste contains substances or preparations classified as dangerous.

While the Directive is designed to control waste resulting from these activities it does not, however, cover waste generated indirectly from operations eg food wastes, waste oil etc. In addition the provisions only cover onshore activities and do not extend to the injection of water and re-injection of pumped ground water. Resultant inert waste and unpolluted soil is also exempted from the majority of the Directive’s requirements, unless deposited at a Category A facility. In addition, Member States

¹⁸⁰ Directive 2006/21/EC of the European Parliament and of the Council of 15 March 2006 on the management of waste from extractive industries and amending Directive 2004/35/EC, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:102:0015:0033:EN:PDF>

are allowed flexibility in terms of implementation with the right to reduce or waive certain requirements for:

- the deposit of non-hazardous waste generated except oil and evaporates;
- the deposit of unpolluted soil and waste resulting from the extraction, treatment and storage of peat; and
- non hazardous non inert waste, unless deposited at a Category A facility.

The Directive's purpose is to ensure that extractive waste is managed without endangering human health or without using processes/methods that could harm the environment. This covers the sites and facilities, defined above, during both operation and importantly after closure. The abandonment, dumping or uncontrolled depositing of extractive waste is prohibited by the Directive. Building on the approach taken in Directive 2008/1/EC on IPPC (see Chapter 1.4), action taken by operators to prevent and reduce adverse impacts on the environment and health should be based on the 'best available techniques' (BAT). The application of BAT should take into consideration the characteristics of the facility, its location and local environmental conditions (see below for details of the BREF setting out BAT).

For each site an operator must draw up a waste management plan for the minimisation, treatment, recovery and disposal of extractive waste. These plans are intended to: ensure the prevention and reduction of waste and its harmfulness; encourage the recovery of extractive waste by means of recycling, reusing and reclaiming such waste; and to ensure short and long term safe disposal of extractive waste via ensuring its consideration not only during operation but also in the design phase and importantly after a facility's closure. Details regarding what such a plan must include are outlined in Box 1. Plans must be reviewed every five years and approved by the competent authority.

Box 3 : Content of a waste management plan

According to the Directive, the waste management plan for each facility must include at least the following elements:

- proposed classification of the facility ie does it fall under Category A; if not, evidence to support this must be presented;
- characterisation of the waste and anticipated quantities;
- description of the waste generating activity and any subsequent treatment;
- description of potential impact upon human health and the environment;
- proposed control and monitoring procedures;
- proposed closure plan importantly including rehabilitation and monitoring procedures;
- details of measures to prevent the deterioration of water quality in line with the water framework Directive (see Section 4)
- a survey of land to be affected by the facility and its condition.

The plan must provide sufficient information in relation to the above in order to enable the competent authority to evaluate whether or not the plan will allow objectives to be met.

Under the scheme operators will have to be granted a permit in order to operate. The waste management plan for a facility is an essential element of the permit. As for other industrial regulation, permits should be periodically reconsidered and as necessary updated.

An essential element of the Directive focuses upon major accident prevention. For Category A facilities, in addition to the waste management plan, operators must also draw up a major accident prevention policy. Proof of this policy's existence must be included within the plan. A safety management system must be put in place in order to operationalise the prevention policy. This system must incorporate an emergency plan specifying measures to be taken onsite in the event of an accident. These facility specific plans and policies will be complemented by external emergency plans specifying offsite measures in the event of an accident, to be developed by competent authorities. These emergency plans, in combination, are intended to: contain and control major accidents; implement measures to protect human health and the environment from the effects of any incident; outline lines of communication; and provide for the rehabilitation, restoration and clean up of the environment following an accident. The information in the plans must be reviewed every three years and if, necessary, updated.

Planning for the future is central to compliance with the Directive; hence vital elements of the measure are provisions to deal with site rehabilitation, closure and after closure care. Prior to the commencement of any operation, the competent authority shall require a financial guarantee from the operator. This guarantee can, for example, take the form of a financial deposit, and is intended to ensure that all obligations under the permit are fulfilled - especially after-closure provisions and the rehabilitation of land affected by the waste facility. The guarantee will be calculated based on: the likely environmental impact of the facility; and the assumption that independent, qualified third parties will assess and perform any rehabilitation work.

In terms of closure, a facility will only be able to be classed as 'closed' once the competent authority has completed a final on-site inspection, certified that land affected by the facility has been rehabilitated and communicated approval for closure to the operator. The operator will, however, still be responsible for the maintenance, monitoring, control and corrective measures in the after closure phase, for as long as required by the competent authority. In addition the operator must still report to the competent authority and is responsible for notifying it of any events likely to affect the stability of the facility and implementing its emergency plan if necessary.

Under the Directive transitional periods apply for facilities that have 'been granted a permit' or which are 'already in operation on 1 May 2008'. These operators must comply with the Directive's provisions by 1 May 2012. Additional time is allowed for existing operations to comply with requirements pertaining to the financial guarantee, with the deadline shifted to 1 May 2014.

A separate timetable is set for the reduction in levels of dissolved cyanide in ponds linked to mining. Requirements are detailed in Article 13(6) of the Directive and include maximum limits for 'weak acid dissociable cyanide' for facilities already in operation on 1 May 2008. These limits decrease from 50 ppm on 1 May 2008 to 10 ppm by 1 May 2018. Those facilities which come into operation after the 1 May 2008 deadline must automatically meet the 10 ppm target.

Following on from the adoption of the Directive the Commission has adopted a number Decisions providing detailed guidance on specific aspects of the Directive aimed at aiding implementation. These are as follows:

- Commission Decision 2009/337/EC¹⁸¹ on the Criteria for the classification of waste facilities in accordance with Annex III – This decision discusses the classification of waste facilities as category A and the criteria against which a site must be tested to establish if poses a significant risk to the environment or health and safety.
- Commission Decision 2009/335/EC¹⁸² on the Technical guidelines for the establishment of the financial guarantee – This decision sets out the criteria upon which Member States should base the calculation of the level of financial guarantee required for a given installation. These include the scale of potential risk posed, the scale of after care requirements and potential scale and length of impact.
- Commission Decision 2009/360/EC¹⁸³ completing the technical requirements for waste characterisation. This decision sets out the approach to the different classification of wastes and methods for the collection and evaluation of information related to the former.
- Commission Decision 2009/359/EC¹⁸⁴ on the Definition of inert waste in implementation of Article 22 (1)(f). This decision sets out when waste will be considered inert and testing requirements to establish this.
- Commission Decision 2009/358/EC¹⁸⁵ on the Harmonisation, the regular transmission of the information and the questionnaire referred to in Articles 22(1) (a) and 18. This decision sets out details on the information to be reported from Member States to the Commission, it includes detailed requirements on reporting related to permitting and permit conditions.

In accordance with Article 22 (1) (b and f), the Commission has also given a mandate to CEN in order to develop the required standardised sampling and analysing methods.

¹⁸¹ Commission Decision 2009/337/EC on the Criteria for the classification of waste facilities in accordance with Annex III, OJ L102, 22.4.2009 <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:102:0007:0011:EN:PDF>

¹⁸² Commission Decision of 20 April 2009 on technical guidelines for the establishment of the financial guarantee in accordance with Directive 2006/21/EC of the European Parliament and of the Council concerning the management of waste from extractive industries, OJ L 101, 21.4.2009 <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:101:0025:0025:EN:PDF>

¹⁸³ Commission Decision of 30 April 2009 completing the technical requirements for waste characterisation laid down by Directive 2006/21/EC of the European Parliament and of the Council on the management of waste from extractive industries, OJ L 110, 1.5. 2009 <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:110:0048:0051:EN:PDF>

¹⁸⁴ Commission Decision of 30 April 2009 completing the definition of inert waste in implementation of Article 22(1)(f) of Directive 2006/21/EC of the European Parliament and the Council concerning the management of waste from extractive industries OJ L 110, 1.5.2009 <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:110:0046:0047:EN:PDF>

¹⁸⁵ Commission Decision of 29 April 2009 on the harmonisation, the regular transmission of the information and the questionnaire referred to in Articles 22(1)(a) and 18 of Directive 2006/21/EC of the European Parliament and of the Council on the management of waste from extractive industries, OJ L 101, 1.5. 2009 <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:110:0039:0045:EN:PDF>

Best Available techniques for Management of Tailings and Waste Rock in Mining Activities

A BREF for the management of tailings and waste rock in mining activities has been developed to be used to implement the requirement under Directive 2006/21/EC that action taken by operators to prevent and reduce adverse impacts on the environment and health should be based on BAT. This BREF¹⁸⁶ covers extraction of the following materials:

- Aluminium
- Cadmium
- Chromium
- Copper
- Gold
- Iron
- Lead
- Manganese
- Mercury
- Nickel
- Silver
- Tin
- Tungsten
- Zinc
- Barytes
- Borate
- Feldspar (if recovered by floatation)
- Fluorspar
- Kaolin (if recovered by floatation)
- Limestone (if processed)
- Phosphae
- Potash
- Strontium
- Talc (if recovered by floatation)
- Coal but only when processed and tailings are produced – this generally means that hard coal (or rock coals/black coal) is covered, whereas lignite (or brown coal), which is not processed, is not.

In relation to all these minerals the BREF considers: waste rock management; mineral processing relevant to tailings management; tailings management eg in ponds/dams, heaps or as backfill; topsoil and overburden if used in the management of tailings. The BREF sets out the environmental impacts associated with mining wastes and causes for concern in terms of ongoing management and specific accident events. Details of BAT applicable to tailings and rock waste can be found in the Annex to this chapter.

¹⁸⁶ Available from: http://ec.europa.eu/environment/ipcc/brefs/mtwr_final_0704.pdf

Annex 1: BAT in Relation to the Management of Tailings and Waste Rock in Mining Activities - extracted from Section 5 of the BREF for the management of tailings and waste-rock in mining activities

Introduction

Techniques presented are considered to be appropriate to the sector as a whole and in many cases reflect current performance of some sites within the sector. Where performance levels are presented, this is to be understood as meaning that those levels represent the environmental and safety performance that could be anticipated as a result of the application, in this sector, of the techniques described, bearing in mind the balance of costs and advantages inherent within the definition of BAT. In some cases it may be technically possible to achieve better emission or consumption levels but due to the costs involved or cross-media considerations, they are not considered to be appropriate as BAT for the sector as a whole. However, such levels may be considered to be justified in more specific cases where there are special driving forces.

The emission and consumption levels associated with the use of BAT have to be seen together with any specified reference conditions (e.g. averaging periods). Where available, data concerning costs have been given together with the description of the techniques presented in the previous chapter. These give a rough indication about the magnitude of costs involved. However, the actual cost of applying a technique will depend strongly on the specific situation regarding, for example, taxes, fees, and the technical characteristics of the site concerned. It is not possible to evaluate such site-specific factors fully in this document. In the absence of data concerning costs, conclusions on economic viability of techniques are drawn from observations on existing sites.

It is intended that the general BAT are a reference point against which to judge the current performance of an existing installation or to judge a proposal for a new installation. In this way they will assist in the determination of appropriate "BAT-based" conditions for the installation. It is foreseen that new installations can be designed to perform at or even better than the general BAT performances presented here. It is also considered that existing installations could move towards the general BAT levels or do better, subject to the technical and economic applicability of the techniques in each case. In any case there is a need for site-specific solutions for the design, construction, operational, closure and after-care phases, as well as a permanent control and monitoring of tailings and waste-rock management due to the very different types of mineralisations, mining and mineral processing techniques available, and the different geological, geotechnical, hydrogeological and morphological conditions that occur on a case-by-case and site-by-site basis.

While this document does not set legally binding standards, it is meant to give information for the guidance of industry, Member States and the public on achievable performances, emissions, and consumption levels when using specified techniques. For tailings and waste-rock management, BAT decisions are based on:

- environmental performance
- risk
- economic viability.

In particular, the consideration of risk is a very site-specific factor.

Generic BAT

BAT is to:

- apply the general principles (set out in section 4.1 of the BREF)
- apply a life cycle management approach (set out in section 4.2 of the BREF)

Life cycle management covers all the phases of a site's life, including:

- the design phase:
 - environmental baseline
 - characterisation of tailings and waste-rock
 - TMF studies and plans, which cover the following aspects:
 - site selection documentation
 - environmental impact assessment
 - risk assessment
 - emergency preparedness plan
 - deposition plan
 - water balance and management plan, and
 - decommissioning and closure plan
 - TMF and associated structures design
 - control and monitoring
- the construction phase
- the operational phase, with the elements:
 - OSM manuals
 - auditing (
- the closure and after-care phase, with the elements:
 - long-term closure objectives
 - specific closure issues for
 - heaps
 - ponds, including:
 - water covered ponds
 - dewatered ponds
 - water management facilities.

Furthermore, BAT is to:

- reduce reagent consumption
- prevent water erosion
- prevent dusting
- carry out a water balance and to use the results to develop a water management plan
- apply free water management
- monitor groundwater around all tailings and waste-rock areas.

ARD (acid rock drainage associated with sulphide ore bodies) management

The characterisation of tailings and waste-rock includes the determination of the acid-forming potential of tailings and/or waste-rock. If an acid-forming potential exists, it is BAT to firstly prevent the generation of ARD, and if the generation of ARD cannot be prevented, to control ARD impact or to apply treatment options. Often a combination is used.

All prevention, control and treatment options can be applied to existing and new installations. However, the best closure results will be obtained when plans are developed for the site closure right at the outset (design stage) of the operation (cradle-to-grave philosophy).

The applicability of the options depends mainly on the conditions present at the site. Factors such as:

- water balance;

- availability of possible cover material; and
- groundwater level

influence the options applicable at a given site. Section 4.3.1.5 provides a tool for deciding on the most suitable closure option.

Seepage management

Preferably the location of a tailings or waste-rock management facility will be chosen in a way that a liner is not necessary. However, if this is not possible and the seepage quality is detrimental and/or the seepage flowrate is high, then seepage needs to be prevented, reduced or controlled (listed in order of preference). Often a combination of these measures is applied.

Emissions to water

BAT is to:

- re-use process water
- mix process water with other effluents containing dissolved metals
- install sedimentation ponds to capture eroded fines
- remove suspended solids and dissolved metals prior to discharge of the effluent to receiving watercourses
- neutralise alkaline effluents with sulphuric acid or carbon dioxide
- remove arsenic from mining effluents by the addition of ferric salts.

The respective sections in Chapter 3 on emissions and consumption levels provide examples of the achieved levels. No correlation could be developed between the applied techniques and the available emission data. Therefore, in this document it was not possible to draw BAT conclusions with associated emission levels.

The following techniques are BAT for treating acidic effluents (Section 4.3.11.5):

- active treatments:
 - addition of limestone (calcium carbonate), hydrated lime or quicklime
 - addition of caustic soda for ARD with a high manganese content
- passive treatment:
 - constructed wetlands
 - open limestone channels/anoxic limestone drains
 - diversion wells.

Passive treatment systems are a long-term solution after the decommissioning of a site, but only when used as a polishing step combined with other (preventive) measures.

Noise emissions

BAT is to:

- use continuous working systems (e.g. conveyor belts, pipelines)
- encapsulate belt drives in areas where noise is a local issue
- first create the outer slope of a heap, and then transfer ramps and working benches into the heap's inner area as far as possible.

Dam design

During the design phase of a tailings dam, BAT is to:

- use the once in a 100-year flood as the design flood for the sizing of the emergency discharge capacity of a low hazard dam
- use the once in a 5000 – 10000-year flood as the design flood for the sizing of the emergency discharge capacity of a high hazard dam.

Dam construction

During the construction phase of a tailings dam, BAT is to:

- strip the natural ground below the retaining dam of all vegetation and huminous soils
- choose a dam construction material that is fit for the purpose and which will not weaken under operational or climatic conditions.

Raising dams

During the **constructional** and **operational** phases of a **tailings dam**, BAT is to:

- evaluate the risk of a too high pore pressure and monitor the pore pressure before and during each raise. The evaluation should be done by an independent expert.
- use conventional type dams, under the following conditions, when:
 - the tailings are not suitable for dam construction
 - the impoundment is required for the storage of water
 - the tailings management site is in a remote and inaccessible location
 - retention of the tailings water is needed over an extended period for the degradation of a toxic element (e.g. cyanide)
 - the natural inflow into the impoundment is large or subject to high variations and water storage is needed for its control
- use the upstream method of construction, under the following conditions, when:
 - there is very low seismic risk
 - tailings are used for the construction of the dam: at least 40 – 60 % material with a particle size between 0.075 and 4 mm in whole tailings (does not apply for thickened tailings)
- use the downstream method of construction, under the following conditions, when:
- sufficient amounts of dam construction material are available (e.g. tailings or wasterock)
- use the centreline method of construction (Section 4.4.6.4), under the following conditions when:
 - the seismic risk is low.

Dam operation

During the operational phase of a tailings pond, BAT is to:

- monitor stability as further specified below
- provide for diversion of any discharge into the pond away from the pond in the event of difficulties
- provide alternative discharge facilities, possibly into another impoundment
- provide second decant facilities (e.g. emergency overflow) and/or standby pump barges for emergencies, if the level of the free water in the pond reaches the predetermined minimum freeboard
- measure ground movements with deep inclinometers and have a knowledge of the pore pressure conditions
- provide adequate drainage
- maintain records of design and construction and any updates/changes in the design/construction
- maintain a dam safety manual as described in Section 4.2.3.1 in combination with independent audits as mentioned in Section 4.2.3.2
- educate and provide adequate training for staff.

Removal of free water from the pond

BAT is to:

- use a spillway in natural ground for valley site and off valley site ponds
- use a decant tower:
 - in cold climates with a positive water balance
 - for paddock-style ponds
- use a decant well:
 - in warm climates with a negative water balance
 - for paddock-style ponds

- if a high operating freeboard is maintained.

Dewatering of tailings

The choice of method (slurried, thickened or dry tailings) depends mainly on an evaluation of three factors, namely:

- cost
- environmental performance
- risk of failure.

For tailings management, BAT is to apply:

- dry tailings management
- thickened tailings management or
- slurried tailings management

There are many other factors that influence the choice of the appropriate techniques for a given site. Some of these factors are:

- mineralogy of the ore
- ore value
- particle size distribution
- availability of process water
- climatic conditions
- available space of tailings management.

Tailings and waste-rock management facility operation

During the operational phase of any tailings and waste-rock management facility, BAT is to:

- divert natural external run-off
- manage tailings or waste-rock in pits. In this case heap/dam slope stability is not an issue
- apply a safety factor of at least 1.3 to all heaps and dams during operation
- carry out progressive restoration/revegetation.

Monitoring stability

BAT is to:

- monitor in a tailings pond/dam:
 - the water level
 - the quality and quantity of seepage flow through the dam
 - the position of the phreatic surface
 - pore pressure
 - movement of dam crest and tailings
 - seismicity, to ensure stability of the dam and the supporting strata
 - dynamic pore pressure and liquefaction
 - soil mechanics
 - tailings placement procedures
- monitor in a heap:
 - bench/slope geometry
 - sub-tip drainage
 - pore pressure
- also carry out:
 - in the case of a tailings pond/dam:
 - visual inspections
 - annual reviews
 - independent audits
 - safety evaluations of existing dams (SEED)
 - in the case of a heap:
 - visual inspections

- geotechnical reviews
- independent geotechnical audits .

Mitigation of accidents

BAT is to:

- carried out emergency planning
- evaluate and follow-up incidents
- monitor the pipelines.

Reduction of footprint

BAT is to:

- if possible, prevent and/or reduce the generation of tailings/waste-rock
- backfill tailings, under the following conditions, when:
 - backfill is required as part of the mining method
 - the additional cost for backfilling is at least compensated for by the higher ore recovery
 - in open pit mining, if the tailings easily dewater (i.e. evaporation and drainage, filtration) and thereby a TMF can be avoided or reduced in size
 - use nearby mined-out open pits is available for backfilling
 - backfill large stopes in underground mines. Stopes backfilled with slurried tailings will require drainage. Binders may also need to be added to increase the stability
- backfill tailings in the form of paste fill, if the conditions to apply backfill are met and if:
 - there is a need for a competent backfill
 - the tailings are very fine, so that little material would be available for hydraulic backfill. In this case, the large amount of fines sent to the pond would dewater very slowly it is desirable to keep water out of the mine or where it is costly to pump the water draining from the tailings (i.e. over a large distance)
- backfill waste-rock, under the following conditions, when:
 - it can be backfilled within an underground mine
 - one or more mined-out open pits are nearby (this is sometimes referred to as ‘transfer mining’)
 - the open pit operation is carried out in such a way that it is possible to backfill the waste-rock without inhibiting the mining operation
- investigate possible uses of tailings and waste-rock.

Closure and after-care

During the closure and after-care phase of any tailings and waste-rock management facility,

BAT is to:

- develop closure and after-care plans during the planning phase of an operation, including cost estimates, and then to update them over time (Section 4.2.4). However, the requirements for rehabilitation develop throughout the lifetime of an operation and can first be considered in precise detail in the closure phase of a TMF
- apply a safety factor of at least 1.3 for dams and heaps after closure although a split view concerning water covers exists.
- For the closure and after-care phase of tailings ponds, BAT is to construct the dams so that they stay stable in the long term if a water cover solution is chosen for the closure.

Gold leaching using cyanide

In addition to the generic measures, for all sites applying gold leaching using cyanide, BAT is to do the following:

- reduce the use of CN, by applying:

- operational strategies to minimise cyanide addition
- automatic cyanide control
- if applicable, peroxide pretreatment
- destroy the remaining free CN prior to discharge in the pond
- apply the following safety measures:
 - size the cyanide destruction circuit with a capacity twice the actual requirement
 - install a backup system for lime addition
 - install backup power generators.

Aluminium

In addition to the generic measures for all alumina refineries, BAT is to do the following:

- during operation:
 - avoid discharging effluents into surface waters. This is achieved by re-using process water in the refinery
- in the after-care phase:
 - treat the surface run-off from TMFs prior to discharge, until the chemical conditions have reached acceptable concentrations for discharge into surface waters
 - maintain access roads, drainage systems and the vegetative cover (including revegetation if necessary)
 - continue groundwater quality sampling.

Potash

In addition to the generic measures in Section 5.2 for all potash sites, BAT is to do the following:

- if the natural soil is not impermeable, make the ground under the TMF impermeable
- reduce dust emissions from conveyor belt transport
- seal/line the toe of the heaps outside the impermeable core zone and collect the run-off
- backfill large stopes with dry and/or slurried tailings.

Coal

In addition to the generic measures in Section 5.2 for all coal sites, BAT is to do the following:

- prevent seepage
- dewater fine tailings <0.5 mm from flotation.

Environmental management

A number of environmental management techniques are determined as BAT. The scope (e.g. level of detail) and nature of the EMS (e.g. standardised or non-standardised) will generally be related to the nature, scale and complexity of the installation, and the range of environmental impacts it may have.

BAT is to implement and adhere to an Environmental Management System (EMS) that incorporates, as appropriate to individual circumstances, the following features:

- definition of an environmental policy for the installation by top management (commitment of the top management is regarded as a precondition for a successful application of other features of the EMS)
- planning and establishing the necessary procedures
- implementation of the procedures, paying particular attention to
 - structure and responsibility
 - training, awareness and competence
 - communication

2.6 AGRICULTURE

2.6.1 Installations for the intensive rearing of poultry or pigs

Introduction

Increasing market demands and the development of new farming equipment and cheap feed is leading to increased and intensive livestock farming. The resulting environmental problems mainly arise from the large amounts of manure generated which often exceeds the requirements of the surrounding agricultural land. Excess manure can lead to contamination of local ground water, and surface water nutrient over load, local odour (from ammonia), a build-up of heavy metals, eutrophication and even acidification.

This chapter addresses installations for the intensive rearing of poultry and pigs. These are activities covered in Annex I of Directive 2008/1/EC¹⁸⁷ (6.6) as well as by Directive 91/676/EC¹⁸⁸. The scope of the chapter is on *intensive* installations and, in particular, Directive 2008/1/EC regulates installations for rearing poultry or pigs with more than: 40,000 places for poultry; 2000 places for production pigs (over 30 kg); or 750 places for sows. The BREF on ‘the Intensive rearing of Poultry and Pigs’ focuses on laying hens and broilers in terms of poultry and for pigs, rearing of weaners (young pigs) and of sows (female breeding pigs).

EU Legislation

Water

Directive 91/676/EC seeks to reduce or prevent the pollution of water caused by the application and storage of inorganic fertilizer and manure on farmland. It is intended both to safeguard drinking water supplies and to prevent wider ecological damage in the form of the eutrophication of freshwater and marine waters generally. It lays down minimum provisions on storage of manure and for applying manure to land in designated Nitrate Vulnerable Zones.

Member States have identified waters (surface freshwaters, coastal waters, groundwater and other freshwater bodies). All known areas of land which drain into waters identified in this way and contribute to pollution have been designated as ‘vulnerable zones’. Some Member states have opted not to designate Nitrate Vulnerable Zones, but to apply Action Programmes to their whole territory. Where

¹⁸⁷ Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:024:0008:0029:EN:PDF>

¹⁸⁸ Council Directive of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1991L0676:20031120:EN:PDF>

Action Programmes relating to vulnerable zones have been established, which must be revised every four years, these include the following measures:

- periods when the application of certain fertilizers is prohibited;
- limits on the quantities of fertilizers applied, taking into account certain characteristics of the vulnerable zones;
- a limit on the application of livestock manure per hectare to an amount containing no more than 170 kg N, or 210 kg N during the first four year action programme. These limits may be varied by Member States on the basis of ‘objective criteria’ so long as the aims of the Directive are not prejudiced, and subject to the approval of an advisory committee established by the Directive. Derogations have, to date, been agreed for Belgium, Northern Ireland, Ireland, Germany, Denmark and the Netherlands;
- conditions relating to the available storage capacity on farms for livestock manure;
- a code of good agricultural practice covering measures set out in an Annex II. (In areas other than vulnerable zones, the code of practice is to be implemented by farmers on a voluntary basis, and a training and information programme made available to them).

Member States are responsible for monitoring and reporting to the Commission the state of their waters, including in their Nitrate Vulnerable Zones (NVZ) and their Action Programmes. Thus the Action Programmes of each Member State will reveal the location of these NVZs as well as the specific measures to be enforced within them. Ultimately this will mean increasing storage capacity of manure and greater restrictions for the spreading of manure on land. Directive 91/676/EEC is covered in more detail in Chapter 1.12, including considering of case law interpreting the Directive.

Directive 2000/60/EC concerning the management of water bodies is covered in more detail in Chapter 1.12 on surface water quality. However, it is useful to note here that the River Basin Management Plans which Member States are responsible for making for all their waters will include environmental quality standards for surface waters which may have impacts on livestock units.

Environmental Impact Assessment

According to Directive 85/337/EEC¹⁸⁹, installations for the intensive rearing of poultry and pigs are in Annex 1 (17 a-b) and so subject to an EIA. These include installations with more than:

- 85,000 places for broilers, 60 000 places for hens;
- 3,000 places for production pigs (over 30 kg); or
- 900 places for sows.

Animal Welfare

¹⁸⁹ Council Directive of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1985L0337:20030625:EN:PDF>

In addition to these pieces of EU environmental legislation, there are several items of EU animal welfare legislation which may have an impact on the implementation of the BREF. These include legislation for the protection of chickens kept for meat production, for the protection of pigs and for the protection of laying hens .

Directive 91/630/EEC¹⁹⁰ laying down minimum standards for the protection of pigs and aims in particular to:

- ban the use of individual stalls for pregnant sows and gilts during a period starting from 4 weeks after service to 1 week before the expected time of farrowing and the use of tethers;
- improve the quality of the flooring surfaces;
- increase the living space available for sows and gilts;
- allow the sows and gilts to have permanent access to materials for rooting;
- introduce higher level of training and competence on welfare issues for the stockmen and the personnel in charge of the animals;
- request new scientific advice in relation to certain issues of pig farming.

These requirements apply to all holdings newly built or rebuilt and to all holdings from 1 January 2013.

Directive 91/630/EEC on the welfare of pigs aims to introduce improved standards concerning the following issues:

- light requirements and maximum noise levels;
- permanent access to materials for rooting and playing;
- permanent access to fresh water;
- additional restrictive conditions to carry out mutilations on pigs;
- minimum weaning age of four weeks.

Directive 1999/74/EC,¹⁹¹ sets out provisions for the protection of laying hens. It differentiates between three types of rearing systems for laying hens:

- enriched cages where laying hens have at least 750 cm² of cage area per hen;
- non enriched cage systems where hens have at least 550 cm² of cage area per hen. From 1 January 2003 onwards such cages may not anymore be built or utilised for the first time. By January 2012 at the latest this system must be prohibited;
- non-cage systems with nests (at least one for 7 hens), adequate perches and where the stocking density does not exceed 9 laying hens per m² usable area.

¹⁹⁰ Council Directive of 19 November 1991 laying down minimum standards for the protection of pigs, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1991L0630:20030605:EN:PDF>

¹⁹¹ Council Directive 1999/74/EC of 19 July 1999 laying down minimum standards for the protection of laying hens, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1999L0074:20030605:EN:PDF>

The hens kept in the enriched cage systems and the non-cage systems must also have a nest, perching space of 15cm per hen, litter to allow pecking and scratching and unrestricted access to a feed trough measuring at least 12cm per hen in the cage.

Directive 2007/43/EC¹⁹² lays down minimum rules for the protection of chickens kept for meat production. The Directive aims to reduce the overcrowding of chicken holdings, by setting a maximum stocking density of 33kg/m², or 39kg/m² if stricter welfare standards are met. The new legislation also lays down a number of other conditions to ensure better animal welfare, such as lighting, litter, feeding, and ventilation requirements. The Directive also provides for the Commission to possibly introduce further measures in the future, based on the scientific data and practical evidence collected by the Member States. All Member States must transpose the Directive in national legislation and implement it by June 2010.

Best Available Techniques

The central aim of reducing contamination from manure in these livestock installations is reflected in the on-farm activities which are considered in the BREF¹⁹³. These include: good agricultural practice; feeding strategies to influence quality and composition of the manure, methods of removing the manure from the housing system, the storage and treatment of manure and finally the land-spreading of manure. In terms of air pollution, the focus is on reducing emissions of ammonia in the air. It is assumed that techniques reducing the emissions of ammonia will reduce emissions of the other gaseous substances as well.

In the paragraphs below the applied techniques and the conclusions on BAT are summarised for poultry and pigs.

Good agricultural practice in the intensive rearing of pigs and poultry

For improving the general environmental performance of an intensive livestock farm, BAT is to do all of the following:

- identify and implement education and training programmes for farm staff;
- keep records of water and energy usage, amounts of livestock feed, waste arising and field applications of inorganic fertiliser and manure;
- have an emergency procedure to deal with unplanned emissions and incidents;
- implement a repair and maintenance programme to ensure that structures and equipment are in good working order and that facilities are kept clean;

¹⁹² Council Directive 2007/43/EC of 28 June 2007 laying down minimum rules for the protection of chickens kept for meat production, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:182:0019:0028:EN:PDF>

¹⁹³ Available from: http://ec.europa.eu/environment/ipcc/brefs/ilf_bref_0703.pdf

- plan activities at the site properly, such as the delivery of materials and the removal of products and waste; and
- plan the application of manure to land properly.

Feeding strategies for poultry and pigs

Apart from formulating the feed to closely match the requirements of the birds and the pigs, different types of feeding are also given during production cycles. Table 1 shows the indicative protein content for feed phases which is BAT.

Table 1: Indicative crude protein levels in BAT-feeds for poultry and pigs

Species	Phases	Crude protein content (% in feed) ¹⁾	Total phosphorus content (% in feed) ²⁾	Remark
Broiler	starter	20 – 22	0.65 – 0.75	1) With adequately balanced and optimal digestible amino acid supply and 2) With adequate digestible phosphorus by using e.g. highly digestible inorganic feed phosphates and/or phytase
	grower	19 – 21	0.60 – 0.70	
	finisher	18 – 20	0.57 – 0.67	
Turkey	<4 weeks	24 – 27	1.00 – 1.10	
	5 – 8 weeks	22 – 24	0.95 – 1.05	
	9 – 12 weeks	19 – 21	0.85 – 0.95	
	13+ weeks	16 – 19	0.80 – 0.90	
	16+ weeks	14 – 17	0.75 – 0.85	
Layer	18 – 40 weeks	15.5 – 16.5	0.45 – 0.55	
	40+ weeks	14.5 – 15.5	0.41 – 0.51	
Weaner	<10 kg	19 – 21	0.75 – 0.85	
Piglet	<25 kg	17.5 – 19.5	0.60 – 0.70	
Fattening pig	25 – 50 kg	15 – 17	0.45 – 0.55	
	50 – 110 kg	14 – 15	0.38 – 0.49	
Sow	gestation	13 – 15	0.43 – 0.51	
	lactation	16 – 17	0.57 – 0.65	

An applied technique to reduce the excretion of nutrients (nitrogen and phosphorus) in manure, for pigs and poultry, is ‘nutritional management’. This aims to match feeds more closely to animal requirements at various production stages, thus reducing the amount of nitrogen waste arising from undigested nitrogen eliminated through urine. Feeding measures include phase-feeding, formulating diets based on digestible/available nutrients, using low protein amino acid-supplemented diets and using low phosphorus phytase-supplemented diets or diets with highly digestible inorganic feed phosphates. Furthermore the use of certain feed additives, such as enzymes, may increase the feed efficiency thereby improving the nutrient retention and hence reducing the amount of nutrient left over in the manure.

Housing systems for poultry; laying hens

Most laying hens are still kept in cages. The principle behind the reduction of ammonia emissions from the cages is a frequent removal of the manure. The cage systems commonly applied, and which are BAT are:

- a cage system with manure removal, at least twice a week, by way of manure belts to a closed storage
- vertical tiered cages with a manure belt and with forced air drying, where the manure is removed at least once a week to a covered storage
- vertical tiered cages with a manure belt and with whisk-forced air drying, where the manure is removed at least once a week to a covered storage
- vertical tiered cages with a manure belt and with improved forced air drying, where the manure is removed from the house at least once a week to a covered storage
- vertical tiered cages with a manure belt and with drying tunnel over the cages; the manure is removed to a covered storage after 24 – 36 hours.

Directive 1999/74/EC laying down minimum standards for the protection of laying hens will prohibit the installation of any new conventional cage systems by 2003 and lead to a total ban on the use of such cage systems by 2012. The banning of conventional cage systems will require farmers to use the so-called enriched cage or non-cage systems. Different techniques applying the enriched cage concept are currently under development. Applied non-cage housing systems, which are concluded to be BAT, are:

- a deep litter system (with or without forced drying of the manure)
- a deep litter system with a perforated floor and forced drying of the manure
- an aviary system with or without range and/or outside scratching area.

Housing systems for poultry; broilers

To reduce ammonia emissions from the housing wet litter must be avoided. The decision on BAT was that BAT on housing systems for broilers is:

- the naturally ventilated house with a fully littered floor and equipped with non-leaking drinking systems
- the well-insulated fan ventilated house with a fully littered floor and equipped with non-leaking drinking systems (VEA-system).

Some newly developed systems have a forced drying system that blows air through a layer of litter and droppings. When already in place they are concluded to be BAT. These techniques are:

- a perforated floor system with forced air drying system
- a tiered floor with forced air drying system
- a tiered cage system with removable cage sides and the forced drying of manure.

Housing systems for pigs; gestating sows

Regarding housing systems for mating/gestating sows which reduce ammonia emissions, BAT is to have:

- fully- or partly-slatted floors with a vacuum system underneath for frequent slurry removal, or
- partly-slatted floors and a reduced manure pit.

In addition, there are a number of conditional BATs. For example, new to build housing systems with a fully- or partly-slatted floor and flush gutters or tubes underneath and flushing is applied with non-aerated liquid are conditional BAT. In instances where the peak in odour, due to the flushing, is not expected to give nuisance to neighbours, these techniques are BAT for new to build systems. In instances where this technique is already in place, it is BAT (without condition). A manure scraper is not BAT for new to build housing systems, but it is BAT when the technique is already in place.

Housing systems for pigs; growers/finishers

On housing systems for growers/finishers, BAT is:

- a fully-slatted floor with a vacuum system for frequent removal, or
- a partly-slatted floor with a reduced manure pit, including slanted walls and a vacuum system, or
- a partly-slatted floor with a central, convex solid floor or an inclined solid floor at the front of the pen, a manure gutter with slanted sidewalls and a sloped manure pit.

Again, a number of similar conditional BATs exist as above.

Housing systems for pigs; farrowing sows

BAT is a crate with a fully-slatted iron or plastic floor and with a:

- combination of a water and manure channel, or
- flushing system with manure gutters, or
- manure pan underneath.

A number of conditional BATs exist. For example, for new installations the following techniques are not BAT:

- crates with a partly-slatted floor and a reduced manure pit, and
- crates with a fully-slatted floor and a board on a slope.

However, when these techniques are already in place, it is BAT.

Housing systems for pigs; weaners

BAT are a pen:

- or flatdeck with a fully-slatted- or partly-slatted floor with a vacuum system for frequent slurry removal, or

- or flatdeck with a fully-slatted floor beneath which there is a concrete sloped floor to separate faeces and urine, or
- with a partly-slatted floor (two-climate system), or
- with a partly-slatted iron or plastic floor and a sloped or convex solid floor, or
- with a partly-slatted floor with metal or plastic slats and a shallow manure pit and channel for spoiled drinking water, or
- with a partly-slatted floor with triangular iron slats and a manure channel with sloped side walls.

A number of conditional BAT exist. For example, new to build housing systems with a fully-slatted floor and flush gutters or tubes underneath and where flushing is applied with non-aerated liquid are conditional BAT. In instances where the peak in odour, due to the flushing, is not expected to give nuisance to neighbours these techniques are BAT for new to build systems. In instances where this technique is already in place, it is BAT (without condition).

Weaners are also kept on solid concrete floors with part- or full litter. The following system is an example of what is BAT: a natural ventilated pen with a fully littered floor.

Water for pigs and poultry

In the rearing of pigs and poultry water is used for cleaning activities and for watering the animals. On activities where water is used, it is BAT to reduce water use by doing all of the following:

- cleaning animal housing and equipment with high-pressure cleaners after each production cycle or each batch. For pig housing, typically wash-down water enters the slurry system and therefore it is important to find a balance between cleanliness and using as little water as possible. In poultry housing it is also important to find the balance between cleanliness and using as little water as possible;
- carry out a regular calibration of the drinking-water installation to avoid spill;
- keeping record of water use through metering of consumption; and
- detecting and repairing leakages.

Energy for pigs and poultry

BAT for pigs and poultry is to reduce energy use by application of good farming practice starting with animal housing design and by adequate operation and maintenance of the housing and the equipment.

Some specific BAT measures are mentioned below:

BAT for poultry housing is to reduce energy use by doing all of the following:

- insulating buildings in regions with low ambient temperatures (U-value 0.4 W/m²/°C or better)

- optimising the design of the ventilation system in each house to provide good temperature control and to achieve minimum ventilation rates in winter
- avoiding resistance in ventilation systems through frequent inspection and cleaning of ducts and fans, and
- applying low energy lighting.

BAT for pig housing is to reduce energy use by doing all of the following:

- applying natural ventilation where possible; this needs proper design of the building and of the pens (i.e. microclimate in the pens) and spatial planning with respect to the prevailing wind directions to enhance the airflow; this applies only to new housing
- for mechanically ventilated houses: optimising the design of the ventilation system in each house to provide good temperature control and to achieve minimum ventilation rates in winter
- for mechanically ventilated houses: avoiding resistance in ventilation systems through frequent inspection and cleaning of ducts and fans, and
- applying low energy lighting.

Storage of manure from pigs and poultry – link with Nitrates Directive

BAT is to design storage facilities for pig and poultry manure with sufficient capacity until further treatment or application to land can be carried out. This measure is to protect all waters from pollution. The required capacity depends on the climate and the periods in which application to land is not possible.

For a stack of pig manure that is always situated on the same place, either on the installation or in the field, BAT is to:

- apply a concrete floor, with a collection system and a tank for run-off liquid, and
- locate any new to build manure storage areas where they are least likely to cause annoyance to sensitive receptors for odour, taking into account the distance to receptors and the prevailing wind direction.

If poultry manure needs to be stored, BAT is to store dried poultry manure in a barn with an impermeable floor, and with sufficient ventilation.

For a temporary stack of pig or poultry manure in the field, BAT is to position the manure heap away from sensitive receptors such as, neighbours, and watercourses (including field drains) that liquid run-off might enter.

BAT on the storage of pig slurry in a concrete or steel tank comprises all of the following:

- a stable tank able to withstand likely mechanical, thermal and chemical influences
- the base and walls of the tank are impermeable and protected against corrosion

- the store is emptied regularly for inspection and maintenance, preferably every year
- double valves are used on any valved outlet from the store
- the slurry is stirred only just before emptying the tank for, e.g., application on land.

It is BAT to cover slurry tanks using one of the following options:

- a rigid lid, roof or tent structure, or
- a floating cover, such as chopped straw, natural crust, canvas, foil, peat, light expanded clay aggregate (LECA) or expanded polystyrene (EPS).

It is BAT to cover lagoons where slurry is stored using one of the following options:

- a plastic cover, or
- a floating cover, such as chopped straw, LECA or natural crust.

On-farm treatment of manure from pigs and poultry

In general, on-farm processing of manure is BAT only under certain conditions (i.e. is a conditional BAT). The conditions of on-farm manure processing that determine if a technique is BAT relate to conditions such as the availability of land, local nutrient excess or demand, technical assistance, marketing possibilities for green energy, and local regulations.

Table 2 gives some examples on the conditions for BAT for pig manure processing. The list is not exhaustive and other techniques may also be BAT under certain conditions. It is also possible that the chosen techniques are also BAT under other conditions.

Table 2: Examples of conditional BAT on on-farm pig manure processing

Under the following conditions	an example of what is BAT:
<ul style="list-style-type: none"> • the farm is situated in an area with nutrient surplus but with sufficient land in the vicinity of the farm to spread the liquid fraction (with decreased nutrient content), and • the solid fraction can be spread on remote areas with a nutrient demand or can be applied in other processes 	mechanical separation of pig slurry using a closed system (e.g. centrifuge or press-auger) to minimise the ammonia emissions (Section 4.9.1)
<ul style="list-style-type: none"> • the farm is situated in an area with nutrient surplus but with sufficient land in the vicinity of farm to spread treated liquid fraction, and • the solid fraction can be spread on remote areas with a nutrient demand, and • the farmer gets technical assistance for running the aerobic treatment installation properly 	mechanical separation of pig slurry using a closed system (e.g. centrifuge or press-auger) to minimise the ammonia emissions, followed by aerobic treatment of the liquid fraction (Section 4.9.3.) and where the aerobic treatment is well-controlled so that ammonia and N ₂ O production are minimised
<ul style="list-style-type: none"> • there is a market for green energy, and 	anaerobic treatment of manure in

<ul style="list-style-type: none"> • local regulations allow co-fermentation of (other) organic waste products and land spreading of digested products 	a biogas installation (Section 4.9.6.)
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An example of a conditional BAT on poultry manure processing is applying an external drying tunnel with perforated manure belts, when the housing system for layers does not incorporate a manure drying system or another technique for reducing ammonia emissions.

Land spreading of manure from pigs and poultry

BAT is to minimise emissions from manure to soil and groundwater by balancing the amount of manure with the foreseeable requirements of the crop (nitrogen and phosphorus, and the mineral supply to the crop from the soil and from fertilisation).

BAT is to take into account the characteristics of the land concerned when applying manure; in particular soil conditions, soil type and slope, climatic conditions, rainfall and irrigation, land use and agricultural practices, including crop rotation systems.

BAT is to reduce pollution of water by doing in particular all of the following:

- not applying manure to land when the field is:
 - water-saturated;
 - flooded;
 - frozen;
 - snow covered;
- not applying manure to steeply sloping fields;
- not applying manure adjacent to any watercourse (leaving an untreated strip of land); and
- spreading the manure as close as possible before maximum crop growth and nutrient uptake occur.

BAT is managing the landspreading of manure to reduce odour nuisance where neighbours are likely to be affected, by doing in particular all of the following:

- spreading during the day when people are less likely to be at home and avoiding weekends and public holidays, and
- paying attention to wind direction in relation to neighbouring houses.

Manure can be treated to minimise odour emissions which can then allow more flexibility for identifying suitable sites and weather conditions for land application.

Pig manure

The emissions of ammonia to air caused by the land spreading can be reduced through the selection of the right equipment. Each technique has its limitations and is not applicable in all circumstances and/or on all types of land. BAT conclusions are shown in Table 3.

Table 3: BAT on land spreading equipment for pig manure

Land use	BAT	Emission reduction	Type of manure	Applicability
grassland and land with crop height below 30 cm	trailing hose (land spreading)	30 % this may be less if applied on grass height >10 cm	slurry	slope (<15 % for tankers; <25 % for umbilical systems); not for slurry that is viscous or has a high straw content, size and shape of the field are important
mainly grassland	trailing shoe (land spreading)	40 %	slurry	slope (<20 % for tankers; <30 % for umbilical systems); not viscous slurry, size and shape of the field, grass less than 8 cm high
grassland	shallow injection (open slot)	60 %	slurry	slope <12 %, greater limitations for soil type and conditions, not viscous slurry
mainly grassland, arable land	deep injection (closed slot)	80 %	slurry	slope <12 %, greater limitations for soil type and conditions, not viscous slurry
arable land	Band spreading and incorporation within 4 hours	80 %	slurry	incorporation is only applicable for land that can be easily cultivated, in other situations BAT is bandspreading without incorporation
arable land	incorporation as soon as possible, but at least within 12 hours	within: 4 hrs: 80 % 12 hrs: 60 – 70 %	solid pig manure	only for land that can be easily cultivated

Poultry manure

Poultry manure has a high available nitrogen content and it is therefore important to get an even spread distribution and an accurate application rate. In this respect the rota-spreader type is poor. However, no conclusion about which spreading technique is BAT has been drawn.

BAT on land-spreading – wet or dry – solid poultry manure is incorporation within 12 hours.

Case Law

There has been one case in the ECJ relating to the interpretation of Directive 2008/1/EC with regard to intensive animal units. Case C-437/07 addressed the interpretation of the term ‘poultry’. This is still a preliminary ruling concerning whether the term ‘poultry’, used in subheading 6.6(a) of Annex I to Directive 96/61/EC, includes quails, partridges and pigeons. The French Government asserted, inter alia, that quails, partridges and pigeons cannot be reared intensively and that it excluded them from the poultry category. The preliminary ruling rejected that view, and stated that such poultry could be reared intensively. It was also asked whether subheading 6.6(a) of Annex I to precludes a Member State from establishing a system, known as ‘animal-equivalents’, which consists of establishing prior

authorisation thresholds for installations for intensive rearing of poultry by weighting the number of animals per place according to species so that account may be taken of the amount of nitrogen actually excreted by the various birds. The preliminary ruling concluded that the Directive precludes such an option.

2.6.2 *Water management projects for agriculture (including irrigation and land drainage)*

Introduction

This chapter addresses water management projects for the purposes of agriculture including irrigation schemes and land drainage. This area is not covered by the IPPC Directive and so does not have a BREF. It is however, affected by Directives 2000/60/EC¹⁹⁴, 92/43/EC¹⁹⁵ and 2009/147/EC (formerly 79/409/EEC)¹⁹⁶. In addition, these projects come under Annex II of the Directive 85/337/EEC¹⁹⁷ and so Member States may require an EIA to be completed.

The main environmental impacts which can be caused by water management projects for agriculture are related to either water catchment areas (basins) or habitats and species conservation. Water abstraction and drainage can have obvious downstream implications in terms of lowering the water flows. In addition construction projects of any nature in rural areas can have implications on wildlife and habitats, especially if crossing areas rich in biodiversity, or with endangered or rare habitats and species.

Obligations with respect to Environmental Impact Assessment

Directive 85/337/EEC includes ‘Water management projects for agriculture, including irrigation and land drainage projects’ in its Annex II, and therefore require an EIA where they are considered to require one by the relevant Member State. Member States may specify certain types of projects as being subject to an assessment or may establish the criteria and/or thresholds necessary to determine which of the projects will be subject to EIA.

Obligations with respect to Water Management

The EU legislation most relevant to these types of projects is Directive 2000/60/EC concerning water management and its amending Directive 2008/105/EC on environmental quality standards in the field of water policy. These Directives are covered in more detail in Chapter 1.12. However, it is useful to note here that the River Basin Management Plans which Member States are responsible for making for all their waters are likely to affect these types of water management projects. These

¹⁹⁴ Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2000L0060:20080321:EN:PDF>

¹⁹⁵ Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1992L0043:20070101:EN:PDF>

¹⁹⁶ Directive 2009/147/EC of 30 November 2009 of the European Parliament and of the Council on the conservation of wild birds (codified version), <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:020:0007:0025:EN:PDF>

¹⁹⁷ Council Directive of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1985L0337:20030625:EN:PDF>

plans contain a series of management objectives, many of which are relevant to these types of projects:

- Measures to meet environmental quality standards for groundwater.
- Monitoring, investigation and review of authorisations in all waters not classified as “good”.
- *Controls over abstraction, including a register of abstractors and ensuring that abstraction only amounts to a small proportion of available resources.*
- *Requirement for prior authorisation for all activities that have a potentially adverse impact of water status.*
- Prohibition of direct discharges to groundwaters.

It is therefore necessary to check the River Basin Management Plan for the River Basin District of a proposed project for specific requirements which have been devised to implement these objectives in particular localities.

Obligations with respect to nature conservation

A second Directive which could affect these types of water management projects is Directive 92/43/EEC concerning the protection of habitats. This Directive is dealt with in more detail in Chapter 1.14. However it useful to point out here the most relevant implications of this Directive on these types of water management projects. Under this Directive Member States are obliged to designate a series of sites to protect the species and habitats found there resulting in the establishment of a ‘coherent-European ecological network’ of sites of Community importance known as Natura 2000. For these habitat sites the Directive sets out the following obligations:

- Member States must take ‘appropriate steps’ to avoid the deterioration of the habitats concerned and any disturbance of those species for which the sites have been designated.
- All plans or projects which are likely to have a significant effect on sites are to be subject to an ‘appropriate assessment’ of the implications for the conservation value of the site. The national authorities shall permit the plan or project only if they have established that it will not adversely affect the integrity of the site and, if appropriate, having consulted the general public.
- Where an assessment indicates that a plan or project will damage the conservation interest of a site and there are no alternative solutions, but it must be carried out for ‘imperative reasons of overriding public interest’, including those of a ‘social or economic nature’, the Member State must inform the Commission and take all compensating measures necessary to protect the overall coherence of Natura 2000.

In relation to species conservation the Directive states that Member States are obliged to establish a system of strict protection for lists of animal and plant species of Community interest which are specified in Annex II of the Directive. For animal species deliberate disturbance, destruction and deterioration or destruction of breeding sites or resting places is prohibited. For plants the obligations on Member States are fewer, but deliberate destruction of such plants in their natural range in the wild is prohibited. Thus projects which fall either within these Natura 2000 sites or others sites containing any of the species contained in the list in the Annex II of this

Directive will be subject to the restrictions set out in this Directive and summarised here.

Directive 2009/147/EC (formerly 79/409/EEC) focuses particularly on the conservation of birds. This Directive is also covered in more detail in Chapter 1.14. It prohibits the following activities which may be relevant to the development of water management projects for agriculture:

- deliberate destruction of, or damage to, bird nests and eggs or removal of nests;
- deliberate disturbance of birds, particularly during breeding and rearing;

Annex I of the Directive lists the 181 species which are protected under this Directive.

2.7 OTHER INDUSTRIES

2.7.1 Installations for the production of cement (clinker)

Introduction

The 2001 BREF on best available techniques (BAT) in the cement and lime industries¹⁹⁸ has two parts, one for the cement industry and one for the lime industry. These installations are regulated under the Directive 2008/1/EC¹⁹⁹, further details of which are given in Chapter 1.4. It is important to note that the BREF is currently in the final stages of review, with revisions, inter alia, to the BAT associated emission levels. Even though this has not yet been formally adopted a draft BREF has been released and a summary of its provisions are given at the end of this Chapter.

Cement Industry: BAT

The cement industry is an energy intensive industry. Various fuels can be used to provide the heat required for the process. The clinker burning takes place in a rotary kiln which can be part of a wet or dry long kiln system, a semi-wet or semi-dry grate preheater (Lepol) kiln system, a dry suspension preheater kiln system or a preheater/precalciner kiln system. BAT for the production of cement clinker is considered to be a dry process kiln with multi-stage suspension preheating and precalcination. The associated BAT heat balance value is 3000 MJ/tonne clinker.

The BREF states that clinker burning is the most important part of the process with regard to environmental impacts. The adoption of general primary measures, such as process control optimisation, use of modern, gravimetric solid fuel feed systems, optimised cooler connections and use of power management systems improve clinker quality and lower costs, but they also reduce the energy use and air emissions.

The BREF states that BAT for reducing NO_x emissions are a combination of general primary measures, primary measures to control NO_x emissions, staged combustion and selective non-catalytic reduction (SNCR). The BAT emission level associated with the use of these techniques is 200-500 mg NO_x/m³ (as NO₂). However, there was an opposing view within the Technical Working Group that developed the BREF that the BAT emission level associated with the use of these techniques is 500-800 mg NO_x/m³ (as NO₂). There was also a view that selective catalytic reduction (SCR) is BAT with an associated emission level of 100-200 mg NO_x/m³ (as NO₂). These differences reflect those between old and new plant – the latter being expected to adopt stricter emission controls, such as SCR.

¹⁹⁸The BREF (and documents relating to its revision) is available at: <http://eippcb.jrc.ec.europa.eu/pages/FActivities.htm>

¹⁹⁹ Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:024:0008:0029:EN:PDF>

The BREF states that BAT for reducing SO₂ emissions are a combination of general primary measures and absorbent addition for initial emission levels not higher than about 1200 mg SO₂/m³ and a wet or dry scrubber for initial emission levels higher than about 1200 mg SO₂/m³. The BAT emission level associated with these techniques is 200-400 mg SO₂/m³. SO₂ emissions from cement plants are primarily determined by the content of the volatile sulphur in the raw materials. Kilns that use raw materials with little or no volatile sulphur have SO₂ emission levels well below this level without using abatement techniques.

The BREF states that BAT for reducing dust emissions are a combination of general primary measures and efficient removal of particulate matter from point sources by application of electrostatic precipitators and/or fabric filters. The BAT emission level associated with these techniques is 20-30 mg dust/m³. BAT also include minimisation and prevention of dust emissions from fugitive sources.

The BREF states that BAT for reducing waste are to recycle collected particulate matter to the process wherever practicable. When the collected dusts are not recyclable the utilisation of these dusts in other commercial products, when possible, is considered BAT.

Lime Industry: BAT

The lime making process consists of the burning of calcium and/or magnesium carbonates to liberate carbon dioxide and to obtain the derived oxide ($\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$). The lime industry is a highly energy-intensive industry. Kilns are fired with solid, liquid or gaseous fuels. The use of natural gas has increased substantially over the last few years.

The key environmental issues associated with lime production are air pollution and the use of energy, principally from the lime burning process. The secondary processes of lime slaking and grinding can also be of significance. The key environmental emissions are dust, nitrogen oxides (NO_x), sulphur dioxide (SO₂) and carbon monoxide (CO).

Many lime plants have taken general primary measures such as process control optimisation. These measures are usually taken to improve product quality and lower production costs but they also reduce the energy use and air emissions.

The BREF states that BAT for reducing dust emissions are a combination of general primary measures and efficient removal of particulate matter from point sources by application of fabric filters, electrostatic precipitators and/or wet scrubbers. The BAT emission level associated with the use of these techniques is 50 mg dust/m³. BAT also include minimisation and prevention of dust emissions from fugitive sources.

The BREF states that BAT for reducing waste are the utilisation of dust, out-of-specification quicklime and hydrated lime in selected commercial products.

The BREF states that NO_x emissions depend mainly on the quality of lime produced and the design of kiln. Low-NO_x burners have been fitted to a few rotary kilns. Other NO_x reduction technologies have not been applied in the lime industry. SO₂

emissions, principally from rotary kilns, depend on the sulphur content of the fuel, the design of kiln and the required sulphur content of the lime produced. The selection of fuels with low sulphur content can therefore limit the SO₂ emissions, and so can production of lime with higher sulphur contents. There are absorbent addition techniques available, but they are currently not applied in the lime industry.

Draft revised BREF

The revision process of the BREF concerning cement manufacture is still ongoing. A draft was made available in May 2009. Although it keeps the same basic structure of the existing BREF some modification are introduced. First it widens the scope of the previous BREF in adding a third part for the manufacture of magnesium oxide by using the dry process route based on mined natural magnesite. It also extends its scope to the associated activities which could have an effect on emissions or pollution, “from the preparation of raw materials to the dispatch of the finished products”.

Cement industry

The draft BREF reiterates the importance of the clinker burning regarding the environmental impacts.

The draft BREF proposes the following BAT associated emission level:

- with the use of preheater kilns: 200-450 mg NO_x/m³ (as NO₂),
- with the use of lepol and long rotary kilns: 400-800 mg NO_x /m³ (as NO₂).
- either with absorbent addition or a wet and dry scrubber not higher than about 50-400 mg SO₂/m³
- dust emission of 10-20 mg dust/m³.

The draft BREF states that BAT also include minimisation and prevention of dust emissions from fugitive sources.

Lime industry

The BREF states that BAT for reducing dust emissions are a combination of general primary measures and efficient removal of particulate matter from point sources by application of fabric filters, electrostatic precipitators and/or wet scrubbers. The BAT emission level associated with the use of these techniques is 50 mg dust/m³. BAT also include minimisation and prevention of dust emissions from fugitive sources.

The BREF states that BAT for reducing waste are the utilisation of dust, out-of-specification quicklime and hydrated lime in selected commercial products.

The BREF states that NO_x emissions depend mainly on the quality of lime produced and the design of kiln. Low-NO_x burners have been fitted to a few rotary kilns. Other NO_x reduction technologies have not been applied in the lime industry. SO₂ emissions, principally from rotary kilns, depend on the sulphur content of the fuel, the design of kiln and the required sulphur content of the lime produced. The selection of fuels with low sulphur content can therefore limit the SO₂ emissions, and so can

production of lime with higher sulphur contents. There are absorbent addition techniques available, but they are currently not applied in the lime industry.

Magnesium oxide industry

Magnesium oxide (MgO) is the most important industrial magnesium compound and is used, inter alia, in the steel and refractory industry. Different types of magnesium oxide are produced by using the dry process route, such as dead burned magnesia (DBM), caustic calcined magnesia (CCM), fused magnesia (FM). The magnesium oxide industry is a source of air pollution, particularly during the firing process. The manufacture of MgO is also energy intensive, requiring very high temperature of combustion.

The draft BREF states a general objective of reducing the energy consumption. It also provides BAT associated emission level for the emission of dust, NO_x, SO_x and CO:

- The dust emissions from the kiln firing processes is not beyond 20-35 mg/Nm₃,
- NO_x stated as NO₂ is defined at 500 - 1500 mg/Nm³,
- For the emissions of SO_x, the values depend on the sulphur content in the raw material, the BAT AEL varies between not over 50 to not beyond 400 mg/Nm³ according to the content of sulphur (from 0.10% to beyond 0.25%).
- Reduce the emissions of CO from the flue-gases of kiln firing processes to 50-1000 mg/Nm³.

2.7.2 Installations for surface treatment using organic solvents

Introduction

This chapter addresses installations for the surface treatment of substances objects or products using organic solvents, in particular for dressing, printing, coating, degreasing, waterproofing, sizing, painting, cleaning or impregnating, with a consumption capacity of more than 150 kg per hour or more than 200 tonnes per year. These are activities covered in Annex I of the IPPC Directive (2008/1/EC²⁰⁰) and by the solvent emissions Directive (1999/13/EC²⁰¹). It is important to note that Directive 1999/13/EC covers a wider range of activities than those included within Directive 2008/1/EC.

Directive 2008/1/EC regulates a sub-set of solvent emitting processes. The generic requirements concerning the implementation of IPPC (permitting, monitoring, etc) are addressed in Chapter 1.4. This chapter begins by setting out the obligatory requirements arising from the solvent emissions Directive and then sets out the conclusions relating to the understanding of BAT within the BREF entitled ‘Surface Treatment Using Organic Solvents (STS)’.

Control of solvent emissions

Directive 1999/13/EC aims to reduce emissions of volatile organic compounds (VOCs) from the use of solvents in certain sectors of industry. Directive 1999/13/EC applies immediately to new installations and existing installations were to be brought into compliance by the end of October 2007 (in line with the Directive 2008/1/EC). The principal focus of Directive 1999/13/EC is the reduction of solvent emissions. However, it sets out three different ways in which this can be achieved: uniform emission limit values; reduction schemes, or national plans. However, no Member State has adopted the route of a national plan and, therefore, only emission limit values and reduction schemes will be considered here.

Article 5 of Directive 1999/13/EC obliges Member States to ensure that certain emission controls are achieved through the imposition of conditions in individual authorisations or the use of general building rules. The controls must achieve one of two aims: either all installations must comply with specific limits laid down in Annex IIA to Directive 1999/13/EC (see Table 5); or they must meet the requirements of a reduction scheme specified in accordance with Annex IIB.

²⁰⁰ Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:024:0008:0029:EN:PDF>

²⁰¹ Council Directive 1999/13/EC of 11 March 1999 on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1999L0013:20040430:EN:PDF>

Annex IIA is very precise, setting out different emission limit values for waste gases and fugitive emissions, or alternatively for total emissions, for each of the main activities covered by Directive 1999/13/EC. The limits are set out later in this Chapter. Annex IIB is much less specific. It provides a route for operators to achieve by other means the reductions that would be realised if the Annex IIA limits were applied. Where this option is exercised, emission reduction schemes must be designed for individual installations. Annex IIB sets out the principles for such schemes, as well as practical issues to be addressed including calculation of reference points and target emission levels, and production of emission reduction plans.

For individual installations the limits for fugitive emissions in Annex IIA do not have to be applied where it is demonstrated that they are not technically and economically feasible, as long as there is no significant risk to humans or the environment and as long as BAT are being applied. Some activities which cannot be operated under contained conditions may be exempted from the controls of Annex IIA and also from the reduction scheme approach, again where this is not technically and economically feasible. Also in this case the best available technique must be used to limit emissions.

Article 5 also incorporates additional controls for certain specific types of VOCs. In particular, substances or preparations that carry certain 'risk phrases' under Directive 67/548/EEC, due to their content of VOCs which are carcinogenic, mutagenic or toxic to reproduction, must be replaced by less harmful alternatives. The VOCs in question are subject to a specific emission limit where the discharge exceeds a given level. Another emission limit applies to certain halogenated VOCs. Releases of the VOCs which are subject to these special provisions are to be controlled under 'contained conditions' as far as technically and economically feasible. For emissions of VOCs with specific risk phrases, where the mass flow of the sum of the compounds causing the labelling referred to is greater than, or equal to, 10 g/h, an emission limit value of 2 mg/Nm³ shall be complied with. The emission limit value refers to the mass sum of the individual compounds. For emissions of halogenated VOCs, which are assigned the risk phrase R40, where the mass flow of the sum of the compounds causing the labelling R40 is greater than, or equal to, 100 g/h, an emission limit value of 20 mg/Nm³ shall be complied with. The emission limit value refers to the mass sum of the individual compounds.

Installations must provide monitoring data to competent authorities once a year or upon request. Monitoring must be continuous where abatement equipment is used and the discharge exceeds 10 kg/h. In other cases where end-of-pipe equipment is required to comply with ELVs, monitoring may be periodic. Operators must demonstrate their compliance with the applicable emission limit values or reduction schemes. Where an installation does not comply with Directive 1999/13/EC, the operator must inform the competent authority and remedy the problem in the shortest possible time. If the non-compliance causes an immediate danger to human health, the activity must be suspended. Directive 1999/13/EC also requires Member States to determine sanctions applicable to breaches. These must be 'effective, proportionate and dissuasive'.

The activities addressed by Directive 1999/13/EC are:

1. Adhesive coating: any activity in which an adhesive is applied to a surface, with the exception of adhesive coating and laminating associated with printing activities.
2. Coating activity: any activity in which a single or multiple application of a continuous film of a coating is applied to:
 - (a) either of the following:
 - (i) new cars, defined as vehicles of category M1 in Directive 70/156²⁰² on the approximation of the laws of the Member States relating to the type-approval of motor vehicles and their trailers and of category N1 in so far as they are coated at the same installation as M1 vehicles;
 - (ii) truck cabins, defined as the housing for the driver, and all integrated housing for the technical equipment, of vehicles of categories N2 and N3 in Directive 70/156;
 - (iii) vans and trucks, defined as vehicles of categories N1, N2 and N3 in Directive 70/156, but not including truck cabins;
 - (iv) buses, defined as vehicles of categories M2 and M3 in Directive 70/156;
 - (v) trailers, defined in categories O1, O2, O3 and O4 in Directive 70/156;
 - (b) metallic and plastic surfaces including surfaces of airplanes, ships, trains, etc;
 - (c) wooden surfaces;
 - (d) textile, fabric, film and paper surfaces;
 - (e) leather.
3. Coating activities do not include the coating of substrate with metals by electrophoretic and chemical spraying techniques. If the coating activity includes a step in which the same article is printed by whatever technique used, that printing step is considered part of the coating activity. However, printing activities operated as a separate activity are not included, but may be covered by the Directive if the printing activity falls within the scope thereof.
4. Coil coating: any activity where coiled steel, stainless steel, coated steel, copper alloys or aluminium strip is coated with either a film forming or laminate coating in a continuous process.
5. Dry cleaning: any industrial or commercial activity using VOCs to clean garments, furnishing and similar consumer goods with the exception of the manual removal of stains and spots in the textile and clothing industry.
6. Footwear manufacture: any activity of producing complete footwear or parts thereof.
7. Manufacturing of coating preparations, varnishes, inks and adhesives. The manufacture of the final products, and of intermediates where carried out at the same site, by mixing of pigments, resins and adhesive materials with organic solvent or other carrier, including dispersion and predispersion activities, viscosity and tint adjustments and operations for filling the final product into its container.

²⁰² Council Directive of 6 February 1970 on the approximation of the laws of the Member States relating to the type-approval of motor vehicles and their trailers, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1970L0156:20070712:EN:PDF>

8. Manufacturing of pharmaceutical products. The chemical synthesis, fermentation, extraction, formulation and finishing of pharmaceutical products and, where carried out at the same site, the manufacture of intermediate products.
9. Printing: any reproduction activity of text and/or images in which, with the use of an image carrier, ink is transferred onto whatever type of surface. It includes associated varnishing, coating and laminating techniques. However, only the following sub-processes are subject to the Directive:
 - (a) flexography - a printing activity using an image carrier of rubber or elastic photopolymers on which the printing areas are above the non-printing areas, using liquid inks which dry through evaporation;
 - (b) heatset web offset - a web-fed printing activity using an image carrier in which the printing and non-printing area are in the same plane, where web-fed means that the material to be printed is fed to the machine from a reel as distinct from separate sheets. The non-printing area is treated to attract water and thus reject ink. The printing area is treated to receive and transmit ink to the surface to be printed. Evaporation takes place in an oven where hot air is used to heat the printed material;
 - (c) laminating associated to a printing activity - the adhering together of two or more flexible materials to produce laminates;
 - (d) publication rotogravure - a rotogravure printing activity used for printing paper for magazines, brochures, catalogues or similar products, using toluene-based inks;
 - (e) rotogravure - a printing activity using a cylindrical image carrier in which the printing area is below the non-printing area, using liquid inks which dry through evaporation. The recesses are filled with ink and the surplus is cleaned off the non-printing area before the surface to be printed contacts the cylinder and lifts the ink from the recesses;
 - (f) rotary screen printing - a web-fed printing activity in which the ink is passed onto the surface to be printed by forcing it through a porous image carrier, in which the printing area is open and the non-printing area is sealed off, using liquid inks which dry only through evaporation. Web-fed means that the material to be printed is fed to the machine from a reel as distinct from separate sheets;
 - (g) varnishing - an activity by which a varnish or an adhesive coating for the purpose of later sealing the packaging material is applied to a flexible material.
10. Rubber conversion: any activity of mixing, milling, blending, calendering, extrusion and vulcanisation of natural or synthetic rubber and any ancillary operations for converting natural or synthetic rubber into a finished product.
11. Surface cleaning: any activity except dry cleaning using organic solvents to remove contamination from the surface of material including degreasing. A cleaning activity consisting of more than one step before or after any other activity shall be considered as one surface cleaning activity. This activity does not refer to the cleaning of the equipment but to the cleaning of the surface of products.
12. Vegetable oil and animal fat extraction and vegetable oil refining activities: any activity to extract vegetable oil from seeds and other vegetable matter, the processing of dry residues to produce animal feed, the purification of fats and vegetable oils derived from seeds, vegetable matter and/or animal matter.
13. Vehicle refinishing: any industrial or commercial coating activity and associated degreasing activities performing:

- a) the original coating of road vehicles as defined in Directive 70/156 or part of them with refinishing-type materials, where this is carried out away from the original manufacturing line;
 - b) the coating of trailers (including semi-trailers) (category O).
14. Winding wire coating: any coating activity of metallic conductors used for winding the coils in transformers and motors, etc.
15. Wood impregnation: any activity giving a loading of preservative in timber.
16. Wood and plastic lamination: any activity to adhere together wood and/or plastic to produce laminated products.

Obligations with respect to Integrated Pollution Prevention and Control

The BREF²⁰³ developed to assist in implementation of Directive 2008/1/EC specifically considers the following activities (all of which are also covered by Directive 1999/13/EC):

- three printing processes using solvents on a large scale (heatset web offset, flexible packaging and publication gravure);
- coating and/or painting of winding wires, cars and commercial vehicles, buses, trains, agricultural equipment, ships and yachts, aircraft, steel and aluminium coil, metal packaging, furniture and wood, as well as other metal and plastic surfaces;
- adhesive application in the manufacture of abrasives and adhesive tapes;
- impregnation of wood with preservatives; and
- cleaning and degreasing associated with these activities. No separate degreasing industry was identified.

The BREF does not generally propose emission limit values but suggests consumption and emission values that are usually associated with the use of a combination of BAT and other actions to reduce environmental impacts. The following sections outline generic conclusions on BAT across all activities and then conclusions concerning individual types of activities. It follows the structure of (and often quotes) the BREF executive summary.

Generic BAT

Installation design, construction and operation

The BREF states that “BAT is to minimise consumptions and emissions by:

- implementing and adhering to environmental and other management systems. These include planning the reduction of the environmental footprint of the

²⁰³BREF on Surface Treatment Using Solvents (August 2007) available from: <http://eippcb.jrc.es/pages/FActivities.htm>

- installation, benchmarking consumptions and emissions, considering eventual decommissioning in designing new plants or upgrades, etc;
- using simple risk management to design, construct and operate an installation. This aids site decommissioning by reducing unplanned emissions, recording the history of usage of priority and hazardous chemicals and dealing promptly with potential contamination; and
 - using operational techniques including automation, training, and written procedures for operation and maintenance”.

Monitoring

BAT is to monitor solvent emissions so as to minimise them by:

- using a solvent management plan, to calculate fugitive or total emissions;
- ensuring monitoring equipment is maintained and calibrated regularly.

Reducing water consumption and/or conserving raw materials in water-based treatment processes

The BREF states that “BAT is to use:

- techniques, eg cascade (multiple) rinsing, ion exchange or membrane separation;
- control measures to minimise the use of cooling waters; and
- closed cooling systems and/or heat exchangers”.

Minimising energy usage

BAT is, inter alia, to: “minimise the air volumes to be moved, minimise reactive energy losses, control high energy demands on equipment start up, use energy efficient equipment, etc”.

Raw material management

The BREF states that “BAT is to:

- minimise the environmental impact of emissions when selecting suitable raw materials;
- minimise raw material usage by using one or a combination of techniques described”.

Systems for surface treatment, application and drying/curing

BAT is to adopt a system to minimise VOC emissions and energy consumption, and maximise raw material efficiency.

Cleaning

The BREF states that “BAT is to use techniques to:

- conserve raw materials and reduce emissions by minimising colour changes and cleaning;
- reduce solvent emissions by collecting and re-using purge solvent when cleaning spray guns;
- minimise emissions by selecting one or more techniques according to the process and equipment, persistence of the contamination and whether cleaning the equipment or the substrate”.

Using less hazardous substances (substitution)

BAT is to:

- use non-solvent or low solvent techniques for cleaning and production;
- replace those with the risk phrases R45, R46, R49, R60 and R61 in accordance with Article 5 of Directive 1999/13/EC;
- replace those with the risk phrases R58 and R50/53 where there is a risk of emission to the environment and alternatives exist;
- replace those with the risk phrases R59. In particular, all halogenated or partially halogenated solvents with the risk phrase R59 used in cleaning should be replaced or controlled;
- use VOCs or mixtures with a lower ozone formation potential (OFP) where other measures cannot achieve the associated emission values or are not technically applicable, and when substituting. Where the OFP is not increased, substitution can be made using solvents with a flashpoint of >55 °C.

Emissions to air and waste gas treatment

BAT is to (in the design, operation and maintenance of the installation):

- minimise emissions at source, recover solvent from emissions or destroy solvents in waste gases. Emission values are given for individual industries in the BREF;
- seek opportunities to minimise the energy used and recover and use excess heat generated in VOC destruction;
- reduce solvent emissions and energy consumption.

Particulates discharged to air from paint spraying

BAT associated emission values are:

- 5 mg/m³ or less for existing installations
- 3 mg/m³ or less for new installations.

The industry for the coating of wood and furniture recorded a split view in the BREF: the associated emission value is 10 mg/m³ or less for both new and existing installations.

Waste water

BAT is:

- to minimise emissions to water by using water minimisation techniques, carry out waste water pretreatment and treatment;
- to monitor raw materials and effluent to minimise the discharge of materials with aquatic toxicity, and reduce their effects where there is a risk of contact with water;
- where solvents may be in contact with water, to prevent hazardous levels in the atmosphere of receiving sewers by maintaining a safe discharge level;
- BAT associated emission values for discharge to surface waters are COD 100 - 500 mg/l and suspended solids 5 - 30 mg/l;
- for wet scrubber systems, reduce water consumption and effluent discharges and treatment by optimising paint transfer minimising paint sludge build up.

Materials recovery and waste management

“BAT is to reduce material usage, material losses, and recover, re-use and recycle materials”.

Odour nuisance

BAT is to control emissions, e.g. by using less odorous materials and/or processes, and/or waste gas treatment including high stacks.

Noise

"Where noise may have an impact, BAT is to use good practice techniques such as closure of bay doors, minimising deliveries and/or using engineered controls, such as silencers on large fans".

Specific industry BAT

Printing with heatset web offset

“BAT is to use a combination of techniques for printing, cleaning, waste gas management, as well as generic BAT to reduce the sum of fugitive emissions and the VOCs remaining after waste gas treatment. Associated emission values for the combined isopropyl alcohol (IPA) and cleaning solvent are:

- for new or upgraded presses, 2.5 to 10 % VOC expressed as wt-% of the ink consumption;
- for existing presses, 5 to 15 % VOC expressed as wt-% of the ink consumption.

Note that the top half of the ranges are associated with IPA emissions for ‘difficult’ jobs. Concentration techniques cannot be used because of odour problems”.

Printing flexible packaging by flexography and packaging gravure

“BAT is to:

- use a combination of techniques described to reduce the sum of fugitive and non-fugitive VOC emissions. Associated emission values for the three scenarios occurring in the industry are (using the reference emission defined in Annex IIb to Directive 1999/13/EC):

(Scenario 1) Installations where all production machines are solvent-based and connected to abatement equipment:

- with incineration: total emissions 7.5 - 12.5 % of the reference emission;
- with solvent recovery: total emissions 10.0 - 15.0 % of the reference emission.

(Scenario 2) Existing installations, where there is waste gas abatement equipment but not all solvent-based production machines are connected:

- (2.1) for the machines that are connected to the abatement equipment:
 - with incineration: total emissions 7.5 - 12.5 % of reference emission relating to those machines;
 - with solvent recovery: total emissions 10.0 - 15.0 % of the reference emission relating to those machines.
- (2.2) for the machines not connected to waste gas treatment, BAT is one of:
 - use low solvent or solvent free products on these machines;
 - connect to the waste gas abatement equipment when there is capacity;
 - preferentially run high solvent content work on machines connected to waste gas abatement.

(Scenario 3) Where installations have no waste gas abatement equipment and are using substitution, it is BAT to follow the developments of low solvent and solvent free inks, varnishes and adhesives, and continuously decrease the amount of solvents consumed. In Scenarios 1 and 2.1, where an installation has a solid:solvent ratio of higher than 1:5.5 for the total of the solvent-based inks, varnishes and adhesives, the emission values may not be obtainable. In this case, it is BAT to cover the ink fountains or apply chamber doctor blades and to apply a suitable combination of other techniques, as described. BAT is also to:

- minimise energy consumption when optimising waste gas treatment in all sites;
- seek opportunities to recover and use any surplus energy in all sites”.

Printing with publication gravure

“BAT is to:

- reduce the sum of fugitive emissions and the VOCs remaining after gas treatment, expressed as total solvent input:
 - for new plants to 4 to 5 %, using techniques applicable to new plants;

- for existing plants to 5 to 7 %, using techniques applicable to existing plants;
- prevent the excessive use of energy by using the optimum number of regenerations required to maintain emissions within the emission values expressed;
- reduce the emissions of toluene to a municipal sewer to below 10 mg/l by air stripping”.

Manufacturing of winding wire

“BAT is to:

- minimise energy consumption after drying the wire by cooling using room and/or exterior air;
- reduce the total VOC emissions by a combination of techniques as well as the generic BAT. Total emission values associated with these techniques are:
 - 5 g/kg or less for non-fine wires (>0.1 mm diameter);
 - 10 g/kg or less for fine wires (0.01 – 0.1 mm diameter).
- reduce VOC emissions further by seeking and implementing low or no solvent techniques in place of solvent-based lubricants”.

Manufacturing of abrasives

“BAT is to reduce total VOC emissions by one or more of the following in conjunction with the generic BAT:

- using no or low solvent-based bonding materials, such as when water cooling is not required during the process, e.g. for the manufacture of dry grinding abrasives;
- increasing the internal solvent concentration in the driers;
- using a suitable combination of the waste gas treatment techniques.

Total emission values for VOCs associated with these techniques are 9 – 14 wt-% of the solvent input”.

Manufacturing of adhesive tapes

“BAT is to:

- for the production of tapes using solvent-based adhesives, reduce VOC emissions by using a combination of techniques in conjunction with generic BAT, including:
 - using non-solvent based adhesives when applicable. Water-based and hot melt adhesives only use small amounts of solvents (e.g. in cleaning). However, they can only be used in certain applications;
 - using one of the following waste gas treatments or combinations: a+b, a+c, b, or c, where:
 - a) condensation after a pre-drying step using an inert gas drier;
 - b) adsorption with a recovery efficiency of more than 90 % of the solvent input and direct emissions after this abatement technique of less than 1 %;
 - c) oxidisers with energy recovery.

Emission values associated with these techniques are 5 wt-% or less of the total solvent input”.

Vehicle coating

For the coating of cars, trucks and buses, BAT includes:

- “minimise raw material consumption and waste by maximising material transfer efficiencies;
- minimise waste production by either dewatering paint sludge, recycling paint sludge or using the water emulsion technique”.

Coating of cars

“BAT is to:

- minimise energy consumption in the selection and operation of painting, drying/curing and associated waste gas abatement systems;
- minimise solvent emissions, and energy and raw material consumption, by selecting a paint and drier system. A whole coating system needs to be considered, as individual steps may be incompatible. The associated emission values are 10 - 35 g/m² (e-coat area) (or 0.3 kg/body + 8 g/m² to 1.0 kg/body + 26 g/m² equivalent)”;
- where spray booth waste gas treatment is applied, concentrate the VOC by using a pretreatment technique;
- optimise transfer efficiencies” using one or more techniques described in the BREF;

Coating of trucks and commercial vehicles

“BAT is to:

- minimise solvent emissions, as well as energy and raw material consumptions, using a combination of paint and drier systems in conjunction with waste gas treatment systems. In particular, use solvent-free polyurethane materials applied with airless spraying for noise dampening and floor covering, as well as pre-coated materials. Overall associated emission values are 10 – 55 g/m² for new truck cabins and 15 – 50 g/ m² for new vans and trucks (e-coat area). Use a combination of techniques to reduce solvent emissions from cleaning. The associated emission values are less than 20 g/ m² (e-coat area).”

Coating of buses

“BAT is to:

- minimise solvent emissions, and energy and raw material consumption, using a combination of paint and drier systems in conjunction with waste gas treatment systems. In particular, use solvent-free polyurethane materials applied with airless spraying for noise dampening and floor covering, as well

as pre-coated materials. Overall associated emission values are 92 – 150 g/ m² (e-coat area)

- use a combination of techniques to reduce solvent emissions from cleaning. The associated emission values are less than 20 g/ m² (e-coat area).

Coating of trains

“BAT is to:

- reduce VOC emissions by using a combination of generic BAT techniques. Associated emission values are 70 - 110 g VOC/m² of the painted area (not e-coat area);
- use a combination of techniques to reduce particulate emissions to air. The associated emission values are 3 mg/m³ or less”.

Coating of agricultural and construction equipment

“BAT is to:

- reduce solvent consumptions and emissions, maximise efficiency of the coating application and minimise energy usage by a combination of paint, drier and waste gas treatment techniques. The associated emission values are either:
 - emissions of 20 – 50 mg C/m³ in waste gas and 10 – 20 % for fugitive emissions, or
 - overall emissions of 0.2 to 0.33 kg VOC/kg solids input.
- reduce material consumptions, solvent emissions and the amount of airflow to be treated by using dipping techniques for the coating of components prior to assembly;
- use other paint systems to replace paints based on halogenated solvents”.

Coating of ships and yachts

“BAT is to:

- minimise emissions to the environment by including the BAT in this section in the dry docks discipline for the installation;
- reduce solvent emissions by a combination of generic BAT and some or all of:
 - using water-based, high-solids or 2-component paints where not limited by customer and/or technical requirements;
 - reducing overspray and increasing application efficiency by a combination of techniques;
 - for new construction, spray sections prior to assembly in enclosed areas with waste gas extraction and treatment.
- reduce particulate emissions by one or a combination of techniques.
- reduce waste water contamination by removing paint residues, leftovers and containers, used abrasives, mud, oil residues and any other scrap materials from the dock before flooding, storing them in containers for proper management, e.g. re-use and/or disposal”.

Coating of aircraft

“BAT is to:

- minimise emissions of Cr(VI) to water by using alternative passivation systems;
- reduce solvent emissions to air by:
 - using high-solids paints;
 - capturing and treating waste gases during paint application on components.
- reduce emissions from cleaning by one or more of:
 - automation of cleaning equipment;
 - measuring solvent used for cleaning;
 - using pre-impregnated wipes.
- reduce particulate emissions to air using specified techniques. The associated emission values are 1 mg/m³ or less”.

Coating of other metal surfaces

“BAT is to:

- reduce solvent consumptions and emissions, maximise efficiency of the coating application and minimise energy usage by one or a combination of paint, drier and waste gas treatment techniques. The associated emission values are 0.1 to 0.33 kg VOC/kg solids input. However, this does not apply to installations where the emissions are included in the mass emission calculations for the serial coatings of vehicles;
- reduce material consumptions by using high efficiency application techniques;
- use other paint systems to replace paints based on halogenated solvents”.

Coil coating

“BAT is to:

- reduce energy consumption using a selection of techniques. Associated consumption values are (coil coating: energy consumption for aluminium and steel substrates) outlined in Table 1 below:

Table 1

Energy consumption per 1000 m² of substrate	Minimum	Maximum
Electricity used as kWh/1000 m ² for aluminium	270	375
Electricity used as kWh/1000 m ² for steel	250	440
Fossil fuels used as MJ/1000 m ² for aluminium	4000	9800
Fossil fuels used as MJ/1000 m ² for steel	3000	10200

- reduce solvent emissions using a combination of techniques described. Associated emission values are:
 - for new plants: 0.73 – 0.84 g/m² for waste gases, and 3 – 5 % for fugitive emissions;

- for existing plants: 0.73 – 0.84 g/m² for waste gases, and 3 – 10 % fugitive emissions. Existing plants will only achieve the lower values of the range when they are significantly upgraded.
- recycle the aluminium and steel from residual substrates”.

Coating and printing of metal packaging

“BAT is to:

- reduce energy consumption by using various techniques and/or energy recovery from thermal waste gas treatment. Associated consumption values, e.g. for DWI cans are:
 - natural gas 5 - 6.7 kWh/m²
 - electricity 3.6 - 5.5 kWh/m²
 - recovered energy (where energy can be recovered, but not possible where emissions levels are met by substitution) 0.3 - 0.4 kWh/m²
- reduce solvent emissions using a selection of techniques. Associated emission values are outlined in Table 2 below:

Table 2

	VOC emission level at application (g/m ²) (2)	
	Solvent-based	Water-based
Food contact		
● DWI drink cans	6.7 – 10.5	3.2 – 4.5
● sheet for ends, cans and components	4 – 93	1 – 30
● drums	90 – 100	
Non-food contact		
● sheet for ends, cans and components	4 – 93	1 – 30
● drums	60 – 70	11 – 20
Print paint		
● sheet for ends, cans and components (1)	2.5 – 13	1 – 6
Notes:		
¹ UV ink and paint applications are limited to non-food and special applications but can achieve lower values than reported in this table		
² Values also include fugitive emissions		

- minimise emissions to water using a selection of techniques. The associated emission values are outlined in Table 3 below:

Table 3

Compound	Concentration (mg/l)
COD	<350
AOX	0.5 – 1
HC	20 or less
Sn	4 or less

Coating of plastic work pieces

“BAT is to:

- reduce solvent consumptions and emissions, maximise efficiency of coating application and minimise energy usage by one or a combination of paint, drier and waste gas treatment techniques. The associated emission values are 0.25 to 0.35 kg VOC/kg solids input. However, this does not apply to installations where the emissions are included in the mass emission calculations for the serial coatings of vehicles;
- reduce material consumption by using high efficiency application techniques;
- give priority to water-based techniques for new and upgraded systems;
- degrease simple polypropylene areas by hand with solvent impregnated wipes”.

Coating of furniture and wood

“BAT is to:

- reduce solvent consumptions and emissions, maximise efficiency of coating application and minimise energy usage by a combination of paint, drier and waste gas treatment techniques. The associated emission values are either 0.25 kg VOC or less per kg solids input, or as in Table 4 below:

Table 4

Paint system organic solvent content	Solvent content (wt-%)	Emission reduction measures	VOC emission (g/m²)
High	65	High efficiency application techniques and good housekeeping	40 - 60
Medium	20		10 - 20
Low	5		2 - 5

- reduce particulate emissions to air. This industry recorded a split view: the associated emission value is 10 mg/m³ or less for both new and existing installations as this is economically and technically feasible in the industry”.

Wood preservation

“BAT is to:

- reduce solvent emissions by using vacuum impregnation with water-based or high concentration pesticide systems, with waste gas treatment for solvent systems;
- use the final vacuum stage of the process cycle to remove excess solvent or carrier;
- use a solvent with lower ozone-forming potential for solvent systems;
- drain surplus pesticide in contained areas with both water- and solvent-based systems.

It is not BAT to spray as this has a low overall application efficiency”.

Coating of mirrors

“BAT is to:

- reduce solvent consumptions and emissions (mainly xylene) by a combination of the techniques described and generic BAT. The associated emission values are 1 to 3 g/ m² for waste gas emissions (2 to 3% of the solvent input) and 5 to 10 g/m² for fugitive emissions (8 to 15 % of the solvent input)
- reduce the use of hazardous materials by using low lead paints.

This industry also uses water-based surface treatments described (with BAT) in the surface treatment of metals BREF”.

Table 5 Emission limit values from Annex IIA of Directive 1999/13/EC

Activity (solvent consumption threshold in tonnes/year)	Threshold (solvent consumption threshold in tonnes/year)	Emission limit values in waste gases (mg C/Nm ³)	Fugitive emission values (percentage of solvent input)		Total emission limit values		Special Provisions
			New	Existing	New	Existing	
Heatset web offset printing (> 15)	15-25	100	30 ⁽¹⁾				(1) Solvent residue on finished product is not to be considered as part of fugitive emissions.
	>25	20	30 ⁽¹⁾				
Publication rotogravure (>25)		75	10	15			
Other rotogravure, flexography, rotary screen printing, laminating or varnishing units (>15) rotary screen printing on textile/cardboard (>30)	15-25	100	25				(1) Threshold for rotary screen printing on textile and on cardboard.
	>25	100	20				
	>30 ⁽¹⁾	100	20				
Surface cleaning ⁽¹⁾ (>1)	1-5	20 ⁽²⁾	15				(1) Using compounds specified in Article 5(6) and (8). (2) Limit refers to mass of compounds in mg/Nm ³ , and not to total carbon.
	>5	20 ⁽²⁾	10				
Other surface cleaning (>2)	2-10	75 ⁽¹⁾	20 ⁽¹⁾				(1) Installations which demonstrate to the competent authority that the average organic solvent content of all cleaning material used does not

			Fugitive emission values (percentage of solvent input)		Total emission limit values	Special Provisions
	>10	75 ⁽¹⁾	15 ⁽¹⁾			exceed 30% by weight are exempt from application of these values.
Vehicle coating (<15) and vehicle refinishing	>0.5	50 ⁽¹⁾	25			(1) Compliance in accordance with Article 9(3) should be demonstrated based on 15 minute average measurements.
Coil coating (>25)		50 ⁽¹⁾	5	10		(1) For installations which use techniques which allow reuse of recovered solvents, the emission limit shall be 150.
Other coating, including metal, plastic, textile ⁽⁵⁾ , fabric, film and paper coating (>5)	5- 15	100 ^{(1) (4)}	<u>C2</u> 25 ⁽⁴⁾			(1) Emission limit value applies to coating application and drying processes operated under contained conditions. (2) The first emission limit value applies to drying processes, the second to coating application processes. (3) For textile coating installations which use techniques which allow reuse of recovered solvents, the emission limit applied to coating application and drying processes taken together shall be 150. (4) Coating activities which cannot be applied under contained

			Fugitive emission values (percentage of solvent input)	Total emission limit values	Special Provisions
	>15	50/75 ⁽²⁾⁽³⁾⁽⁴⁾	20 ⁽⁴⁾		conditions (such as shipbuilding, aircraft painting) may be exempted from these values, in accordance with Article 5(3)(b) (5) Rotary screen printing on textile is covered by activity No 3
Winding wire coating (>5)				10 g/kg ⁽¹⁾ 5g/kg ⁽²⁾	(1) Applies for installations where average diameter of wire ≤ 0.1 mm (2) Applies for all other installations
Coating of wooden surfaces (>15)	15-25 >25	100 ⁽¹⁾ 50/75 ⁽²⁾	25 20		(1) Emission limit applies to coating application and drying processes operated under contained conditions. (2) The first value applies to drying processes, the second to coating application processes.
Dry cleaning				20 g/kg ⁽¹⁾⁽²⁾⁽³⁾	(1) Expressed in mass of solvent emitted per kilogram of product cleaned and dried. (2) The emission limit in Article 5(8) does not apply for this sector (3)The following exemption refers only to Greece: the total emission limit value does not apply, for a period of 12 years after the date on

			Fugitive emission values (percentage of solvent input)	Total emission limit values	Special Provisions
					which this Directive is brought into effect, to existing installations located in remote areas and/or islands, with a population of no more than 2000 permanent inhabitants where the use of advanced technology equipment is not economically feasible.
Wood impregnation (>25)		100 ⁽¹⁾	45	11kg/m ³	(1) Does not apply for impregnation with creosote.
Coating of leather (>10)	10-25 >25 >10 ⁽¹⁾			85 g/m ² 75 g/m ² 150 g/m ²	Emission limits are expressed in grams of solvent emitted per m2 of product produced. (1) For leather coating activities in furnishing and particular leather goods used as small consumer goods like bags, belts, wallets, etc.
Footwear manufacture (>5)				25g per pair	Total emission limit values are expressed in grams of solvent emitted per pair of complete footwear produced
Wood and Plastic lamination (>5)				30 g/m ²	
Adhesive coating (>5)	5-15	50 ⁽¹⁾	25		(1) If techniques are used which allow reuse of recovered solvent,

			Fugitive emission values (percentage of solvent input)	Total emission limit values	Special Provisions
	>15	50 ⁽¹⁾	20		the emission limit value in waste gases shall be 150.
Manufacture of coating preparations, varnishes, inks and adhesives (>100)	100 – 1000	150	5	5% of solvent input	The fugitive emission value does not include solvent sold as part of a coatings preparation in a sealed container
	>1000	150	3	3% of solvent input	
Rubber conversion (>15)		20 ⁽¹⁾	25 ⁽²⁾	25 % of solvent input	(1) If techniques are used which allow reuse of recovered solvent, the emission limit value in waste gases shall be 150. (2) The fugitive emission value does not include solvent sold as part of products or preparations in a sealed container
Vegetable oil and animal fat extraction and vegetable oil refining activities (>10)				Animal fat: 1,5 kg/tonne Castor: 3 kg/tonne Rape Seed: 1 kg/tonne Sunflower seed: 1 kg/tonne	(1) Total emission limit values for installations processing individual batches of seeds and other vegetable matter should be set by the competent authority on a case by case basis, applying the best available techniques. (2) Applies to all fractionation processes excluding de-gumming (the removal of gums from the oil) (3) Applies to de-gumming.

			Fugitive emission values (percentage of solvent input)		Total emission limit values		Special Provisions
					Soya beans (normal crush): 0.8 kg/tonne Soya beans (white flakes): 1.2 kg/tonne Other seeds and other vegetable matter: 3 kg/tonne ⁽¹⁾ 1.5 kg/tonne ⁽²⁾ 4 kg/tonne ⁽³⁾		
Manufacturing of pharmaceutical products (>50)		20 ⁽¹⁾	5 ⁽²⁾	15 ⁽²⁾	5 % of solvent input	15% of solvent input	(1) If techniques are used which allow reuse of recovered solvent, the emission limit value in waste gases shall be 150. (2) The fugitive emission limit value does not include solvent sold as part of products or preparations in a sealed container.

2.7.3 Industrial plants for the production of pulp and paper

Industrial plants for the production of pulp and paper are subject to the EIA requirements of Directive 85/337/EEC²⁰⁴ and to Directive 2008/1/EC²⁰⁵ on IPPC.

Obligations with respect to Environmental Impact Assessment

An EIA is always required for industrial plants producing pulp from timber or similar fibrous materials. An EIA is also always required for the production paper and board with a production capacity exceeding 200 tonnes per day.

An EIA might be required for all other industrial plants producing paper and board below 200 tonnes per day (Annex II projects). For these Annex II projects Member States are required to determine through a case-by-case assessment and/or thresholds or criteria, set by the Member State in question, whether the project is subject to an EIA or not. Further details about this screening procedure as well as a description of the EIA process can be found in Chapter 1.1.

Obligations with respect to Integrated Pollution Prevention and Control

The IPPC Directive covers industrial plants producing pulp from timber or similar fibrous materials as well as the production of paper and board with a production capacity exceeding 200 tonnes per day. The generic requirements concerning the implementation of IPPC (permitting, monitoring, etc) are addressed in Chapter 1.4.

Common BAT

Some general remarks on the selection of BAT²⁰⁶ apply across the pulp and paper sector. For describing best available techniques for pulp and paper industry the following aspects have to be considered:

- There is no single reference of best available techniques in pulp and paper industry. In contrast, the list of techniques to consider in the determination of BAT provides a lot of different options of an overall BAT for given mills, which may be combined in different ways.

²⁰⁴ Council Directive of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1985L0337:20030625:EN:PDF>

²⁰⁵ Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:024:0008:0029:EN:PDF>

²⁰⁶ Available at: http://ec.europa.eu/environment/ippc/brefs/ppm_bref_1201.pdf

- The BAT-concept is process-related because the environmental impact is caused on this level i.e. by different manufacturing processes as for instance cooking, bleaching, de-inking, coating etc. The single processes, the raw materials used and the product properties to be achieved determine the emission of a mill. That means when approaching the pulp and paper industry different types of raw materials used and processes involved have to be distinguished.
- As pulp and paper products are highly diverse, where utilised processes even for one and the same product may vary greatly, many factors of production technology must be taken into account to guarantee a high level of environmental protection. For the pulp and paper industry the best available techniques cannot be defined solely by describing unit processes. Instead, the whole installations must be examined and dealt with as entities. BAT in pulp and paper industry is linked to the environmental performance of mills.
- There are different options for suitable combinations of processes depending - besides other things - on the product properties to be achieved. As a consequence, the process-oriented approach has to be extended by a product-oriented concept i.e. the BAT approach must be linked to the environmental performance of specific types of mills where specific products are manufactured. Thus, in the BREF best available techniques are presented for major mill classes separately.

Instead of single distinctive values the environmental performance of paper mills is expressed as a range of values. This reflects that the manufacturing of different paper grades requires different quantities and qualities of raw materials (e.g. kraft pulp, different groundwoods, mixture of furnishes etc.), with the consequence that emissions per end product are of different levels. To a certain extent, higher emissions caused by the use of more polluting raw materials or processes respectively can be compensated by higher efforts for pollution prevention and control. Presenting ranges considers also that emissions vary with time to a certain extent, e.g. between years, even if the same techniques have been used. There may be a large number of mills that have concentrated first on emissions to water and water consumption and then on air achieving very good performance in the former. They might be less performing in solid waste reduction. But following the objective of IPPC, mills should try to run and control the whole system in an integrated manner to reduce emissions and the impact on the environment as a whole. Following the integrated approach it is evident that BAT levels can be achieved in different ways, i.e. there are several options to achieve similar emission levels. The final choice of a suitable combination of pollution prevention and control measures is generally somewhat different in existing mills and new mills. Furthermore, for existing mills the installation of BAT is in general more expensive. This is due to limitations in changing already fixed lay out solutions, retrofitting costs when the plant is in full operation (downtime costs) and the fact that some techniques may be used a shorter time period than within new mills (shorter depreciation time). But beyond that and except of possible limitations in space for existing mills, the best available techniques given below are, if not stated otherwise, applicable to existing and new mills.

Specific BAT

The specific BATs vary depending on the process used and the summaries of the main processes are discussed below.

Kraft (Sulphate) Pulping Process

The sulphate or kraft process accounting for ca. 80% of world pulp production is the most applied production method of chemical pulping processes. It has a superior pulp strength properties compared with sulphite process, its can be applied to all wood species, as well as an efficient chemical recovery systems.

The techniques or combination of techniques that are considered as BAT for integrated and non-integrated kraft pulp mills are given in Section 2.4 of the BREF. The list of BAT is not considered exhaustive and any other technique or combination of techniques achieving the same (or better) performance can also be considered; such techniques may be under development or an emerging technique or already available but not described in the BREF. For integrated kraft pulp and paper mills Section 6.4 includes further details on BAT for papermaking. If not stated otherwise, the data refer to yearly average values.

The BREF covers BAT for general measures, measures for reducing emissions to water, external biological waste water treatment, measures for reducing emissions to air, measures regarding solid waste and energy saving measures.

Sulphite Pulping Process

The production of sulphite pulps is much smaller than the production of kraft pulps. Sulphite pulps are more used in special purposes in papermaking rather than being an alternative market pulp grade for kraft pulps.

The techniques or combination of techniques that are considered as BAT for integrated and non-integrated sulphite pulp mills are given in Section 3.4 of the BREF. The list of BAT is not considered exhaustive and any other technique or combination of techniques achieving the same (or better) performance can also be considered; such techniques may be under development or an emerging technique or already available but not described in the BREF. For integrated kraft pulp and paper mills Section 6.4 includes further details on BAT for papermaking. If not stated otherwise, the data refer to yearly average values.

The BREF in this section covers BAT for general measures, measures for reducing emissions to water, measures for reducing emissions to air, energy saving measures and chemical usage.

Mechanical Pulping and Chemi-Mechanical Pulping

In mechanical pulping the wood fibres are separated from each other by mechanical energy applied to the wood matrix causing the bonds between the fibres to break gradually and fibre bundles, single fibres and fibre fragments to be released. It is the

mixture of fibres and fibre fragments that gives mechanical pulp its favourable printing properties.

For mechanical and chemi-mechanical pulp and paper mills the techniques or combination of techniques that are considered as BAT for integrated and non-integrated sulphite pulp mills are given in Section 4.4 of the BREF. The list of BAT is not considered exhaustive and any other technique or combination of techniques achieving the same (or better) performance can also be considered; such techniques may be under development or an emerging technique or already available but not described in the BREF. For integrated kraft pulp and paper mills Section 6.4 includes further details on BAT for papermaking. If not stated otherwise, the data refer to yearly average values.

The BREF in this section covers BAT for general measures, measures for reducing emissions to water, other grades of mechanical pulp and paper mills, measures for reducing emissions to air and energy saving measures.

Recovered Paper Processing Mills

Recovered fibre has become an important raw material for the paper manufacturing industry, accounting about one-third of the total raw materials because of the favourable price of recovered fibres in comparison with the corresponding grades of market pulp and because of the promotion of wastepaper recycling by many European countries.

For recovered paper processing mills the techniques or combination of techniques that are considered as BAT for integrated and non-integrated sulphite pulp mills are given in Section 5.4 of the BREF. The list of BAT is not considered exhaustive and any other technique or combination of techniques achieving the same (or better) performance can also be considered; such techniques may be under development or an emerging technique or already available but not described in the BREF. For integrated kraft pulp and paper mills Section 6.4 includes further details on BAT for papermaking. If not stated otherwise, the data refer to yearly average values.

The BREF in this section covers BAT for general measures, measures for reducing emissions to water, measures for reducing emissions to air, measures for reducing solid waste, noise reduction, chemical usage and energy saving measures

2.7.4 Food and beverage processing

Introduction

This chapter addresses the food and drink processing industry. This sector is spread all over Europe in both industrialised regions as well as rural areas. Thus it is subject to very diverse local economic, social and environmental conditions as well as varying national legislation. As well as environmental considerations, there are other legal requirements and prohibitions which have to be considered in this sector including food safety standards and laws. These may have an influence on environmental considerations e.g. frequent cleaning is required and this uses heated water and detergents. The most significant environmental issues associated with food and drink processing installations are water consumption and contamination, energy consumption; and waste minimisation.

These activities are covered in Annex I of Directive 2008/1/EC²⁰⁷ concerning IPPC (6.4 b and c) as well as by Directive 91/271/EC²⁰⁸ concerning urban waste water. The scope of this chapter includes the whole range of activities producing food for human consumption and animal feed that may be found in *large scale* European installations. The BREF on the ‘food, drink and milk industries’²⁰⁹ regulates installations with capacities exceeding the following threshold values:

- Treatment and processing intended for the production of food products from:
 - animal raw materials (other than milk) with a finished product production capacity greater than 75 tonnes per day;
 - vegetable raw materials with a finished product production capacity greater than 300 tonnes per day (average value on a quarterly basis);
- Treatment and processing of milk, the quantity of milk received being greater than 200 tonnes per day (average value on an annual basis).

Thus this chapter does not cover small scale activities such as catering or upstream activities such as agriculture or non food products from animals such as soap and cosmetics.

²⁰⁷ Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:024:0008:0029:EN:PDF>

²⁰⁸ Council Directive of 21 May 1991 concerning urban waste water treatment, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1991L0271:20031120:EN:PDF>

²⁰⁹ Available from: http://ec.europa.eu/environment/ippc/brefs/fdm_bref_0806.pdf

Obligations with respect to Environmental Impact Assessment

Activities relevant to the food and beverage industry are included in Annex II of Directive 85/337/EEC²¹⁰ and therefore require an EIA where this is specified in the national legislation of the Member State concerned. The activities in question are:

- Manufacture of vegetable and animal oils and fats;
- Packing and canning of animal and vegetable products;
- Manufacture of dairy products;
- Brewing and malting;
- Confectionery and syrup manufacture;
- Installations for the slaughter of animals;
- Industrial starch manufacturing installations;
- Fish-meal and fish-oil factories;
- Sugar factories.

Member States may specify certain types of projects as being subject to an assessment or may establish the criteria and/or thresholds necessary to determine which of the projects will be subject to EIA.

Waste water

Directive 91/271/EEC concerning urban waste water treatment specifies that industrial waste water, discharges into collecting systems and treatment plants is to be subject to prior regulation and/or specific authorisation, and subject to forms of pre-treatment specified in an Annex in order to:

- protect the health of staff working in collecting systems and treatment plants,
- ensure that collecting systems, waste water treatment plants and associated equipment are not damaged,
- ensure that the operation of the waste water treatment plant and the treatment of sludge are not impeded,
- ensure that discharges from the treatment plants do not adversely affect the environment, or prevent receiving water from complying with other EU Directives,
- ensure that sludge can be disposed of safely in an environmentally acceptable manner.

Obligations with respect to Integrated Pollution Prevention and Control

In the paragraphs below the principal BAT conclusions are summarised for the food and drink processing sector. The first section summarises the generic BAT for all food and drink installations and the second section touches on the additional BAT for some individual sectors. Many of the BAT are operational and therefore require very little investment in new equipment. Very few of the BAT provide only one

²¹⁰ Council Directive of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1985L0337:20030625:EN:PDF>

environmental benefit, so they are not listed according to environmental issues. The BAT take various approaches to protect the environment as a whole. These include techniques for general environmental management and operation; minimisation of air emissions; waste water treatment; equipment and installation cleaning; and collaboration with upstream and downstream activities.

Generic BAT for all Installations

Environmental management and operation

The general management BAT contribute to the overall minimisation of consumption and emission levels, by providing systems of work which encourage good practice and raise awareness. The BAT focus on issues such as using an environmental management system; providing training; using a planned maintenance programme; applying and maintaining a methodology for preventing and minimising the consumption of water and energy and the production of waste and implementing a system for monitoring and reviewing consumption and emission levels for both individual production processes and at site level.

Other BAT address some key environmental issues more directly, through operation, e.g. by transporting solid raw materials, products, co-products, by-products and waste dry. This reduces water consumption and consequently also reduces waste water production and pollution. It also increases the potential for the recovery and recycling of substances generated in the process which, in many cases, can be sold for use as animal feed, so it reduces waste production.

Another example applicable to the whole food and beverage sector is the segregation of outputs, to optimise use, re-use, recovery, recycling and disposal and minimise waste water contamination. Numerous examples exist in the sector where raw materials, partially processed foods and final products either originally intended for human consumption or from which the part intended for human consumption has been removed, may be used as animal feed. This has both environmental and economic benefits.

General application of technology

Some more technologically based BAT include the application and use of process controls, e.g. by using analytical measurement and control techniques to reduce waste of material and water and to reduce waste water generation in processing and cleaning. An example of this is measuring turbidity to monitor process water quality and to optimise both the recovery of material/product from water and the re-use of cleaning water.

Collaboration with upstream and downstream partners

The operations of those involved in the supply of raw materials and other ingredients to food and beverage processing installations, including the farmers and the hauliers, can have environmental consequences in those installations. Likewise, the installation can affect the environmental impact of those downstream installations they supply, including other FDM installations. BAT are to seek collaboration with upstream and

downstream partners, to create a chain of environmental responsibility, to minimise pollution and to protect the environment as a whole, e.g. by providing fresh materials at the time they are required, which minimises the energy required to store them as well as waste and odour associated with their decomposition.

Equipment and installation cleaning

In common with other BAT, the BAT for cleaning minimise the contact between water and food and beverage materials, by, e.g. optimising the use of dry cleaning. The environmental benefits include reduced water consumption and volume of waste water; reduced entrainment of materials in waste water and, therefore, reduced levels of, e.g. Chemical Oxygen Demand and Biochemical Oxygen Demand. Use of the various dry cleaning techniques increases the potential for the recovery and recycling of substances generated in the process. It also reduces the use of energy needed to heat water for cleaning and the use of detergents. Other BAT associated with cleaning include cleaning-in-place of closed equipment, minimising the use of EDTA and avoiding the use of halogenated oxidising biocides.

Additional BAT for some processes and unit operations applied in a number of FDM sectors

BAT are set out for some of the individual unit operations of the individual food and beverage sectors. BAT are listed for materials reception/despatch; centrifugation/separation; smoking; cooking; frying; preservation in cans, bottles and jars; evaporation; freezing and refrigeration; packing; energy generation and use; water use; compressed air systems and steam systems. The application of many of these BAT achieves reduced energy consumption, e.g. by using multi-effect evaporators, optimising vapour recompression related to heat and power availability in the installation, to concentrate liquids. Many reduce energy consumption by optimising operating conditions. Some reduce emissions to air. For example in smoking, BAT is to achieve a TOC air emission level of <50 mg/Nm³.

Minimisation of air emissions and waste water treatment

Process-integrated BAT which minimise emissions to air and water by the selection and use of substances and techniques should be applied. The selection of air emission abatement and waste water treatment techniques can then be made, if further control is required. For example, BAT is to optimise the use of dry cleaning and this reduces the volume of waste water and the mass flow of solid food materials in it, so also reducing the requirement for waste water treatment.

BAT is to apply an air emissions control strategy and where process-integrated BAT which minimise air emissions by the selection and use of substances and the application of techniques do not achieve emission levels of 5 - 20 mg/Nm³ for dry dust, 35-60 mg/Nm³ for wet/sticky dust and <50 mg/Nm³ TOC, to achieve these levels by applying abatement techniques.

The emission levels given in the following table are indicative of the emission levels that would be achieved with those techniques generally considered to represent BAT. They do not necessarily represent levels currently achieved within the industry.

Table 1: Typical waste water quality after treatment

Parameter	Concentration (mg/l)
BOD ₅	<25
COD	<125
TSS	<50
pH	6 – 9
Oil and grease	<10
Total nitrogen	<10
Total phosphorus	0.4 – 5
Note: Better levels of BOD ₅ and COD can be obtained. It is not always possible or cost effective to achieve the total nitrogen and phosphorus levels shown, in view of local conditions.	

Accidental releases

Several BAT are listed related to identifying potential accidents, risk assessments, implementing controls, developing and testing emergency plans and learning from past accidents and near misses.

Additional BAT for some individual FDM sectors

Additional BAT have been determined for the some individual food and beverage sectors. The general BAT (above) apply to these sectors and to the other sectors for which no additional BAT have been determined.

The additional BAT for the meat and poultry sector apply to specific unit operations applied in some parts of that sector. They reduce the consumption of water, energy and packaging.

The main environmental benefits of the additional BAT for the fish and shellfish sector are reduced waste and less water consumption and several apply to the thawing, scaling, skinning, eviscerating and filleting of fish. For example, BAT have been determined for thawing mackerel to achieve a water consumption of <2 m³/t of raw fish; for thawing whitefish to achieving a water consumption of 1.8 – 2.2 m³/t of raw fish and to thaw shrimps and prawns by one or other of the two techniques using filtered peeling water.

For the fruit and vegetables sector, the BAT address storage, dry separation of rejected raw material, collection of soil, peeling, blanching and optimising water re-use. Application of the BAT lead to maximised production yield; material not used in the main product being used for other purposes, often as animal feed and consequently reduced waste generation. The environmental benefits of applying the BAT for storage, peeling and blanching include, e.g. reducing energy consumption.

The environmental benefits of applying the additional BAT for the vegetable oils and fats sector are mainly the reduction of energy consumption and the recovery of hexane used during extraction. One BAT associated emission level was determined, i.e. BAT is to use cyclones, to reduce wet dust emissions arising from vegetable oil extraction, to achieve a wet dust emission level of <50 mg/Nm³.

There are additional BAT for dairies and specific BAT for producing market milk, powdered milk, butter, cheese and ice-cream. The BAT apply to specific parts of the processes and to cleaning. They address water consumption, energy consumption and waste prevention. There are both operational and technological BAT. Consumption and emission levels indicative of the levels that can be achieved by applying in-process BAT have been determined. These ranges are shown in the following table. The ranges reflect a variety of operating conditions. Energy consumption levels may vary due to, e.g. production volumes. Warm climates may use more energy for cooling and vice versa. Water consumption and waste water emission levels may vary due to, e.g. different product portfolios, batch sizes and cleaning. The waste water emission level may be lower compared to the water consumption level because many dairies measure the intake of cooling water, but then discharge it unmeasured. In warm climates, water may be lost due to evaporation.

Table 2: Consumption and emission levels associated with some dairy processes

	Energy consumption	Water consumption	Waste water
Production of market milk from 1 litre of received milk	0.07 – 0.2 kWh/l	0.6 – 1.8 l/l	0.8 – 1.7 l/l
Production of milk powder from 1 litre of received milk	0.3 – 0.4 kWh/l	0.8 – 1.7 l/l	0.8 – 1.5 l/l
Production of 1 kg of ice-cream	0.6 – 2.8 kWh/kg	4.0 – 5.0 l/kg	2.7 – 4.0 l/kg

The application of the additional BAT for starch manufacturing mainly address reducing water consumption and waste water production, especially by re-using water.

Re-use of water is also addressed by the BAT for the sugar sector. Minimising energy consumption is also achieved by avoiding drying sugar beet pulp if an outlet is available for pressed sugar beet pulp, e.g. animal feed; otherwise to dry sugar beet pulp using steam driers or using high temperature driers combined with measures to reduce emissions to air.

The main environmental issues addressed by the application of the additional BAT for the coffee sector are related to energy consumption and emissions to air, including odour. When roasting coffee, where process-integrated BAT which minimise air emissions by the selection and use of substances and the application of techniques do not achieve emission levels of 5 - 20 mg/Nm³ for dry dust; <50 mg/Nm³ TOC for light roasted coffee (this level is more difficult to achieve as the darkness of roasting is increased); BAT is to achieve these levels by applying abatement techniques.

The additional general BAT for drinks manufacturing address avoiding production of CO₂ directly from fossil fuels, recovery of yeast, collection of spent filter material and the selection and optimised use of bottle cleaning machines. Application of the additional BAT for brewing reduce both water and energy consumption. For brewing, BAT is to achieve a water consumption level of 0.35 – 1 m³/hl of beer produced. The application of the additional BAT for winemaking re-uses the alkaline solution used for cleaning after cold stabilisation and addresses the method of its ultimate disposal to prevent disruption of the waste water treatment plant.

2.8 INFRASTRUCTURE PROJECTS

2.8.1 Construction of long-distance railway lines

Introduction

The construction of (long-distance) railway lines is subject to the EIA requirements of Directive 85/337/EEC.²¹¹ There is no other EU environmental legislation that applies specifically to these projects, though the noise management plans to be drawn up by Member States pursuant to Directive 2002/49/EC (see Chapter 1.9) may in the future have an impact on the location of any new railway lines. In addition the provisions of Directives 2009/147/EC and 92/43/EEC (see Chapter 1.14) need to be taken into account.

Obligations with respect to Environmental Impact Assessment

The construction of lines for long-distance railway traffic is listed under Annex I of the EIA Directive and consequently an EIA must always be undertaken as part of the consent procedure for the planned development.

The construction of other railway lines falls under Annex II of the EIA Directive and as such is not always subject to an EIA. When planning to construct railway lines other than long-distance railway lines, the Member State must decide on a case by case examination, and/or by reference to thresholds or criteria whether a project should be subject to an EIA or not.

Further details about this screening procedure as well as a description of the EIA process can be found in Chapter 1.1.

Obligations with respect to nature conservation

The construction of railway lines may lead to habitat fragmentation and therefore any such infrastructure projects need to be planned with due regard to the relevant provisions of Directives 2009/147/EC and 92/43/EEC, as detailed in Chapter 1.14.

²¹¹ Council Directive of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1985L0337:20030625:EN:PDF>

2.8.2 Airports (with a basic runway length of 2,100 m or more)

Introduction

The construction of airports is subject to the provisions of Directive 85/337/EC²¹² on EIA. In addition, there are certain operating restrictions on airports in the EU with regard to noise which will need to be taken into account in the case of airport infrastructure extension projects. The relevant aspects of EU noise legislation will be examined in this chapter.

Obligations with respect to Environmental Impact Assessment

The construction of airports with a basic runway of 2,100 meters or more is listed under Annex I of the EIA Directive and consequently an EIA must always be undertaken as part of the consent procedure for the planned development. A planned modification to an existing airport falls under Annex II of the EIA Directive and as such is not always subject to an EIA. In fact, the Member State must decide on a case by case examination, and/or by reference to thresholds or criteria whether a project should be subject to an EIA or not.

However one ruling of the ECJ is directly relevant for modifications to airports. In this judgment, the Court decided that national courts should determine whether airports that make a series of small infrastructure changes that do not formally constitute a project and thus fall under Annex II of the EIA Directive, should nevertheless be required to undertake an EIA.²¹³

Further details about this screening procedure as well as a description of the EIA process can be found in Chapter 1.1.

Obligations with respect to Noise Management

Directive 2002/30/EC²¹⁴ on the establishment of rules and procedures with regard to the introduction of noise-related operating restrictions at Community airports has certain implications for projects involving the extension of existing airport infrastructure within the EU. While the EIA Directive includes an assessment of the noise implications of a planned project, this assessment is considered to only meet in

²¹² Council Directive of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1985L0337:20030625:EN:PDF>

²¹³ Judgment of 28 February 2008, Case C-2/07, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:62007J0002:EN:HTML>

²¹⁴ Directive 2002/30/EC of the European Parliament and of the Council of 26 March 2002 on the establishment of rules and procedures with regard to the introduction of noise-related operating restrictions at Community airports, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2002L0030:20081211:EN:PDF>

part the requirements of Directive 2002/30/EC in the case of airport infrastructure extension projects. According to this Directive, a 'balanced approach' to managing noise from aircraft includes appropriate land-use planning and management measures. The Directive applies to civil airports within the EU with more than 50,000 movements (take-off or landing) of subsonic jet aeroplanes per calendar year.

A planned airport extension project subject to an EIA is considered to meet the requirements of Directive 2002/30/EC if the assessment takes into account, as far as possible, provisions outlined in Annex II of Directive 2002/30/EC. This includes information on the current operations of the airport and existing noise contours, the forecasted impacts of other airport developments that have already been approved and an assessment of proposed developments which should include the following:

- A description of the proposed measures, the cost of introducing these measures; the number of people expected to benefit and timeframe and a ranking of the overall effectiveness of the measure.
- An assessment of the cost/effectiveness or cost/benefit analysis of the new measures which takes into account the socio-economic effects on users of the airport and local communities.
- An overview of the possible environmental and competitive effects on other airports, operators and interested parties.
- The reasons for selection of the preferred option.
- A non-technical summary on the above mentioned measures.

Other EU noise legislation includes *inter alia* restrictions on the operation of certain types of aircraft in Community airports and the development of strategic noise maps and action plans by national authorities. This legislation does not have implications for the development / construction phase of an airport, and is rather concerned with the operation and day-to-day management of airports.

2.8.3 Construction of motorways and (express) roads

Introduction

The construction of motorways and (express) roads is subject to the EIA requirements of Directive 85/337/EEC²¹⁵. There is no other EU environmental legislation that applies specifically to these projects, though the noise management plans to be drawn up by Member States pursuant to Directive 2002/49/EC (see Chapter 1.9) may in the future have an impact on the location of any new motorways and (express) roads. In addition the provisions of Directives 2009/147/EC and 92/43/EEC (see Chapter 1.14) need to be taken into account.

Obligations with respect to Environmental Impact Assessment

The construction of motorways and express roads is listed under Annex I of the EIA Directive and consequently an EIA must always be undertaken as part of the consent procedure for the planned development. This holds too for the construction of a new road of four or more lanes, or realignment and/or widening of an existing road of two lanes or less so as to provide four or more lanes, where such new road, or realigned and/or widened section of road, would be 10 km or more in a continuous length.

The construction of other roads falls under Annex II of the EIA Directive and as such is not always subject to an EIA. When planning to construct roads other than motorways, express roads and roads with four or more lanes, the Member State must decide on a case by case examination, and/or by reference to thresholds or criteria whether a project should be subject to an EIA or not.

Case law

Member States have thus been allowed a measure of discretion in specifying which types of projects will be subject to an assessment. However, the European Court of Justice made clear in Case C-427/07 that there are limits to this discretion which are to be found in the obligation set out in Article 2(1) of the EIA Directive. This article states that projects likely, by virtue *inter alia* of their nature, size or location, to have significant effects on the environment are to be subject to an impact assessment. Therefore the Court holds that a Member State would exceed the limits of its discretion if an entire class of projects would be exempted in advance from the requirement of an impact assessment as a result of establishing too weak criteria or too low thresholds. On basis of that the Court judged that Ireland had failed to comply with the EIA Directive by failing to adopt all measures to ensure that, before consent is given, projects likely to have significant effects on the environment in the road construction category covered by Annex II to the EIA Directive. Ireland in particular failed to adopt such measures with respect to private road projects which are to be considered infrastructure projects covered by point 10(e) of Annex II.

²¹⁵ Council Directive of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1985L0337:20030625:EN:PDF>

In Case C-142/07 the Court judged that the EIA Directive provides for environmental impact assessment of refurbishment and improvement projects for urban roads, either where they are projects covered by Annex I or Annex II, which are likely, by virtue of their nature, size or location, to have significant effects on the environment.

Further details about this screening procedure as well as a description of the EIA process can be found in Chapter 1.1.

Obligations with respect to nature conservation

The construction of roads may lead to habitat fragmentation and therefore any such infrastructure projects need to be planned with due regard to the relevant provisions of Directives 2009/147/EC and 92/43/EEC, as detailed in Chapter 1.14.

2.8.4 Dams and other installations designed for the permanent storage of water

Introduction

Dams and other installations designed for the permanent storage of water are subject to the EIA provisions of Directive 85/337/EEC.²¹⁶

In addition, EU legislation that relates to nature protection may also apply to these installations, in particular Directive 2009/147/EC²¹⁷ on the conservation of wild birds (commonly referred to as the Birds Directive) and Directive 92/43/EEC²¹⁸ on the conservation of natural habitats and of wild fauna and flora (commonly referred to as the Habitats Directive). Furthermore, there are a number of provisions under Directive 2000/60/EC²¹⁹ (usually referred to as the Water Framework Directive) that apply to dams.

In addition to the EU legislation that needs to be taken into account, the World Commission on Dams (WCD) has developed recommendations to be considered when planning to develop a dam. Although under the EU legislation compliance with the WCD criteria and guidelines is not binding, clean development mechanism (CDM) hydroelectric power production projects are required to comply with them in order to be eligible under Directive 2003/87/EC establishing the EU Emission Trading Scheme (EU ETS) as amended by Directive 2004/101/EC, Directive 2008/101/EC and Directive 2009/29/EC. In this regard, the provisions of the Directive regulating the admission of CDM credits into the EU ETS state that ‘in the case of hydroelectric power production project activities with a generating capacity exceeding 20MW, Member States shall, when approving such project activities, ensure that relevant international criteria and guidelines, including those contained in the World Commission on Dams November 2000 Report ‘Dams and Development: A New Framework for Decision-Making’, will be respected during the development of such project activities.’ In addition, the European Investment Bank (EIB) and the European Bank for Reconstruction and Development (EBRD) have announced that they will take into account the international standards for dam-building set by the WCD.

²¹⁶ Council Directive of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1985L0337:20030625:EN:PDF>

²¹⁷ Directive 2009/147/EC of 30 November 2009 of the European Parliament and of the Council on the conservation of wild birds (codified version), <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:020:0007:0025:EN:PDF>

²¹⁸ Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1992L0043:20070101:EN:PDF>

²¹⁹ Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2000L0060:20080321:EN:PDF>

Obligations with respect to Environmental Impact Assessment

Dams and other installations designed for the holding back or permanent storage of water, where a new or additional amount of water held back or stored exceeds 10 million cubic metres are listed under Annex I of Directive 85/337/EEC and consequently an EIA is mandatory and must always be undertaken as part of the consent procedure for the planned development.

In addition, dams and other installations designed to hold water or store it on a long-term basis (i.e. projects not included in Annex I of the Directive) are listed under Annex II of Directive 85/337/EEC. Member States have some discretion regarding Annex II projects and consequently an EIA may or may not be undertaken as part of the consent procedure for the planned development.

Projects listed in Annex II must be subject to screening in order to evaluate whether they are likely to have significant environmental effects, and hence require an EIA. The screening is made through:

- a case-by-case examination of projects; or
- thresholds and criteria set by any of the Member States; or
- a combination of both

Further details about this screening procedure as well as a description of the EIA process can be found in Chapter 1.1.

Obligations with respect to nature conservation

Directive 2009/147/EC provides a system of protection for all species of wild birds found in Europe, while Directive 92/43/EEC aims to maintain and improve biodiversity in the EU through the conservation of natural habitats and the protection of wild fauna and flora.

When proposing a new dam or other installation designed for the permanent storage of water, the developer must determine if the installation is located within, or is likely to have a 'significant' effect on the integrity of a designated, proposed, or candidate Natura 2000 site (Special Areas of Conservation (SACs) and/or Special Protection Areas (SPAs), as designated under Directive 92/43/EEC and Directive 2009/147/EC respectively). If a significant effect is likely, the 'competent authorities' are required to carry out an 'appropriate assessment' under Directive 92/43/EEC. The assessment aims at determining if these effects will be (a) significant; and (b) adverse (this includes indirect effects from outside the site). Further details can be found in Chapter 1.14.

Obligations with respect to water management

Directive 2000/60/EC (commonly referred to as Water Framework Directive) was introduced with the aim of coordinating water environment policy and regulation across Europe. The Directive applies to surface waters, that is lakes, rivers, transitional waters (estuaries) and coastal waters (up to one nautical mile from land), and to ground waters.

The environmental objectives are set out in Article 4 of Directive 2000/60/EC and require Member States to:

- prevent deterioration of ecological quality and pollution of surface waters and restore polluted waters, in order to achieve good water status in all surface waters by 31 December 2015;
- prevent deterioration of groundwater quality, restore polluted groundwater, and ensure a balance between abstraction and recharge of groundwater, in order to achieve good groundwater status in all ground waters by 31 December 2010; and
- comply with all standards and objectives relating to Protected Areas by 31 December 2010, unless otherwise specified in the Community, national or local legislation under which the individual Protected Areas have been established.

The key criterion for judging performance is the achievement of ‘good ecological status’.

A dam and other similar installations designed for the permanent storage of water produce changes in the hydromorphological conditions and physico-chemical conditions on the body of water. Therefore, the construction of these installations can compromise the achievement of good ecological status, good groundwater status and the prevention of further deterioration.

For a new project such as a dam that modifies the physical characteristics in such a way that will either downgrade the ecological status or cause it to drop below good, it is possible to apply the objective derogations listed under Article 4(7).

The list of derogations from meeting some of the environmental objectives includes situations where:

- heavily modified water bodies are designated;
- technical feasibility to achieve objectives requires an extension to the deadline;
- cost implications to achieve objectives requires an extension to the deadline; and
- natural conditions require additional time to meet the objectives.

Member States are also allowed to fail to meet the requirements of the Directive when this is due to new modifications of the physical characteristics of a surface water body or alterations to the levels of groundwater or where water status declines from high to good due to ‘new sustainable human development activities’. In such cases the following conditions must be met:

- to take all practical mitigating steps;
- the reasons for the changes are of overriding public interest and/or the benefits to the environment and society are outweighed by the benefits to the new modifications to human health, safety or to ‘sustainable development’; and

- the benefits cannot be achieved by other means due to technical or cost issues.

For projects falling under the scope of Directive 85/337/EEC, the information provided by such an assessment should be used in helping to determine if the above mentioned conditions of derogations are met. Furthermore, a joint procedure which combines the provisions of Directive 85/337/EEC and those of the Directive 2000/60/EC may be applied by Member States.

For projects which do not fall under the scope of Directive 85/337/EEC, a specific water assessment procedure implemented by each Member State should determine if the referred conditions of derogation are met.

The provisions which allow derogation from Directive 2000/60/EC objectives cannot though be used as an exemption from fulfilling the legal requirements of other Directives. For instance, a new development that would cause deterioration of status of a water body and that fails to achieve the objectives for a Natura 2000 site would have to fulfil both Directive 2000/60/EC and Directive 92/43/EEC, i.e.:

- the relevant conditions set out in Article 4(7) of Directive 2000/60/EC for allowing deterioration of status would have to be met to the extent that it is a water body; and
- the conditions set out in Article 6 of Directive 92/43/EEC for allowing a failure to achieve a Natura 2000 site's objective.

New dams and other installations designed for the permanent storage of water are thus compatible with Directive 2000/60/EC as long as the derogations listed under Article 4(7) apply. As for existing schemes, this will either reclassify the water body as heavily modified or establish a lesser objective. In order for a derogation to apply, the social and economic benefits must be shown to outweigh any negative impact on the ecology. The proposal must also demonstrate that it will be the best environmental option.

2.8.5 Urban development projects (including the construction of shopping centres, car parks and large housing estates)

Introduction

Urban development projects are subject to the EIA requirements of Directive 85/337/EEC.²²⁰ There is no other EU environmental legislation that applies specifically to these projects, though national legislation implementing Directive 2002/91/EC will have to be duly taken into account (see Chapter 1.10).

Obligations with respect to Environmental Impact Assessment

Urban development projects, including the construction of shopping centres and car parks, fall under Annex II of the EIA Directive and as such are not always subject to an EIA. When planning urban development projects, the Member State must decide on a case by case examination, and/or by reference to thresholds or criteria whether a project should be subject to an EIA or not. Further details about this screening procedure as well as a description of the EIA process can be found in Chapter 1.1.

Energy performance of buildings

In the planning of any urban development projects, the requirements with respect to the energy performance of buildings laid down by national legislation adopted pursuant to Directive 2002/91/EC will have to be duly taken into account (see Chapter 1.10).

²²⁰ Council Directive of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1985L0337:20030625:EN:PDF>

2.8.6 Healthcare facilities, clinics and hospitals (including related waste treatment and disposal facilities)

Introduction

This chapter addresses health care facilities. These activities are not covered in the Directive 2008/1/EC and so do not have a BREF but a number of pieces of EU legislation regulate the design and activities of these facilities, particularly in the field of waste policy. These include the Directive on Waste (2008/98/EC²²¹) as well as Directive 2000/76/EC²²² concerning the incineration of waste.

The main environmental impacts from health care facilities involve waste management and emissions into the air. These facilities can generate hazardous and or infectious waste which must be identified, segregated and disposed of adequately. Hazardous waste which can be generated by these facilities includes mercury and aerosol cans; waste with a content of heavy metals; products containing PVC; radio active waste. Infectious waste generated includes blood faeces, urine and other wastes from patients treated with genotoxic drugs. Environmental impacts in terms of emissions to air occur mainly from the incineration of waste on site in large health care facilities. These incineration plants can potentially emit: heavy metals; organics in the flue gas; various organic compounds; hydrogen chloride and fluorides; as well as typical combustion products such as sulphur oxides, nitrogen oxides, volatile organic compounds, carbon monoxide.

Waste management

Directive 2008/98/EC provides a framework for dealing with waste in the Member States. More detailed measures are provided by other Directives, such as those on hazardous waste and on incineration. It does not cover waste water, some types of agricultural waste, or gaseous waste which are dealt with in other Directives. Directive 2008/98/EC is dealt with in more detail in Chapter 1.8.

The Directive obliges any establishment or undertaking which carries out disposal or possible recovery operations to obtain a permit from the competent authority. These permits must cover: the types and quantities of waste; technical requirements; security precautions; the disposal site; the treatment method. Permits may be time-limited, renewable, subject to conditions and obligations and, where appropriate, refused. Thus health care facilities must make sure that the operation disposing and or collecting their waste has such a permit unless the facility will dispose of the waste on site. Exemptions from these permitting requirement may be made for establishments

²²¹ Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:312:0003:0030:EN:PDF>

²²² Directive 2000/76/EC of the European Parliament and of the Council of 4 December 2000 on the incineration of waste, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2000L0076:20001228:EN:PDF>

or undertakings which carry out their own waste disposal at the place of production or which carry out waste recovery, provided that the competent authorities have adopted 'general rules' governing these activities and that the general duty to recover or dispose of waste safely is complied with. The cost of disposing of waste must be borne by the holder who has waste handled by a collector or disposer; and/or by the previous holder or the producer of the product from which the waste came.

Hazardous Waste

The Directive 91/689/EC²²³ places a number of obligations on the handling of hazardous waste. It obliges establishments which dispose of, recover, collect or transport hazardous waste not to mix different categories of hazardous waste or mix it with non-hazardous waste. Mixing is only permitted where it has the purpose of improving safety during disposal or recovery and it must be subject to the permitting requirement of Directive 2008/98/EC concerning waste. All establishments which carry out their own hazardous waste disposal must have a permit to do so from the competent authorities. Recovery operators must be registered with these authorities. Producers of hazardous waste are subject to periodic inspections by the competent authorities. Producers and transporters of hazardous waste must keep detailed records, which are to be preserved for at least three years and one year respectively. Documentary evidence of management operations must be supplied to the competent authorities or a previous holder on request. Waste must be recorded and identified on every site where hazardous waste is tipped and properly packaged and labelled in accordance with EU and international standards in the course of collection, transport and temporary storage.

Incineration of Waste

The aim of Directive 2000/76/EC²²⁴ is to prevent or limit negative effects on the environment and risks to human health, from the incineration of non hazardous waste, including clinical waste, and also to some types of hazardous waste. This Directive is dealt with in Chapter 2.4.2 on incineration of waste. Thus health care facilities wishing to incinerate some types of their own waste including some clinical and hazardous waste will be regulated by this Directive.

The Directive lays down the following operating requirements:

- the Total Organic Carbon (TOC) content of slag and bottom ashes must be less than 3% or their loss on ignition must be less than 5% of the dry weight of the material;
- incineration and co-incineration plants must be operated in such a way that the gas from the combustion has a minimum temperature of 850 °C for two seconds even under the most unfavourable conditions;

²²³ Council Directive of 12 December 1991 on hazardous waste, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1991L0689:20060224:EN:PDF>

²²⁴ Directive 2000/76/EC of the European Parliament and of the Council of 4 December 2000 on the incineration of waste, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2000L0076:20001228:EN:PDF>

- in case the hazardous waste to be incinerated or co-incinerated has a content of more than 1% of halogenated organic substances (expressed as chlorine), the temperature has to be raised to 1100 °C;
- incineration and co-incineration plants must have and operate an automatic system to prevent waste feed in certain circumstances and also to prevent emissions at ground level;
- any heat generated by the incineration or the co-incineration process must be recovered as far as practicable
- infectious clinical waste must be placed straight into the furnace; and
- the management of the incineration or co-incineration plant must be controlled by a “natural person”.

The Directive sets up emission limit values (ELV) for many atmospheric pollutants from standard incinerators (Annex V). Annex V provides the daily and half-hourly average emission limit values for total dust, gaseous and organic substances, hydrogen chloride, hydrogen fluoride, sulphur dioxide and the sum of nitrogen monoxide and nitrogen dioxide. The ELV for the nitrogen oxides are either 200 mg/m³ or 400 mg/m³ depending on the incineration plants nominal capacity (over or under 6 tonnes per hour). Exemptions to the ELV for NO_x may be authorised by the competent authority in specific circumstances (until 1.1.2008 or 1.1.2010, depending on the conditions) as well as for dust (until 1.1.2008). Annex V also sets out the average values (within defined sample periods) for cadmium, thallium, mercury, antimony, arsenic, lead, chromium, cobalt, copper, manganese, nickel, vanadium and the total concentration of dioxin and furans. The concentrations of carbon monoxide in the waste gas are also restricted. The emission limit value for dioxins and furans is set at 0.1ng/m³ to be sampled over a period of 6-8 hours. For calculating the total concentration of dioxins and furans, the Directive uses the international toxic equivalent scheme (I-TEQ), which does not include dioxin-like polychlorinated biphenyls (PCBs).

The Directive requires waste water from the cleaning of exhaust gases discharged from an incineration or co-incineration plant to be limited as far as practicable, at least in accordance with the ELV set out in Annex IV, for total suspended solids, mercury, cadmium, thallium, arsenic, lead, chromium, copper, nickel, zinc, and the total concentration of dioxins and furans.

The Directive sets out that measurement equipment shall be installed and techniques used in order to monitor the ‘parameters, conditions and mass concentrations relevant to the incineration or co-incineration process’. The measurement requirements are to be laid down in the permit or in the conditions attached to the permit issued by the competent authority. Annex III sets out the measurements of air pollutants that should be carried out including:

- continuous measurements of the following substances: NO_x, provided that emission limit values are set, CO, total dust, TOC, HCl, HF, SO₂;
- continuous measurements of the following process operation parameters: temperature near the inner wall or at another representative point of the combustion chamber as authorised by the competent authority, concentration of oxygen, pressure, temperature and water vapour content of the exhaust gas;

- at least two measurements per year of heavy metals, dioxins and furans; one measurement at least every three months shall however be carried out for the first 12 months of operation. Member States may fix measurement periods where they have set emission limit values for polycyclic aromatic hydrocarbons or other pollutants.

Energy performance of buildings

In the planning of any new health care facilities, the requirements with respect to the energy performance of buildings laid down by national legislation adopted pursuant to Directive 2002/91/EC will have to be duly taken into account (see Chapter 1.10).

2.8.7 Industrial estates

Introduction

Industrial estates which contain a variety of enterprises, ranging from installations covered under Directive 2008/1/EC (chemicals and petrochemicals, energy) (see Chapter 1.4), to smaller operations regulated under other EU or national legislation are common throughout the EU. The components of such estates can be linked (such as in energy supply, solid or waste water disposal, use of products, etc), or operate independently. In most cases there could be some potential for optimising environmental benefits and business costs if the regulation of these estates was integrated for certain aspects, such as into a single permit, or appropriately coordinated.

Industrial estates are not regulated under EU law by single items of legislation. They are generally affected by the following Directives:

- IPPC (Directive 2008/1/EC²²⁵)
- Seveso II (Directive 96/82/EC²²⁶ amended by Directive 2003/105/EC)
- EIA (Directive 85/337/EEC²²⁷ amended by Directives 97/11/EC and 2003/35/EC)
- SEA (Directive 2001/42/EC²²⁸)

They will also be affected by the various Directives relating to environmental quality set out in Part 1 of this Sourcebook, depending upon the types of activity present on the estate. The requirements of these individual items of legislation are described elsewhere. Thus this chapter is not able to provide ‘hard and fast’ rules regarding industrial estates. Rather it sets out some discussion of the way that, firstly, Directive 2008/1/EC might apply and, then, other legal and non-legal approaches might be used to improve their environmental performance.

²²⁵ Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:024:0008:0029:EN:PDF>

²²⁶ Council Directive 96/82/EC of 9 December 1996 on the control of major-accident hazards involving dangerous substances, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1996L0082:20031231:EN:PDF>

²²⁷ Council Directive of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1985L0337:20030625:EN:PDF>

²²⁸ Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2001:197:0030:0037:EN:PDF>

Obligations with respect to Integrated Pollution Prevention and Control

In an extreme case, where all activities are regulated under Directive 2008/1/EC or directly associated activities technically connected with them, then it is feasible to regard the estate as one large installation and hence offer one permit (see Chapter 1.4). However, there is limited use of such permits in the EU, and where this is the case this is only for restricted cases such as single permits for the same operator. Such permits must cover all relevant activities. An important detail is that the estate companies have strong technical and functional connections (they work together on contract conditions, on human resources and on facilitating services). This is an exceptional situation as a permit for a part of such an industrial estate is only possible if there are enough organizational, technical and functional links between the installations.

The advantages and disadvantages to considering an integrated approach to industrial estates are described below.

Advantages:

- A truly integrated approach assessing impacts on the environment as a whole, including assessing interactions between activities;
- Ability to assess interactions between different activities;
- Optimisation of pollution control and monitoring systems;
- Integrated waste management;
- Cost-benefits to industry due both to administrative integration and achieving cost-effective measures on a large scale;
- Cost-effectiveness and environmental benefits possible.

Disadvantages:

- Probable lack of clear responsibilities for individual operators;
- Difficulties in undertaking detailed assessments of the relative impacts, etc, of each activity and, therefore, establishing integrated permit conditions;
- In complex situations very complex permits might result, causing difficulties in interpretation for operators and regulators;
- Difficulties in identifying sources responsible for offences;
- Difficulties in implementing legal obligations.

Instruments for regulating industrial estate activity

There are limited opportunities for some aspects of estate-wide permitting where there is clear technical connection. An EIA under Directive 83/337/EEC would give some integrated view of activities and impacts at an early stage, but it does not necessarily lead to single permitting for pollution control subsequently. The opportunities for introducing such permits are somewhat limited, and practice focuses more on voluntary co-operation and seeking links with other environmental management regulations. Constraints to this approach include legal problems, as well as resistance by owners and the technical complications of the assessments that would be needed for such complex sites.

The types of measures/approaches that could be used in relation to industrial estates are:

- Voluntary co-operation;
- Co-ordination of permitting processes for installations within an estate;
- Establishing requirements during the planning of an estate so that all new investors need to comply with these;
- Linking various decision-making processes, including planning, building, pollution control, etc. When designed an estate could have an environmental plan which could direct future EIA, pollution control and other permitting decisions;
- Possibilities to allow interaction between companies on environmental matters (eg use of each others' energy, warm or cold (waste) waters, waste, etc).

However, the constraints on integrated regulation include:

- Legal constraints, such as the need for the permit holder to be a legal entity, whereas an estate is only a geographic location;
- The problem of identifying, allocating and enforcing responsibility;
- The possibility of having a potentially complex regime that could confuse;
- If there were to be a permit for the entire estate instead of single installations, this could make interpreting BAT in such a context especially challenging and could imply a move away from BAT and could lead to a lower level of environmental protection;
- Research costs to determine optimisation of environmental performance could be high.

Other instruments

A number of other instruments could be used to assist in the regulation of industrial estates and/or treatment of environmental issues. Estate-wide EIAs or SEAs would require common assessments of issues by all of the operators and regulator and could provide a basis for further regulation. Furthermore, an operator, when carrying out an impact assessment of his installation, has to take into account the other installations and evaluate the cumulated impact on the environment and on the health of the surrounding population. Under Directive 96/82/EC requirements for risk assessment, the use of domino effect evaluation and prevention, co-ordinating security management systems and emergency plans are required. The emissions trading Directive could also provide a stimulus for integration. At a national level the use of economic instruments (eg tax incentives) could be used to encourage units to work together as can other mechanisms to encourage a voluntary approach – which could involve not just negotiated agreements, but the development of estate wide management systems. Areas of particular benefit could be managing common environmental services (eg waste water treatment), address noise and smells, encourage efficient use of natural resources and waste (eg waste heat as input to others on the site), emissions that have a cumulative affect locally. Having said this, it is important to note that a full assessment of operational activities and impacts under

Directive 2008/1/EC should take account of other neighbouring activities and could result in some limited integration of understanding, even if not formal regulation.

An estate wide approach could, therefore, result in environmental benefits, improved capacity of institutions and public understanding. It would also stimulate a feeling of shared responsibility and progress towards new ways of achieving environmental outcomes. However, there is concern over the regulatory costs, especially whether it will be a disproportionate burden to the lower impact units within an estate.

ANNEX: INDEX OF LEGISLATION

Reference	Full Name	Link	Chapter
Directive 67/548/EEC	Council Directive 67/548/EEC of 27 June 1967 on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31967L0548:EN:HTML	1.7
Directive 70/156/EEC	Council Directive of 6 February 1970 on the approximation of the laws of the Member States relating to the type-approval of motor vehicles and their trailers	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1970L0156:20070712:EN:PDF	2.8.6
Directive 75/439/EEC	Council Directive of 16 June 1975 on the disposal of waste oils	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1975L0439:20051228:EN:PDF	2.5.1; 2.5.3
Directive 75/440/EEC	Council Directive of 16 June 1975 concerning the quality required of surface water intended for the abstraction of drinking water in the Member States	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1975L0440:19911223:EN:PDF	1.12
Directive 78/660/EEC	Fourth Council Directive of 25 July 1978 based on Article 54 (3) (g) of the Treaty on the annual accounts of certain types of companies	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1978L0660:20070101:EN:PDF	1.2
Directive 80/68/EEC	Council Directive of 17 December 1979 on the protection of groundwater against pollution caused by certain dangerous substances	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1980L0068:19911223:EN:PDF	2.5.3
Directive 80/876/EEC	Council Directive 80/876/EEC of 15 July 1980 on the approximation of the laws of the Member States relating to straight ammonium nitrate fertilizers of high nitrogen content	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31980L0876:EN:HTML	2.4.1
Directive 82/176/EEC	Council Directive of 22 March 1982 on limit values and quality objectives for mercury discharges by the chlor-alkali electrolysis	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1982L0	1.12

	industry	176:19911223:EN:PDF	
Directive 83/349/EEC	Seventh Council Directive of 13 June 1983 based on the Article 54 (3) (g) of the Treaty on consolidated accounts	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1983L0349:20070101:EN:PDF	1.2
Directive 83/513/EEC	Council Directive of 26 September 1983 on limit values and quality objectives for cadmium discharges	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1983L0513:19911223:EN:PDF	1.12
Directive 84/491/EEC	Council Directive of 9 October 1984 on limit values and quality objectives for discharges of hexachlorocyclohexane	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1984L0491:19911223:EN:PDF	1.12
Directive 85/337/EEC	Council Directive of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1985L0337:20030625:EN:PDF	1.1
Directive 86/278/EEC	Council Directive of 12 June 1986 on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1986L0278:20030605:EN:PDF	1.13
Directive 86/280/EEC	Council Directive of 12 June 1986 on limit values and quality objectives for discharges of certain dangerous substances included in List I of the Annex to Directive 76/464/EEC	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1986L0280:19911223:EN:PDF	1.12
Directive 86/635/EEC	Council Directive of 8 December 1986 on the annual accounts and consolidated accounts of banks and other financial institutions	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1986L0635:20060905:EN:PDF	1.2

Directive 91/271/EEC	Council Directive of 21 May 1991 concerning urban waste water treatment	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1991L0271:20031120:EN:PDF	2.5.5
Directive 91/630/EEC	Council Directive of 19 November 1991 laying down minimum standards for the protection of pigs	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1991L0630:20030605:EN:PDF	2.6.1
Directive 91/674/EC	Council Directive of 19 December 1991 on the annual accounts and consolidated accounts of insurance undertakings	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1991L0674:20060905:EN:PDF	1.2
Directive 91/676/EC	Council Directive of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1991L0676:20031120:EN:PDF	1.12
Directive 91/689/EEC	Council Directive of 12 December 1991 on hazardous waste	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1991L0689:20060224:EN:PDF	2.5.1
Directive 92/43/EC	Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1992L0043:20070101:EN:PDF	1.14
Directive 94/62/EC	European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1994L0062:20050405:EN:PDF	1.8
Directive 96/59/EC	Council Directive 96/59/EC of 16 September 1996 on the disposal of polychlorinated biphenyls and polychlorinated terphenyls (PCB/PCT)	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31996L0059:EN:HTML	1.8
Directive 96/82/EC	Council Directive 96/82/EC of 9 December 1996 on the control of major-accident hazards involving dangerous substances	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1996L0	1.5

		082:20031231:EN:PDF	
Directive 1999/13/EC	Council Directive 1999/13/EC of 11 March 1999 on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1999L0013:20040430:EN:PDF	2.7.2
Directive 1999/31/EC	Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1999L0031:20031120:EN:PDF	1.11
Directive 1999/45/EC	Directive 1999/45/EC of the European Parliament and of the Council of 31 May 1999 concerning the approximation of the laws, regulations and administrative provisions of the Member States relating to the classification, packaging and labelling of dangerous preparations	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1999L0045:20070601:EN:PDF	1.7
Directive 1999/74/EC	Council Directive 1999/74/EC of 19 July 1999 laying down minimum standards for the protection of laying hens	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1999L0074:20030605:EN:PDF	2.6.1
Directive 2000/53/EC	Directive 2000/53/EC of the European Parliament and of the Council of 18 September 2000 on end-of life vehicles	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2000L0053:20050701:EN:PDF	2.5.3; 2.5.4
Directive 2000/60/EC	Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2000L0060:20080321:EN:PDF	1.12; 1.13
Directive 2000/69/EC	Directive 2000/69/EC of the European Parliament and of the Council of 16 November 2000 relating to limit values for benzene and carbon monoxide in ambient air	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2000:313:0012:0021:EN:PDF	2.4.3

Directive 2000/76/EC	Directive 2000/76/EC of the European Parliament and of the Council of 4 December 2000 on the incineration of waste	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2000L0076:20001228:EN:PDF	2.5.2
Regulation 2037/2000/EC	Regulation (EC) No 2037/2000 of the European Parliament and of the Council of 29 June 2000 on substances that deplete the ozone layer	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2000R2037:20080101:EN:PDF	1.11
Directive 2001/80/EC	Directive 2001/80/EC of the European Parliament and of the Council of 23 October 2001 on the limitation of emissions of certain pollutants into the air from large combustion plants	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2001L0080:20070101:EN:PDF	2.1.1
Directive 2001/81/EC	Directive 2001/81/EC of the European Parliament and of the Council of 23 October 2001 on national emission ceilings for certain atmospheric pollutants	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2001L0081:20070101:EN:PDF	1.11
Directive 2001/34/EC	Directive 2001/34/EC of the European Parliament and of the Council of 28 May 2001 on the admission of securities to official stock exchange listing and on information to be published on those securities	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2001L0034:20070120:EN:PDF	1.2
Directive 2001/42/EC	Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2001:197:0030:0037:EN:PDF	1.1
Directive 2001/77/EC	Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2001L0077:20070101:EN:PDF	1.11
Directive 2002/3/EC	Directive 2002/3/EC of the European Parliament and of the	<a 485="" 510="" 917="" 938"="" data-label="Page-Footer" href="http://eur-</td> <td>2.4.3</td> </tr> </table> </div> <div data-bbox=">381	

	Council of 12 February 2002 relating to ozone in ambient air	lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2002:067:0014:0030:EN:PDF	
Directive 2002/4/EC	Commission Directive 2002/4/EC of 30 January 2002 on the registration of establishments keeping laying hens, covered by Council Directive 1999/74/EC	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2002L0004:20070101:EN:PDF	2.6.1
Directive 2002/30/EC	Directive 2002/30/EC of the European Parliament and of the Council of 26 March 2002 on the establishment of rules and procedures with regard to the introduction of noise-related operating restrictions at Community airports	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2002L0030:20081211:EN:PDF	2.8.2
Directive 2002/49/EC	Directive 2002/49/EC of the European Parliament and of the Council of 25 June 2002 relating to the assessment and management of environmental noise	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2002:189:0012:0025:EN:PDF	1.9
Directive 2002/91/EC	Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on the energy performance of buildings	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:001:0065:0071:EN:PDF	1.10
Directive 2002/95/EC	Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2002L0095:20080321:EN:PDF	1.8
Directive 2002/96/EC	Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment (WEEE)	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2002L0096:20080321:EN:PDF	1.6
Regulation 1606/2002/EC	Regulation (EC) No 1606/2002 of the European Parliament and of the Council of 19 July 2002 on the application of international accounting standards	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2002R1606:20080410:EN:PDF	1.2
Directive 2003/4/EC	Directive 2003/4/EC of the European Parliament and of the Council of 28 January 2003 on public access to environmental	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:041:002	1.2

	information and repealing Council Directive 90/313/EEC	6:0032:EN:PDF	
Directive 2003/30/EC	Directive 2003/30/EC of the European Parliament and of the Council of 8 May 2003 on the promotion of the use of biofuels or other renewable fuels for transport	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:123:0042:0046:EN:PDF	1.11
Directive 2003/51/EC	Directive 2003/51/EC of the European Parliament and of the Council of 18 June 2003 amending Directives 78/660/EEC, 83/349/EEC, 86/635/EEC and 91/674/EEC on the annual and consolidated accounts of certain types of companies, banks and other financial institutions and insurance undertakings,	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32003L0051:EN:NOT	1.2
Directive 2003/87/EC	Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2003L0087:20041113:EN:PDF	1.11
Directive 2004/107/EC	Directive 2004/107/EC of the European Parliament and of the Council of 15 December 2004 relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2005:023:0003:0016:EN:PDF	1.11
Directive 2004/17/EC	Directive 2004/17/EC of the European Parliament and of the Council of 31 March 2004 coordinating the procurement procedures of entities operating in the water, energy, transport and postal services sectors	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2004L0017:20080101:EN:PDF	1.6
Directive 2004/18/EC	Directive 2004/18/EC of the European Parliament and of the Council of 31 March 2004 on the coordination of procedures for the award of public works contracts, public supply contracts and public service contracts	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2004L0018:20080101:EN:PDF	1.6

Directive 2004/35/EC	Directive 2004/35/CE of the European Parliament and of the Council of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2004L0035:20060501:EN:PDF	1.3
Directive 2006/11/EC	Directive 2006/11/EC of the European Parliament and of the Council of 15 February 2006 on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:064:0052:0059:EN:PDF	1.12
Directive 2006/12/EC	Directive 2006/12/EC of the European Parliament and of the Council of 5 April 2006 on waste	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:114:0009:0021:EN:PDF	1.8
Directive 2006/21/EC	Directive 2006/21/EC of the European Parliament and of the Council of 15 March 2006 on the management of waste from extractive industries and amending Directive 2004/35/EC	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:102:0015:0033:EN:PDF	2.8.2
Directive 2006/40/EC	Directive 2006/40/EC of the European Parliament and of the Council of 17 May 2006 relating to emissions from air-conditioning systems in motor vehicles and amending Council Directive 70/156/EEC	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:161:0012:0018:EN:PDF	1.11
Directive 2006/66/EC	Directive 2006/66/EC of the European Parliament and of the Council of 6 September 2006 on batteries and accumulators and waste batteries and accumulators and repealing Directive 91/157/EEC	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2006L0066:20080320:EN:PDF	2.5.3; 2.5.4
Directive 2006/118/EC	Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:372:0019:0031:EN:PDF	1.13
Regulation 166/2006/EC	Regulation (EC) No 166/2006 of the European Parliament and of	<a 485="" 511="" 918="" 938"="" data-label="Page-Footer" href="http://eur-</td> <td>1.2</td> </tr> </table> </div> <div data-bbox=">384	

	the Council of 18 January 2006 concerning the establishment of a European Pollutant Release and Transfer Register and amending Council Directives 91/689/EEC and 96/61/EC	lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:033:0001:0017:EN:PDF	
Regulation 1013/2006/EC	Regulation (EC) No 1013/2006 of the European Parliament and of the Council of 14 June 2006 on shipments of waste	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2006R1013:20071130:EN:PDF	1.8
Regulation 1907/2006/EC	Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2006R1907:20071123:EN:PDF	1.7
Directive 2007/7/EC	Directive 2006/7/EC of the European Parliament and of the Council of 15 February 2006 concerning the management of bathing water quality and repealing Directive 76/160/EEC	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:064:0037:0051:EN:PDF	1.12
Directive 2007/43/EC	Council Directive 2007/43/EC of 28 June 2007 laying down minimum rules for the protection of chickens kept for meat production	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:182:0019:0028:EN:PDF	2.6.1
Directive 2008/1/EC	Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control (Codified version)	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:024:0008:0029:EN:PDF	1.4; 1.10
Directive 2008/50/EC	Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:152:0001:0044:EN:PDF	

Directive 2008/98/EC	Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:312:0003:0030:EN:PDF	1.8; 2.4.1; 2.4.2
Directive 2008/101/EC	Directive 2008/101/EC of the European Parliament and of the Council of 19 November 2008 amending Directive 2003/87/EC so as to include aviation activities in the scheme for greenhouse gas emission allowance trading within the Community	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:008:0003:0003:EN:PDF	1.11
Directive 2008/56/EC	Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive)	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:164:0019:0040:EN:PDF	1.12
Directive 2008/105/EC	Directive 2008/105/EC of the European Parliament and of the Council of 16 December 2008 on environmental quality standards in the field of water policy, amending and subsequently repealing Council Directives 82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC, 86/280/EEC and amending Directive 2000/60/EC of the European Parliament and of the Council	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:348:0084:0097:EN:PDF	1.12
Directive 2009/29/EC	Directive 2009/29/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0063:0087:EN:PDF	1.11
Directive 2009/28/EC	Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:EN:PDF	1.11

	Directives 2001/77/EC and 2003/30/EC		
Directive 2009/31/EC	Directive 2009/31/EC of the European Parliament and of the Council of 23 April 2009 on the geological storage of carbon dioxide and amending Council Directive 85/337/EEC, European Parliament and Council Directives 2000/60/EC, 2001/80/EC, 2004/35/EC, 2006/12/EC, 2008/1/EC and Regulation (EC) No 1013/2006	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0114:0135:EN:PDF	1.3, 1.1
Regulation (EC) No 443/2009	Regulation (EC) No 443/2009 of the European Parliament and of the Council of 23 April 2009 setting emission performance standards for new passenger cars as part of the Community's integrated approach to reduce CO2 emissions from light-duty vehicles	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0001:0015:EN:PDF	1.11
Directive 2009/30/EC	Directive 2009/30/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 98/70/EC as regards the specification of petrol, diesel and gas-oil and introducing a mechanism to monitor and reduce greenhouse gas emissions and amending Council Directive 1999/32/EC as regards the specification of fuel used by inland waterway vessels and repealing Directive 93/12/EEC	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0088:0113:EN:PDF	1.11
Directive 2009/125/EC	Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products (recast)	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:285:0010:0035:EN:PDF	1.6
Regulation (EC) No	Regulation (EC) No 1221/2009 of the European Parliament and of	<a 485="" 510="" 918="" 938"="" data-label="Page-Footer" href="http://eur-</td> <td>1.6</td> </tr> </table> </div> <div data-bbox=">387	

1221/2009	the Council of 25 November 2009 on the voluntary participation by organisations in a Community eco-management and audit scheme (EMAS), repealing Regulation (EC) No 761/2001 and Commission Decisions 2001/681/EC and 2006/193/EC	lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:342:0001:0045:EN:PDF	
Directive 2009/147/EC	Directive 2009/147/EC of 30 November 2009 of the European Parliament and of the Council on the conservation of wild birds (codified version)	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:020:0007:0025:EN:PDF	1.14

