Sector Guidance Note

IPPC S2.03

Integrated Pollution Prevention and Control (IPPC)

Interim Guidance for the Ferrous Foundries Sector

ENVIRONMENT AND HERITAGE SERVICE

SEPA

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Executive summary

This guidance has been produced by the Environment Agency for England and Wales in collaboration with the Scottish Environment Protection Agency (SEPA) and the Northern Ireland Environment and Heritage Service (EHS). Together these are referred to as "the Regulator" in this document. Its publication follows consultation with industry, government departments and non-governmental organisations.

What is IPPC

Integrated Pollution Prevention and Control (IPPC) is a regulatory system that employs an integrated approach to control the environmental impacts of certain industrial activities. It involves determining the appropriate controls for industry to protect the environment through a single permitting process. To gain a Permit, Operators will have to show that they have systematically developed proposals to apply the 'Best Available Techniques' (BAT) and meet certain other requirements, taking account of relevant local factors.

The Regulators intend to implement IPPC to:

- protect the environment as a whole;
- promote the use of "clean technology" to minimise waste at source;
- encourage innovation, by leaving significant responsibility for developing satisfactory solutions to environmental issues with industrial Operators; and
- provide a "one-stop shop" for administering applications for Permits to operate.

Once a Permit has been issued, other parts of IPPC come into play. These include compliance monitoring, periodic Permit reviews, variation of Permit conditions and transfers of Permits between Operators. IPPC also provides for the restoration of industrial sites when the permitted activities cease to operate.

This Guidance and the BREF

This UK Guidance for delivering the PPC (IPPC) Regulations in the Ferrous Foundries sector will be based on the BAT Reference document BREF (see Ref. 1) produced by the European Commission once it becomes available. The BREF will be the result of an exchange of information between member states and industry. The BREF for this sector is not available at the time of writing this guidance document and it is planned that this document will be reviewed and revised as appropriate once the BREF becomes available.

The aims of this Guidance

The aims of this Guidance are to:

- provide a clear structure and methodology which Operators making an application should follow to ensure that all aspects of the PPC Regulations (see Appendix 2 for equivalent legislation in Scotland and Northern Ireland) and other relevant Regulations have been addressed (see Section 1.2), and it should thereby assist the Operator to make a satisfactory application;
- minimise the effort by both Operator and Regulator in the permitting of an installation by use of clear indicative standards and the use of material from previous applications and from accredited Environmental Management Systems (EMSs);
- improve the consistency of applications by ensuring that all relevant issues are addressed;
- increase the transparency of the permitting process by having a structure in which the Operator's response to each issue, and any departures from the standards, can be seen clearly;
- improve consistency of regulation across installations and sectors by facilitating the comparison of applications;
- provide a summary of the BAT techniques for pollution control from the BREF and UK experience which are relevant in the UK context expressed, where possible, as clear indicative standards and which need to be addressed by Applicants;
- provide an arrangement of information which allows the reader to find, quickly all of the guidance associated with:
  - a subject (e.g. accidents, energy or noise) (Sections 2.1 and 2.5 - 2.11);
  - the technical areas (e.g. casting or sand reclamation) (Sections 2.3 - 2.4);
  - particular emissions (e.g. VOCs or particulates) (Section 3).

Additionally, to assist Operators in making applications, separate, horizontal guidance is available on a range of topics such as waste minimisation, monitoring, calculating stack heights etc. The majority of this guidance is available free through the Environment Agency, SEPA or EHS (Northern Ireland) web sites (see References).

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1.1 Understanding IPPC and BAT

IPPC and the Regulations

Integrated Pollution Prevention and Control (IPPC) is a regulatory system that employs an integrated approach to control the environmental impacts of certain industrial activities. It involves determining the appropriate controls for industry to protect the environment through a single permitting process. To gain a Permit, Operators will have to show that they have systematically developed proposals to apply the 'Best Available Techniques' (BAT) and meet certain other requirements, taking account of relevant local factors.

The essence of BAT is that the selection of techniques to protect the environment should achieve an appropriate balance between realising environmental benefits and costs incurred by Operators.

IPPC operates under the Pollution Prevention and Control (England and Wales) Regulations, (see Ref. 3 and Appendix 2). These Regulations have been made under the Pollution Prevention and Control (PPC) Act 1999 and implement the EC Directive 96/61 on IPPC. Further information on the overall system of IPPC, together with Government policy and more detailed advice on the interpretation of the Regulations, can be found in the Department of the Environment, Transport and the Regions (DETR) document *IPPC: A Practical Guide,* (see Ref. 4).

Installation based, NOT national emission limits

The "BAT" approach of IPPC is different from regulatory approaches based on fixed national emission limits (except where General Binding Rules have been issued by the Secretary of State). The legal instrument which ultimately defines BAT is the permit and this can only be issued at the installation level.

Indicative BAT standards

Indicative BAT standards (essentially for BAT but also covering other aspects) are laid out in national guidance (such as this) and should be applied unless there is strong justification for another course of action. It should be noted that BAT includes both the technical components of the installation given in Section 2 and the benchmark levels identified in Section 3. Departures from those standards, in either direction, can be justified at the local level taking into account the technical characteristics of the installation concerned, its geographical location and the local environmental conditions. Notwithstanding this, if there are any applicable mandatory EU emission limits, they must be met, although BAT may go further than them.

BAT and EQSs

The "BAT" approach is also different from, but complementary to, regulatory approaches based on Environmental Quality Standards (EQS). Essentially BAT requires measures to be taken to **prevent** or, where this is not practicable, to reduce emissions. That is, if emissions can be reduced further, or prevented altogether, at reasonable cost, then this should be done **irrespective** of whether any environmental quality standards are already being met. It requires us not to consider the environment as a recipient of pollutants and waste, which can be filled up to a given level, but to do all that is practicable to minimise the impact of industrial activities. The process considers what can be reasonably achieved within the installation first (this is covered by Sections 2 and 3 of this Guidance) and only then checks to ensure that the local environmental conditions are secure, (Section 4 of this Guidance and Ref. 6). The BAT approach is, in this respect, a more precautionary one, which may go beyond the requirements of Environmental Quality Standards.

Conversely, it is feasible that the application of what is BAT may lead to a situation in which an EQS is still threatened. The Regulations therefore allow for expenditure beyond BAT where necessary. However, this situation should arise very rarely assuming that the EQS is soundly based on an assessment of harm. The BAT assessment, which balances cost against benefit (or prevention of harm) should in most cases have come to the same conclusion about the expenditure which is appropriate to protect the environment.

Advice on the relationship of environmental quality standards and other standards and obligations is given in *IPPC: A Practical Guide,* (see Ref. 4) and in Section 3.

Assessing BAT at the sector level

The assessment of BAT takes place at a number of levels. At the European level, the EC issues a BAT reference document (BREF) for each sector. The BREF is the result of an exchange of information which member states should take into account when determining BAT, but which leaves flexibility to member states in its application. This UK Sector Guidance Note takes into account the information contained in the BREF and lays down the indicative standards and expectations in the UK. At this national level, techniques which are considered to be BAT should, first of all, represent an appropriate balance of costs and benefits for a typical, well-performing installation in that sector. Secondly, the techniques should normally be affordable without making the sector as a whole uncompetitive either on a European basis or worldwide. NOTE: BREF not available yet.

Assessing BAT at the installation level

When assessing the applicability of the sectoral, indicative BAT standards at the installation level departures may be justified in either direction as described above. The most appropriate technique may depend upon local factors and, where the answer is not self evident, a local assessment of the costs and benefits of the available options may be needed to establish the best option. Individual company profitability is **not** considered.

In summary, departures may be justified on the grounds of the technical characteristics of the installation concerned, its geographical location and the local environmental conditions, but not on grounds of individual company profitability. Further information on this can be found in the Guide for Applicants, (see Refs. 4 and 5).

Costs may only be taken into account at the local level:

- where the BAT cost/benefit balance of an improvement only becomes favourable when the relevant item of plant is due for renewal/renovation anyway (e.g. BAT for the sector may be to change to a different design of furnace when a furnace comes up for rebuild). In effect, these are cases where BAT for the sector can be expressed in terms of local investment cycles.
- where a number of expensive improvements are needed, a phasing programme may be appropriate as long as it is not so long as to be seen as rewarding a poor performing installation, (see Ref. 6 for more details).

Innovation

The Regulators encourage the development and introduction of new and innovative techniques which meet the BAT criteria and are looking for continuous improvement in the overall environmental performance of the process as a part of progressive sustainable development. This Sector Guidance Note describes the appropriate indicative standards at the time of writing. However, Operators should keep up to date with the best available techniques relevant to the activity and this Note may not be cited in an attempt to delay the introduction of improved, available techniques. Furthermore, the technical characteristics of a particular installation may allow for opportunities not foreseen in the Guidance; as BAT is ultimately determined at the installation level (except in the case of GBRs) it is valid to consider these even where they go beyond the indicative standards.

New installations

The indicative requirements apply to both new and existing activities but it will be more difficult to justify departures from them in the case of new activities. For new installations, the indicative requirements should normally be in place before the commencement of operations. In some cases, such as where the requirement is for an audit of ongoing operations, this is not feasible and indicative upgrading timescales are given for such cases.

Existing installations - standards

For an existing activity a less strict proposal (or an extended timescale) may, for example, be acceptable where the activity operates to a standard that is very close to an indicative requirement, but using different plant or processes from that upon which the indicative requirement is based. In such a case it may impose a disproportionate cost to replace the old plant with the new techniques for only a small decrease in emissions.

Existing installations - timescales

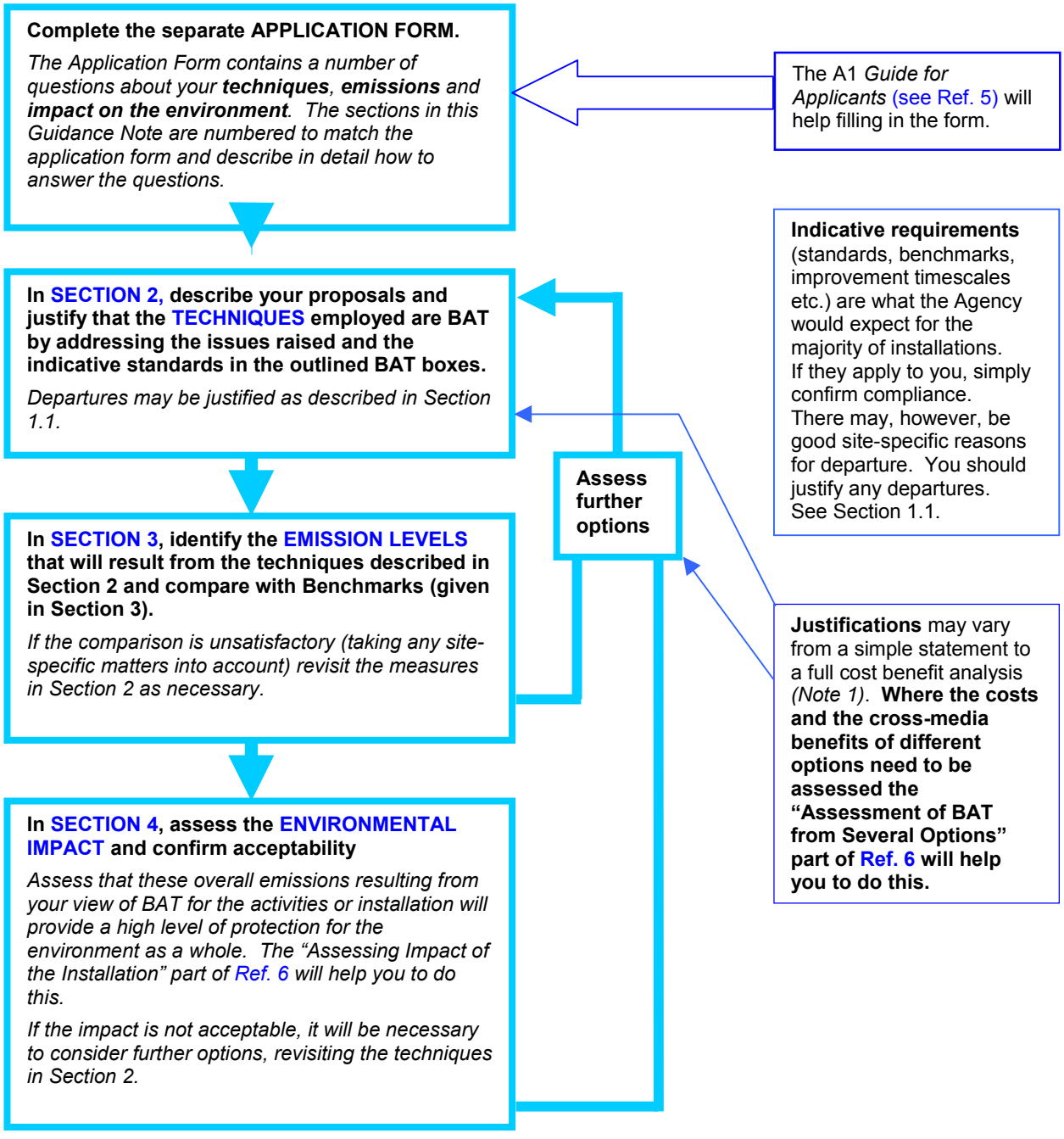
The timescales for the major cost improvements for the control of NO_x, SO_x, particulate, dioxins and effluent treatment in this sector will depend upon local factors and the results of the cost benefit assessments. The timescales for such improvements should be to the approval of the Regulator.

The whole programme of any other items should be completed at the latest within 3 years of the issue of the Permit. Any longer timescales will need to be justified by the Operator in accordance with the principles above.

All improvements should be carried out at the earliest opportunity and to a programme approved by the Regulator.

The Applicant should include a proposed timetable covering all improvements.

1.2 Making an Application



Note 1 The amount of detail needed to support the application should be sufficient to support the Applicant's contention that either the conditions of the guidance have been met or an alternative measure has been justified. The level of detail should be commensurate with the scale of the operation and its ability to cause pollution. An Applicant is not required to supply detail that could not reasonably be expected to contribute to a decision to issue a Permit.

Note 2 **For existing IPC or Waste Management Permit holders**, your response to each point in Sections 2, 3 or 4 may rely heavily on your previous application. The Regulator does not wish you to duplicate information as long as the previous information adequately addresses the issues. However, the more the information can be reorganised to demonstrate that all the issues have been adequate addressed the better. You will need to send us copies of any information referred to.

Note 3 The contents of the outlined BAT boxes in Sections 2, 3 and 4, and additional blank tables etc., are available electronically on the Environment Agency's Website, for the assistance of Applicants.

1.3 Installations Covered

This Note covers installations, described in Section 2.1 Part A (Part A(1) in England and Wales) of Schedule 1 to the PPC Regulations (see Ref. 3) as follows.

(b) Producing, melting or refining iron or steel or any ferrous alloy, including continuous casting, **except** where the only furnaces used are –

(i) electric arc furnaces with a designated holding capacity of less than 7 tonnes, or

(ii) cupola, crucible, reverbatory, rotary, induction or resistance furnaces.

Processes prescribed under Part A(2) are as follows:

(a) Producing pig iron or steel, including continuous casting, in a plant with a production capacity of more than 2.5 tonnes per hour unless falling within paragraphs (b) of Part A(1) of this Section.

(d) Casting ferrous metal at a foundry with a production capacity of more than 20 tonnes per day.

In this Section, "ferrous alloy" means an alloy of which iron is the largest constituent, or equal to the largest constituent, by weight, whether or not that alloy also has a non-ferrous metal content greater than any percentage specified in Section 2.2.

The installation includes the main activities as stated above and associated activities which have a technical connection with the main activities and which may have an effect on emissions and pollution.

This guidance note does **not** address melting or refining activities that take place within the electric arc furnace, or within an argon oxygen decarburisation (AOD) converter; nor does it address the issues associated with raw materials, emissions or waste from those operations. All such activities are addressed by the IPPC Guidance note; S2.01 Guidance for the Coke, Iron and Steel Sector.

This guidance note does address the following aspects of the prescribed process, which are considered to be “foundry” operations, namely operations that occur after the melt has been tapped from the furnace:

- storage and handling of raw materials (only those associated with the following foundry operations)
- launders
- desulphurisation of molten iron in ladles
- nodularisation of SG iron in ladles
- preparation of moulds and cores
- casting, pouring or moulding
- the power plant
- a waste to energy plant
- knocking out
- fettling, dressing or finishing of castings
- sand reclamation
- waste handling and recycling facilities
- Advice on the extent of the physical site which is contained within the installation, e.g. split sites, is given in *IPPC Part A(1) Installations: Guide for Applicants* (see Ref. 5). Operators are advised to discuss this issue with the Regulator prior to preparing their application.

Where associated activities are carried out **in conjunction** with the main activities and are not covered in this guidance note (for example combustion activities), reference should be made to:

- other relevant IPPC Guidance Notes and,
- where appropriate, the Secretary of State’s Guidance for Local Authority Air Pollution Control. (NB In Northern Ireland this guidance is produced by the Department of the Environment’) in particular

PG 1/11(96) reheat and heat treatment furnaces, 20-50 MW net rated thermal input

PG 1/3(95) boilers and furnaces, 20-50MW net rated thermal input

1.4 Review Periods

Permits can be reviewed or varied at any time. However, the PPC Regulations impose a requirement on Regulators to review Permits in certain specific circumstances such as where the pollution caused by the installation is of such significance that the existing emission limit values need to be revised or new limits set.

In addition, Regulators are required to review the conditions of Permits "periodically". The Government stated in its third consultation paper (England, Wales and Scotland) on the implementation of IPPC, that the new sector-specific IPPC Sector Guidance Notes would provide guidance on appropriate review periods for each sector. These would take into consideration guidance on the relevant criteria, to be provided by the Government. Examples of the likely relevant criteria for setting these review periods are "the risk and level of environmental impacts associated with the sector" and "the cost to the Regulators and regulated industry of undertaking the reviews".

The Regulators consider that at the present time, having regard to those criteria, it is in fact appropriate to set indicative minimum review periods which differ only between those sectors which have been subject to integrated permitting (i.e. IPC or Waste Management Licensing), and those which have not. It is therefore proposed that Permit conditions should normally be reviewed on the following basis:

- for individual activities **NOT** previously subject to regulation under IPC or Waste Management Licensing, a review should normally be carried out within four years of the issue of the IPPC Permit;
- for individual activities previously subject to regulation under IPC or Waste Management Licensing, a review should normally be carried out within six years of the issue of the IPPC Permit.

This means that activities/installations not currently in IPC or Waste Management Licensing will be initially reviewed within four years and thereafter within six years.

An exception to this is where discharges of List I or List II substances have been permitted or where disposal or tipping for the purposes of disposal, of any matter which might lead to an indirect discharge of any substance on List I or II. In such cases the review must be carried out within four years.

This period will be kept under review and, if any of the above factors change significantly, may be shortened or extended.

1.5 Key Issues for this Sector

Nature and consumption of raw and recycled materials

Selection and use of materials to give the best practicable environmental option. This will include making choices that enhance the opportunities for recycling. Choice of binder systems, release agents and carrier solvents will need to be considered.

Raw material storage and handling

Fugitive dust emissions from unloading, transport, storage and reclamation of stocks, principally of fluxes, refractories, desulphurisation materials (such as lime or limestone, carbon, aluminium), nodularisation materials (such as magnesium or a magnesium alloy with iron or nickel), sand and binders. Transfer and storage facilities for handling must be designed to minimise the risk and consequences of spillage. Both air and groundwater contamination are to be avoided.

Air quality management

The potential for air pollution is a major problem associated with foundries. Potentially significant pollutants are:

- particulate matter;
- nitrogen oxides;
- carbon oxides;
- iron and its oxides;
- heavy metals;
- ammonia;
- VOCs including formaldehyde, phenols and esters, and
- Dioxins, where dirty scrap is used

Many of these pollutants are malodorous.

Emissions from **launders** consist of iron and its oxides.

Dust and fume from **refining in ladles** may include :

a) from **desulphurisation** of molten iron in ladles – magnesium oxide or calcium oxide, carbon monoxide and carbon dioxide

b) from **nodularisation** of SG iron in ladles – magnesium oxide (in large quantities).

Preparation of **moulds and cores** gives rise to dust from sand handling and gases from any resin, hardener and catalyst used (the binder system) and their reactions during mixing and curing. The different binder systems give rise to different emissions, but the main types emit two or more of the following gases: ammonia, hydrogen sulphide, sulphur dioxide, methyl diisocyanate, phenol, formaldehyde and a range of other VOCs including amines and esters.

Mould and core storage areas may have high concentrations of VOCs such as triethylamine (TEA) and dimethyethylamine (DMA), which exude from the cores.

Casting, pouring, moulding and knocking out give rise to emissions relating to the pyrolisation of the moulds. They include all of those mentioned above for the preparation of moulds and cores, as well as carbon monoxide, carbon dioxide and some PAHs such as cresols and xylenols that are malodorous.

Fettling, dressing or finishing give rise to particulate matter and some fume if techniques involving heat are used. In particular, metallic dusts from shot blastting operations are highly aggressive and damaging to paintwork.

Sand reclamation gives rise to dust from mechanical reclamation and fume from thermal reclamation. (An aqueous stream is created by wet reclamation techniques.)

More detail relating to the emissions from each part of the process is provided in section 2.3

Water management

Key issues to be addressed include the following:

- consumption levels;
- monitoring and management of mass flows of individual pollutants;
- management of surface water run-off and treatment facilities;
- security of underground drains; and
- pollution prevention systems and contingency arrangements.

Operators in a CCL Agreement are not expected to implement capital improvement projects for energy efficiency under a PPC Permit.

Energy efficiency and fuels

The sector is a major energy consumer. There remain significant opportunities for reduction of emissions caused by energy use and choice of energy source (CO_2, SO_x, NO_x, etc. contributing in particular to global warming and acidification). The industry may enter into a Climate Change Agreement or Trading Agreement with the Government. The applicability of techniques and standards for IPPC is explained in Section 2.7.

A Negotiated Agreement has been made between the UK Steel Association and the Government concerning a rebate of the Climate Change Levy (CCL). Signatories will be subject to a reduced level of site specific regulation on energy efficiency matters, in particular capital expenditure is not required on energy efficiency improvements beyond the baseline measures (though a plan has to be provided in case the Operator drops out of the agreement). Some activities covered here may be exempt from the CCL, e.g. The applicability of techniques and standards for PPC is explained in Section **2.7**.

Key issues include:

- reclamation of heat from cooling plant;
- minimising use of heavy fuel oil;
- low NO_x combustion systems; and
- the balance between energy use and environmental protection.

Recovery, recycling and waste disposal

A strategy and plan are required for the minimisation, recovery and recycling of process materials and for the disposal of waste, in accordance with the Regulator's policies on waste minimisation. Considerations should include collected dusts and slags, coolant water, treated effluents and recovered oils. Wastes sent to landfill are a key issue, particularly slag from the ladles, scrubber liquors and sludge, refractory waste, sand and fettling waste.

Noise

The major noise sources associated with foundry processes are related to mould production and handling including pattern cleaning, knocking out and cleaning permanent moulds, fettling and finishing castings, final product handling and sand reclamation. All potential sources of significant noise need to be identified and managed.

Accident risk and pollution prevention

Apart from the normal process and spillage risks, many older sites (especially those not regulated under IPC) will have drainage systems that will need attention (see Section 2.8).

An assessment is required of the environmental hazards posed by non-routine operation and accidents. This should be co-ordinated with any responsibilities under the COMAH Regulations. Appropriate pollution prevention measures and contingency arrangements are required, protecting all environmental media.

Long distance and transboundary pollution

The foundries are unlikely to be of sufficient size to have significant transboundary effects.

Site restoration

BAT improvement: Air quality management plan to meet AQS objectives

Many ferrous foundries will have been operating on the same site for many years. There may well be ground contamination that could be confused with potential future contamination from the activities as operated under IPPC. In such cases it will be necessary to assess the degree of contamination as a baseline for future operations.
Consideration for remediation would include:

- contamination of stocking and handling areas for raw and recycled materials;
- heavy metals and alkaline materials at slag and metal recovery operations in alloy steel processes;
- alkaline and sulphide contamination at other slag sites; and
- sediments in lagoons.

1.6 Summary of Releases for each Sector

Releases to air usually result in a subsequent, indirect emission to land and can therefore affect human health, soil and terrestrial ecosystems.

For releases from combustion and incineration plant see the appropriate guidance.

SOURCE → / RELEASES ↓	Raw material storage and handling	Launders	Desulphurisation of molten iron	Nodularisation of SG iron	Preparation of cores and moulds	Casting, pouring and moulding	Knocing out, reclamation	Fettling, dressing or finishing of castings	Slag and dust from refining processes
Oxides of sulphur			A		A	A	A		
Oxides of nitrogen					A	A	A		
Carbon dioxide			A	A	A	A	A		
Carbon monoxide			A	A	A	A	A		
Hydrogen sulphide					A	A	A		
Ammonia					A	A	A		
Oxides of iron		A	A	A		A	AL	AL	
Alkali metal compounds		A	AL		L				
Alkaline-earth metal compounds		A	AL	A	L	A			
Metal oxide particulates		A	A	A		A	AL	AL	L
Non-metallic particulates	AW	A	A		AL	A	AL	AL	L
Metallic iron								AL	
Hydrogen cyanide					A				
Cadmium and cadmium oxide									L
Zinc, lead and their oxides									L
Sulphur			A						
Amines/amides					A	A			
Dioxins						A			
Volatile organic compounds					A	A	A		
Oils and greases					L				
Resins					L		L		
Acid vapours					A	A			
Slag waste			L	L					
Sludges								LW	
Refractory waste		L			L		AL	L	
KEY	A – Release to Air, W – Release to Water, L – Release to Land								

Substances include their compounds, except where separate reference to the compound is made.

Releases to air may also be released to land or water, depending upon the abatement technology employed, e.g. via collected dusts, sludges or liquors.

Some releases are specific to a particular binder system.

1.7 Overview of the Activities in this Sector

The processes which are described in this Section are those Part A foundry processes defined in Schedule 1 of the Regulations[1] which are related to, or used in conjunction with the melting of iron and steel **in an electric arc furnace with a capacity of more than 7 tonnes**. As a result this Guidance Note applies to a small number of the larger iron and steel founders using electric arc furnace melting to produce castings to their final, or near final shape. The main operations covered by the description in Section 2.1 of the Regulations and which are included in this Note are:-

- Storage and handling of raw materials;
- Launders;
- Desulphurisation of molten iron in ladles;
- Nodularisation of SG iron in ladles;
- Preparation of cores and moulds;
- Casting, pouring or moulding;
- Knocking out;
- Sand reclamation
- Fettling, dressing or finishing of castings; and
- Handling of waste materials.

1.8 Economic Aspects for this Sector

Introduction

In determining an application, the Regulator must translate BAT into conditions to be included in the Permit. These criteria require that judgements are made balancing cost against environmental damage, and also concerning the relative significance of discharges to different media. The operator should have presented the reasons why the proposed option is considered to represent BAT. The advantages over any other feasible techniques should be identified.

The cost of controlling releases should not be disproportionate to the environmental benefits delivered. There may be cost savings resulting from changes made to improve environmental performance. BAT is not concerned with the financial health or resources of a particular operator, and excessive costs are viewed in the context of the process and the industry. While techniques and achievable release levels may vary between industry sectors, the same principles apply to all sectors. For existing processes, the timing of improvement programmes may be a factor in the determination of BAT.

The information contained in this section gives background on the economics of the industry and the ability of operators to raise funds for investment as well as an indication of possible abatement costs.

1.9 This sector

Information concerning the economic position of this industry sector is given in IPC Guidance Note S2 2.01.

THE FOUNDRY BREF NOTE WILL CONTAIN UP TO DATE INFORMATION FOR THE SECTOR ACROSS EUROPE. The BREF note is expected to be published in 2002.

1.10 Site-specific issues

Disposing of used foundry sand represents a major item, both environmentally and financially.

Environmental Technology Good Practice Guide GG119 (see Ref 26) provides valuable guidance to assist in optimising use of sand, whilst the sister publication GG104 (see Ref 26)provides similar guidance on the management of chemical binders. Application of the principles developed in these documents, after due regard for any overarching BAT requirements applicable at the site under consideration, will lead to cost effective waste minimisation and pollution prevention at source.

As the process is, by definition, part of a much larger operation, there needs to be careful consideration of the range of operations impacted, and the procedure for allocating costs.

Cost information for abatement techniques

Sand recycling

Figures presented in GG119 (see Ref 26)show that there is **significant financial benefit** to be obtained by operating an effective sand recovery system.

A primary reclamation system handling 5520 tonnes of sand per year is described as achieving a net cost saving of £147,108 per year.

The same source describes a thermal reclamation system with a throughput of 1 tonne per hour, yielding a net cost saving of £92,581 per year.

2 TECHNIQUES FOR POLLUTION CONTROL

BAT Boxes to help in preparing applications

This section summarises, in the outlined BAT boxes,

- what is required in the application
- the indicative standards (i.e. what is BAT in most circumstances).

The indicative standards cover the techniques and measures which have been identified as representing BAT in a general sense. They also cover the other requirements of the PPC Regulations and requirements of other Regulations such as the Waste Management Licensing Regulations (see Appendix 2 for equivalent legislation in Scotland and Northern Ireland), and the Groundwater Regulations insofar as they are relevant to an IPPC Permit. For the sake of brevity these boxes simply use the term "BAT".

At the top of each BAT box is the question from the application form (derived from the Regulations) which is being addressed, (see Section 1.2).

In responding to the requirements the Operator should keep the following general principles in mind.

- As a first principle there should be evidence in the application that full consideration has been given to the possibility of **PREVENTING** the release of harmful substances. This may, most commonly, be by:
  - substituting materials or processes (see Section 2.2.1), For example, scope for this in this sector would be by the replacement of binder systems and release agents with less harmful alternatives.
  - preventing releases of water altogether (see Section 2.2.3),
  - preventing waste emissions by reuse or recovery.
- Only where that is not practicable should the second principle be adopted of reducing emissions which may cause harm.
- All available options should be reviewed and it should be demonstrated that the selected combination of primary process and abatement equipment satisfies the Regulations.
- All plant and equipment should be subject to regular preventative maintenance programmes, in line with operational requirements, to ensure continued optimum performance. This should be detailed in response to Section 2.1 and elsewhere as appropriate.

2.1 Management Techniques

Within IPPC, an effective system of management is a key technique for ensuring that all appropriate pollution prevention and control techniques are delivered reliably and on an integrated basis. The Regulators strongly support the operation of environmental management systems (EMSs). An Operator with such a system will find it easier to complete not only this section but also the technical/regulatory requirements in the following sections.

The Regulators recommend that the ISO 14001 standard is used as the basis for an environmental management system. Certification to this standard and/or registration under EMAS (EC Eco Management and Audit Scheme) (OJ L168, 10.7.93) are also strongly supported by the Regulator. Both certification and registration provide independent verification that the EMS conforms to an assessable standard. EMAS now incorporates ISO 14001 as the specification for the EMS element. For further details about ISO 14001 and EMAS contact British Standards Institute (BSI) and the Institute of Environmental Management and Assessment (IEMA) respectively.

The steps required in this and subsequent sections may help the Operator to make good any shortfalls in their management system. An effective EMS will help the Operator to maintain compliance with regulatory requirements and to manage other significant environmental impacts. While the requirements below are considered to be BAT for IPPC, they are the same techniques as required in a formal EMS and are also capable of delivering wider environmental benefits. However, it is information on their applicability to IPPC which is primarily required in this application.

Application Form Question 2.1

Provide details of your proposed management techniques.

With the Application the Operator should:

1. Describe their management system to demonstrate how it meets the ***"Requirements for an effective management system"*** below. The description should make clear who holds responsibility for each of the requirements. The second column explains where in the application the response to each requirement is best dealt with to avoid duplication. Copies of all procedures are not needed, but examples may be included in your application.

   If you are certified to ISO 14001 or registered under EMAS (or both), you may provide a statement derived from certification records/assessments to support your application.

   Further specific management procedures are dealt with under the appropriate section on the remainder of the document. It is recommended that you understand all the requirements of the application before completing this section, as many management issues are dealt with in other sections.

2. The type of management system employed will depend upon the scale and complexity of the operations undertaken. The Operator should demonstrate that the proposals are BAT, by confirming compliance with the indicative requirements below, or by justifying departures (as described in Section 1.2 and in the *A1 Guide for Applicants*) or alternative measures.

Indicative BAT Requirements

BAT for management techniques

The Operator should have a management system in place for the activities which delivers the requirements given in column 1 below. The development of any aspects of the management system not already in place should be completed within the timescale given in Section 1.1.

Requirement for an effective management system	How delivered for IPPC
1. **Clear management structure and allocated responsibilities** for environmental performance, in particular meeting the aspects of the IPPC Permit	Describe in this section who has allocated responsibilities
2. **Identification, assessment and management of significant environmental impacts**	By responding to the requirements in Section 5.1 in the application
3. **Compliance with legal and other requirements applicable to activities impacting on the environment**	Compliance with the Permit satisfies this requirement

Cont.

4. **Establishing an environmental policy and setting objectives and targets** to prevent pollution, meet legal requirements and continually improve environmental performance	The applicant should provide a copy of their environmental policy statement applicable to the installation. The Applicant should make proposals in response to each of Sections 2.2 to 2.12. These proposals may be incorporated within the Permit improvement programme
5. **Environmental improvement programmes to implement policy objectives and targets**	
6. **Establish operational controls to prevent and minimise significant environmental impacts**	By responding to the requirements in Sections 2.2 to 2.7, 2.11 and 2.12 in the application
7. **Preventative maintenance programmes for relevant plant and equipment** – method of recording and reviews	Describe system here. List procedures in Section 2.3
8. **Emergency planning and accident prevention**	By responding to the requirements in Section 2.8 in the application
9. **Monitoring and measuring performance** Identify key indicators of environmental performance and establish and maintain a programme to measure and monitor indicators to enable review and improvement of performance	Describe in this Section
10. **Monitoring and control systems**: • to ensure that the installation functions as intended; • to detect faults and unintended operations; • to detect slow changes in plant performance to trigger preventative maintenance	By responding to the requirements in Section 2.10 in the application
11. **Training** Provision of adequate procedures and training for all relevant staff (including contractors and those purchasing equipment and materials), which should include: • a clear statement of the skills and competencies required for each job; • awareness of the regulatory implications of the Permit for the activity and their work activities; • awareness of all potential environmental effects from operation under normal and abnormal circumstances; • prevention of accidental emissions and action to be taken when accidental emissions occur; • implementation and maintenance of training records; Expertise required depends on the activities being carried out. However, both technical and managerial staff upon whom the installation's compliance depends need sufficient qualifications, training and experience for their roles. This may be assessed against any industry sector standards or codes of practice	To be described in this Section confirming that training for each of the areas covered by Sections 2.2 to 2.3 and 2.5 to 2.10 are covered
12. **Communication and reporting of incidents of actual or potential non-compliance and complaints** Actions taken in response, and about proposed changes to operations	Describe in this Section

Cont.

13. **Auditing** Regular, (preferably) independent, audits to check that all activities are being carried out in conformity with these requirements. All of these requirements should be audited at least once per year	Describe in this Section
14. **Corrective action to analyse faults and prevent recurrence** Define responsibility and authority for handling and investigating non-conformance, taking action to mitigate any impacts caused and for initiating and completing corrective and preventive action Recording, investigating, taking corrective action and preventing recurrence, in response to environmental complaints and incidents	Describe in this Section how this is dealt with for each of Sections 2.2 to 2.3 and 2.5 to 2.10 as appropriate
15. **Reviewing and Reporting Environmental Performance** Senior management review environmental performance and ensure appropriate action taken where necessary to ensure that policy commitments are met and that policy remains relevant. Review progress of the Management Programmes at least annually. Incorporate environmental issues in all other relevant aspects of the business, insofar as they are required by IPPC, in particular: • the control of process change on the installation; • design and review of new facilities, engineering and other capital projects; • capital approval; • the allocation of resources; • planning and scheduling; • incorporation of environmental aspects into normal operating procedures; • purchasing policy; • accounting for environmental costs against the process involved rather than as overheads. Report on environmental performance, based on the results of management reviews (annual or linked to the audit cycle), for: • information required by the Regulator; and • effectiveness of the management system against objectives and targets, and future planned improvements. Report externally preferably via public environmental statement	Describe in this Section Describe in this Section This will become a Permit requirement Describe in this Section Describe in this Section
16. **Managing documentation and records** List the core elements of the EMS (policies, responsibilities, procedures etc) and links to related documentation in order to be able to control, locate and update documentation. Describe how environmental records and results of audits and reviews are identified, maintained and stored	Describe in this Section

Selection of raw materials

2.2 Materials Inputs

This section covers the use of **raw materials and water** and the techniques for both minimising their use and minimising their impact by selection. (The choice of fuels is covered under Section 2.7.3, Energy).

As a general principle, the Operator will need to demonstrate the measures taken to:

Reduce

Substitute

Understand

- **reduce** the use of chemicals and other materials (Section 2.2.2);
- **substitute** less harmful materials or those which can be more readily abated and when abated lead to substances which in themselves are more readily dealt with;
- **understand** the fate of by-products and contaminants and their environmental impact (Section 5).

2.2.1 Raw materials selection

Summary of materials in use

This section looks at the **selection and substitution** of raw materials used while Section 2.2.2 describes the techniques to **minimise** their use.

Raw materials used in foundry processes consist of:-

- desulphurisation materials;
- nodularisation materials;
- mould materials; principally sand and binders, also catalysts where required;
- refractories for launder, ladle and furnace linings;
- pattern release agents and carriers

The various stages are inter-related, with decisions at each step influencing the degree of freedom for other steps.

The primary consideration when selecting core and mould making techniques is the ability of the foundry to produce castings of the required quality at a competitive price. Quality requirements feed forward to mould and core manufacture, and ultimately to the raw materials to be used. This in turn may place restrictions on the proportion of recycled sand that can be used.

Similarly, the nature of the binders used will affect the fume released during casting, and also the ease with which sand can be removed and recycled.

When assessing an application, the Agency must assess BAT for the operation as a whole.

Selection of raw materials

Application Form Question 2.2 (part 1)

Identify the raw and auxiliary materials, other substances and water that you propose to use.

With the Application the Operator should:

1. supply a list of the materials used, which have the potential for significant environmental impact, including:
   - the chemical composition of the materials where relevant;
   - the quantities used,
   - the fate of the material (i.e. approximate percentages to each media and to the product),
   - environmental impact where known (e.g. degradability, bioaccumulation potential, toxicity to relevant species).
   - any reasonably practicable alternative raw materials which may have a lower environmental impact including, but not be limited to, any alternatives described in BAT Requirement 5 below (the substitution principle).

   A suitable template is included in the electronic version of this document.

   Generic information about materials, and grouping information of those of a similar type, is normally adequate rather than listing every commercial alternative used. A common sense approach to the level of detail should be used; ensuring that any material could have a significant effect of the environment is included. Product data sheets should be available on-site.
2. justify (e.g. on the basis of impact on product quality), the continued use of any substance for which there is a less hazardous alternative and that the proposed raw material section is therefore BAT;
3. for existing activities, identify shortfalls in the above information, e.g. the environmental impact of certain substances, which the Operator believes require longer term studies to establish.

Indicative BAT Requirements

BAT for selection

1 The Operator should:
   - complete any longer-term studies (Item 3 above),
   - carry out any substitutions identified, as improvement conditions to a timescale to be approved by the Regulator

2 The Operator should maintain a detailed inventory of raw materials used on-site.

3 The Operator should have procedures for the regular review of new developments in raw materials and the implementation of any suitable ones which are less hazardous.

4 The Operator should have quality assurance procedures for the control of the content of raw materials.

5 The following raw material substitutions should be applied where appropriate:

Raw material	Selection techniques
Mould materials	• sand • binder system • catalyst • gases
Pattern release agents and carriers	• use of carrier organic solvents should be avoided if possible. Otherwise, non-chlorinated solvents should be used as sparingly as possible.
Degreasers	• where solvent based de-greasing is necessary, then non-chlorinated solvents should be used.

Waste minimisation

2.2.2 Waste minimisation (minimising the use of raw materials)

Principles

The prevention and minimisation of waste and emissions to the environment is a general principle of IPPC. Operators will be expected to consider the application of waste minimisation techniques so that, wherever practicable, all types of wastes and emissions are prevented or reduced to a minimum. The steps below will also help to ensure the prudent use of natural resources.

Waste minimisation can be defined simply as:

"a systematic approach to the reduction of waste at source, by understanding and changing processes and activities to prevent and reduce waste".

A variety of techniques can be classified under the general term of waste minimisation and they range from basic housekeeping techniques through statistical measurement techniques, to the application of clean technologies.

In the context of waste minimisation and this Guidance, **waste** relates to the inefficient use of raw materials and other substances at an installation. A consequence of waste minimisation will be the reduction of gaseous, liquid and solid emissions.

Key operational features of waste minimisation will be:

- the ongoing identification and implementation of waste prevention opportunities;
- the active participation and commitment of staff at all levels including, e.g. staff suggestion schemes;
- monitoring of materials usage and reporting against key performance measures.

See Ref. 8 for detailed information, guides and case studies on waste minimisation techniques.

Application Form Question 2.2 (part 2)

Identify the raw and auxiliary materials, other substances and water that you propose to use.

With the Application the Operator should:

1. identify, from a knowledge of the plant, the main opportunities for waste minimisation and supply information on waste minimisation audits and exercises and the improvements made or planned.

Indicative BAT Requirements

BAT for waste minimisation

1. A regular waste minimisation audit should be carried out. Where one has not been carried out recently, an initial comprehensive audit should be carried out at the earliest opportunity within the improvement programme. New plants will need to have been operating for some time before an audit will be meaningful. Further audits should be at least as frequent as the IPPC Permit reviews. The audit should be carried out as follows:

   The Operator should analyse the use of raw materials, assess the opportunities for reductions and provide an action plan for improvements using the following three essential steps:
   i) process mapping;
   ii) raw materials mass balance;
   iii) action plan.

   The use and fate of raw materials and other materials, including reactants, intermediates, by-products, solvents and other support materials, such as inerting agents, fuels, catalysts and abatement agents, should be mapped onto a process flow diagram (see Ref. 8) using data from the raw materials inventory (see Section 2.2.1) and other company data as appropriate. Data should be incorporated for each principal stage of the operation in order to construct a mass balance for the installation.

   In particular the audit should encompass:
   - the match between cast shape and final product;
   - process control to maximise the lifetime of refractory material

   Using this information, opportunities for improved efficiency, changes in process and waste reduction should be generated and assessed, and an action plan prepared for the implementation of improvements to a timescale approved by the Regulator.

2. See Sections 2.5 and 2.6 for identified areas of waste handling, recovery and disposal.

Water use

2.2.3 Water use

Water use should be minimised within the BAT criteria for the prevention or reduction of emissions and be commensurate with the prudent use of water as a natural resource.

Reasons for reducing water use

Reducing water use may be a valid environmental (or economic) aim in itself, perhaps because of local supply constraints. In addition, from the point of view of reducing polluting emissions, any water passing through an industrial process is degraded by the addition of pollutants, and there are distinct benefits to be gained from reducing the water used, in particular:

- reducing the size of (a new) treatment plant thereby supporting the cost benefit BAT justification of better treatment;
- cost savings where water is purchased or disposed off to another party;
- associated benefits within the process such as reduction of energy requirements for heating and pumping, and reduced dissolution of pollutants into the water leading to reduced sludge generation in the effluent treatment plant.

The use of a simple mass balance for water use will reveal where reductions can be made.

Advice on cost-effective measures for minimising water can be found in ETBPP publications (see Ref. 9).

The amount of water used in foundries is small. Its main uses are: as a coolant; in sand reclamation, if a wet technique is used; as a scrubber medium in abatement plant; and from tumbling drums used for finishing small items.

Application Form Question 2.2 (part 3)

Identify the raw and auxiliary materials, other substances and water that you propose to use.

With the Application the Operator should:

1. supply information on water consumption and comparison with any available benchmarks;
2. supply a diagram of the water circuits with indicative flows;
3. describe the current or proposed position with regard to the indicative BAT requirements below, or any other techniques which are pertinent to the installation;
4. demonstrate that the proposals are BAT, by confirming compliance with the indicative requirements, by justifying departures (as described in Section 1.2 and in the Guide for Applicants) or alternative measures;
5. describe, in particular, any water audits already conducted and the improvements made or planned.

Indicative BAT Requirements

1. A regular review of water use (water efficiency audit) should be carried out. Where one has not been carried out recently, an initial comprehensive audit should be carried out at the earliest opportunity within the improvement programme. New plants will need to have been operating for some time before an audit will be meaningful. Further audits should be at least as frequent as the IPPC Permit reviews. The audit should be carried out as follows:
   - The Operator should produce flow diagrams and water mass balances for the activities.
   - Water efficiency objectives should be established by comparison with sector guidance or, where not available, national benchmarks (see Ref. 10). In justifying any departures from these (see Section 1.2), or where benchmarks are not available, the techniques described below and those in the existing sector guidance should be taken into account. The constraints on reducing water use beyond a certain level should be identified by each Operator, as this is usually installation-specific.
   - Water pinch techniques should be used in the more complex situations, particularly on chemical plant, to identify the opportunities for maximising reuse and minimising use of water (see ETBPP publications, Ref. 9).
   - Using this information, opportunities for reduction in water use should be generated and assessed and an action plan prepared for the implementation of improvements to a timescale approved by the Regulator.

Cont.

Water use

BAT for water efficiency

2. The following general principles should be applied in sequence to reduce emissions to water:
   - water-efficient techniques should be used at source where possible;
   - water should be recycled within the process from which it issues, by treating it first if necessary. Where this is not practicable, it should be recycled to another part of the process which has a lower water quality requirement;
   - in particular, uncontaminated roof and surface water, which cannot be used, should be discharged separately.
3. Measures should be implemented to minimise contamination risk of process or surface water (see Section 2.3.14).
4. To identify the scope for substituting water from recycled sources, the water quality requirements associated with each use should be identified. Less contaminated water streams, e.g. cooling waters, should be kept separate where there is scope for reuse, possibly after some form of treatment.
5. Ultimately wastewater will need some form of treatment (see Section 2.3.12). However, in many applications, the best conventional effluent treatment produces a good water quality which may be usable in the process directly or when mixed with fresh water. While treated effluent quality can vary, it can be recycled selectively when the quality is adequate, reverting to discharge when the quality falls below that which the system can tolerate. The Operator should identify where treated water from the effluent treatment plant could be used and justify where it is not.

   In particular, the cost of membrane technology continues to reduce. They can be applied to individual process streams or to the final effluent from the effluent treatment plant. Ultimately, they could completely replace the ETP plant, leading to a reduced effluent volume. There remains, however, a concentrated effluent stream but, where this is sufficiently small, and particularly where waste heat is available for further treatment by evaporation, a zero effluent system could be produced. Where appropriate, the Operator should assess the costs and benefits of providing such treatment.

BAT (cont)

6. Water used in cleaning and washing down should be minimised by:
   - vacuuming, scraping or mopping in preference to hosing down;
   - evaluating the scope for reusing wash water;
   - trigger controls on all hoses, hand lances and washing equipment.
7. The use of fresh water should be minimised. It should only be used for:
   - dilution of resin and other additives
   - wet scrubber make up water when recycled water cannot be used
8. Where a proposal involves a wet process for reclaiming sand, the Regulator will pay particular attention to the arguments put forward by the operator for considering such a process as BAT
9. Fresh water consumption across the foundry should be directly measured and recorded regularly - typically on a daily basis.

2.3 The Main Activities and Abatement

(includes **"directly associated activities"** in accordance with the PPC Regulations)

Application Form Question 2.3

Describe the proposed installation activities and the proposed techniques and measures to prevent and reduce waste arisings and emissions of substances and heat (including during periods of start-up or shut-down, momentary stoppage, leak or malfunction).

With the Application the Operator should:

1. provide adequate **process descriptions** of the activities and the abatement and control equipment for all of the activities such that the Regulator can understand the process in sufficient detail to assess the Operator's proposals and, in particular, to assess opportunities for further improvements. This should include:
   - process flow sheet diagrams (schematics);
   - diagrams of the main plant items where they have environmental relevance; e.g launder and ladle design, extraction and abatement plant design, sand reclamation plant design, landfill liner design, etc.;
   - details of any chemical reactions and their reaction kinetics/energy balance; eg optimisation of desulphurisation, optimisation of nodularisation, reactions during core manufacture and mould manufacture.
   - control system philosophy and how the control system incorporates environmental monitoring information;
   - annual production, mass and energy balance information;
   - venting and emergency relief provisions;
   - summary of extant operating and maintenance procedures;
   - a description of how protection is provided during abnormal operating conditions such as momentary stoppages, start-up, and shut-down for as long as is necessary to ensure compliance with release limits in Permits;
   - additionally, for some applications it may be appropriate to supply piping and instrumentation diagrams for systems containing potentially polluting substances.

   If there is uncertainty, the degree of detail required should be established in pre-application discussions.
2. describe the current or proposed position for all of the indicative BAT requirements for each subsection of 2.3, or any others which are pertinent to the installation;
3. identify shortfalls in the above information which the Operator believes require longer term studies to establish.
4. demonstrate that the proposals are BAT, by confirming compliance with the indicative requirements, by justifying departures (as described in Section 1.2 and in the Guide for Applicants) or alternative measures;

In assessing the integrated impacts of proposals and balancing the impacts of different techniques it should be noted that energy should be taken into account whether or not there is a Climate Change Agreement or Trading Agreement in place (see Section 2.7.3).

Indicative BAT Requirements

See each subsection of this Section 2.3.

2.3.1 Storage and handling of raw materials

Summary of the activities

Process: Raw materials including fluxes in lump and powder form, deoxidants and refractories, are normally stored under cover. Following delivery, handling is kept to a minimum. Powdered materials can be stored in sealed silos and conveyed pneumatically or kept and handled in sealed bags.

Storage and handling of raw materials

Sand is normally delivered in bulk and discharged directly to silo via pneumatic conveyor. Specialist sands arrive in bags.

Liquid binders, resins and catalysts are delivered in drums, or by bulk container or road tanker. They are stored in their delivery containers or, in the case of rail tankers, discharged direct into dedicated storage. The containers are connected by pipe directly to the sand/resin/catalyst mixing unit. Some catalysts and co-reactants are used in a gaseous form but these are also delivered as liquids and handled in a similar fashion before being evaporated and mixed with a carrier gas. Evaporation is enclosed and may be effected by a variety of methods.

Refractories, release agents and other minor deliveries are stored indoors.

Environmental impact

Water: Not significant

Land: Spillage, overloading of silos and other containers

Air: Dust and local odour.

Waste: Refer to accidents.

Energy: Not significant

Accidents: Delivery to silos – excessive transfer rates of solids by pneumatic conveyors risks over pressurisation causing filter failure. Overfilling can cause spillage of liquids or powders. Charging materials into the wrong silo or tank can cause waste, spillage or uncontrolled chemical reaction.

Noise: Delivery vehicles may cause nuisance especially if close to the site boundary.

BAT for raw materials storage and handling

Application Form Question 2.3 (cont.) — Storage and handling of raw materials

With the Application the Operator should:

1. supply the general application requirements for Section 2.3 listed on page 20 for this aspect of the activities;

Indicative BAT Requirements

The main control issues relate to the potential for fugitive emissions. Refer to section 2.3.9

- Deliveries should be carried out in such a way so as to avoid spillage, leaks and dusty emissions. In particular, those arising from accidents during materials transfer.

2.3.2 Launders

Summary of the activities

Process: Foundry launders are open channels lined with refractory material through which the molten metal runs from the furnace into the ladle. (In steelworks they are also used to direct metal into the moulds.)

Environmental impact

Water: Not significant

Land: Not significant

Air: Fume containing iron oxides.

Waste: refractory liners – sent to landfill

Energy: Not significant

Accidents: Not significant

Noise: Not significant

BAT for launders

Application Form Question 2.3 (cont.) — Launders

With the Application the Operator should:

1. supply the general application requirements for Section 2.3 listed on page 20 for this aspect of the activities;

Indicative BAT Requirements

The main control issues are:

- Containing fugitive emissions

2.3.3 Desulphurisation of molten iron in ladles

Summary of the activities

Process: molten iron can be desulphurised using magnesium or calcium carbide which reacts with the sulphur to produce a slag which can be separated from the metal.

A number of different methods can be used. In the "shaking" process a barrel shaped ladle containing iron and de-sulphurising agent is shaken to swirl the contents around the inner lining of the ladle and thereby promote mixing.

In the Continuous Divided Ladle process the iron is tapped continuously from the cupola, through a slag of lime and calcium carbide, into the first compartment of the divided ladle. The compartment is stirred by injecting nitrogen into the base of the ladle through a porous plug. Iron which reaches the bottom of the compartment will be de-sulphurised and passes under the dividing wall into the second compartment, from where it flows into a transfer ladle, driven continuously by the head of the hot metal pouring from the furnace. Because of its continuous nature the divided ladle process produces a steadier emission of fume.

Environmental impact

Water: Not significant

Land: Slag

Air: Dust and local odour.

Waste: Slag

Energy: Not significant

Accidents: Electrical failure during process operations is likely to generate fume and some scrap.

Noise: Not significant

Application Form Question 2.3 (cont.) → Desulphurisation of molten iron in ladles

With the Application the Operator should:

1. supply the general application requirements for Section 2.3 listed on page 20 for this aspect of the activities;

Indicative BAT Requirements

The main control issues are:

- Containing the fume emissions.

BAT for desulphurisation of molten iron in ladles

Nodularisation

2.3.4 Nodularisation of SG iron in ladles

Summary of the activities

Process: Conversion of flake grey iron into ductile iron (nodular or spheroidal graphite iron) is accompanied by an improvement in mechanical properties. Such conversion is referred to as nodularisation and involves the treatment of the liquid metal with magnesium and rare earth elements.

There are a number of methods of introducing the nodularising agent into the metal and these include pour over, plunging, pressure vessel, tundish cover ladle, in-stream and in-mould techniques. Some methods result in the evolution of large volumes of fume whilst others produce relatively little.

Environmental impact

Water: Not significant

Land: Not significant

Air: Fume.

Waste: Slag

Energy: Not significant

Accidents: Electrical failure during process operations is likely to generate fume and some scrap.

Noise: Not significant

Application Form Question 2.3 (cont.) → Nodularisation of SG iron in ladles

With the Application the Operator should:

1 supply the general application requirements for Section 2.3 listed on page 20 for this aspect of the activities;

Indicative BAT Requirements

The main control issues are:

- Containing the emissions of fume

2.3.5 Preparation of cores and moulds

Summary of the activities

Many different methods of mould manufacture have been developed. Table 3 lists the various techniques together with potential emissions released during production and casting. Some of the most common are described below:-

The green sand method

A schematic of the process is shown in ***Figure 1.*** This uses a mixture of sand, an organic component such as dextrose or coal dust (optional), a clay binder and water which is moulded around a pattern within an open box. It is then mechanically compacted. The main emission is dust released during mixing which is captured and filtered. When the organic components are used there is also a release of VOCs and oxides of carbon during casting operations. In common with all sand moulding techniques there is a significant waste disposal problem.

The shell sand method

This involves immersing a hot metal pattern into a box of sand pre-coated with a novolac resin. The resin cures and binds the sand together. The longer the invest time the thicker the mould. The method is used for mass production of relatively small castings.

Fumes are emitted during production and during cooling. The fumes are normally extracted and discharged to atmosphere uncleaned. The emissions are primarily VOCs.

Cold setting techniques

These rely on the chemical reaction between a resin and a hardener, possibly in the presence of a catalyst. There are several basic systems although minor variations may be applied:-

- furan - a phenolic urethane formaldehyde resin blended with furfuryl alcohol which is hardened by mixing with sulphonic, sulphuric or phosphoric acid. The moulds or cores are self setting.
- alkaline phenolic - a phenolic alkaline resin which is hardened by mixing with a liquid ester. It is also possible to use a gaseous ester carried in a methyl formate vapour.
- phenolic urethane - a blend of phenolic urethane formaldehyde resin with polymeric polyisocyanate. This is also available as a gas hardened system using an amine gas.
- sodium silicate - sodium silicate is hardened by mixing with an ester. Gas hardening can be achieved by replacing the ester with CO_2 gas.

Fans are sometimes used to disperse fumes which are evolved during mixing and curing, collection and extraction being rarely employed. However, when using amine gas curing it is necessary to collect and scrub the exhaust gases prior to discharge. Methyl formate is flammable and the releases must either be condensed for reuse or abated, possibly via an afterburner.

Mould Coating

Iron moulds may be coated with a powdered refractory material to protect the mould surface and to reduce the chilling effect of the iron. The coating is water based and is usually applied by spray under local fume extraction hoods leading to bag filters.

Steel moulds or dies are not coated but are externally water cooled. They are used for pipe casting where the limited thickness of the pipe wall does not have a significant impact on the steel mould temperature and the pipe quickly contracts away from the mould to be ready for withdrawal. Details of components such as the socket ends of pipes or the spigot ends of rolls are formed by sand sub-moulds within the main mould.

Sand moulds are often coated with a refractory material to protect the mould surface and to improve the surface finish of the casting. The coating may be based on either water or alcohol and may be applied using spray, flow coating, dipping, brushing or swabbing.

Oil Sand Process

This technique makes use of an oil which is polymerised by heating in an oven. Larger installations may require hoods and abatement plant to collect and destroy associated VOC emissions.

Pattern release agents and carriers

These are used in many mould applications. Typical carrier solvents are 1,1,1 trichloroethane, hydrocarbons and alcohols. Chlorinated solvents tend to produce better results than hydrocarbons and alcohol blends which are inferior in evaporation rates, cleaning ability and flammability. Some non-solvent release agents are available but are difficult to apply and expensive. Release coatings are normally applied under extraction hoods.

Environmental impact

Water: Not significant

Land: Not significant

Air: The most important issues from mould and core preparation and storage are as follows:

- Odour; – the sources of which are the gases mentioned below
- Dust from sand handling;
- Resin handling;
- VOC emissions including amines, aldehydes and phenol;
- Emissions of oxides of carbon;
- Fume;
- Leaks of gases being used as a gassing agent in certain mould and coremaking processes, such as sulphur dioxide;
- Leaks of gases being used as catalysts, such as triethylamine (TEA) and dimethylethylamine (DMEA). Both gases have unpleasant odours. These gases exude from the cores in storage;
- Emissions of ammonia arising from the thermal decomposition of hexamethylene tetramine which is a catalyst used in the shell process;
- Particulate emissions.

Waste: Choice of binder system affects potential for recycling and recovery.

Energy: Not significant

Accidents: Mixing and blending problems can impact upon recovery

Noise: Not significant

BAT for preparation of cores and moulds

Application Form Question 2.3 (cont.) → Preparation of cores and moulds

With the Application the Operator should:

1. supply the general application requirements for Section 2.3 listed on page 20 for this aspect of the activities;

Indicative BAT Requirements

- Minimise consumption of binder chemicals through good process control, using the whole range of techniques described in Guidance Note GG104 (see Ref 26), Cost Effective Management of Chemical Binders in Foundries, produced by the Environmental Technology Best Practice Programme.
- Control amine emissions from gassed phenolic urethane systems where necessary for control of odour nuisance, using chemical scrubbing, incineration or an effective odour neutraliser. This is mainly required where DMEA is used.
- Where gas-fired heating systems are used (resin shell or oil sand), particular attention should be paid to good cleaning and maintenance of burner systems.
- Solvent-based mould coatings should be torched off as soon as it is safe to do so after application.
- In most cases scrap moulds and cores should be segregated from other waste to facilitate reclamation.
- Use of carrier organic solvents for pattern release agents or elsewhere should be avoided. If avoidance is not possible, non-chlorinated solvents should be employed and the amount used should be minimised.

Releases to the environment commonly associated with the processes described are listed in Table Table 2-1 release routes.

Table 2-1Fumes evolved from current foundry processes

System Name and Binder Constituents	Setting Method	Fumes during Mixing and Setting	Fumes during Casting
GREEN SAND Clay Coal dust or substitute Water	Pressure	Dust	Carbon oxides Aromatics (inc polycyclics) Nitro aromatics
SHELL SAND Phenol Formaldehyde (Novalak) Resin	Heat	Formaldehyde Ammonia Phenol Aromatics	Carbon oxides Phenols Ammonia Aldehydes Aromatics (inc polycyclics)
ALKALI PHENOLIC Alkaline phenol Formaldehyde resin 1. Self-setting, eg "Alphaset", "Novaset" 2. Gas hardened, eg "Betaset"	 Cold set with esters Gas hardened with methyl formate vapour	 Formaldehyde Phenol Esters Formaldehyde Phenol Methyl formate	 Carbon oxides Formaldehyde Phenol Aromatics
PHENOLIC URETHANE 1. Gas hardened, eg "Coldbox", "Isocure" 2. Self setting, eg "Novathane", Pepset"	Amine vapour Self set with substituted pyridine	Solvents Isocyanate (MDI) Amine Solvents Isocyanates (MDI)	Carbon oxides Nitrogen oxides Monoisocyanates Formaldehyde Phenol Aromatics (inc polycyclics) Anilines Naphthalenes Ammonia
FURANE Combination resins of: Phenol Urea Furfuryl alcohol Formaldehyde	Cold set with acids	Formaldehyde Phenol Furfuryl alcohol Hydrogen sulphide Sulphur dioxide Acid mists	Carbon oxides Phenol Formaldehyde Aromatics Sulphur dioxide Ammonia Aniline
HOT BOX Combination resins of: Phenol Urea Furfuryl alcohol Formaldehyde	Heat	Formaldehyde Acids Furfuryl alcohol Phenol	Carbon oxides Nitrogen oxides Formaldehyde Phenol Aromatics Aniline Ammonia
OIL SAND Linseed oil and starch	Heat	Acrolein Complex organics	Carbon oxides Butadiene Ketones Acrolein
CO_2 PROCESS Sodium silicate	Gas hardened with CO_2 gas	None	Carbon oxides
SILICATE ESTER "Self set" Sodium silicate	Cold set with esters	Esters	Carbon oxides Alkanes Acetone Acetic acid Acrolein

Casting, pouring or moulding

2.3.6 Casting, pouring or moulding

Fume generated during casting arises from two sources. Fine iron oxide is generated at the surface of the molten metal as it is poured, and the organic products are expelled from the mould as the resins and binders decompose. The former only occurs as the metal is being poured, whilst smoke and fumes caused by decomposition of the binder will continue to be evolved as the mould cools.

Whilst COSHH assessments can be of value in assessing the environmental impact of fugitive releases, they should be interpreted with care. The high temperatures involved make the emitted fume very buoyant, and significant environmental releases can occur even though the work areas remain clear of fume.

Where moulds are water-cooled or no sand/binder systems are used, casting fume production is small and extraction, other than for hygiene requirements, may not be needed. Concentrations of pollutants will be low and arrestment will probably not be needed.

Table 3 of IPR 2/2 identifies the type of fume that will be released into the atmosphere from mould and core preparation, curing and subsequent casting.

Casting Practices

Summary of the activities

Static Sand Casting

This is the simplest technique whereby the sand moulds are arranged on the shop floor and filled from a ladle. The castings are then left to solidify. It is generally impracticable to have fixed extraction hoods and ductwork in the casting area. In more automated foundries the moulds may be moved by conveyor into the pouring position where local extraction can be employed.

Pipe Casting

Pipe casting is carried out by pouring hot metal from a ladle, via a tundish and runner into the rapidly rotating horizontal mould. The metal is forced out on to the inner cooling surface where it solidifies. The mould is stopped and the casting withdrawn.

Roll Casting

This can be carried out centrifugally or statically. In the centrifugal system the vertical mould is placed in a machine and spun at high speed while the hot metal is bottom poured into it. Some time after filling, the mould is lifted from the machine, and is left for several days before stripping. Fume extraction is normal on the machine although not in the cooling pit.

In the static system the mould is mounted vertically and bottom poured from the ladle. It remains stationary while it cools and solidifies. Typically no fume extraction is required.

Environmental impact

Water: Not significant

Land: Not significant

Air: Fume.

Waste: Slag

Energy: Not significant

Accidents: Not significant

Noise: Not significant

Application Form Question 2.3 (cont.)

Casting, pouring or moulding

With the Application the Operator should:

1. supply the general application requirements for Section 2.3 listed on page 20 for this aspect of the activities;

BAT for casting, pouring or moulding

Indicative BAT Requirements

- For certain types of casting operation, e.g. automotive castings and greensand foundries, and where a relatively large number of similar castings are being manufactured, BAT will normally include the use of a fixed pouring station with the moulds moving past on a conveyor belt system. Where possible, moulds should be totally enclosed or fully enclosed casting machines used. This will enable all the casting fume to be extracted efficiently and treated. Where there are significant fumes emitted after pouring then the conveyor should be enclosed and extracted.
- For large items such as rolls, machine tool beds, etc., it may be necessary to carry the hot metal in a ladle to a mould in a casting pit or casting bay. Here a movable or extendable extraction hood connected to fixed arrestment plant installed in the most advantageous position to collect casting fume should be considered.
- Where suction hoods are used, these should be placed as close to the sources of fume as possible to reduce dilution of the fumes caused by large volumes of air being drawn into the hoods. Suction hoods should not hinder process operations or compromise safety; considerations should be given to push–pull systems to improve efficiency.
- The effectiveness of hoods and extraction systems can be assessed using photographic systems to record the movement of emitted fume. Where optical photography is not practicable, infrared imaging may be an effective alternative.
- Part of the improvement programme to update operations should include a quantitative assessment of the emissions so that a further improvement programme can be established to reduce them if possible within BAT considerations. This is particularly important where an odour problem has occurred.

2.3.7 Knockout and reclamation

Knockout and reclamation

Knocking out or stripping is the practice of removing the casting from the mould. Smaller castings may be removed from the casting box manually or by use of a vibrating table which dislodges the casting from the box and allows any sand to fall through the open surface of the table. Dust from these operations is usually collected and cleaned by bag filters.

Large moulds will be broken up and castings removed in-situ, using an overhead crane or bucket excavator. Although large quantities of dust may be generated, local extraction and filtration is impractical. Pipes are removed from their rotary moulds by mechanical means. The sand from the knocking-out area is excavated, normally by mechanical digger and is either recycled or disposed of to landfill.

Environmental impact

Water: Not significant

Land: Contaminated sand

Air: During knockout the mould is broken open and the surface area from which organic compounds may be liberated is significantly increased. Pyrolysis products adsorbed onto the resin coated sand, such as phenols for example, volatilise, and are emitted to the foundry atmosphere. Formaldehyde will be present in the knockout section as it exists in the resin binder. Dust is emitted on which organic compounds may be adsorbed

Waste: Contaminated sand

Energy: Not significant

Accidents: Not significant

Noise: Many parts of the machine are very noisy and require acoustic shelters for worker protection. Standard noise protection measures should be taken to minimise disturbance in the local neighbourhood.

Application Form Question 2.3 (cont.) — Knock out and reclamation

With the Application the Operator should:

1. supply the general application requirements for Section 2.3 listed on page 20 for this aspect of the activities;

Indicative BAT Requirements

BAT for knock out and reclamation

Cooling of the mould before knockout reduces the mass of organics released.

- Knockout area should be enclosed and connected to arrestment plant. (cyclones not considered sufficient to be BAT).
- Knockout should not be done by hand.
- Fixed vacuum cleaning system around knockout area.

Sand reclamation

2.3.8 Sand reclamation

Used moulds can be broken down in ball mills and impeller or vibrating crushers. In some cases the castings and sand are put into vibratory crushers together in order to separate the castings from the sand.

An alternative method of reclaiming mould sand is by mixing with water and scrubbing the sand/water mixture in attrition cells using abrasion resistant high speed paddles. The sand must then be de-watered, dried and regraded. This method leads to an aqueous stream, which is avoided by other methods.

Summary of the activities

Thermal reclamation is used primarily for organic binder systems. It is used as a second stage, after mechanical reclamation, and achieves a high reclamation rate. The waste gases are burnt at 750EC to 800EC. Units of up to 5 tonnes/hr are in use usually employing a fluidised bed. An after-burning zone ensures that combustible gases are completely oxidised. After cooling, the gases should be cleaned by bag filtration before release to atmosphere.

Two other techniques are currently at the pilot plant stage and may be commercially available soon. The first involves plasma technology whereby the sand passes through a plasma arc with temperatures up to 3,000EC for a few milliseconds which volatilises the organic binders without altering the composition of the sand. The VOCs are ionised and, as the gas cools, react with the air to form CO_2 and water.

In a second development the use of a toroidal fluidised bed reactor which achieves a high degree of turbulent mixing and high processing rates and is also expected to yield a lower capital cost and reduced energy requirements compared with a conventional fluidised bed unit.

Environmental impact

Water: Not significant;

Land: Contaminated sand, fugitive dust;

Air: Fume, products of combustion;

Waste: Contaminated sand;

Energy: Afterburners are significant energy users, and temperature settings should be the minimum compatible with acceptable emission control;

Accidents: Not significant;

Noise: Many parts of the machine are very noisy and require acoustic shelters for worker protection. Standard noise protection measures should be taken to minimise disturbance in the local neighbourhood.

Application Form Question 2.3 (cont.) — Sand reclamation

With the Application the Operator should:

1. supply the general application requirements for Section 2.3 listed on page 20 for this aspect of the activities;

BAT for sand reclamation

Indicative BAT Requirements

The main control issues are:

- Use of afterburner followed by bag filtration of the waste gases when thermal reclamation used
- Effective and reliable temperature control systems on the afterburner

Fettling, dressing or finishing of castings

2.3.9 Fettling, dressing or finishing of castings

Summary of the activities

After the castings have cooled they are subjected to a number of finishing processes in order to obtain the final finish required for the product. These operations, some of which are referred to as fettling or dressing include:-

- Cleaning by shotblasting or other means to remove core and mould materials and scale.
- Removal of excess metal such as feeder heads, runner or gating systems and any other superfluous metal.
- Removal of blemishes and defects.
- Smoothing over of weldments, areas from which metal has been cut, and any other rough areas on the surface of the casting, generally be grinding.

Fettling is generally achieved by flame cutting, grinding or chiselling, and usually results in the generation of dust and fume. Small items may be finished by grinding in tumbling drums together with ceramic chips. This is usually carried out in water to which surfactants may be added. In the case of pipes the internal surface is dressed by extending a rotating grinding wheel or burr the full length of the pipe. Another method uses an electric arc to selectively remelt unwanted small areas of the casting.

Environmental impact

Water: **S**ludge where wet techniques are used.

Land: Fugitive dust

Air: Dust and Fume.

Waste: Collected dust

Energy: Not significant

Accidents: Not significant

Noise: Many of these processes are very noisy and require acoustic shelters for worker protection. Standard noise protection measures should be taken to minimise disturbance in the local neighbourhood.

Application Form Question 2.3 (cont.) → Fettling, dressing or finishing of castings

With the Application the Operator should:

1. supply the general application requirements for Section 2.3 listed on page 20 for this aspect of the activities;

BAT for fettling, dressing or finishing of castings

Indicative BAT Requirements

- Containment and extraction
- Effective means of detection for filter failure

Waste handling and recycling facilities

2.3.10 Waste handling and recycling facilities

Summary of the activities

The most important issues from waste handling and recycling facilities are as follows:

- Slag from ladles
- Collected dust
- Collected sludge
- Refractory waste

Environmental impact

Water:	Not significant
Land:	Slag, contaminated sand
Air:	Fume.
Waste:	Slag
Energy:	Not significant
Accidents:	Not significant
Noise:	Not significant

Application Form Question 2.3 (cont.) → Waste handling and recycling facilities

With the Application the Operator should:

1. supply the general application requirements for Section 2.3 listed on page 20 for this aspect of the activities;

BAT for waste handling and recycling facilities

Indicative BAT Requirements

The main control issues are:

- Water efficiency techniques should be employed - see Section 2.3.14.
- Waste should be recovered - see Section 2.6.

No further issues are identified.

Emissions to air

2.3.11 Control of point source emissions to air

Sources

The nature and source of the emissions expected from each activity is given in previous sections and will be confirmed in detail in the Operator's response to Section 3.1. In general they comprise:

- SO_X, NO_X, and CO_X from most foundry operations;
- particulates from sand handling, knocking out, finishing operations and sand reclamation;
- fume from launders and refining operations;
- ammonia, hydrogen sulphide, hydrogen cyanide, phenol, amines, other VOCs, and acid vapours from mixing and curing of bonding systems in mould and core preparation; also from knocking out and sand reclamation.
- solvents e.g. from carriers in formulated chemicals (e.g. release agents);
- odorous compounds from refining operations, from mould and core preparation and storage, from casting, pouring and moulding, from knocking out and from sand reclamation.

Cross-sectoral guidance on abatement techniques for point source emissions to air can be found in Ref. 11.

Abatement to air *cont.*

Application Form Question 2.3 (cont.)

Control of Point Source Emissions to Air

With the Application the Operator should:

1. supply the general application requirements for Section 2.3 on page 20 for control and abatement equipment; and in addition
2. describe measures taken to increase the reliability with which the required control and abatement performance is achieved.
3. where VOCs are released, identify the main chemical constituents of the emissions and provide an assessment of the fate of these chemicals in the environment.

Indicative BAT Requirements

1. The Operator should complete any detailed studies required into abatement or control options (see item 2 in Section 2.3) as an improvement condition to a timescale to be agreed with the Regulator but in any case within the timescale given in Section 1.1;
2. ***Steam plume elimination.*** Releases from wet scrubber vents should be hot enough to avoid visible plume formation in the vicinity of the vent. This is to prevent the condensation or adsorption of environmentally harmful substances by the condensing water vapour. Exhaust gases from a wet scrubber can be heated by the use of waste heat to raise the temperature of the exhaust gases and prevent immediate condensation on the exit from the vent. This procedure also aids the thermal buoyancy of the plume. Where there is no available waste heat and the vent contains no significant environmentally harmful substances, the Applicant may be able to demonstrate that the BAT criteria have nonetheless been met.

2.3.12 Abatement of point source emissions to surface water and sewer

Effluent treatment

The nature and source of the emissions expected from each activity is given in previous sections and will be confirmed in detail in the Operator's response to Section 3.1. In general, wastewater can arise from the process activity, from storm water, from cooling water, from accidental emissions of raw materials, products or waste materials, and from fire-fighting. In addition to the BREF and the techniques below, guidance on cost-effective effluent treatment techniques can be found in ETBPP Guides (Ref. 9).

Summary of the activities

The nature and source of the effluent from each activity in foundries is given in the preceding sections of 2.3. The amounts of process water used in foundries is small and comprises principally:-

- Discharge and blowdown from wet scrubbers;
- Cooling water, often containing biocides and anti-oxidants;
- Discharge from wet sand reclamation plant;
- Drum tumbling discharge containing metals and surfactants;
- Site drainage and stormwater;
- Leachate from slag and waste tips.

A wide variety of chemicals are also used in the core and mould preparation process and the effluent from reclamation will be a complex mixture.

Effluent treatment

Application Form Question 2.3 (cont.)

Effluent Treatment

With the Application the Operator should:

1. supply the general application requirements for Section 2.3 on page 20 to prevent or reduce point source emissions to water and land; and in addition,
2. include, where appropriate, off site treatment in the description of the wastewater treatment system for the activity;
3. provide, where effluent is discharged, a justification for not cleaning the effluent to a level at which it can be reused (e.g. by ultrafiltration where appropriate);
4. describe measures taken to increase the reliability with which the required control and abatement performance is delivered (heavy metals are measured only occasionally – what techniques ensure that they are controlled all the time? etc.);
5. identify the main chemical constituents of the treated effluent (including the make-up of the COD) and assessment of the fate of these chemicals in the environment. These steps will be carried out as in response to Sections 3.1 and 4.1 but need to be understood here in order to demonstrate that the controls are adequate. This applies whether treatment is on- or off-site;
6. identify the toxicity of the treated effluent (see Section 2.10). Until the Regulator's toxicity guidance is available, this should, unless already in hand, normally be carried out as part of an improvement programme;
7. where there are harmful substances or levels of residual toxicity, identify the causes of the toxicity and the techniques proposed to reduce the potential impacts;
8. consider whether the effluent flow is sufficient to fall within the requirements of the Urban Waste Water Treatment Directive.

Indicative BAT Requirements

BAT for effluent

1. The Operator should complete any detailed studies required into abatement or control options (see item 2 in Section 2.3) as an improvement condition to a timescale to be agreed with the Regulator but in any case within the timescale given in Section 1.1;
2. The following general principles should be applied in sequence to control emissions to water:
   - water use should be minimised and wastewater reused or recycled (see Section 2.2.3);
   - contamination risk of process or surface water should be minimised (see Section 2.3.14);
   - ultimately, surplus water is likely to need treatment to meet the requirements of BAT (and statutory and non-statutory objectives). Generally, effluent streams should be kept separate as treatment will be more efficient. However, the properties of dissimilar waste streams should be used where possible to avoid adding further chemicals, e.g. neutralising waste acid and alkaline streams. Also, biological treatment can occasionally be inhibited by concentrated streams, while dilution, by mixing streams, can assist treatment;
   - systems should be engineered to avoid effluent by-passing the treatment plant.
3. All emissions should be controlled, as a minimum, to avoid a breach of water quality standards (see Sections 3.2 and 5.1) but noting that where BAT can deliver prevention or reduction at reasonable cost it should do so (see Section 1.1). Calculations and/or modelling to demonstrate this will be carried out in response to Section 5.1.
4. With regard to BOD, the nature of the receiving water should be taken into account. However, in IPPC the prevention or reduction of BOD is also subject to BAT and further reductions which can be made at reasonable cost should be carried out. Furthermore, irrespective of the receiving water, the adequacy of the plant to minimise the emission of specific persistent harmful substances must also be considered. Guidance on treatment of persistent substances can be found in References (see Ref. 12).

Cont.

Effluent treatment *Cont.*

5. Where effluent is treated off-site at a sewage treatment works, the above factors apply in particular demonstrating that:
   - the treatment provided at the sewage treatment works is as good as would be achieved if the emission was treated on-site, based on reduction of load (not concentration) of each substance to the receiving water;
   - the probability of sewer bypass, via storm/emergency overflows or at intermediate sewage pumping stations, is acceptably low;
   - action plans in the event of bypass, e.g. knowing when bypass is occurring, rescheduling activities such as cleaning or even shutting down when bypass is occurring;
   - a suitable monitoring programme is in place for emissions to sewer, taking into consideration the potential inhibition of any downstream biological processes and actions plan for any such event.
6. Minimising the use of water and minimising the level of pollutants in each water stream are the primary aims followed by the recycling of waste water streams wherever possible. In this industry cleaning the water to 35 mg/l of suspended solids is likely to ensure that most of the insoluble pollutants will be within their normal limits. Such cleaned water would generally be of good quality and should be considered for recycling - however it is also important to consider the levels of dissolved chemicals before concluding that recycling of the water is viable.
7. For furnace gas cleaning, dry filtration systems eliminate potential waste water streams, however with a wet cleaning system there is no need for an aqueous discharge if appropriate measures are taken to clean the water and recycle it. As long as solids are removed to a level acceptable to the scrubbing device solubles can normally be allowed to reach saturation without any adverse effects. There are a variety of techniques, or combination thereof, which would adequately separate the solids - e.g. multistage separation, flocculation, chemical precipitation, hydrocyclones, sand filtration, filter pressing.
8. Having taken all steps to minimise the use of organic solvents, binders and chlorinated release agents, VOCs can be destroyed by incineration, and this would be BAT for a new process. It would also be acceptable to use scrubbing as long as there is no release of liquor to the environment, the liquor being cleaned and recycled. For an existing plant every effort should be made to prevent and minimise the waste water stream.
9. Run-off from all open areas, but in particular from raw materials stocking areas, will contain suspended solids which will have to be removed by settlement or other techniques. Oil interceptors may be necessary in drainage from scrap handling areas. Drainage sumps should be of sufficient size to handle storm water and should be designed to accommodate storm surge in order to prevent carry-over of unsettled material.
10. Bunding is a sensible precaution in all but the most trivial cases eg. dilute non-hazardous aqueous solutions. It is essential in many cases where there is a risk to controlled waters, sewers and drains, and on-site effluent treatment plants. Shared bunds are possible in cases where the materials stored are not incompatible. Bund capacities should always exceed the volume of the largest storage by a minimum of 10%.
11. High level alarms and trips on storage tanks should be designed to an appropriate integrity and tested regularly. The integrity of storage tanks and bunds should also be regularly inspected, particularly where corrosive substances are involved, requiring well managed and documented inspections. Procedures for preventing the unauthorised discharges or leakages from bunds should be in place. Where it is considered inappropriate to bund a particular storage tank or process vessel then the applicant must justify this approach.

Fugitives

2.3.13 Control of fugitive emissions to air

On many installations fugitive, or diffuse, emissions may be more significant than point source emissions. Common examples of the sources of fugitive emissions are:

- storage areas (e.g. bays, stockpiles, lagoons etc.);
- the loading and unloading of transport containers;
- transferring material from one vessel to another (e.g. furnace, ladle, reactors, silos);
- conveyor systems;
- pipework and ductwork systems (e.g. pumps, valves, flanges, catchpots, drains, inspection hatches etc.);
- poor building containment and extraction;
- potential for bypass of abatement equipment (to air or water);
- accidental loss of containment from failed plant and equipment including leakage eg. from mould and core preparation plant;.

Application Form Question 2.3 (cont.) — Fugitive emissions to air

With the Application the Operator should:

1. supply the general application requirements for Section 2.3 on page 20 for control of fugitive emissions to air; and in addition,
2. identify, and where possible, quantify significant fugitive emissions to air from all relevant sources, including those below, estimating the proportion of total emissions which are attributable to fugitive releases for each substance; these steps will be carried out as in response to Section 3.1 but need to be understood here in order to demonstrate that the controls are adequate.

- Handling of molten metals - Handling of dusty materials - Process sources such as refining, pouring and casting fumes - Finishing (dust)	- Wastewater treatment (odour) - Handling odorous raw materials Bag house dust - Storage silos

Indicative BAT Requirements

1. The Operator should complete any detailed studies required into abatement or control options (see item 2 in Section 2.3) as an improvement condition to a timescale to be agreed with the Regulator but in any case within the timescale given in Section 1.1.
2. Where there are opportunities for reductions, the Permit may require the updated inventory of fugitive emissions to be submitted on a regular basis.
3. ***Dust*** - The following general techniques should be employed where appropriate:
   - covering of skips and vessels;
   - avoidance of outdoor or uncovered stockpiles (where possible);
   - where unavoidable, use of sprays, binders, stockpile management techniques, windbreaks etc.;
   - wheel and road cleaning (avoiding transfer of pollution to water and wind blow);
   - closed conveyors, pneumatic conveying (noting the higher energy needs), minimising drops;
   - regular housekeeping.
4. VOCs
   - When transferring volatile liquids, the following techniques should be employed – subsurface filling via filling pipes extended to the bottom of the container, the use of vapour balance lines that transfer the vapour from the container being filled to the one being emptied, or an enclosed system with extraction to suitable abatement plant.
   - Vent systems should be chosen to minimise breathing emissions (e.g. pressure/vacuum valves) and, where relevant, should be fitted with knock-out pots and appropriate abatement equipment.
5. ***Odour -*** See Section 2.3.15.

Fugitives

2.3.14 Control of fugitive emissions to surface water, sewer and groundwater

Application Form Question 2.3 (cont.) → Fugitive Emissions to Water

With the Application the Operator should:

1. supply the general application requirements for Section 2.3 on page 20 for control of fugitive emissions to water; and in addition,
2. identify, and where possible, quantify significant fugitive emissions to water from all relevant sources, estimating the proportion of total emissions which are attributable to fugitive releases for each substance; These steps will be carried out as in response to Section 3.1 but need to be understood here in order to demonstrate that the controls are adequate.

Indicative BAT Requirements

1. Where there are opportunities for reductions, the Permit may require the updated inventory of fugitive emissions to be submitted on a regular basis.
2. ***Subsurface structures – the Operator should:***
   - establish and record the routing of all installation drains and subsurface pipework;
   - identify all subsurface sumps and storage vessels;
   - engineer systems to ensure leakages from pipes etc are minimised and where these occur, can be readily detected, particularly where hazardous (e.g. listed) substances are involved;
   - provide in particular, secondary containment and/or leakage detection for such subsurface pipework, sumps and storage vessels;
   - establish an inspection and maintenance programme for all subsurface structures, e.g. pressure tests, leak tests, material thickness checks or CCTV.
3. Surfacing – the Operator should:
   - describe the design(#),and condition of the surfacing of all operational areas;
   - have an inspection and maintenance programme of impervious surfaces and containment kerbs;
   - justify where operational areas have not been equipped with:
     - an impervious surface;
     - spill containment kerbs;
     - sealed construction joints;
     - connection to a sealed drainage system.

   (# Relevant information may include as appropriate: capacities; thicknesses; falls; material; permeability; strength/reinforcement; resistance to chemical attack; inspection and maintenance procedures; and quality assurance procedures.)
4. Bunds
   All tanks containing liquids whose spillage could be harmful to the environment should be bunded. For further information on bund sizing and design, see Ref. 12. Bunds should:
   - be impermeable and resistant to the stored materials;
   - have no outlet (i.e. no drains or taps) and drain to a blind collection point;
   - have pipework routed within bunded areas with no penetration of contained surfaces;
   - be designed to catch leaks from tanks or fittings;
   - have a capacity which is the greater of 110% of the largest tank or 25% of the total tankage;
   - be subject to regular visual inspection and any contents pumped out or otherwise removed under manual control after checking for contamination;
   - where not frequently inspected, be fitted with a high-level probe and an alarm as appropriate;
   - have fill points within the bund where possible or otherwise provide adequate containment;
   - have a routine programmed inspection of bunds, (normally visual but extending to water testing where structural integrity is in doubt).

Odour

2.3.15 Odour

Application Form Question 2.3 (cont.)

Odour control

With the Application the Operator should:

1. supply the general application requirements for Section 2.3 on page 20 for odour control; and in addition, where odour could potentially be a problem, the Operator should:
2. ***categorise the emissions as follows:***
   - ***a.*** ***a high level release which is expected to be acknowledged in the Permit*** – i.e. there will be an allowed release from the process (e.g. An odorous release from a stack or high level scrubber) and an element of BAT is adequate dispersion between source and receptor to prevent odour nuisance. The release will be allowed under the Permit but it is acknowledged that, under certain conditions, the plume may ground causing odour problems. Conditions in Permits are likely to be based on the actions to take when such events occur.
   - ***b.*** ***release should be preventable*** – i.e. releases can normally be contained within the site boundary by using BAT such as containment, good practice or odour abatement.
   - ***c.*** ***release is not preventable under all circumstances*** e.g. from a landfill or uncovered effluent treatment plant but potential problems are controlled by a programme of good practice measures;
3. for each relevant category, demonstrate that there will not be an odour problem from the emissions under normal conditions (see odour guidance).
4. for each relevant category, identify the actions to be taken in the event of abnormal events or conditions which might lead to odour, or potential odour problems (see odour guidance).
5. describe the current or proposed position with regard to any techniques given below or in Ref. 23.

Indicative BAT Requirements

1. The requirements for odour control will be sector specific and dependant upon the sources and nature of the potential odour. In general terms:
   - where odour can be contained, for example within buildings, the Operator should ensure that the maintenance of the containment and the management of the operations are such as to prevent its release at all times;
   - Where odour releases are permitted, (see examples above):
     - for new installations or significant changes, the releases should be modelled to demonstrate a low frequency of ground level concentrations above the odour threshold (or other threshold of acceptability). For occasions where weather conditions or other incidents are liable, in the view of the Regulator, to cause exceedances of the threshold of acceptability, the Operator should take appropriate and timely action, including shutting down the operations, to prevent further annoyance,
     - for existing installations, the same principle applies, except that where experience shows there to be no odour problem such modelling and actions will not be necessary.
2. For complex installations, for example where there are a number of potential sources of odorous releases or where there is an extensive programme of improvements to bring odour under control, an odour management plan should be maintained. The Regulator may incorporate the odour management plan in the Permit.
3. The dispersal of odours during casting, cooling and knocking-out is associated with large volumes of air which makes collection and treatment difficult. The use of inorganic bonds such as sodium silicate will substantially reduce emissions, whilst odorous products of pyrolysis may vary according to the type of organic bonding agent used. A tall stack may moderate nuisance in the locality. No totally effective proven method of eliminating foundry generated smells is known to be currently available. Wet bioscrubbers and dry bacterial beds are another alternative.

Groundwater

2.4 Emissions to Groundwater

Groundwater protection legislation

The Groundwater Regulations for the UK came into force on 1 April 1999. An IPPC Permit will be subject to the following requirements under these Regulations.

i. It shall not be granted at all if it would permit the direct discharge of a List I substance (Regulation 4(1)) (except in limited circumstances – see note 1 below).

ii. If the Permit allows the disposal of a List I substance or any other activity which might lead to an indirect discharge (see note 2 below) of a List I substance then **prior investigation** (as defined in Regulation 7) is required and the Permit shall not be granted if this reveals that indirect discharges of List I substances would occur and in any event conditions to secure prevention of such discharges must be imposed (Regulation 4(2) and (3)).

iii. In the case of List II substances, Permits allowing direct discharges or possible indirect discharges cannot be granted unless there has been a prior investigation and conditions must be imposed to prevent groundwater pollution (Regulation 5).

iv. The Regulations contain further detailed provisions covering **surveillance** of groundwater (Regulation 8); conditions required when direct discharges are permitted (Regulation 9); when indirect discharges are permitted (Regulation 10); and review periods and compliance (Regulation 11).

The principles, powers and responsibilities for groundwater protection in England and Wales, together with the Agency's policies in this regard, are outlined in the Environment Agency's document "*Policy and Practice for the Protection of Groundwater*"(PPPG) (see Ref. 24). This outlines the concepts of vulnerability and risk and the likely acceptability from the Agency's viewpoint of certain activities within groundwater protection zones.

A **Prior investigation** of the potential effect on groundwater of on-site disposal activities or discharges to groundwater. Such investigations will vary from case to case, but the Regulator is likely to require a map of the proposed disposal area; a description of the underlying geology, hydrogeology and soil type, including the depth of saturated zone and quality of groundwater; the proximity of the site to any surface waters and abstraction points, and the relationship between ground and surface waters; the composition and volume of waste to be disposed of; and the rate of planned disposal.

B **Surveillance** - this will also vary from case to case, but will include monitoring of groundwater quality and ensuring the necessary precautions to prevent groundwater pollution are being undertaken.

Note 1 The Regulations state that, subject to certain conditions, the discharges of List I substances to groundwater may be authorised if the groundwater is "permanently unsuitable for other uses". Advice must be sought from the Regulator where this is being considered as a justification for such discharges.

Note 2 List I and List II refer to the list in the Groundwater Regulations and should not be confused with the similar lists in the Dangerous Substances Directive.

Application Form Question 2.4

Identify if there may be a discharge of any List I or List II substances and if any are identified, explain how the requirements of the Groundwater Regulations 1998 have been addressed.

Meeting the requirements of the Groundwater Regulations

With the Application the Operator should:

1. confirm that there are no direct or indirect emissions to groundwater of List I or List II substances from the installation, or
2. where there are such releases, provide the information and surveillance arrangements described in A and B above.

Under these Regulations the Permit may not be granted if the situation is not satisfactory, therefore, with the application, the Operator should supply information on list I and list II substances and if necessary, prior investigation and surveillance information:

Cont.

Groundwater

List I and List II substances

List I

1.-(1) Subject to sub-paragraph (2) below, a substance is in list I if it belongs to one of the following families or groups of substances-

(a) organohalogen compounds and substances which may form such compounds in the aquatic environment;

(b) organophosphorus compounds;

(c) organotin compounds;

(d) substances which possess carcinogenic, mutagenic or teratogenic properties in or via the aquatic environment (including substances which have those properties which would otherwise be in list II);

(e) mercury and its compounds;

(f) cadmium and its compounds;

(g) mineral oils and hydrocarbons;

(h) cyanides.

2. A substance is not in list I if it has been determined by the Agency to be inappropriate to list I on the basis of a low risk of toxicity, persistence and bioaccumulation.

List II

1.-(1) A substance is in list II if it could have a harmful effect on groundwater and it belongs to one of the families or groups of substances:

(a) the following metalloids and metals and their compounds:

Zinc	Tin	Copper
Barium	Nickel	Beryllium
Chromium	Boron	Lead
Uranium	Selenium	Vanadium
Arsenic	Cobalt	Antimony
Thallium	Molybdenum	Tellurium
Titanium	Silver	

(b) biocides and their derivatives not appearing in list I;

(c) substances which have a deleterious effect on the taste or odour of groundwater, and compounds liable to cause the formation of such substances in such water and to render it unfit for human consumption;

(d) toxic or persistent organic compounds of silicon, and substances which may cause the formation of such compounds in water, excluding those which are biologically harmless or are rapidly converted in water into harmless substances;

(e) inorganic compounds of phosphorus and elemental phosphorus;

(f) fluorides;

(g) ammonia and nitrites

(2) A substance is also in list II if-

(a) it belongs to one of the families or groups of substances set out in paragraph 1(1) above;

(b) it has been determined by the Agency to be inappropriate to list I under paragraph 1(2); and

(c) it has been determined by the Agency to be appropriate to list II having regard to toxicity, persistence and bioaccumulation.

3.-(1) The Secretary of State may review any decision of the Agency in relation to the exercise of its powers under paragraph 1(2) or 2 (2).

3.-(2) The Secretary of State shall notify the Agency of his decision following a review under sub-paragraph (1) above and it shall be the duty of the Agency to give effect to that decision.

4.- The Agency shall from time to time publish a summary of the effect of its determinations under this Schedule in such manner as it considers appropriate and shall make copies of any such summary available to the public free of charge.

Waste Handling

2.5 Waste Handling

The normal nature and source of the waste from each activity is given in Section 2.3 and will be confirmed in detail in the Operator's response to Section 3.1. In general the waste streams comprise:

- raw material dusts collected in bag or cartridge filters;
- launder and ladle gas cleaning dust and sludge;
- slag from ladles;
- casting dust and fume collected in filter plant;
- fettling waste;
- scrubber liquors and sludges and the ETP (Section 2.3.12);
- refractory waste from launders and ladles;
- sand
- chemical containers and general inert industrial waste.

Application Form Question 2.5

Characterise and quantify each waste stream and describe the proposed measures for waste management storage and handling.

With the Application the Operator should:

1. identify and quantify the waste streams;
2. identify the current or proposed handling arrangements;
3. describe the current or proposed position with regard to the techniques below or any others which are pertinent to the installation;
4. demonstrate that the proposals are BAT, by confirming compliance with the indicative requirements, by justifying departures (as described in Section 1.2 and in the Guide for Applicants) or alternative measures.

Indicative BAT Requirements

1. A system should be maintained to record the quantity, nature, origin and where relevant, the destination, frequency of collection, mode of transport and treatment method of any waste which is disposed of or recovered.
2. Wherever practicable, waste should be segregated and the disposal route identified which should be as close to the point of production as possible.
3. Records should be maintained of any waste that is sent off-site (Duty of Care).
4. Storage areas should be located away from watercourses and sensitive boundaries e.g. adjacent to areas of public use and protected against vandalism.
5. Storage areas should be clearly marked and signed and containers should be clearly labelled.
6. The maximum storage capacity of storage areas should be stated and not exceeded. The maximum storage period for containers should be specified.
7. Appropriate storage facilities should be provided for special requirements such as for substances that are flammable, sensitive to heat or light etc., and incompatible waste types should be kept separate.
8. Containers should be stored with lids, caps and valves secured and in place. This also applies to emptied containers.
9. Storage containers, drums etc. should be regularly inspected.
10. Procedures should be in place to deal with damaged or leaking containers.
11. All appropriate steps to prevent emissions (e.g. liquids, dust, VOCs and odour) from storage or handling should be taken (see Sections 2.3.13, 2.3.14 and 2.3.15).

Waste Recovery or Disposal

2.6 Waste Recovery or Disposal

The Regulations require the Regulator, in setting Permit conditions, to take account of certain general principles including that the installation in question should be operated in such a way that "waste production is avoided in accordance with Council Directive 75/442/EEC on waste; and where waste is produced it is recovered, or where this is technically or economically impossible it is disposed of, while avoiding or reducing the impact on the environment". The objectives of the National Waste Strategies should also be considered.

In order to meet this requirement the Regulator needs Operators to provide the information below.

Application Form Question 2.6

Describe how each waste stream is proposed to be recovered or disposed of. If you propose any disposal, explain why recovery is technically and economically impossible and describe the measures planned to avoid or reduce any impact on the environment.

With the Application the Operator should:

1. describe, in respect of each waste stream produced by the installation, whether the waste in question is to be recovered or disposed of, and if a disposal option is planned, to justify why recovery is "technically and economically impossible" together with "the measures planned to avoid or reduce any impact on the environment";
2. include in the description, the Operator's view as to whether waste disposal is likely to be restricted by the implementation of the Landfill Directive;
3. describe the current or proposed position with regard to the techniques below or any others which are pertinent to the installation;
4. demonstrate that the proposals are BAT, by confirming compliance with the indicative requirements, by justifying departures (as described in Section 1.2 and in the Guide for Applicants) or alternative measures;

Indicative BAT Requirements

1. Unless agreed with the Regulator to be inappropriate, the Operator should provide a detailed assessment identifying the best practicable environmental options for waste disposal. For existing activities, this may be carried out as an improvement condition to a timescale to be approved by the Regulator.
2. Where landfill is the only option it should be noted that, particularly when high in fillers, sludge does not readily de-water and can cause serious problems in landfill sites.
3. Table 2-2 summarises the routes of the various waste streams from a typical foundry site. Whether recycling is possible at a particular site will depend on the particular fuels and raw materials being used, the products being made and the methods of operation employed. The table reflects where recycling can be achieved when the appropriate combination of these factors can be arranged.
4. Operators should identify all of the dusts, sludges and slags arising from the process, identify their content, whether they are recycled and, if not, the steps which would need to be taken in order to recycle the wastes, including any economic factors which need to be taken into account.
5. Where sludge has to be landfilled, consideration should be given to what will happen to the water. In many plants the sludge is de-watered to produce a cake with about 20% moisture content.
6. The application should identify the species likely to be present in releases to land from a knowledge of the process and process metallurgy, validated as necessary by the appropriate analytical techniques.

Cont.

Table 2-2 Solid waste stream routes

PROCESS	WASTE STREAM
Raw material bag filters	Recycled
Desulphurisation: collected dusts	Landfill - not suitable for recycling
slag	Landfill - not suitable for recycling
Sand	Recycled wherever possible
Nodularisation dust - primarily magnesium oxide	Recycling to be investigated - else to landfill
Filter casting dust and fume a) leaded	To landfill as special precautions waste
b) unleaded	Low tramp content permits recycling
Fettling waste	Recycled to furnace, where significant
Refractory waste	Landfill
Scrubber liquors and sludges	Minimised then to licensed waste disposal contractors

Energy

2.7 Energy

BAT for energy efficiency under the PPC Regulations will be satisfied provided the Operator meets the following conditions:

either

- the Operator meets the basic energy requirements in sections 2.7.1 and 2.7.2 below and is a participant to a Climate Change Agreement (CCA) or Trading Agreement with the government

or

- the Operator meets the basic energy requirements in sections 2.7.1 and 2.7.2 below and the further sector-specific energy requirements in section 2.7.3 below.

Note that even where a Climate Change Agreement or Trading Agreement is in place, this does not preclude the consideration of energy efficiency as part of an integrated assessment of Best Available Techniques in which it may be balanced against other emissions.

Further guidance is given in the Energy Efficiency Guidance Note (Ref. 14).

2.7.1 Basic energy requirements (1)

Application Form Question 2.7 (part 1)

Provide a breakdown of the energy consumption and generation by source and the associated environmental emissions.

The requirements of this section are basic, low cost, energy standards which apply whether or not a Climate Change Agreement or Trading Agreement is in force for the installation.

With the Application the Operator should:

1. **provide the following Energy consumption information**:

   Energy consumption information should be provided in terms of delivered energy and also, in the case of electricity, converted to primary energy consumption. For the public electricity supply, a conversion factor of 2.6 should be used. Where applicable, the use of factors derived from on-site heat and/or power generation, or from direct (non-grid) suppliers should be used. In the latter cases, the Applicant shall provide details of such factors. Where energy is exported from the installation, the Applicant should also provide this information. An example of the format in which this information should be presented is given in Table 2.1 below. The Operator should also supplement this information with energy flow diagrams (e.g. "Sankey" diagrams or energy balances) showing how the energy is used throughout the process.

   (Note that the Permit will require energy consumption information to be submitted annually)

Table 2.1 - Example breakdown of delivered and primary energy consumption

Energy source	Energy consumption		
	Delivered, MWh	Primary, MWh	% of total
Electricity*			
Gas			
Oil			
Other (Operator to specify)			

* specify source.

2. **provide the following Specific Energy Consumption information**

   The Operator should define and calculate the specific energy consumption of the activity (or activities) based on primary energy consumption for the products or raw material inputs which most closely match the main purpose or production capacity of the installation. The Operator should provide a comparison of Specific Energy Consumption against any relevant benchmarks available for the sector.

3. **provide associated environmental emissions**

   This is dealt with in the Operator's response to Section 3.1.

Energy Continued

2.7.2 Basic energy requirements (2)

Application Form Question 2.7 (part 2)

Describe the proposed measures for improvement of energy efficiency.

The requirements of this section are basic, low cost, energy standards which apply whether or not Climate Change Agreement or Trading Agreement is in force for the installation.

With the Application the Operator should:

1. describe the current or proposed position with regard to the **basic, low cost energy requirements** below, and provide justifications for not using any of the techniques described;
2. provide an energy efficiency plan which appraises the costs and benefits of different energy options as described below.

Basic Energy Requirements

1. ***Operating, maintenance and housekeeping measures*** should be in place in the following areas, according to the checklists provided in Appendix 2 of the IPPC Energy Efficiency Guidance Note, where relevant:

- air conditioning, process refrigeration and cooling systems (leaks, seals, temperature control, evaporator/condenser maintenance);
- operation of motors and drives;
- compressed gas systems (leaks, procedures for use);
- steam distribution systems (leaks, traps, insulation);
- space heating and hot water systems;
- lubrication to avoid high friction losses;
- boiler maintenance e.g. optimising excess air;
- other maintenance relevant to the activities within the installation.

2. ***Basic, low cost, physical techniques*** should be in place to avoid gross inefficiencies; to include insulation, containment methods, (e.g. seals and self-closing doors) and avoidance of unnecessary discharge of heated water or air (e.g. by fitting simple control systems).

3. ***Building services energy efficiency techniques*** should be in place to deliver the requirements of the Building Services Section of the Energy Efficiency Guidance Note. For energy-intensive industries these issues may be of minor impact and should not distract effort ***from*** the major energy issues. They should nonetheless find a place in the programme, particularly where they constitute more than 5% of the total energy consumption.

4. ***Provide an energy efficiency plan*** which:

- identifies all techniques relevant to the installation, including those listed below and in Section 2.7.3;
- identifies the extent to which these have been employed;
- prioritises the applicable techniques according to the appraisal method provided in the Energy Efficiency Guidance Note which includes advice on appropriate discount rates, plant life etc.;
- identifies any techniques that could lead to other adverse environmental impacts, thereby requiring further assessment (e.g. according to methodology, see Ref. 6).

Where other appraisal methodologies have been used, state the method, and provide evidence that appropriate discount rates, asset life and expenditure (£/t) criteria have been employed.

This should be submitted in a summary format similar to the example below, together with supporting information from any appraisal procedure carried out. The plan is required to ensure that the Operator has considered all relevant techniques. **However, where a Climate Change Agreement or Trading Agreement is in place the Regulator will only enforce implementation of those measures in categories 1-3 above**.

Cont.

Table 2-3
Example Format for Energy Efficiency Measures

Energy efficiency option	NPV £k	CO_2 savings (tonnes)		NPV/CO_2 saved £/tonne	Priority* for implementation
		annual	lifetime		
7MW CHP plant	1,372	13,500	135,000	10	high
High efficiency motor	0.5	2	14	35	medium
Compressed air	n/a	5	n/a	n/a	immediate

* Indicative only, based on cost/benefit appraisal:

Where a Climate Change Agreement or Trading Agreement is in place, the Energy Efficiency Plan should be submitted as an improvement condition to a timescale to be agreed with the Regulator but in any case within the timescale given in Section 1.1.

5. ***Energy management techniques*** should be in place, according to the requirements of Section 2.1 noting, in particular, the need for monitoring of energy flows and targeting of areas for reductions.

Indicative BAT Requirements

BAT for energy

1. ***Operating, maintenance and housekeeping measures*** should be in place, according to the checklists provided in Appendix 3 of the Energy Efficiency Guidance Note, in the following areas as applicable:
   - air conditioning, process refrigeration and cooling systems (leaks, seals, temperature control, evaporator/condenser maintenance);
   - operation of motors and drives;
   - compressed gas systems (leaks, procedures for use);
   - steam distribution systems (leaks, traps, insulation);
   - space heating and hot water systems;
   - lubrication to avoid high friction losses;
   - boiler maintenance e.g. optimising excess air;
   - other maintenance relevant to the activities within the installation.
2. ***Basic, low cost, physical techniques*** should be in place to avoid gross inefficiencies; to include insulation, containment methods, (e.g. seals and self-closing doors) and avoidance of unnecessary discharge of heated water or air (e.g. by fitting simple control systems).
3. ***Building services*** energy efficiency techniques should be in place to deliver the requirements of the Building Services Section of the Energy Efficiency Guidance Note. For energy-intensive industries these issues may be of minor impact and should not distract effort ***from*** the major energy issues. They should nonetheless find a place in the programme, particularly where they constitute more than 5% of the total energy consumption.
4. ***Energy management techniques*** should be in place, according to the requirements of Section 2.1 noting, in particular, the need for monitoring of energy flows and targeting of areas for reductions.

2.7.3 Further energy efficiency requirements

Application Form Question 2.7 (part 3)

Describe the proposed measures for improvement of energy efficiency…..(only where the installation is <u>not</u> the subject of a Climate Change Agreement or Trading Agreement).

Where there is no Climate Change Agreement or Trading Agreement in place, the Operator should demonstrate the degree to which the further energy efficiency measures identified in the implementation plan, including those below, have been taken into consideration for this sector and justify where they have not.

With the Application the Operator should:

1. identify which of the measures below are applicable to the activities, and include them in the appraisal for the energy efficiency plan in section 2.7.2.
2. describe the current or proposed position with regard to the techniques below, or any others which are pertinent to the installation;
3. demonstrate that the proposals are BAT, by confirming compliance with the indicative requirements, by justifying departures (as described in Section 1.2 and in the Guide for Applicants) or alternative measures;

Indicative BAT Requirements

BAT for energy

BREF Sections: 4.3.9, 5.3.7, 6.3.8

The following techniques should be implemented where they are judged to be BAT based on a cost/benefit appraisal according to the methodology provided in Appendix 4 of the Energy Efficiency Guidance note (Ref. 14).

1. Energy efficiency techniques

Within IPPC it is valid to consider both the emission of direct (heat and emissions from on-site generation) and indirect (emissions from a remote power station) pollution when considering options for energy efficiency.

The following techniques are applicable in this sector. Further information will be found in (Ref. 14).

- heat recovery from different parts of the processes;
- high efficiency dewatering techniques to minimise drying energy;
- minimisation of water use and closed circulating water systems;
- good insulation;
- plant layout to reduce pumping distances;
- phase optimisation of electronic control motors;
- using spent cooling water (which is raised in temperature) in order to recover the heat;
- belt conveying instead of pneumatic (although this must be balanced against higher potential for fugitive releases);
- optimised efficiency measures for combustion plant e.g. air/feedwater preheating, excess air etc.;
- continuous processing instead of batch processes.

Note to Authors: Continue with sector specific techniques (see pulp and paper and other notes for examples)

2. Energy supply techniques

- use of CHP;
- recovery of energy from waste;
- use of less polluting fuels.

Cont.

BAT for energy (cont,)

Irrespective of whether a Climate Change Agreement or Trading Agreement is in place, where there are other BAT considerations involved, such as:

- the choice of fuel impacts upon emissions other than carbon e.g. sulphur in fuel;
- where the potential minimisation of waste emissions by recovery of energy from waste conflicts with energy efficiency requirements;
- the Operator should provide justification that the proposed or current situation represents BAT.

Where there is an on-site combustion plant other guidance is also relevant. For plants greater than 50MW, Operators should consult the IPPC guidance on power generation (reference S2 1.01 and supplement S31.01) and the Operators of plant of 20-50MW should consult the Local Authority Air Pollution Control guidance. On IPPC installations this guidance will be generally applicable to plant under 20MW also. For incineration plant S2.501 Waste Incineration should be consulted.

2.8 Accidents and their Consequences

Guidance

IPPC requires as a general principle that necessary measures should be taken to prevent accidents which may have environmental consequences, and to limit those consequences. This section covers general areas of any installation operations which have the potential for accidental emission.

Some installations will also be subject to the Control of Major Accident Hazards Regulations 1999 (COMAH) (see Appendix 2 for equivalent legislation in Scotland and Northern Ireland). There is an element of overlap between IPPC and COMAH and it is recognised that some systems and information for both regimes may be interchangeable.

The COMAH regime applies to major hazards. For accident aspects covered by COMAH, reference should be made to any reports already held by the Regulator. However, the accident provisions under IPPC may fall beneath the threshold for major accident classification under COMAH and therefore consideration should be given to smaller accidents and incidents as well. Guidance (see Ref. 19), prepared in support of the COMAH Regulations may also be of help to IPPC Operators (whether or not they are covered by the COMAH regime), in considering ways to reduce the risks and consequences of accident.

General management requirements are covered in Section 2.1. For accident management, there are three particular components:

- **identification of the hazards** posed by the installation/activity;
- **assessment of the risks** (hazard x probability) of accidents and their possible consequences;
- implementation of **measures to reduce the risks** of accidents, and contingency plans for any accidents that occur.

Application Form Question 2.8

Describe your documented system that you proposed to be used to identify, assess and minimise the environmental risks and hazards of accidents and their consequences.

With the Application the Operator should:

1. provide the accident management plan described in the indicative BAT requirements below describing the current or proposed position with regard to the techniques listed below or any others which are pertinent to the installation;
2. demonstrate that the proposals are BAT, by confirming compliance with the indicative requirements, by justifying departures (as described in Section 1.2 and in the Guide for Applicants) or alternative measures;
3. identify any issues which may be critical.

Indicative BAT Requirements

BAT for control of accidents

1. A structured accident management plan should be submitted to the Regulator which should:
   - ***a.*** ***identify the hazards*** to the environment posed by the installation. Particular areas to consider may include, but should not be limited to, the following:
     - transfer of substances (e.g. loading or unloading from or to silos or storage tanks);
     - overfilling of silos or tanks;
     - failure of plant and/or equipment (e.g. extraction fans or pumps, over-pressure of storage silos and pipework, blocked drains);
     - failure of containment (e.g. bund and/or overfilling of drainage sumps);
     - fires and problems arising from fighting fires such as failure to contain firewaters;
     - making the wrong connections in drains or other systems;
     - preventing incompatible substances coming into contact;
     - unwanted reactions and/or runaway reactions;
     - emission of an effluent before adequate checking of its composition has taken place;
     - steam main issues;
     - vandalism.

Cont.

BAT for control of accidents (cont.)

b. ***Assess the risks*** - having identified the hazards, the process of assessing the risks can be viewed as addressing six basic questions:

1. what is the estimated probability of their occurrence? (Source frequency);
2. what gets out and how much? (Risk evaluation of the event);
3. where does it get to? (Predictions for the emission – what are the pathways and receptors?);
4. what are the consequences? (Consequence assessment – the effects on the receptors);
5. what are the overall risks? (Determination of the overall risk and its significance to the environment);
6. what can prevent or reduce the risk? (Risk management – measures to prevent accidents and/or reduce their environmental consequences).

The depth and type of assessment will depend on the characteristics of the installation and its location. The main factors which should be taken into account are:

- the scale and nature of the accident hazard presented by the installation and the activities;
- the risks to areas of population and the environment (receptors);
- the nature of the installation and complexity or otherwise of the activities and the relative difficulty in deciding and justifying the adequacy of the risk control techniques.

c. ***identify the techniques necessary to reduce the risks including:***

c1. the following techniques, which are relevant to most installations:

- an inventory should be maintained of substances, present or likely to be present, which could have environmental consequences if they escape. It should not be forgotten that many apparently innocuous substances can be environmentally damaging if they escape (e.g. a tanker of milk spilled into a watercourse could destroy its ecosystem). The Permit will require the Regulator to be notified of any changes to the inventory;
- procedures should be in place for checking raw materials and wastes to ensure compatibility with other substances with which they may accidentally come into contact;
- adequate storage arrangements for raw materials, products and wastes should be provided;
- to ensure that control is maintained in emergency situations, consideration should be given to process design alarms, trips and other control aspects, e.g. automatic systems based on microprocessor control and passing valve control, tank level readings such as ultrasonic gauges, high-level warnings and process interlocks and process parameters;
- preventative techniques, such as suitable barriers to prevent damage to equipment from the movement of vehicles, should be included as appropriate;
- appropriate containment should be provided, e.g. bunds and catchpots, building containment;
- techniques and procedures should be implemented to prevent overfilling of storage tanks (liquid or powder), e.g. level measurement, independent high-level alarms, high-level cut-off, and batch metering;
- installation security systems to prevent unauthorised access should be provided as appropriate and should include maintenance arrangements where necessary;
- there should be an installation log/diary to record all incidents, near-misses, changes to procedures, abnormal events and findings of maintenance inspections;
- procedures should be established to identify, respond to and learn from such incidents;
- the roles and responsibilities of personnel involved in accident management should be identified;

Cont.

BAT for control of accidents (cont.)

- clear guidance should be available on how each accident scenario should be managed, e.g. containment or dispersion, to extinguish fires or let them burn;
- procedures should be in place to avoid incidents occurring as a result of poor communication among operations staff during shift changes and maintenance or other engineering work;
- safe shutdown procedures should be in place;
- communication routes should be established with relevant authorities and emergency services both before and in the event of an accident. Post-accident procedures should include the assessment of harm caused and steps needed to redress this;
- appropriate control techniques should be in place to limit the consequences of an accident, such as oil spillage equipment, isolation of drains, alerting of relevant authorities and evacuation procedures;
- personnel training requirements should be identified and provided;
- the systems for the prevention of fugitive emissions are generally relevant (Sections 2.3.13 and 2.3.14) and in addition, for drainage systems:
  - procedures should be in place to ensure that the composition of the contents of a bund sump, or sump connected to a drainage system, are checked before treatment or disposal;
  - drainage sumps should be equipped with a high-level alarm or sensor with automatic pump to storage (not to discharge); there should be a system in place to ensure that sump levels are kept to a minimum at all times;
  - high-level alarms etc. should not be routinely used as the primary method of level control;
  -

c2. the following plus any other specific techniques identified as necessary to minimise the risks as identified in 1 and 2 above

- adequate redundancy or standby plant should be provided with maintenance and testing to the same standards as the main plant;
- process waters, site drainage waters, emergency firewater, chemically contaminated waters and spillages of chemicals should, where appropriate, be contained and where necessary, routed to the effluent system, with provision to contain surges and storm-water flows, and treated before emission to controlled waters or sewer. Sufficient storage should be provided to ensure that this could be achieved. There should also be spill contingency procedures to minimise the risk of accidental emission of raw materials, products and waste materials and to prevent their entry into water. Any emergency firewater collection system should also take account of the additional firewater flows or fire-fighting foams. Emergency storage lagoons may be needed to prevent contaminated firewater reaching controlled waters (see Refs. 15 and 16);
- consideration should be given to the possibility of containment or abatement for accidental emissions from vents and safety relief valves/bursting discs. Where this may be inadvisable on safety grounds, attention should be focused on reducing the probability of the emission;

2.9 Noise and Vibration

Within this section "*noise*" should be taken to refer to "*noise and/or vibration*" as appropriate, detectable beyond the site boundary.

The PPC Regulations require installations to be operated in such a way that *"all the appropriate preventative measures are taken against pollution, in particular through the application of BAT*". The definition of pollution includes *"emissions which may be harmful to human health or the quality of the environment, cause offence to human senses or impair or interfere with amenities and other legitimate uses of the environment".* BAT is therefore likely to be similar, in practice, to the requirements of the statutory nuisance legislation, which requires the use of "best practicable means" to prevent or minimise noise nuisance.

In the case of noise, "offence to any human senses" can normally be judged by the likelihood of complaints, but in some cases it may be possible to reduce noise emissions still further at reasonable costs, and this may exceptionally therefore be BAT for noise emissions.

For advice on how noise and/or vibration related limits and conditions will be determined see *"IPPC Noise – Part 1 Regulation and Permitting",* (see Ref. 20).

Application Form Question 2.9

Describe the main sources of noise and vibration (including infrequent sources); the nearest noise-sensitive locations and relevant environmental surveys which have been undertaken; and the proposed techniques and measures for the control of noise.

Information needed to determine BAT for noise and vibration

With the Application the Operator should:

1. provide the following information for ***each main source of noise and vibration*** that fall within the IPPC installation:
   - the source and its location on a scaled plan of the site;
   - whether continuous/ intermittent, fixed or mobile;
   - the hours of operation;
   - its description, (e.g. clatter, whine, hiss, screech, hum, bangs, clicks, thumps or tonal elements);
   - its contribution to overall site noise emission (categorise each as high, medium or low unless supporting data is available).

   A common sense approach needs to be adopted in determining which sources to include. The ones which need to be considered are those which may have environmental nuisance impact; e.g. a small unit could cause an occupational noise issue in an enclosed space but would be unlikely to cause an environmental issue. Conversely a large unit or a number of smaller units enclosed within a building could, for example, cause a nuisance if doors are left open. It must also be remembered that noise, which is not particularly noticeable during the day, may become more noticeable at night.

2. Provide the information required in (1) for each source plus its times of operation for ***Infrequent sources of noise and vibration,*** not listed above that fall within the IPPC installation: (such as infrequently operated/ seasonal operations, cleaning/maintenance activities, on-site deliveries/collections/transport or out-of-hours activities, emergency generators or pumps and alarm testing),

3. identify ***the nearest noise-sensitive sites*** (typically dwellings, parkland and open spaces – schools, hospitals and commercial premises may be, depending upon the activities undertaken there) and any other points/boundary where conditions have been applied by Local Authority officers or as part of a planning consent, relating to:
   (a) the local environment:
      - provide an accurate map or scaled plan showing grid reference, nature of the receiving site, distance and direction from site boundary;

   (b) conditions/limits imposed which relate to other locations (i.e. boundary fence or surrogate for nearest sensitive receptor):
      - any planning conditions imposed by the Local Authority;
      - other conditions imposed by agreements, e.g. limits on operating times, technologies etc;
      - any requirements of any legal notices etc.

Cont.

Information needed to determine BAT for noise and vibration (cont.)

(c) the noise environment:

- background noise level, if known (day/night/evening) $L_{A,90,T}$;
- specific noise level (day/evening/night) $L_{A\ eq,T}$; and/or
- ambient noise level (day/evening/night) $L_{A\ eq,T}$, as appropriate;
- vibration data which may be expressed in terms of the peak particle velocity (ppv) in mm s^{-1} or the vibration dose value (VDV) in m $s^{-1.75}$.

For noise these are given the meaning as defined in BS4142:1997 "Method for rating industrial noise affecting mixed residential and industrial areas", and to which reference should be made for a full description. For vibration, the appropriate standard is BS6472:1992 "Evaluation of human exposure to vibration in buildings1 to 80 Hz". In very general terms "background" is taken to be the equivalent continuous A-weighted noise remaining when the source under investigation is not operational averaged over a representative time period, T. The "ambient" level is the equivalent continuous A-weighted combination of all noise sources far and distant, including the source under investigation and "specific noise" is the equivalent continuous A-weighted noise level produced by the source under investigation as measured at a selected assessment point. Both are averaged over a time period, T. BS4142 gives advice on the appropriate reference periods. "Worst case" situations and impulsive or tonal noise should be accounted for separately and not "averaged out" over the measurement period.

4. provide ***details of any environmental noise measurement surveys,*** modelling or any other noise measurements undertaken relevant to the environmental impact of the site, identifying:
   - the purpose/context of the survey;
   - the locations where measurements were taken;
   - the source(s) investigated or identified;
   - the outcomes.
5. Identify any specific local issues and proposals for improvements.
6. describe the current or proposed position with regard to the techniques below, any in Ref. 20 or any others which are pertinent to the installation.
7. demonstrate that the proposals are BAT, by confirming compliance with the indicative requirements, by justifying departures (as described in Section 1.2 and in the Guide for Applicants) or alternative measures.

Indicative BAT Requirements

1. The Operator should employ basic good practice measures for the control of noise, including adequate maintenance of any parts of plant or equipment whose deterioration may give rise to increases in noise (eg maintenance of bearings, air handling plant, the building fabric as well as specific noise attenuation measures associated with plant, equipment or machinery).
2. In addition the Operator should employ such other noise control techniques to ensure that the noise from the installation does not give rise to reasonable cause for annoyance, in the view of the Regulator and, in particular should justify where either Rating Levels ($L_{Aeq,T}$) from the installation exceed the numerical value of the Background Sound Level ($L_{A90,T}$), or the absolute levels of 50dB L_{Aeq} by day or 45 by night are exceeded. Reasons why these levels may be exceeded in certain circumstances are given in Ref. 20.
3. In some circumstances "creeping background" see Ref. 20 may be an issue. Where this has been identified in pre-application discussions or in previous discussions with the Local Authority, the Operator should employ such noise control techniques as are considered to be appropriate to minimise problems of to an acceptable level within the BAT criteria.
4. Noise surveys, measurement, investigation (which can involve detailed assessment of sound power levels for individual items of plant) or modelling may be necessary for either new or existing installations depending upon the potential for noise problems. Operators may have a noise management plan as part of their management system. More information on such techniques is given in Part 2 of Ref. 20

2.10 Monitoring

This section describes monitoring and reporting requirements for emissions to all environmental media. Guidance is provided for the selection of the appropriate monitoring methodologies, frequency of monitoring, compliance assessment criteria and environmental monitoring.

Application Form Question 2.10

Describe the proposed measures for monitoring emissions, including any environmental monitoring, and the frequency, measurement methodology and evaluation procedure proposed.

With the Application the Operator should:

1. describe the current or proposed position with regard to the monitoring requirements below or any others which are pertinent to the installation for "Emissions monitoring", "Environmental monitoring", "Process monitoring" (where environmentally relevant) and "Monitoring standards" employed;
2. provide, in particular, the information described in requirement 13 below;
3. provide justifications for not using any of the monitoring requirements described;
4. Identify shortfalls in the above information which the Operator believes require longer term studies to establish.

Emissions monitoring

The following monitoring parameters and frequency are normally appropriate in this sector. Generally, monitoring should be undertaken during commissioning, start-up, normal operation and shut-down unless the Regulator agrees that it would be inappropriate to do so.

Where effective surrogates are available they may be used to minimise monitoring costs.

Where monitoring shows that substances are not emitted in significant quantities, consideration can be given to a reduced monitoring frequency.

Monitoring and reporting of emissions to water and sewer

1. Monitoring of process effluents released to controlled waters and sewers should include at least:

Parameter	Monitoring frequency
Flow rate	Continuous and integrated daily flow rate
pH	Continuous
Temperature	Continuous
COD/BOD	Flow weighted sample or composite samples, weekly analysis, reported as flow weighted monthly averages
TOC	Continuous
Turbidity	Continuous
Dissolved oxygen	Continuous

***NB** - other parameters specifically limited in the Permit should be monitored. The appropriateness of the above frequencies will vary depending upon the sensitivity of the receiving water and should be proportionate to the scale of the operations.*

BOD/ADt and COD/ADt should be established annually as an annual average.

2. In addition, the Operator should have a fuller analysis carried out covering a broad spectrum of substances to establish that all relevant substances have been taken into account when setting the release limits. This should cover the substances listed in Schedule 5 of the Regulations unless it is agreed with the Regulator that they are not applicable. This should normally be done at least annually.

Cont.

Emmisions monitoring (cont.)

3. Any substances found to be of concern, or any other individual substances to which the local environment may be susceptible and upon which the operations may impact, should also be monitored more regularly. This would particularly apply to the common pesticides and heavy metals. Using composite samples is the technique most likely to be appropriate where the concentration does not vary excessively.

4. In some sectors there may be releases of substances which are more difficult to measure and whose capacity for harm is uncertain, particularly when in combination with other substances. "Whole effluent toxicity" monitoring techniques can therefore be appropriate to provide direct measurements of harm, e.g. direct toxicity assessment. Some guidance on toxicity testing is available (Ref. 21) and the Regulator will be providing further guidance in due course. Except in special circumstances toxicity testing should await that guidance.

Monitoring and reporting of emissions to air

5. Continuous monitoring would be expected where the releases are significant and where it is needed to maintain good control;

6. Gas flow should be measured, or otherwise determined, to relate concentrations to mass releases;

7. To relate measurements to reference conditions, the following will need to be determined and recorded:
   - temperature and pressure;
   - oxygen, where the emissions are the result of a combustion process;
   - water vapour content, where the emissions are the result of a combustion process or any other wet gas stream. It would not be needed where the water vapour content is unable to exceed 3% v/v or where the measuring technique measures the other pollutants without removing the water.

8. Where appropriate, periodic visual and olfactory assessment of releases should be undertaken to ensure that all final releases to air should be essentially colourless, free from persistent trailing mist or fume and free from droplets.

Monitoring and reporting of waste emissions

9. For waste emissions the following should be monitored and recorded:
   - the physical and chemical composition of the waste;
   - its hazard characteristics;
   - handling precautions and substances with which it cannot be mixed;
   - where waste is disposed of directly to land, for example sludge spreading or an on-site landfill, a programme of monitoring should be established that takes into account the materials, potential contaminants and potential pathways from the land to groundwater surface water or the food chain.

Environmental monitoring (beyond the installation)

Environmental monitoring

10. The Operator should consider the need for environmental monitoring to assess the effects of emissions to controlled water, groundwater, air or land or emissions of noise or odour.

    Environmental monitoring may be required, e.g. when:
    - there are vulnerable receptors;
    - the emissions are a significant contributor to an Environmental Quality Standard (EQS) which may be at risk;
    - the Operator is looking for departures from standards based on lack of effect on the environment;
    - there is a need to validate modelling work.

Cont.

Environmental monitoring (cont.)

The need should be considered for:

- groundwater, where it should be designed to characterise both quality and flow and take into account short and long-term variations in both. Monitoring will need to take place both up-gradient and down-gradient of the site;
- surface water, where consideration will be needed for sampling, analysis and reporting for upstream and downstream quality of the controlled water;
- air, including odour;
- land contamination, including vegetation, and agricultural products;
- assessment of health impacts;
- noise.

Where environmental monitoring is needed the following should be considered in drawing up proposals:

- determinands to be monitored, standard reference methods, sampling protocols;
- monitoring strategy, selection of monitoring points, optimisation of monitoring approach;
- determination of background levels contributed by other sources;
- uncertainty for the employed methodologies and the resultant overall uncertainty of measurement;
- quality assurance (QA) and quality control (QC) protocols, equipment calibration and maintenance, sample storage and chain of custody/audit trail;
- reporting procedures, data storage, interpretation and review of results, reporting format for the provision of information for the Regulator.

Guidance on air quality monitoring strategies and methodologies can be found in Technical Guidance Notes M8 and M9 (see Ref. 21), for noise (see Ref. 20) and for odour (see Ref. 23).

Monitoring of process variables

Monitoring process variables

11. Some process variables will have potential environmental impact and these should be identified and monitored as appropriate. Examples might be:
    - raw materials monitoring for contaminants where contaminants are likely and there is inadequate supplier information (see Section 2.2.1);
    - plant efficiency where it has an environmental relevance;
    - energy consumption across the plant and at individual points of use in accordance with the energy plan. Frequency – normally continuous and recorded;
    - fresh water use across the activities and at individual points of use should be monitored as part of the water efficiency plan (see Section 2.2.3). Frequency – continuous and recorded.

Monitoring standards (Standard Reference Methods)

Equipment standards

Equipment standards MCERTS

The Environment Agency has introduced its Monitoring Certification Scheme (MCERTS) to improve the quality of monitoring data and to ensure that the instrumentation and methodologies employed for monitoring are fit for purpose. Performance standards have been published for continuous emissions monitoring systems (CEMs), and other MCERTS standards are under development to cover manual stack emissions monitoring, portable emissions monitoring equipment, ambient air quality monitors, water monitoring instrumentation, data acquisition and Operators' own arrangements, such as for installation, calibration and maintenance of monitoring equipment, position of sampling ports and provision of safe access for manual stack monitoring.

12. As far as possible, Operators should ensure their monitoring arrangements comply with the requirements of MCERTS where available, e.g. using certified instruments and equipment, and using a registered stack testing organisation etc. Where the monitoring arrangements are not in accordance with MCERTS requirements, the Operator should provide justification and describe the monitoring provisions in detail. See Environment Agency Website (Ref. 21) for listing of MCERTS equipment

Cont.

Monitoring standards (cont.)

13. The following should be described in the application indicating which monitoring provisions comply with MCERTS requirements or for which other arrangements have been made:
    - monitoring methods and procedures (selection of Standard Reference Methods);
    - justification for continuous monitoring or spot sampling;
    - reference conditions and averaging periods;
    - measurement uncertainty of the proposed methods and the resultant overall uncertainty;
    - criteria for the assessment of non-compliance with Permit limits and details of monitoring strategy aimed at demonstration of compliance;
    - reporting procedures and data storage of monitoring results, record keeping and reporting intervals for the provision of information to the Regulator;
    - procedures for monitoring during start-up and shut-down and abnormal process conditions;
    - drift correction calibration intervals and methods;
    - the accreditation held by samplers and laboratories or details of the people used and the training/competencies.

Standards for sampling and analysis

BREF: Monitoring REF document in preparation.

Sampling and analysis standards

14. The analytical methods given in Appendix 1 should be used. In the event of other substances needing to be monitored, standards should be used in the following order of priority:
    - Comité Européen de Normalisation (CEN);
    - British Standards Institution (BSI);
    - International Standardisation Organisation (ISO);
    - United States Environmental Protection Agency (US EPA);
    - American Society for Testing and Materials (ASTM);
    - Deutches Institute für Normung (DIN);
    - Verein Deutcher Ingenieure (VDI);
    - Association Française de Normalisation (AFNOR).

Further guidance on standards for monitoring gaseous releases relevant to IPC/IPPC is given in the Technical Guidance Note 4 (Monitoring) (see Ref. 21). A series of updated Guidance Notes covering this subject is currently in preparation. This guidance specifies manual methods of sampling and analysis which will also be suitable for calibration of continuous emission monitoring instruments. Further guidance relevant to water and waste is available from the publications of the Standing Committee of Analysts.

If in doubt the Operator should consult the Regulator.

2.11 De-commissioning

The IPPC application requires the preparation of a site report whose purpose, as described in more detail in Refs. 4 and 5 is to provide a point of reference against which later determinations can be made of whether there has been any deterioration of the site and information on the vulnerability of the site.

Application Form Question 2.11

Describe the proposed measures, upon definitive cessation of activities, to avoid any pollution risk and return the site of operation to a satisfactory state (including, where appropriate, measures relating to the design and construction of the installation).

With the Application the Operator should:

1. supply the site report;
2. describe the current or proposed position with regard to the techniques below or any others which are pertinent to the installation;
3. for existing activities, identify shortfalls in the above information which the Operator believes require longer term studies to establish.

Indicative BAT Requirements

BAT for decommissioning

1. **Operations during the IPPC Permit**

   Operations during the life of the IPPC Permit should not lead to any deterioration of the site if the requirements of the other sections of this and the specific sector notes are adhered to. Should any instances arise which have, or might have, impacted on the state of the site the Operator should record them along with any further investigation or ameliorating work carried out. This will ensure that there is a coherent record of the state of the site throughout the period of the IPPC Permit. This is as important for the protection of the Operator as it is for the protection of the environment. Any changes to this record should be submitted to the Regulator.

2. **Steps to be taken at the design and build stage of the activities**

   Care should be taken at the design stage to minimise risks during decommissioning. For existing installations, where potential problems are identified, a programme of improvements should be put in place to a timescale agreed with the Regulator. Designs should ensure that:

   - underground tanks and pipework are avoided where possible (unless protected by secondary containment or a suitable monitoring programme);
   - there is provision for the draining and clean-out of vessels and pipework prior to dismantling;
   - lagoons and landfills are designed with a view to their eventual clean-up or surrender;
   - insulation is provided which is readily dismantled without dust or hazard;
   - materials used are recyclable (having regard for operational or other environmental objectives).

3. **The site closure plan**

   A site closure plan should be maintained to demonstrate that, in its current state, the installation can be decommissioned to avoid any pollution risk and return the site of operation to a satisfactory state. The plan should be kept updated as material changes occur. Common sense should be used in the level of detail, since the circumstances at closure will affect the final plans. However, even at an early stage, the closure plan should include:

   - either the removal or the flushing out of pipelines and vessels where appropriate and their complete emptying of any potentially harmful contents;
   - plans of all underground pipes and vessels;
   - the method and resource necessary for the clearing of lagoons;
   - the method of ensuring that any on-site landfills can meet the equivalent of surrender conditions;
   - the removal of asbestos or other potentially harmful materials unless agreed that it is reasonable to leave such liabilities to future owners;

Cont.

BAT for decommissioning (cont.)

- methods of dismantling buildings and other structures, see Ref. 25 which gives guidance on the protection of surface and groundwater at construction and demolition-sites;
- testing of the soil to ascertain the degree of any pollution caused by the activities and the need for any remediation to return the site to a satisfactory state as defined by the initial site report.

(Note that radioactive sources are not covered by this legislation, but decommissioning plans should be co-ordinated with responsibilities under the Radioactive Substances Act 1993.)

For existing activities, the site closure plan may, if agreed with the Regulator, be submitted as an improvement condition.

2.12 Installation Wide Issues

In some cases it is possible that actions which benefit the environmental performance of the overall installation will increase the emissions from one Permit holder's activities. For example, taking treated effluent as a raw water supply will probably slightly increase emissions from that activity but could dramatically cut the total emissions from the whole installation.

Application Form Question 2.12

Where you are not the only Operator of the installation, describe the proposed techniques and measures (including those to be taken jointly by yourself and other Operators) for ensuring the satisfactory operation of the whole installation.

With the Application the Operator should:

1. where there are a number of separate Permits for the installation (particularly where there are different Operators), **identify** any installation wide issues and opportunities for further interactions between the Permit holders whereby the performance of the overall installation may be improved; and in particular
2. describe the current or proposed position with regard to the techniques below, or any others which are pertinent to the installation;

BAT across the whole installation

Indicative BAT Requirements

The possibilities will be both sector and site-specific, and include:

1. communication procedures between the various Permit holders; in particular those needed to ensure that the risk of environmental incidents is minimised;
2. benefiting from the economies of scale to justify the installation of a CHP plant;
3. the combining of combustible wastes to justify a combined waste-to-energy/CHP plant;
4. the waste from one activity being a possible feedstock for another;
5. the treated effluent from one activity being of adequate quality to be the raw water feed for another activity;
6. the combining of effluent to justify a combined or upgraded effluent treatment plant;
7. the avoidance of accidents from one activity which may have a detrimental knock-on effect on the neighbouring activity;
8. land contamination from one activity affecting another – or the possibility that one Operator owns the land on which the other is situated.

3 EMISSION BENCHMARKS

3.1 Emissions Inventory and Benchmark Comparison

Application Form Question 3.1

Describe the nature, quantities and sources of foreseeable emissions into each medium (which will result from the techniques proposed in Section 2).

With the Application the Operator should:

1. provide a table of significant emissions of substances (except noise, vibration, odour or heat which are covered in their respective sections) that will result from the proposals in Section 2 and should include, preferably in order of significance:
   - substance (where the substance is a mixture, e.g. VOCs or COD, separate identification of the main constituents or inclusion of an improvement proposal to identify them);
   - source, including height, location and efflux velocity;
   - media to which it is released;
   - any relevant EQS or other obligations;
   - benchmark;
   - proposed emissions normal/max expressed, as appropriate (see Section 3.2), for:
     - mass/unit time;
     - concentration;
     - annual mass emissions.
   - statistical basis (average, percentile etc.);
   - notes covering the confidence in the ability to meet the benchmark values;
   - if intermittent, the appropriate frequencies;
   - plant loads at which the data is applicable;
   - whether measured or calculated (the method of calculation should be provided).

   The response should clearly state whether the emissions are current emission rates or those planned following improvements, and should cover emissions under both normal and abnormal conditions for:
   - point source emissions to surface water, groundwater and sewer;
   - waste emissions (refer to Sections 2.5 and 2.6 – Waste Management);
   - point source emissions to air;
   - significant fugitive emissions to all media, identifying the proportion of each substance released which is due to fugitives rather than point source releases;
   - abnormal emissions from emergency relief vents, flares etc.;
   - indirect and direct emission of carbon dioxide associated with energy consumed or generated.

   Emissions of carbon dioxide associated with energy use should be broken down by energy type and, in the case of electricity, by source e.g. public supply, direct supply or on site generation. Where energy is generated on site, or from a direct (non-public) supplier, the Operator should specify and use the appropriate factor. Standard factors for carbon dioxide emissions are provided in the Energy Efficiency Guidance Note.

   Where VOCs are released, the main chemical constituents of the emissions should be identified. The assessment of the impact of these chemicals in the environment will be carried out as in response to Section 4.1.

   For waste, emissions relate to any wastes removed from the installation, or disposed of at the installation under the conditions of the Permit, e.g. landfill. Each waste should have its composition determined and the amounts expressed in terms of cubic metres or tonnes per month.

   A suitable table on which to record this information is provided in the electronic version of this Guidance Note.
2. compare the emissions with the benchmark values given in the remainder of this Section;
3. where the benchmarks are not met, revisit the responses made in Section 2 as appropriate (see Section 1.2) and make proposals for improvements or justify not doing so.

3.2 The Emission Benchmarks

Introduction to emission benchmarks

Guidance is given below on release concentrations or mass release rates achievable for key substances using the best combination of techniques. These BAT-based benchmarks are not mandatory release limits and reference should be made to Section 1 and the *Guide for Applicants* regarding their use.

3.2.1 Emissions to air associated with the use of BAT

The emissions quoted in Table 3.1 are as daily averages based upon continuous monitoring during the period of operation. Standard conditions of 273 K and 101.3 kPa with no correction is applied for water vapour or oxygen content of the emission. Care should always be taken to convert benchmark and proposed releases to the same reference conditions for comparison. To convert measured values to reference conditions, see Technical Guidance Note M2 (Ref.21) for more information

Limits in Permits may be set for mean or median values over long or short periods. The periods and limits selected should reflect:

- the manner in which the emission may impact upon the environment;
- likely variations which will arise during operation within BAT;
- possible failure modes and their consequences;
- the capabilities of the monitoring and testing system employed.

Where emissions are expressed in terms of concentrations and where continuous monitors are employed, it is recommended that limits are defined such that:

- not more than one calendar monthly average during any rolling twelvemonth period shall exceed the benchmark value by more than 10%;
- not more than one half hour period* during any rolling 24 hour period shall exceed the benchmark value by more than 50%.

* for the purpose of this limit half hourly periods commence on the hour and the half hour.

Where spot tests are employed:

- the half hour limit above shall be applied over the period of the test;
- the mean of three consecutive tests taken during a calendar year shall not exceed the benchmark value by more than 10%.

3.2.2 Emissions to water associated with the use of BAT

Wastewater treatment systems can maximise the removal of metals using precipitation, sedimentation and filtration. The reagents used for precipitation will be defined by the mix of metals present, and may include hydroxide, sulphide or a combination of both. Concentrated effluents should be pre treated before discharge into the final effluent treatment system, and techniques such as electrolysis, reverse osmosis and metal removal using ion exchange systems may need to be employed. Water discharges should be kept to a minimum by using closed cycle cooling systems and by maximising the reuse of treated process water.

Where automatic sampling systems are employed, limits may be defined such that:

- not more than 5% of samples shall exceed the benchmark value.

Where spot samples are taken:

- no spot sample shall exceed the benchmark value by more than 50%.

Examples of emissions to water associated with the use of BAT:

Table 3-1 Emissions to air associated with the use of BAT

Process	Emission	New Processes - Abated Release		
		Average Concentration mg/m^3	Peak Concentration mg/m^3	Mass Emission g/tonne of product
EAF Secondary	Particulate	10	20	50
EAF Combined Extraction	Particulate	15	30	
Roof Extraction	Particulate	10	20	20
Ladle Treatment	Particulate	10	20	
General Local Extraction	Particulate	10	-	
Leaded Steel Processes	Lead	3	-	
Stainless Steel & Special Alloy Processes	Chromium	4	-	
	Nickel	2	-	
All Iron & Steel Processes	Dioxins (ITEQ)	1ng/m^3	-	
	Cadmium	0.2	-	
	Lead	1	-	
	Chromium	2	-	
	Nickel	1	-	
	VOC * as total carbon	50	-	
	Fluorides	5	-	

NOTES:

1. Figures are based on measurements taken at the point of discharge.
2. The average concentration figures refer to measurements taken over a complete process cycle for batch operations. For continuous processes, releases are based on an hourly average figure over a rolling 24 hour period taking into account only the hours when the plant is in actual operation, including start-up and shut-down. The maximum hourly average value should not exceed the release level indicated in the table.
3. The term "Volatile Organic Compounds" includes all organic compounds released to air in the gas phase. For details of the classification scheme see Appendix 1.
4. Operators should be aware of the potential for the release of polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans ("dioxins") from metals processes particularly in secondary recovery/refining processes. An achievable release of 1ng/m^3 ITEQ is appropriate.

All releases must be controlled and minimised to ensure that ambient air quality beyond the process boundary complies, as a minimum, with air quality standards (see Ref 11).

3.2.3 Standards and obligations

In addition to meeting the requirements of BAT, there are other national and international standards and obligations which must either be safeguarded through the IPPC Permit or, at least, taken into account in setting Permit conditions. This is particularly the case for any EC based EQSs.

EC based EQ standards

IPPC: A Practical Guide (see Ref. 4) explains how these should be taken into account and contains an annex listing the relevant standards. See Appendix 2 for equivalent legislation in Scotland and Northern Ireland). They can be summarised as follows..

Air Quality

- Statutory Instrument 1989 No 317, Clean Air, The Air Quality Standards Regulations 1989.
- Statutory Instrument 1997 No 3043, Environmental Protection, The Air Quality Regulations 1997.

Water Quality

- Directive 76/464/EEC on Pollution Caused by Dangerous Substances Discharged to Water contains two lists of substances. List I relates to the most dangerous, and standards are set out in various daughter Directives. List II substances must also be controlled. Annual mean concentration limits for receiving waters for List I substances can be found in SI 1989/2286 and SI 1992/337 the Surface Water (Dangerous Substances Classification) Regulations. Values for List II substances are contained in SI 1997/2560 and SI 1998/389. Daughter Directives cover EQS values for mercury, cadmium, hexachlorocyclohexane, DDT, carbon tetrachloride, pentachlorophenol, aldrin, dieldrin, endrin, isodrin, hexachlorobenzene, hexachlorobutadiene, chloroform,1,2-dichloroethane, trichloroethane, perchloroethane and trichlorobenzene.
- Other waters with specific uses have water quality concentration limits for certain substances. These are covered by the following Regulations:
  - SI 1991/1597 Bathing Waters (Classification) Regulations;
  - SI 1992/1331 and Direction 1997 Surface Waters (Fishlife) (Classification) Regulations;
  - SI 1997/1332 Surface Waters (Shellfish) (Classification) Regulations;
  - SI 1996/3001 The Surface Waters (Abstraction and Drinking Water) (Classification) Regulations.

Future likely changes include:

- Some air and water quality standards may be replaced by new standards in the near future.
- The (Draft) Solvents Directive on the limitation of emissions of VOCs due to the use of organic solvents in certain activities and installations.

Other standards and obligations

Those most applicable to this sector are:

- Hazardous Waste Incineration Directive;
- Waste Incineration Directive;
- Large Combustion Plant Directive;
- Reducing Emissions of VOCs and Levels of Ground Level Ozone: a UK Strategy;
- Water Quality Objectives – assigned water quality objectives to inland rivers and water courses (ref. Surface (Rivers Ecosystem) Classification);
- The UNECE convention on long-range transboundary air pollution;
- The Montreal Protocol;
- The Habitats Directive (see Section 5.3).

3.2.4 Units for benchmarks and setting limits in Permits

Releases can be expressed in terms of:

- "**concentration**" (e.g. mg/l or mg/m^3) which is a useful day-to-day measure of the effectiveness of any abatement plant and is usually measurable and enforceable The total flow must be measured/controlled as well;
- "**specific mass release**" (e.g. kg/ tproduct or input or other appropriate parameter) which is a measure of the overall environmental performance of the plant (including the abatement plant) compared with similar plants elsewhere;

- "**absolute mass release**" (e.g. kg/hr, t/yr) which relates directly to environmental impact.

When endeavouring to reduce the environmental impact of an installation, its performance against each of these levels should be considered, as appropriate to the circumstances, in assessing where improvements can best be made.

When setting limits in Permits the most appropriate measure will depend on the purpose of the limit. It may also be appropriate to use surrogate parameters which reflect optimum environmental performance of plant as the routine measurement, supported by less frequent check-analyses on the final concentration. Examples of surrogate measures would be the continuous measurement of conductivity (after ion-exchange treatment) or total carbon (before a guard-column in activated carbon treatment) to indicate when regeneration or replacement is required.

3.2.5 Statistical basis for benchmarks and limits in Permits

Conditions in Permits can be set with percentile, mean or median values over yearly, monthly or daily periods, which reflect probable variation in performance. In addition absolute maxima can be set.

Where there are known failure modes, which will occur even when applying BAT, limits in Permits may be specifically disapplied but with commensurate requirements to notify the Regulator and to take specific remedial action.

For Water: UK benchmarks or limits are most frequently 95 percentile concentrations or absolute concentrations, (with flow limited on a daily average or maximum basis).

For Air: benchmarks or limits are most frequently expressed as daily averages or, typically 95% of hourly averages.

3.2.6 Reference conditions for releases to air

The reference conditions of substances in releases to air from point sources are: temperature 273 K (0° C), pressure 101.3 kPa (1 atmosphere), no correction for water vapour or oxygen.

The reference conditions for combustion or incineration processes are as given in the appropriate guidance note.

These reference conditions relate to the benchmark release levels given in this Note and care should always be taken to convert benchmark and proposed releases to the same reference conditions for comparison. The Permit may employ different reference conditions if they are more suitable for the process in question.

To convert measured values to reference conditions, see Technical Guidance Note M2 (Ref. 21) for more information.

4 BENCHMARK RELEASE LEVELS

The release levels given are achievable by all new processes using the best available techniques described in Sections 2 and 3. They are applicable to each non-combustion point source. They should not be applied as uniform release limits, but should be assessed to take account of site-specific conditions so as to comply with the requirement to use BAT and any relevant environmental quality standards.

The benchmark release levels to air are shown by substance and process sector in Table 4.1.

4.1 Benchmark releases to air

Table 4-1 Benchmark levels for releases to air[a]

Source	Emission	Release concentration ($mg/m^{3)}$	Release rate
Storage and transport of sand, including reclaimed sand	Sand and dust	10	
Storage, handling and use of chemical binders	Volatile organic compounds (VOCs)[b]	20 80	Total Class A 100 g/h Class B 2 kg/h
Knock-out and sand recovery	Sand and dust VOCs	10	 As for storage and handling
Shot blasting, fettling and other finishing operations	Sand, dust, metallic particles Metallurgical fume	10	
Casting station	Metallurgical fume VOCs	10	 As for storage and handling

a) All releases should be essentially colourless, free from persistent trailing mist or fume and free from droplets.

Releases from the processes should not give rise to an offensive odour noticeable outside the site where the process is carried on.

Releases below these mass emission rates may not be trivial, and so may still require controls and the setting of appropriate release limits.

When defining release limits for specific operations, the Agency will take into consideration the accuracy, precision and reliability of the monitoring or testing methods that are to be employed to demonstrate compliance**.**

b) The term 'volatile organic compounds' includes all organic compounds released to air in the gas phase.

Where it is practicable to do so, the VOCs being released should be identified individually using nomenclature compatible with that of the *Inventory of Sources and Releases* (ISR) reporting form devised by the Agency. The VOC concentration levels apply where the total mass release rates are exceeded.

4.2 Benchmark releases to surface water

Releases to surface waters from the ancillary activity are unlikely to represent more than a small fraction of the total discharge from the overall process. Furthermore, it is unlikely that they will be discharged separately from releases arising from the primary process. The benchmark levels for the main iron and steel process should therefore apply. Refer to Section 2.3.12 for indicative BAT requirements for abatement of point sources to surface water and sewer.

5 IMPACT

5.1 Assessment of the Impact of Emissions on the Environment

The Operator should assess that the emissions resulting from the proposals for the activities/installation will provide a high level of protection for the environment as a whole, in particular having regard to EQSs etc, revisiting the techniques in Section 2 as necessary (see Section 1.2).

Application Form Question 4.1

Provide an assessment of the potential significant environmental effects (including transboundary effects) of the foreseeable emissions.

With the Application the Operator should:

1. provide a description, including maps as appropriate, of the receiving environment to identify the receptors of pollution. The extent of the area may cover the local, national and international (e.g. transboundary effects) environment as appropriate.
2. identify important receptors which may include: areas of human population including noise or odour-sensitive areas, flora and fauna (i.e. Habitat Directive sites, special areas of conservation, Sites of Special Scientific Interest (SSSI or in Northern Ireland, ASSI) or other sensitive areas), soil, water, i.e. groundwater (water below the surface of the ground in the saturation zone and in direct contact with the ground and subsoil) and watercourses (e.g. ditches, streams, brooks, rivers), air including the upper atmosphere, landscape, material assets and the cultural heritage.
3. identify the pathways by which the receptors will be exposed (where not self evident).
4. carry out an assessment of the potential impact of the total emissions from the activities on these receptors. Ref. 6 provides a systematic method for doing this and will also identify where modelling needs to be carried out, to air or water, to improve the understanding of the dispersion of the emissions. The assessment will include comparison (see IPPC A Practical Guide (Ref. 4) and Section 3.2) with:
   - community EQS levels;
   - other statutory obligations;
   - non-statutory obligations;
   - environmental action levels (EALs) and the other environmental and regulatory parameters defined in Ref. 6.

   in particular, it will be necessary to demonstrate that an appropriate assessment of vent and chimney heights has been made to ensure that there is adequate dispersion of the minimised emission(s) to avoid exceeding local ground-level pollution thresholds and limit national and transboundary pollution impacts. This should be based on the most sensitive receptor, be it human health, soil or terrestrial ecosystems.

   where appropriate the Operator should also recognise the chimney or vent as an emergency emission point and understand the likely behaviour. Process upsets or equipment failure giving rise to abnormally high emission levels over short periods should be assessed. Even if the Applicant can demonstrate a very low probability of occurrence, the height of the chimney or vent should nevertheless be set to avoid any significant risk to health. The impact of fugitive emissions can also be assessed in many cases.

   consider whether the responses to Sections 2 and 3 and this assessment adequately demonstrate that the necessary measures have been taken against pollution, in particular by the application of BAT, and that no significant pollution will be caused. Where there is uncertainty about this, the measures in Section 2 should be revisited as appropriate to make further improvements.
5. where the same pollutants are being emitted by more than one permitted activity on the installation the Operator should assess the impact both with and without the neighbouring emissions.

5.2 The Waste Management Licensing Regulations

Application Form Question 4.2

Explain how the information provided in other parts of the application also demonstrates that the requirements of the relevant objectives of the Waste Management Licensing Regulations 1994 have been addressed, or provide additional information in this respect.

In relation to activities involving the disposal or recovery of waste, the Regulators are required to exercise their functions for the purpose of achieving the relevant objectives as set out in Schedule 4 of the Waste Management Licensing Regulations 1994. (For the equivalent Regulations in Scotland, see Appendix 2. In Northern Ireland there are no equivalent regulations at the time of writing. Contact EHS for further information.)

The relevant objectives, contained in paragraph 4, Schedule 4 of the Waste Management Licensing Regulations 1994 *(SI 1994/1056 as amended)* are extensive, but will only require attention for activities which involve the recovery or disposal of waste. Paragraph 4 (1) is as follows:

a) "ensuring the waste is recovered or disposed of without endangering human health and without using process or methods which could harm the environment and in particular without:

risk to water, air, soil, plants or animals; or

causing nuisance through noise or odours; or

adversely affecting the countryside or places of special interest;

b) implementing, as far as material, any plan made under the plan-making provisions".

The application of BAT is likely to already address risks to water, air, soil, plants or animals, odour nuisance and some aspects of effects on the countryside. It will, however, be necessary for the Operator to briefly to consider each of these objectives individually and provide a comment on how they are being addressed by the proposals. It is also necessary to ensure that any places of special concern which could be affected, such as SSSIs, are identified and commented upon although, again, these may have been addressed in the assessment for BAT, in which case a cross-reference may suffice.

Operators should identify any development plans made by the local planning authority, including any waste local plan, and comment on the extent to which the proposals accord with the contents of any such plan (see Section 2.6).

5.3 The Habitats Regulations

Application Form Question 4.3

Provide an assessment of whether the installation is likely to have a significant effect on a European site in the UK and if it is, provide an assessment of the implications of the installation for that site, for the purposes of the Conservation (Natural Habitats etc) Regulations 1994 (SI 1994/2716).

Your response should cover all relevant issues pertinent to your installation, including those below. In doing so you should justify your proposals against any indicative requirements stated.

An application for an IPPC Permit will be regarded as a new plan or project for the purposes of the Habitats Regulations (for the equivalent Regulations in Scotland and Northern Ireland see Appendix 2). Therefore, Operators should provide an initial assessment of whether the installation is likely to have a significant effect on any European site in the UK (either alone or in combination with other relevant plans or projects) and, if so, an initial assessment of the implications of the installation for any such site. The application of BAT is likely to have gone some way towards addressing the potential impact of the installation on European sites and putting into place techniques to avoid any significant effects. The Operator should provide a description of how the BAT assessment has specifically taken these matters into account, bearing in mind the conservation objectives of any such site.

European sites are defined in Regulation 10 of the Habitats Regulations to include Special Areas of Conservation (SACs); sites of community importance (sites that have been selected as candidate SACs by member states and adopted by the European Commission but which are not yet formally classified); and Special Protection Areas (SPAs). It is also Government policy (set out in PPG 9 on nature conservation) that potential SPAs and candidate SACs should be considered to be European sites for the purposes of Regulation 10.

Information on the location of European Sites and their conservation objectives is available from

- English Nature (01733 455000), http://www.english-nature.org.uk
- Countryside Council for Wales (01248 385620), http://www.ccw.gov.uk
- Scottish Natural Heritage (0131 447 4784), http://www.snh.org.uk
- Joint Nature Conservation Committee (01733 866852), http://www.jncc.gov.uk
- Environment and Heritage Service, Northern Ireland, http://www.ehsni.gov.uk

The Regulator will need to consider the Operator's initial assessment. If it concludes that the installation is likely to have a significant effect on a European site, then the Regulator will need to carry out an “appropriate assessment” of the implications of the installation in view of that site's conservation objectives. The Regulations impose a duty on the Regulator to carry out these assessments so it cannot rely on the Operator's initial assessments. Therefore the Regulator must be provided with any relevant information upon which the Operator’s assessment is based.

Note that in many cases the impact of the Habitats Regulations will have been considered at the planning application stage, in which case the Regulator should be advised of the details.

REFERENCES

For a full list of available Technical Guidance see Appendix A of the *Guide for Applicants* or visit the Environment Agency Website http://www.environment-agency.gov.uk. Many of the references below are being made available free of charge for viewing or download on the Website. The same information can also be accessed via the SEPA web site http://www.sepa.org.uk , or the NIEHS web site www.ehsni.gov.uk**.** Most titles will also be available in hard copy from The Stationery Office (TSO). Some existing titles are not yet available on the Website but can be obtained from TSO.

1. IPPC Reference Document on Best Available Techniques in the Ferrous Foundry Industry European Commission http://eippcb.jrc.es FOUNDRY NOTE NOT YET PUBLISHED – DUE 2002
2. The Pollution Prevention and Control Act (1999) (www.legislation.hmso.gov.uk).
3. The Pollution Prevention and Control Regulations (SI 1973 2000) (www.legislation.hmso.gov.uk).
4. IPPC: A Practical Guide (for England and Wales) (or equivalents in Scotland and Northern Ireland) (www.environment.detr.gov.uk).
5. IPPC Part A(1) Installations: Guide for Applicants (includes Preparation of a Site Report in a Permit Application) (EA Website).
6. Assessment methodologies:

- E1 BPEO Assessment Methodology for IPC
- IPPC Environmental Assessments for BAT (in preparation as H1)

7. Management system references:

- Sector specific NB: Reference to be included

8. Waste minimisation support references:

- Environment Agency web site. Waste minimisation information accessible via:
- http://www.environment-agency.gov.uk/subjects/waste/131528/
- Waste Minimisation – an environmental good practice guide for industry (helps industry to minimise waste and achieve national environmental goals). Available free to companies who intend to undertake a waste reduction programme (tel 0345 33 77 00)
- Profiting from Pollution Prevention – 3Es methodology (emissions, efficiency, economics). Video and A4 guide aimed at process industries. Available from Environment Agency, North East region (tel 0113 244 0191, ask for regional PIR)
- Waste Minimisation Interactive Tools (WIMIT). Produced in association with the ETBPP and the BOC Foundation (a software tool designed for small and medium businesses.). Available free from The Environmental Helpline (tel 0800 585794)
- Environmental Technology Best Practice Programme – ETBPP. A joint DTI/DETR programme, with over 200 separate case studies, good practice guides, leaflets, flyers, software tools and videos covering 12 industry sectors, packaging, solvents and the generic areas of waste minimisation and cleaner technology. The ETBPP is accessible via a FREE and confidential helpline (tel 0800 585794) or via the web site www.etsu.com/etbpp/
- ETBPP, Increased Profit Through Improved Materials Additions: Management/Technical Guide, GG194/195
- Waste Management Information Bureau. The UK's national referral centre for help on the full range of waste management issues. It produces a database called Waste Info, which is available for online searching and on CD-ROM. Short enquiries are free (tel 01235 463162)
- Institution of Chemical Engineers Training Package E07 – Waste Minimisation. Basic course which contains guide, video, slides, OHPs etc. (tel 01788 578214)

9. Water efficiency references:

- ETBPP, Simple measures restrict water costs, GC22
- ETBPP, Effluent costs eliminated by water treatment, GC24
- ETBPP, Saving money through waste minimisation: Reducing water use, GG26
- ETBPP Helpline 0800 585794

10. Environment Agency (1998) Optimum use of water for industry and agriculture dependent on direct abstraction: Best practice manual. R&D technical report W157, WRc Dissemination Centre, Swindon (tel 01793 865012)
11. Releases to air references:

- BREF on Waste Water and Waste Gas Treatment.
- A1 Guidance on effective flaring in the gas, petroleum etc industries, 1993, ISBN 0-11-752916-8
- A2 Pollution abatement technology for the reduction of solvent vapour emissions, 1994, £5.00, ISBN 0-11-752925-7
- A3 Pollution abatement technology for particulate and trace gas removal, 1994, £5.00, ISBN 0-11-752983-4
- Landfill gas flaring
- Part B PG1/3 Boilers and Furnaces 20-50 MW net thermal input ISBN 0-11-753146-4-7
- Part B PG1/4 Gas Turbines 20-50 MW net thermal input ISBN 0-11-753147-2

12. Releases to water references:
    - BREF on Waste Water and Waste Gas Treatment
- A4 Effluent Treatment Techniques, TGN A4, Environment Agency, ISBN 0-11-310127-9 (EA website)
- Environment Agency, Pollution Prevention Guidance Note – Above-ground oil storage tanks, PPG 2, gives information on tanks and bunding which have general relevance beyond just oil (EA website)

- Mason, P. A, Amies, H. J, Sangarapillai, G. Rose, Construction of bunds for oil storage tanks, Construction Industry Research and Information Association (CIRIA), Report 163, 1997, CIRIA, 6 Storey's Gate, Westminster, London SW1P 3AU. Abbreviated versions are also available for masonry and concrete bunds (www.ciria.org.uk online purchase)

13. Dispersion Methodology Guide D1 (EA website - summary only)
14. IPPC Energy Efficiency Guidance Note (the consultation version, available on the website should be used until the final version is published)
15. BS 5908: Code of Practice for Fire Precautions in the Chemical and Allied Industries
16. Environment Agency, Pollution Prevention Guidance Note – Pollution prevention measures for the control of spillages and fire-fighting run-off, PPG 18, gives information on sizing firewater containment systems (EA website)
17. Investigation of the criteria for, and guidance on, the landspreading of industrial wastes – final report to the DETR, the Environment Agency and MAFF, May 1998
18. Agency guidance on the exemption 7 activity (proposed)
19. COMAH guides

- A Guide to the Control of Major Accident Hazards Regulations 1999, Health and Safety Executive (HSE) Books L111, 1999, ISBN 0 07176 1604 5
- Preparing Safety Reports: Control of Major Accident Hazards Regulations 1999, HSE Books HS(G)190, 1999
- Emergency Planning for Major Accidents: Control of Major Accident Hazards Regulations 1999, HSE Books HS(G)191, 1999
- Guidance on the Environmental Risk Assessment Aspects of COMAH Safety Reports, Environment Agency, 1999 (EA website)
- Guidance on the Interpretation of Major Accidents to the Environment for the Purposes of the COMAH Regulations, DETR, 1999, ISBN 753501 X, available from the Stationery Office

20. Assessment and Control of Environmental Noise and Vibration from Industrial Activities (joint Regulator's guidance in preparation)
21. Monitoring Guidance (EA website)

- M1 Sampling facility requirements for the monitoring of particulates in gaseous releases to atmosphere, March 1993, £5.00, ISBN 0-11-752777-7
- M2 Monitoring emissions of pollutants at source January 1994, £10.00, ISBN 0-11-752922-2
- M3 Standards for IPC Monitoring Part 1: Standards, organisations and the measurement infrastructure, August 1995, £11.00, ISBN 0-11-753133-2
- M4 Standards for IPC Monitoring Part 2 : Standards in support of IPC Monitoring, revised 1998
- MCERTS approved equipment link via http://www.environment-agency.gov.uk/epns "Guidance for Business and Industry";
- Direct Toxicity Assessment for Effluent Control: Technical Guidance (2000), UKWIR 00/TX/02/07.

22. The Categorisation of Volatile Organic Compounds, DOE Research Report No DOE/HMIP/RR/95/009 (EA website)
23. Odour Assessment and Control – Guidance for Regulators and Industry (joint agencies guidance in preparation)
24. "Policy and Practice for the Protection of Groundwater" (PPPG) (EA website)
25. Working at Construction and Demolition-sites (PPG 6) (EA website)
26. The Environmental Technology Best Practice Programme, ETSU, Harwell, Oxfordshire OX11 0RA. Helpline 0800 585794 Good Practice Guides:

- GG104 Cost effective management of chemical binders in foundries.
- GG71 Cost-effective reduction of fugitive solvent emissions.
- GG119 Optimising sand use in foundries.

27. *Beneficial Re-use for Managers*. The Castings Development Centre. June 1998
28. *A Review of the Industrial Uses of Continuous Monitoring Systems: Metals Industries Processes*. Environment Agency Report No NCAS/TR/98/003 March 1998.

DEFINITIONS

BAT	Best Available Techniques – see *IPPC A Practical Guide* or the Regulations for further definition
BAT Criteria	The criteria to be taken into account when assessing BAT, given in Schedule 2 of the PPC Regulations
BOD	Biological Oxygen Demand
BREF	BAT Reference Document
CEM	Continuous Emissions Monitoring
CHP	Combined heat and power plant
COD	Chemical Oxygen Demand
EMS	Environmental Management System
ETP	Effluent treatment plant
ITEQ	International Toxicity Equivalents
MCERTS	Monitoring Certification Scheme
NIEHS	Northern Ireland Environment and Heritage Service
SAC	Special Areas of Conservation
SECp	Specific Energy consumption
SEPA	Scottish Environment Protection Agency
SPA	Special Protection Area
TSS	Total Suspended Solids
TOC	Total Organic Carbon
VOC	Volatile organic compounds

APPENDIX 1 - SOME COMMON MONITORING AND SAMPLING METHODS

Table A1.1: Measurement methods for common substances to water

Determinand	Method	Detection limit Uncertainty	Valid for range mg/l	Standard
Suspended solids	Filtration through glass fibre filters	1 mg/l 20%	10-40	ISO 11929:1997 EN872 Determination of suspended solids
COD	Oxidation with di-chromate	12 mg/l 20%	50-400	ISO 6060: 1989 Water Quality- Determination of chemical oxygen demand
BOD_5	Seeding with microorganisms and measurement of oxygen content	2 mg/l 20%	5-30	ISO 5815: 1989 Water Quality Determination of BOD after 5 days, dilution and seeding method **EN 1899 (BOD 2Parts)**
AOX	Adsorption on activated carbon and combustion	-- 20%	0.4 – 1.0	ISO 9562: 1998 EN1485 – Determination of adsorbable organically bound halogens.
Tot P				BS 6068: Section 2.28 1997 Determination of phosphorus –ammonium molybdate spectrometric method
Tot N				BS 6068: Section 2.62 1998 – Determination of nitrogen Part 1 Method using oxidative digestion with peroxydisulphate BS EN ISO 11905
pH				SCA The measurement of electric conductivity and the determination of pH ISBN 0117514284
Turbidity				SCA Colour and turbidity of waters 1981 ISBN 0117519553 **EN 27027:1999**
Flow rate	Mechanical ultrasonic or electromagnetic gauges			SCA Estimation of Flow and Load ISBN 011752364X
Temperature				
TOC				SCA The Instrumental Determination of Total Organic Carbon and Related Determinants 1995 ISNB 0117529796 **EN 1484:1997**
Fatty Acids				Determination of Volatile Fatty Acids in Sewage Sludge 1979 ISBN 0117514624
Metals				BS 6068: Section 2.60 1998 – Determination of 33 elements by inductively coupled plasma atomic emission spectroscopy
Chlorine				BS6068: Section 2.27 1990 – Method for the determination of total chlorine: iodometric titration method
Chloroform Bromoform				BS 6068: Section 2.58 Determination of highly volatile halogenetaed hydrocarbons – Gas chromatographic methods
Dispersants Surfactants Anionic Cationic Non-ionic				SCA Analysis of Surfactants in Waters, Wastewaters and Sludges ISBN 01176058 **EN 903:1993 (Used for anionic surfactants)**
Pentachloro-Phenol				BS5666 Part 6 1983 – Wood preservative and treated timber quantitative analysis of wood preservatives containing pentachlorophenol **EN 12673:1997 (used for chlorophenol and polychlorinated phenols)**
Formaldehyde				SCA The determination of formaldehyde, other volatile aldehydes and alcohols in water
Phosphates and Nitrates				BS 6068: Section 2.53 1997 Determination of dissolved ions by liquid chromatography
Sulphites and sulphates				BS 6068: Section 2.53 1997 Determination of dissolved ions by liquid chromatography
Ammonia				BS 6068: Section 2.11 1987 – Method for the determination of ammonium: automated spectrometric method
Grease and oils	IR absorption	0.06 mg/kg		SCA The determination of hydrocarbon oils in waters by solvent extraction IR absorption and gravimetry ISBN 011751 7283

Table A1.2: Measurement methods for air emissions

Determinand	Method	Av'ging time Detection limit Uncertainty	Compliance criterion	Standard
Formaldehyde	Impingement In 2,4 dinitro-phenyl-Hydrazine HPLC	1 hour 1 mg/m^3 30%	Two samples taken. Each result below limit after subtraction of measurement uncertainty	NIOSH
Ammonia	Ion Chromato-graphy	1 hour 0.5mg/m^3 25%		US EPA Method 26
VOCs Speciated	Adsorption Thermal Desorption GCMS	1 hour 0.1 mg/m^3 30%		BS EN 1076:Workplace atmospheres. Pumped sorbent tubes for the determination of gases and vapours. Requirements and test methods.
Chloroform	Absorption on activated carbon solvent extraction. GC analysis	1 hour 1 mg/m^3 20%		MDHS 28 Chlorinated hydrocarbon solvent vapours in air (modified)
Oxides of Sulphur	UV fluoresence automatic analyser	1 hour 1 ppm 10%	95% of hourly averages over a year below specified limit	ISO 7935 (BS6069 Section 4.4) Stationary source emissions-determination of mass concentrations of sulphur dioxide CEN Standard in preparation
	Wet sampling train Ion chromatography	1 hour 1 mg/m^3 25%	Two samples taken. Each result below limit after subtraction of measurement uncertainty	ISO 7934 (BS6069 Section 4.1) Method for the determination of the mass concentration of sulphur dioxide-hydrogen peroxide/barium perchlorate method

Measurement uncertainty is defined as total expanded uncertainty at 95% confidence limit calculated in accordance with the Guide to the Expression of Uncertainty in Measurement, ISBN 92-67-10188-9, 1st Ed., Geneva, Switzerland, ISO 1993.

See also Monitoring Guidance (Ref. 21).

APPENDIX 2 - EQUIVALENT LEGISLATION IN SCOTLAND & NORTHERN IRELAND

The legislation referred to in the text is that for England and Wales. The following are the equivalents for Scotland and Northern Ireland.

Table A.2.1 - Equivalent Legislation

England and Wales	*Scotland*	*Northern Ireland*
PPC Regulations (England and Wales) 2000	PPC (Scotland) Regulations 2000; SI 200/323	
Waste Management Licensing Regulations SI:1994 1056	Waste Management Licensing Regulations SI:1994 1056	No NI equivalent
The Water Resources Act 1991	COPA 1974 (S30A-30E equiv to Part III WRA91) Natural Heritage (Scotland) Act 1991(Part II equiv to Part I WRA91)	The Water (NI) Order 1999
SI 1989 No 317: Clean Air, The Air Quality Standards Regulations 1989	SI 1989/317: Clean Air, The Air Quality Standards Regulations 1989	The Air Quality Standards Regulations (Northern Ireland) 1990. Statutory Rules of Northern Ireland 1990 No 145
SI 1997 No 3043: Environmental Protection, The Air Quality Regulations 1997	SSI 2000/97 The Air Quality (Scotland) Regs	No NI equivalent
SI 1989 No 2286 and 1998 No 389 the Surface Water (Dangerous Substances Classification) Regulations. (Values for List II substances are contained in SI 1997/2560 and SI 1998/389)	SI 1990/126 Surface Water (Dangerous Substances) (Classification) (Scotland) Regs	Surface Waters (Dangerous Substances) (Classification) Regulations 1998. Statutory Rules of Northern Ireland 1998 No 397 SI1991/1597:
SI 1991/1597: Bathing Waters (Classification) Regs.	SI 1991/1609 Bathing Waters (Classification) (Scotland) Regs	The Quality of Bathing Water Regulations (NI) 1993
SI 1992/1331 and Direction 1997 Surface Waters (Fishlife) (Classification) Regs.	SI 1997/2471 Surface Waters (Fishlife) (Classification) Regs	The Surface Water (Fishlife) (Classification) Regulations (NI) 1997
SI1997/1332 Surface Waters (Shellfish) (Classification) Regs.	SI 1997/2470 Surface Waters (Shellfish) (Classification) Regs	The Surface Water (Shellfish) (Classification) Regulations (NI) 1997
SI1994/2716 Conservation (Natural Habitats etc) Regulations 1994	SI 1994/2716 Conservation (Natural Habitats etc) Regs	Conservation (Natural Habitats etc) Regulations (Northern Ireland) 1995
Control of Major Accident Hazards Regulations 1999 (COMAH)	SI 1999/743 Control of Major Accident Hazards Regs	Control of Major Accident Hazard Regulations (Northern Ireland) 2000