ENVIRONMENTAL PROTECTION AGENCY

BATNEEC GUIDANCE NOTE

Class 3.6

ROASTING, SINTERING OR CALCINING

(DRAFT 3)

1. INTRODUCTION

This Guidance Note is one of a series issued by the Environmental Protection Agency and is designed to provide guidance to those applying for integrated pollution control licences under the EPA Act. It should also be read in conjunction with *Application Guidance Notes*, available under separate cover.

It should be noted at the outset, that noise is not included within the scope of this work and guidance on this parameter has been issued separately.

This Guidance Note is comprised of seven main sections and an appendix. Following this introduction, Section 2 contains a general note on the interpretation of BATNEEC. The industrial activity covered by the terms of this note is given in Section 3. In Section 4, the technologies to control emissions are tabulated and in Section 5 the specific emission limit values (ELVs) are given. Section 6 contains comments on compliance monitoring requirements, while the principal references are given in Section 7.

The Appendix gives the main sources of emissions, and the principal releases from such sources.

All applicants for Integrated Pollution Control licences, in the sector covered by this note, should carefully examine the information laid down in this Guidance Note, and should use this information to assist in the making of a satisfactory application for an Integrated Pollution Control licence to the Agency. It should be clearly understood that achieving the emission limit values does not, by itself, meet the overall requirements in relation to I.P.C. In addition to meeting such values the applicant will also be required to demonstrate that waste minimisation is a priority objective and to put in place particular abatement measures to reduce overall mass emissions and pollutant load where this is necessary to protect the ambient environment.

The technologies and the associated emission limit values (ELVs) identified in this Guidance Note are, at the time of writing, regarded as representing BATNEEC for new activities. BATNEEC is not a static quality and will change as technologies, environmental factors and costs alter with the passage of time. The Agency may amend or update the guidance contained in this note should such amendments seem appropriate. The information contained in this Guidance Note is intended to be used only as a tool to assist in determining the BATNEEC for an operation in this sector and should not be taken to be a definitive authority on the BATNEEC for this sector**.** This Note should not be considered as a legal document**.**

2. INTERPRETATION OF BATNEEC

BATNEEC means '*the best available technology not entailing excessive costs'*. The technology in question should be **Best** at preventing pollution and **Available** in the sense that it is procurable by any person. **Technology** itself is taken as the techniques and the use of the techniques, including training and maintenance etc.
NEEC addresses the balance between environmental benefit and financial expense.

The objective of the Best Available Technology Not Entailing Excessive Costs (BATNEEC) Guidelines is to provide a list of technologies that will be used by the EPA to determine BATNEEC for a scheduled activity. The BATNEEC identified in this guideline is used as a basis for setting emission limit values. It is intended to update these Guidelines as required in order to incorporate technology advances as they occur.

In the identification of BATNEEC, emphasis is placed on pollution prevention techniques, including cleaner technologies and waste minimisation, rather than end-of-pipe treatment.

Technologies identified in the BATNEEC guidelines are considered to be the current best practice for the purposes of setting emission limit values. These technologies are representative of a wide range of currently employed technologies appropriate to particular circumstances. However, the guidance issued in this note in respect of the use of any technology, technique or standard does not preclude the use of any other similar techniques which may achieve the same emission. The entire range would not necessarily be appropriate in specific cases. The specific choice depends on a wide range of circumstances but the crucial factor is that the selected regime achieves BATNEEC. In applying BATNEEC, Environmental Quality Objectives (EQO's) must be respected where set. Measures such as in-plant changes, raw material substitution, process recycling and improved material handling and storage practices, may also be employed to effect reductions in emissions. As well as providing for the installation of equipment and the operation of procedures for the reduction of possible emissions, BATNEEC will also necessitate the adoption of an on-going programme of environmental management and control, which will focus on continuing improvements aimed at prevention, elimination and/or progressive reduction of emissions.

As described in the EPA Act of 1992, BATNEEC will be used to prevent, eliminate or where that is not practicable, limit, abate, or reduce an emission from an activity which is listed in the first schedule to the Act. The use of BATNEEC is construed in the Act to mean the provision and proper maintenance, operation, use and supervision of facilities which are the most suitable for the purposes.

In determining BATNEEC for an activity, regard shall be had to :

- the current state of technical knowledge;
- the requirements of environmental protection;

- the application of measures for these purposes, which do not entail excessive costs, having regard to the risk of significant environmental pollution which, in the opinion of the agency exists.

For existing facilities, additional regard shall be had to :

- the nature, extent and effect of the emission concerned;

- the nature and age of the existing facilities connected with the activity and the period during which the facilities are likely to be used or to continue in operation, and

- the costs which would be incurred in improving or replacing these existing facilities in relation to the economic situation of activities of the class concerned.

The technologies and the associated emission limit values (ELVs) identified in this Guidance Note are regarded as representing BATNEEC. It is generally envisaged that these emission limit values will gradually be extended to existing facilities. However the specific licence requirements and associated time frames will be identified when the licence is processed. Additional and more stringent requirements may be specified on a site-specific basis.
Where an operator of an existing facility predicts that it will be difficult to meet the emission limit value within the specified time-frame, he will be required to satisfy the Agency as to the reasons why the requirements cannot be met. The applicant will be required to submit an environmental management plan which will give consideration to the following, in order of priority:

- waste reduction/source elimination;
- waste recovery;
- Proposed and alternative treatment technologies and predicted performance data;
- Proposed and alternative waste disposal options.

This management plan must propose a revised time-frame for the achievement of emission limit values as set out in this Guidance Note.

The BATNEEC Guidelines are not the sole basis on which licence emission limit values are to be set, since information from other sources will also be considered; including site-specific environmental and technical data, plant financial data and other relevant information.

3. SECTORS COVERED BY THIS GUIDANCE NOTE

This Guidance Note covers SECTOR 3.6 of the activities specified in the First Schedule to the EPA Act 1992. This is:

3.6 The roasting, sintering or calcining of metallic ores in plants with a capacity exceeding 1,000 tonnes per year.

This Guidance Note refers principally to Lead, Zinc and Iron Ore.

4. CONTROL TECHNOLOGIES

4.1 INTRODUCTION

As explained in Section 2, this Guidance Note identifies BATNEEC but obviously does so in the absence of site-specific information. Accordingly it represents the requirements expected of any new activity covered by the Note, but does not exclude additional requirements which may form part of the granting of a licence for a specific site.

The approach to be used in selecting BATNEEC is based on the following hierarchy:

- Process design / redesign changes to **eliminate** emissions and wastes that might pose environmental problems. (This includes fuel efficiency).

- **Substitution** of fuels etc. by environmentally less harmful ones.

- Demonstration of waste **minimisation** by means of process control, inventory control and end-of-pipe technologies etc.

The existing or possible measures for reducing and controlling emissions are described in this section. These range from relatively simple containment measures to sophisticated recovery and "end-of-pipe" technologies and include:

(i) Load minimisation
(ii) Containment
(iii) Recovery/recycle
(iv) Emission reduction
(v) Waste treatment and disposal

The technical feasibility of the measures listed below has been demonstrated by various sources. Used singly, or in combination, the measures represent BATNEEC solutions when implemented in the appropriate circumstances. The circumstances depend on plant process and scale, fuels used, nature of abatement technology etc. A summary of the treatments for various emissions is given at the end of this section.

Note that where flammable/explosive vapours or dusts are handled, safety procedures (acceptable to HSA) should be adopted and nothing in this note should be construed as advice to the contrary.

4.2 TECHNOLOGIES FOR LOAD MINIMISATION:

(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and on site constraints).

- Control of peak flame temperatures and air additions (for NO_x and CO minimisation).
- Selection of raw materials and fuels to minimise emissions.
- Prevention of rain ingress, wind entrainment for stored materials.
- Inventory control.
- Separation of storm water, bund water and effluents of different origin in order to permit appropriate treatment options.
- Dry equipment cleaning and dry vacuum systems, where feasible.
- Optimisation of process and process technology to minimise emissions.
- For iron processes, continuous desulphurisation during pouring is preferred.

4.3 CONTAINMENT OF EMISSIONS:

(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and on site constraints).

- Storage, handling and transfer should be enclosed.
- Bunding of materials, tanks etc.
- Totally enclosed belt conveyors vented to suitable arrestment plant for dusty materials.
- Conveyors should be fitted with wind boards or equivalent protection.
- Overground pipelines and transfer lines.
- Good housekeeping practise.
- Conveyor transfer points to be reduced to the minimum number practicable and to be designed for minimum free fall, fully enclosed and vented to suitable arrestment plants.
- Conveyors to be fitted with effective means for keeping the return belt clean, and for collection of material removed by this cleaning operation.
- Covered storage for dusty material stockpiles (to contain fugitive emissions).
- Dust from bulk and bag filling of product to be contained by use of local extraction systems. (Wet suppression to be considered as an alternative where dry extraction is not practicable).
- Product storage indoors.
- Overfilling protection on bulk storage tanks.
- Waste material should be damped prior to off-site disposal.
- Fabric filters preferred for dust control where practicable (Electrostatic filters where not).
- Dry adsorption preferred for SO_2 removal.

4.4 TECHNOLOGIES FOR RECOVERY AND RECYCLE:

(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and on site constraints).

- Fines collected in dust abatement systems should where practicable be recycled in enclosed systems to the process.
- Recovery of sulphur/sulphuric acid from SO_2 removal systems.

4.5 TECHNOLOGIES FOR TREATING AIR EMISSIONS:

(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and on site constraints). (Symbols refer to Table 4.1).

- Fabric filters (> 99.5% removal) (T1).
- Electrostatic precipitators (T2).
- Cyclones (for precleaning) (T3).
- Wet suppression (T4).
- Adsorption (Dry or semi dry) (T5).

4.6 TECHNOLOGIES FOR TREATING WATER EMISSIONS:

(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and on site constraints).
(Symbols refer to Table 4.2).

- pH Correction / neutralisation (F1).
- Coagulation / flocculation / precipitation (F2).
- Sedimentation / filtration / floatation (F3).
- Oil/water separation system (F4).

4.7 SPECIFIC TECHNOLOGIES FOR THE TREATMENT AND DISPOSAL OF WASTES:

(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and on site constraints).

- Sludge dewatering.
- Engineered landfill of wastes.
- Outlets should be sought for the reuse of wastes arising from plant cleaning, air filtration etc.
- Waste encapsulation.

Table 4.1 Summary of Technologies for Treating Emissions to Air (Symbols refer to section 4.5)

Emission Type	Technology
Particulates	T1, T2, T3, T4
SO_2	T5 (After T1, T2, T3)

Table 4.2 Summary of Technologies for Treating Water Emissions (Symbols refer to section 4.6)

Emission Type	Technology
Particulates	F2, F3
Metals	F1, F2, F3
Oils etc.	F4

5. EMISSION LIMIT VALUES

5.1 REFERENCE CONDITIONS

The reference conditions for concentrations of substances in emissions to air from contained sources are:

For non-combustion gases:

Temperature 273^{o}K; Pressure 101.3 kPa; no correction for water vapour content.

These units and reference conditions may not be suitable for continuous monitoring methods and may, by agreement with the Agency, be converted for day to day control purposes into values more suitable for the available instrumentation.

5.2 INTERPRETATION OF COMPLIANCE

5.2.1 Emissions to Air

For **continuously monitored** emissions, the following will be required for compliance with measurements based on 30 minute mean values (unless otherwise stated):
(Achievement of ELV concentrations by the introduction of dilution air is not permitted.).

(i) 97% of all 30 minute mean measurements shall be below 1.2 times the emission limit.

(ii) No 30 minute mean measurement shall exceed 2.0 times the emission limit.

(iii) All daily mean values shall be less than the emission concentration limit.

Where **periodic monitoring** is used to check compliance, all samples should meet the consent conditions.

5.2.2 Emissions to Waters

The limit values for discharges to water are based on 24 hour flow proportioned composite samples taken over a representative production period.

5.3 EMISSIONS TO AIR

Table 5.1 Emission Limit Values for Emissions to Air

Emission	Source	Concentration Limit (mg/Nm^3)
Particulates	Iron Ore Sinter Lead/Zinc Processes Secondary Releases	50 10 20
SO_2	Iron Ore Sinter Lead/Zinc Processes	150 800
Lead	Iron Ore Sinter Lead/Zinc Processes	0.5 2
Zinc	Lead/Zinc Processes	5
Arsenic + Selenium + Tellurium	Lead/Zinc Processes	1
Antimony + Copper + Tin	Lead/Zinc Processes	2
Cadmium + Mercury + Thallium	Lead/Zinc Processes	0.5
Fluoride	Iron Ore Sinter	5
Dioxins	All	1 ng/m^3

NOTE 1: Achievement of ELV concentrations by the introduction of dilution air is not permitted

5.4 RELEASES TO WATER

Effluent should be minimised by recycling and re-use wherever practicable. The use of lower quality water may be possible for some parts of the process rather than fresh water.

All releases to controlled waters are subject to a licence from the Agency. However any discharge to sewer will require the consent of the sanitary authority or sewerage undertaker. BATNEEC to minimise the release of substances will generally include minimisation at source and either specific treatment of contaminated waste streams to remove particular substances or co-treatment of combined effluent streams or both. The Emission Limit Values for effluent discharges to waters are set out in Table 5.2.

Table 5. 2 - Emission Limit Values for Discharges to Water*

Constituent Group or Parameter	Limit Value	Notes
pH	6 - 9	3
BOD (mg/l)	25	3
Number of Toxicity Units	1	1,3
Fish Tainting	No Tainting	2
Mineral Oil (mg/l)	20	3
Cadmium (μg/l monthly average)	10	3
Mercury (μg/l monthly average)	5	3
Lead (mg/l)	0.5	3
Zinc (mg/l)	0.5	3
Copper (mg/l)	0.5	3
Nickel (mg/l)	0.5	3
Chromium (VI) (mg/l)	0.1	3
Chromium (Total) (mg/l)	0.5	3

* All values refer to daily averages, except where otherwise stated to the contrary, and except for pH which refers to continuous values. Other metals will be a matter for licensing.

Notes for Table 5.2

1. The toxicity of the effluent shall be determined on an appropriate aquatic species. The number of Toxicity Units (TU) = 100/96 hr LC50 in percentage vol/vol. so that higher TU values reflect greater levels of toxicity. For each TU at least 20 dilutions of the effluent volume must be available in the receiving system.

2. No substance shall be discharged in a manner which, or at a concentration which, following initial dilution causes tainting of fish or shellfish, interferes with normal patterns of fish migration or which accumulates in sediments or biological issues to the detriment of fish, wildlife or their predators.

3. Consent conditions for these parameters for discharge to municipal treatment plants can be established with the Licensing Authority, and different values may apply.

6. COMPLIANCE MONITORING

The monitoring and sampling requirements outlined below primarily relate to the control of releases to air as these will require the most comprehensive control.

6.1. EMISSIONS TO AIR

1. Continuous monitoring of particulate matter in exhaust streams from sinters, calciners and roasters (Opacity may be acceptable as an alternative).

2. Pressure drop indicators to be fitted to all bag filters.

3. Where electrostatic precipitators are in use on major sources, corona power should be continuously recorded.

4. Periodic monitoring of particulate, and SO_2 (where relevant) typically once/quarter taking account of the nature, magnitude and variability of the emission and the reliability of the controls.

6.2 WASTE WATER DISCHARGES

1. Establish existing conditions prior to start-up, of key emission constituents and salient flora and fauna.

2. Daily monitoring of flow and volume, continuous monitoring of pH. Monitoring of other relevant parameters as deemed by the Agency, taking account of the nature, magnitude and variability of the emission and the reliability of the control technologies.

3. Periodic fish tainting and toxicity tests where appropriate, taking account of the nature, magnitude and variability of the emission and the reliability of the control technologies.

6.3 SOLID WASTE MONITORING

1. The recording in a register of the types, quantities, date and manner of disposal of all wastes.

2. Leachate testing of sludges and other material as appropriate being sent for landfilling.

7. PRINCIPAL REFERENCES

7.1 U.K.

7.1.1 Chief Inspectors Guidance to Inspectors Process Guidance Note IPR 2/1 (Iron and Steel Making Processes - Integrated Iron and Steel Works) (Draft 16/11/1993).

7.1.2 Chief Inspectors Guidance to Inspectors Process Guidance Note IPR 2/2 (Iron and Steel Making Processes - Ferrous Foundry Processes) (Draft 14/2/94).

7.1.3 Chief Inspectors Guidance to Inspectors Process Guidance Note IPR 2/5 (Processes for the Manufacture of Lead) (Draft 1/3/94).

7.1.4 Chief Inspectors Guidance to Inspectors Process Guidance Note IPR 2/4 (Processes for the Manufacture of Zinc) (Draft 1/3/94).

7.2 PARCOM

7.2.1 Best Available Technologies for the Reduction of Emissions to the Environment from the Primary Iron and Steel Industry (September 1992).

7.2.2 Recommendation 92/2 concerning limitation of Pollution from New Primary Iron and Steel Production Installations.

7.3. E.C.

7.3.1 Technical Note on Best Available Technologies not Entailing Excessive Costs for Heavy Metal Emissions from Non-ferrous Industrial Plants (May 1991).

Appendix 1

MAIN EMISSIONS

1. INTRODUCTION

In this section, the major sources of emissions to air and water are identified, as are the principal sources of waste from the sector. It should be borne in mind that the identified list of sources is not all encompassing, nor will every plant falling within an individual sector have every one of the emissions which are associated with the sector as a whole.

It should be noted that quarrying aspects of raw material production are outside the scope of this Guidance Note.

Emissions are considered under the following headings: fugitive and unscheduled emissions, and specific process emissions. Some of the latter are considered to have little potential environmental significance and these are designated as minor (m). (However, obviously there could be specific plants where this designation of minor may not be correct. Such emissions must then be examined on a one-off basis).

2. SOURCES OF EMISSIONS TO AIR:

2.1 Fugitive and Unscheduled Emissions

- Dust from delivery of raw materials to site.
- Dust from storage of raw materials, processed materials and product.
- Emissions from site (surfaces, spillages, stockpiles, buildings etc.).

2.2 Process Emissions (Symbols refer to Table A1)

- Dust from crushing and sieving or ore (S1).
- Dust from conveying and transport of materials including discharges from pneumatic systems (S1, S2, S3).
- Dust from sinter cake crushing, air cooling and screening (S1).
- Dust from filling processed material into storage, bulk transport (off-site processing) etc. (S1).
- Sinter, Calciner and Roaster (S1, S4).

3 SOURCES OF EMISSIONS TO WATER: (SYMBOLS REFER TO TABLE A2)

3.1 Spills and Diffuse Sources

- Contaminated surface water (E1).
- Bund drainage (E1 and E2).

3.2 Process Emissions

- Laboratory effluent (m).
- Abatement systems (E1).
- Quench (E3).

4 SOURCES OF WASTE: (SYMBOLS REFER TO TABLE A3)

- Dust from abatement systems and interceptors (W1).
- Sludges from effluent treatment (W1).
- Slag from desulphurisation (S2).

5. RELEASES

The substances most likely to be present in the release to the environment and of principal concern in the processes covered by this note are given below. A licence applicant should identify and quantify all environmentally significant emissions (including heat discharges) from the process.

Table A1 Summary of Sources and Emissions to Air
(Symbols refer to section 2 in Appendix)

Source	Emissions
S1	Particulates (ore, metals etc.)
S2	Particulates (quicklime)
S3	Particulates (coke)
S4	Sulphur and compounds (arising from sulphur in fuel and raw materials) Nitrogen and compounds (associated with fuel and combustion air) Oxides of carbon (incl. CO from incomplete combustion and CO_2 from process and fuel) Metals, metalloids and compounds (raw materials and fuel) Chlorine, fluorine and compounds VOCs (incl. dioxins)

Table A2 Summary of Sources and Emissions to Water
(Symbols refer to section 3 in Appendix)

Source	Emissions
E1	Particulates (ore, sintered, or calcined product, coke, lime) Other substances (depending on raw materials e.g. metals and compounds)
E2	Oil (or other fuels)
E3	Metals (i.e. lead, iron, etc.) Sulphur

Table A3 Summary of Sources and Emissions to Waste
(Symbols refer to section 4 in Appendix)

Source	Emissions
W1	Particulates (ore, sintered or calcined product, coke, lime) Other substances (depending on raw materials e.g. metals and compounds)
W2	Sulphur, metals (e.g. iron)