“Capacity Building and Strengthening Institutional Arrangement”

Workshop: “Best Available Techniques (BAT)

BAT on Smelter Industries

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APAT

Agency for Environmental Protection and Technical Services

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1. Introduction

The most important aspects of iron and steel making in integrated teelworks (sinter plants, pelletisation plants,coke oven plants, blast furnaces and basic oxygen furnaces including continuous or ingot casting) and electric arc furnace steelmaking are:

•**Environmental issues** of iron and steel making relate to emissions to air and to solid wastes/by-products.

•**Wastewater emissions** from coke oven plants, blast furnaces and basic oxygen furnaces (the most relevant emissions to water in this sector).

1. Introduction

Standing shape

Modifying shape

2. BAT for productive cycles

BAT for Sinter Plants

- Sinter, as a product of an agglomeration process of iron-containing materials, represents a major part of the burden of blast furnaces.
- The most relevant environmental issues are the off-gas emissions from the sinter strand, which contains a wide range of pollutants such as dust, heavy metals, SO_2, HCl, HF, PAHs and organochlorine compounds (such as PCB and PCDD/F).
- Most of the techniques to consider in the determination of BAT refer to the reduction of emissions to air.
- The most important parameters are dust and PCDD/F.

2. BAT for productive cycles

BAT for Sinter Plants

•For sinter plants, the following ***techniques*** or ***combination of techniques*** are considered as ***BAT***:

1. **Waste gas de-dusting** by application of:

- Advanced electrostatic precipitation (ESP) (moving electrode ESP, ESP pulse system, high voltage operation of ESP …) *or*
- electrostatic precipitation plus fabric filter *or*
- pre-dedusting (e.g. ESP or cyclones) plus high pressure wet scrubbing system.

Using these techniques dust emission concentrations < **50 mg/Nm3** are achieved in normal operation.

2. BAT for productive cycles

BAT for Sinter Plants

In case of application of a fabric filter, emissions of **10-20 mg/Nm3** are achieved.

2. **Waste gas recirculation**, if sinter quality and productivity are not significantly affected, by applying:
   - recirculation of part of the waste gas from the entire surface of the sinter strand, *or*
   - sectional waste gas recirculation.

2. BAT for productive cycles

BAT for Sinter Plants

***3.* Minimising of PCDD/F emissions**, by means of:

- Application of waste gas recirculation;
- Treatment of waste gas from sinter strand;
- Use of fine wet scrubbing systems, values < **0.4 ng I- TEQ/Nm3** have been achieved.
- Fabric filtration with addition of lignite coke powder also achieves low PCDD/F emissions (> 98 % reduction, **0.1 – 0.5 ng I-TEQ/Nm3**; this range is based on a 6 hours random sample and steady state conditions).

I-TEQ: Indicator-Toxicity Euivalent

2. BAT for productive cycles

BAT for Sinter Plants

4. **Minimisation of heavy metal emissions**

- Use of fine wet scrubbing systems in order to remove water-soluble heavy metal chlorides, especially lead chloride(s) with an efficiency of > 90% or a bag filter

with lime addition;

- Exclusion of dust from last ESP field from recycling to the sinter strand, dumping it on a secure landfill (watertight sealing, collection and treatment of

leachate), possibly after water extraction with subsequent precipitation of heavy metals in order to minimise the quantity to dump.

2. BAT for productive cycles

BAT for Sinter Plants

5. Minimisation of solid waste

- Recycling of by-products containing iron and carbon from the integrated works, taking into account the oil content of the single by-products (< 0.1 %).
- For solid wastes generation, the following techniques are considered BAT in descending order of priority:
  - Minimising waste generation
  - Selective recycling back to the sinter process
- Whenever internal reuse is hampered, external reuse should be aimed at
- If all reuse is hampered, controlled disposal in combination with the minimisation principle is the only option.

2. BAT for productive cycles

BAT for Sinter Plants

6. Lowering the hydrocarbon content of the sinter feed and avoidance of anthracite as a fuel. Oil contents of the recycled by-products/residues < 0.1% are achievable.

7. Recovery of sensible heat:

Sensible heat can be recovered from the sinter cooler waste gas and is feasible in some cases to recover it from the sinter grate waste gas. The application of waste gas recirculation can also be considered a form of sensible heat recovery.

2. BAT for productive cycles

BAT for Sinter Plants

***8.* Minimisation of SO_2 emissions** by, for example:

- Lowering the sulphur input (use of coke breeze with low sulphur content and minimisation of coke breeze consumption, use of iron ore with low sulphur content); with these measures emission concentrations < 500 mg SO_2/Nm^3 can be achieved.
- With wet waste gas desulphurisation, reduction of SO_2 emissions > 98% and SO_2 emission concentrations < 100 mg SO_2/Nm^3 are achievable.

Due to the high cost wet waste gas desulphurisation should only be required in circumstances where environmental quality standards are not likely to be met.

2. BAT for productive cycles

BAT for Sinter Plants

9. Minimisation of NOx emissions by, for example:

- waste gas recirculation
- waste gas denitrification, applying
- regenerative activated carbon process
- selective catalytic reduction

Due to the high cost waste gas denitrification is not applied except in circumstances where environmental quality standards are not likely to be met.

2. BAT for productive cycles

BAT for Sinter Plants

10. Emissions to water (not cooling water)

These are only relevant when rinsing water is used or when wet waste gas treatment system is employed.

In these cases, the effluent water to the receiving environment should be treated by heavy metal precipitation, neutralisation and sand filtration. TOC concentrations < 20 mg C/l and heavy metal concentrations < 0.1 mg/l (Cd, Cr, Cu, Hg, Ni, Pb, Zn) are achieved.

When the receiving water is fresh, attention has to be paid to salt content.

Cooling water can be recycled.

2. BAT for productive cycles

BAT for Sinter

•In principle the techniques mentioned in points 1–10 are applicable to both new and existing installations.

BAT for Pelletisation Plants

Pelletisation is another process to agglomerate iron-containing materials.

While sinter is practically always produced at the steelworks site for various reasons, pellets are mainly produced at the site of the mine or its shipping port.

2. BAT for productive cycles

BAT for Pelletisation Plants

Also for these plants, emissions to air dominate the environmental issues. As a consequence, most of the described techniques to consider in the determination of BAT refer to emissions to air and the conclusions as well.

For ***Pelletisation Plants***, the following techniques or combination of techniques are considered as BAT.

1.Efficient removal of particulate matter, SO2, HCl and HF from the induration strand waste gas, by means of:

- Scrubbing *or*
- Semi-dry desulphurisation and subsequent de-dusting (e.g. gas suspension absorber (GSA)) *or* any other device with the same efficiency.

2. BAT for productive cycles

BAT for Pelletisation Plants

Achievable removal efficiency for these compounds are:

- Particulate matter: >95%; corresponding to achievable concentration of < 10 mg dust/Nm3.
- SO_2: >80%; corresponding to achievable concentration of < 20 mg SO_2/Nm3.
- HF: >95%; corresponding to achievable concentration of < 1 mg HF/Nm3.
- HCl: >95%; corresponding to achievable concentration of < 1 mg HCl/Nm3.

2. Emissions to water from scrubbers are minimised by means of water cycle closure, heavy metal precipitation, neutralisation and sand filtration.

2. BAT for productive cycles

BAT for Pelletisation Plants

3. **Process-integrated NOx abatement**; Plant design should be optimised for recovery of sensible heat and low-NOx emissions from all firing sections (induration strand, where applicable and drying at the grinding mills).

In one plant, of the grate-kiln type and using manetite ore emissions < 150 g NOx/t pellets are achieved.

In other plants (existing or new, of the same or other type, using the same or other raw materials), solutions have to be tailor-made and the possible NOx emission level might vary from site to site.

2. BAT for productive cycles

BAT for Pelletisation Plants

4. **Minimisation of end-of-pipe NOx emissions** by means of end-of-pipe techniques:

Selective Catalytic Reduction or any other technique with a NOx reduction efficiency of at least 80%.

Due to high cost waste gas denitrification should only be considered in circumstances where environmental quality standards are otherwise not likely to be met; to date there are no de-NOx systems in operation at any commercial pelletisation plant.

2. BAT for productive cycles

BAT for Pelletisation Plants

5. **Minimising solid waste/by-products.** The following techniques are considered BAT in descending order of priority:

- Minimising waste generation;
- Effective utilisation (recycling or reuse) of solid wastes/by- products;
- Controlled disposal of unavoidable wastes/by-products.

6. **Recovery of sensible heat**;

Most pelletisation plants already have a high rate of energy recovery. For further improvements, tailor-made solutions are usually necessary.

2. BAT for productive cycles

BAT for Coke Oven Plants

Coke is needed as the primary reducing agent in blast furnaces. Also for coke oven plants, emissions to air are most significant. However, many of these are fugitive emissions from various sources such as leakages from lids, oven doors and leveller doors, ascension pipes and emissions from certain operations like coal charging, coke pushing and coke quenching. In addition, fugitive emissions arise from the coke oven gas treatment plant. The main point source for emissions to air is the waste gas from the underfiring systems.

2. BAT for productive cycles

BAT for Coke Oven Plants

Consequently most of the techniques to consider in the determination of BAT refer to the minimisation of emissions to air.

For coke oven plants, the following techniques or combination of techniques are considered as BAT.

1. **General**:

- Extensive maintenance of oven chambers, oven doors and frame seals, ascension pipes, charging holes and other equipment (systematic programme carried out by specially trained maintenance personnel);
- Cleaning of doors, frame seals, charging holes and lids and ascension pipes after handling.
- Maintaining a free gas flow in the coke ovens.

2. BAT for productive cycles

BAT for Coke Oven Plants

2. **Charging**:

- Charging with charging cars.

From an integrated point of view, "smokeless" charging or sequential charging with double ascension pipes or jumper pipes are the preferred types, because all gases and particulate matter are treated as part of coke oven gas treatment. If however the gases are extracted and treated outside the coke oven, charging with land-based treatment of the extracted gases is the preferred method. Treatment should consist of efficient evacuation and subsequent combustion and fabric filtration. Emissions of particulate matter < 5 g/t coke are achievable.

2. BAT for productive cycles

BAT for Coke Oven Plants

3. **Coking**:

A combination of the following measures:

- Smooth, undisturbed coke oven operation, avoiding strong temperature fluctuations;
- Application of spring-loaded flexible-sealing doors or knife edged doors (in case of ovens ≤5m high and good maintenance) achieving:

<5% visible emissions (frequency of any leaks compared to the total number of doors) from all doors in new plants *and* <10% visible emissions from all doors in existing plants.

2. BAT for productive cycles

BAT for Coke Oven Plants

- Water-sealed ascension pipes, achieving <1% visible emissions (frequency of any leaks compared to the total number of ascension pipes) from all pipes;
- Luting charging holes with clay-suspension (or other suitable sealing material), achieving <1% visible emissions (frequency of any leaks compared to the total number of holes) from all holes;
- Levelling doors equipped with sealing package achieving <5% visible emissions.

2. BAT for productive cycles

BAT for Coke Oven Plants

4. **Firing**:

- Use of desulphurized COG
- Prevention of leakage between oven chamber and heating chamber by means of regular coke oven operation *and*
- Repair of leakage between oven chamber and heating chamber *and*
- Incorporation of low-NOx techniques in the construction of new batteries, such as stage combustion (emissions in the order of 450 – 700 g/t coke and 500-770 mg/Nm3 respectively are achievable in new/modern plants).

2. BAT for productive cycles

BAT for Coke Oven Plants

- Due to the high cost, flue gas denitrification (e.g. SCR) is not applied except in new plants under circumstances where environmental quality standards are not likely to be met.

5. **Pushing**:

- Extraction with an (integrated) hood on coke transfer machine and land-based extraction gas treatment with fabric filter and usage of one point quenching car to achieve less than 5 g particulate matter/t coke (stack emission).

2. BAT for productive cycles

BAT for Coke Oven Plants

6. **Quenching**:

- Emission minimised wet quenching with less than 50 g particulate matter/t coke (determined according VDI method). The use of process-water with significant organic load (like raw coke oven wastewater, wastewater with high content of hydrocarbons etc.) as quenching water is avoided.

- Coke dry quenching (CDQ) with recovery of sensible heat and removal of dust from charging, handling and sieving operations by means of fabric filtration.

2. BAT for productive cycles

BAT for Coke Oven Plants

With respect to present energy prices in the EU, “instrument/operational costenvironmental benefit”- consideration sets strong limitations on the applicability of CDQ. In addition a use of recovered energy must be available.

7. **Coke oven gas desulphurisation**:

- Desulphurisation by absorption systems (H_2S content grid gas 500-1000 mg H_2S/Nm^3) *or* - Oxidative desulphurisation (< 500 mg H_2S/Nm^3), provided that cross-media effects of toxic compounds are abated to a large extent.

2. BAT for productive cycles

BAT for Coke Oven Plants

8. **Gas-tight operation of gas treatment plant**:

All measures to enable virtually gas-tight operation of the gas treatment plant should be considered like:

- Minimising the number of flanges by welding piping connections wherever possible;
- Use of gas-tight pumps (e.g. magnetic pumps);
- Avoiding emissions from pressure valves in storage tanks, by means of connection of the valve outlet to the coke oven gas collecting main (or by means of collecting the gases and subsequent combustion).

2. BAT for productive cycles

BAT for Coke Oven Plants

9. **Wastewater pre-treatment**:

- Efficient ammonia stripping, using alkalis.

Stripping efficiency should be related to subsequent wastewater treatment. Stripper effluent NH_3 concentrations of 20 mg/l are achievable;

- Tar removal.

10. **Wastewater treatment**:

Biological wastewater treatment with integrated nitrification/denitrification achieving:

- COD removal: > 90%
- Sulphide: < 0.1 mg/l
- PAH (6 Borneff): < 0.05 mg/l

2. BAT for productive cycles

BAT for Coke Oven Plants

- CN^-: < 0.1 mg/l
- Phenols: < 0.5 mg/l
- Sum of NH_4^+, NO_3 and NO_2: < 30 mgN/l
- Suspended solids: < 40 mg/l

These concentrations are based on a specific wastewater flow of 0.4 m^3/t coke.

2. BAT for productive cycles

BAT for Blast Furnaces

The ***Blast Furnace*** remains by far the most important process to produce pig iron from iron containing materials.

Because of the high input of reducing agents (mainly coke and coal) this process consumes most of the overall energy input of an integrated steelworks.

Relevant emissions to all media occur.

BAT cover all these aspects including: minimisation of energy input, reduction of dust from the cast house, treatment of wastewater from blast furnace gas scrubbing, reuse of slag and dusts/sludges and finally the energy input minimisation and the reuse of blast furnace gas.

2. BAT for productive cycles

BAT for Blast Furnaces

For blast furnaces, the following techniques or combination of techniques are considered as ***BAT***.

1. Blast furnace gas recovery;
2. Direct injection of reducing agents; e.g. a pulverised coal injection of 180 kg/t pig iron is already proven, but higher injection rates could be possible.
3. Energy recovery of top BF gas pressure where prerequisites are present;
4. Hot stoves
   - emission concentration of dust <10 mg/Nm3 and of NOx<350 mg/Nm3 (related to an oxygen content of 3%) can be achieved
   - energy savings where design permits.

2. BAT for productive cycles

BAT for Blast Furnaces

5. Use of tar-free runner linings;

6. Blast furnace gas treatment with efficient de-dusting; Coarse particulate matter is preferably removed by means of dry separation techniques (e.g. deflector) and should be reused. Subsequently fine particulate matter is removed by means of:

- a scrubber *or*
- a wet electrostatic precipitator *or*
-any other technique achieving the same removal efficiency;

A residual particulate matter concentration of <10 mg/Nm3 is possible.

2. BAT for productive cycles

BAT for Blast Furnaces

7. Cast house de-dusting (tap-holes, runners, skimmers, torpedo ladle charging points);

Emissions should be minimised by covering the runners and evacuation of the mentioned emission sources and purification by means of fabric filtration or electrostatic precipitation. Dust emission concentrations of 1-15 mg/Nm3 can be achieved. Regarding fugitive emissions 5-15 g Dust/t pig iron can be achieved; thereby the capture efficiency of fumes is important. Fume suppression using nitrogen (in specific circumstances, e.g. where the design of the casthouse allows and nitrogen is available).

2. BAT for productive cycles

BAT for Blast Furnaces

8. Treatment of blast furnace gas scrubbing wastewater:

a. Reuse of scrubbing water as much as possible;

b. Coagulation/sedimentation of suspended solids (residual suspended solids < 20 mg/l can be achieved as an annual average, a single daily value up to 50 mg/l may occur);

c. Hydro-cyclonage of sludge with subsequent reuse of the coarse fraction when grain size distribution allows reasonable separation.

9. Minimising slag treatment emissions and slag to landfill;

Slag treatment preferably by means of granulation where market conditions allow.

2. BAT for productive cycles

BAT for Blast Furnaces

Condensation of fume if odour reduction is required. Whenever pit slag is produced, forced cooling with water should be minimised or avoided where possible and where space restrictions allow.

10. Minimising solid waste/by-products. For solid wastes, the following techniques are considered BAT in descending order of priority:

a. Minimising solid waste generation;

2. BAT for productive cycles

BAT for Blast Furnaces

b. Effective utilisation (recycling or reuse) of solid wastes/by-products; especially recycling of coarse dust from BFgas treatment and dust from cast house de-dusting, complete reuse of slag (e.g. in the cement industry or for road construction);

c. Controlled disposal of unavoidable wastes/by-products (fine fraction of sludge from BFgas treatment, part of the rubble).

2. BAT for productive cycles

Basic Oxygen Steelmaking and Casting

The objective of oxygen steelmaking is to oxidise the undesirable impurities still contained in the hot metal from blast furnaces.

The main environmental issues are emissions to air from various sources as described and various solid waste/by-products which are also described. In addition wastewater arises from wet de-dusting (when applied) and from continuous casting.

The techniques to consider in the determination of BAT cover these aspects as well as:

- the recovery of basic oxygen furnace gas;

2. BAT for productive cycles

Basic Oxygen Steelmaking and Casting

- minimisation of dust emissions from the different sources - measures to reuse/recycle solid waste/by-products, wastewater from wet de-dusting and the recovery of basic oxygen furnace gas.

For basic oxygen steelmaking and casting, the following techniques or combination of techniques are considered as ***BAT***.

2. BAT for productive cycles

Basic Oxygen Steelmaking and Casting

1. Particulate matter abatement from hot metal pre-treatment (including hot metal transfer processes, desulphurisation and deslagging), by means of:

- Efficient evacuation;
- Subsequent purification by means of fabric filtration or ESP.

Emission concentrations of 5-15 mg/Nm3 are achievable with bag filters and 20-30 mg/Nm3 with ESP.

2. BAT for productive cycles

Basic Oxygen Steelmaking and Casting

2. BOF gas recovery and primary de-dusting, applying:

- Suppressed combustion *and*
- Dry electrostatic precipitation (in new and existing situations) *or*
- Scrubbing (in existing situations).

Collected BOF gas is cleaned and stored for subsequent use as a fuel. In some cases, it may not be economical or, with regard to appropriate energy management, not feasible to recover the BOF gas. In these cases, the BOF gas may be combusted with generation of steam.

2. BAT for productive cycles

Basic Oxygen Steelmaking and Casting

The kind of combustion (full combustion or suppressed combustion) depends on the local energy management.

Collected dusts and/or sludges should be recycled as much as possible.

Note the usually high zinc content of the dust/sludge. Special attention should be paid to the emissions of particulate matter from the lance hole.

This hole should be covered during oxygen blowing and, if necessary, inert gas injected into the lance hole to dissipate the particulate matter.

2. BAT for productive cycles

Basic Oxygen Steelmaking and Casting

3. Secondary de-dusting, applying:

- Efficient evacuation during charging and tapping with subsequent purification by means of fabric filtration or ESP or any other technique with the same removal efficiency.

Capture efficiency of about 90% can be achieved.

Residual dust content of 5-15 mg/Nm3 in case of bag filters and of 20-30 mg/Nm3 in case of ESP can be achieved. Note the usually high zinc content of the dust.

2. BAT for productive cycles

Basic Oxygen Steelmaking and Casting

- Efficient evacuation during hot metal handling (reladling operations), deslagging of hot metal and secondary metallurgy with subsequent purification by means of fabric filtration or any other technique with the same removal efficiency.

For these operations emission factors below 5 g/t LS are achievable.

Fume suppression with inert gas during reladling of hot metal from torpedo ladle (or hot metal mixer) to charging ladle in order to minimise fume/dust generation.

2. BAT for productive cycles

Basic Oxygen Steelmaking and Casting

4. Minimisation/abatement of emissions to water from primary wet de-dusting of BOF gas applying the following measures:

- Dry BOF gas cleaning can be applied when space permits;
- Recycling of scrubbing water as much as possible (e.g. by means of CO_2 injection in case of suppressed combustion systems);
- Coagulation and sedimentation of suspended solids; 20 mg/l suspended solids can be achieved.

2. BAT for productive cycles

Basic Oxygen Steelmaking and Casting

5. Abatement of emissions to water from direct cooling at the continuous casting machines by:

- Recycling of process and cooling water as much as possible;
- Coagulation and sedimentation of suspended solids;
- Removal of oil using skimming tanks or any other effective device.

6. Minimisation of solid waste

For solid waste generation, the following techniques are considered BAT in descending order of priority: - Minimising waste generation; - Effective utilisation (recycling or reuse) of solid wastes/by-products, especially recycling of BOF slag and coarse and fine dust from BOF gas treatment;

- Controlled disposal of unavoidable wastes.

2. BAT for productive cycles

Electric Steelmaking and Casting

The direct smelting of iron-containing materials, mainly scrap is usually performed in electric arc furnaces which need considerable amounts of electric energy and causes substantial emissions to air an solid wastes/by-products mainly filter dust and slags. The emissions to air from the furnace consist of a wide range of inorganic compounds (iron oxide dust and heavy metals) and organic compounds such as the important organochlorine compounds chlorobenzenes, PCB and PCDD/F. Emissions to air, dust and PCDD/F are the most relevant parameters.

2. BAT for productive cycles

Electric Steelmaking and Casting

Scrap preheating is also considered as BAT just as reuse/recycling of slags and dusts.

The following techniques or combination of techniques are considered as ***BAT***.

1. Dust collection efficiency

- With a combination of direct off gas extraction (4th or 2nd hole) and hood systems *or*
- dog-house and hood systems *or*

-total building evacuation

98% and more collection efficiency of primary and secondary emissions from EAF are achievable.

2. BAT for productive cycles

Electric Steelmaking and Casting

2. Waste gas de-dusting by application of:

-Well-designed fabric filter achieving less than 5 mg dust/Nm3 for new plants and less than 15 mg dust/Nm3 for existing plants, both determined as daily mean values.

The minimisation of the dust content correlates with the minimisation of heavy metal emissions except for heavy metals present in the gas phase like mercury.

3. Minimising of organochlorine compounds, especially PCDD/F and PCB emissions, by means of:

2. BAT for productive cycles

Electric Steelmaking and Casting

- appropriate post-combustion within the off gas duct system or in a separate postcombustion chamber with subsequent rapid quenching in order to avoid de novosynthesis *and/or*

- injection of lignite powder into the duct before fabric filters.

Emission concentrations of PCDD/F 0.1 - 0.5 ng I-TEQ/Nm3 are achievable.

2. BAT for productive cycles

Electric Steelmaking and Casting

4. Scrap preheating (in combination with 3.) in order to recover sensible heat from primary off gas

- With scrap preheating of part of the scrap about 60 kWh/t can be saved, in case of preheating the total scrap amount up to 100 kWh/t liquid steel can be saved. The applicability of scrap preheating depends on the local circumstances and has to be proved on a plant by plant basis. When applying scrap preheating it has to be taken care of possibly increased emissions of organic pollutants.

2. BAT for productive cycles

Electric Steelmaking and Casting

5. Minimising solid waste/by-products

For solid wastes, the following techniques are considered BAT in descending order of priority:

- Minimisation of waste generation
- Waste minimisation by recycling of EAF slags and filter dusts; depending on local circumstances filter dust can be recycled to the electric arc furnace in order to achieve a zinc enrichment up to 30%. Filter dust with zinc contents of more than 20% can be used in the non-ferrous metal industry.

2. BAT for productive cycles

Electric Steelmaking and Casting

- Filter dusts from the production of high alloyed steels can be treated to recover alloying metals.

- For solid wastes, which can not be avoided or recycled, the generated quantity should be minimised. If all minimisation/reuse is hampered, controlled disposal is the only option.

6. Emissions to water

- Closed loop water cooling system for the cooling of furnace devices.

- Wastewater from continuous casting

  - Recycling of cooling water as much as possible

2. BAT for productive cycles

Electric Steelmaking and Casting

- Precipitation/sedimentation of suspended solids
- Removal of oil in shimming tanks or any other effective device.

3. Conclusions

The techniques and levels presented will therefore not necessarily be appropriate for all installations.

The obligation to ensure a high level of environmental protection including the minimisation of long-distance or transboundary pollution implies that permit conditions cannot be set on the basis of purely local considerations.