Scope of BAT Conclusions for non-ferrous metals

BAT Conclusions –BATC NFM

- COMMISSION IMPLEMENTING DECISION (EU) 2016/1032
- of 13 June **2016**
- establishing best available techniques (**BAT**) **conclusions**, under Directive 2010/75/EU of the European Parliament and of the Council, for the **non-ferrous metals industries**

Scope of BAT Conclusions NFM

Concerned activities of Annex I to Directive 2010/75/EU -IED

— **2.1: Metal ore (including sulphide ore) roasting or sintering**;

— **2.5: Processing of non-ferrous metals**:

(a) production of non-ferrous crude metals from ore, concentrates or secondary raw materials by metallurgical, chemical or electrolytic processes;

(b) melting, including the alloyage, of non-ferrous metals, including recovered products and operation of non-ferrous metal foundries, with a melting capacity exceeding **4** tonnes per day for lead and cadmium or **20** tonnes per day for all other metals;

— **6.8: Production of carbon (hard-burnt coal) or electrographite by means of incineration or graphitisation.**

NMF Bref on non-ferrous metals industries

2001; 745 pages	Fin Draft Oct. 2014; 1184 pages BATCs ; 13. June 2016; 74 pages
3-Copper and its Alloys	2-Copper and ist Alloys
4-Aluminium	3-Aluminium
5-Zinc, Lead, Cadmium	4-Lead and Tin
6-Precious Metals	5-Zinc and Cadmium
7-Mercury	6-Precious Metals
8-Refractory Metals	7-Ferro Alloys
9-Ferro-Alloys	8-Nickel and Cobalt
10-Alkali and Alkaline Earth Metals	9-Carbon and Graphite
11-Nickel and Cobalt	
12-Carbon and Graphite	

BATC NFM covered processes and activities

— primary and secondary production of non-ferrous metals;
— the production of zinc oxide from fumes during the production of other metals;
— the production of nickel compounds from liquors during the production of a metal;
— the production of silicon-calcium (CaSi) and silicon (Si) in the same furnace as the production of ferro-silicon;
— the production of aluminium oxide from bauxite prior to the production of primary aluminium, where this is an integral part of the production of the metal;
— the recycling of aluminium salt slag;
— the production of carbon and/or graphite electrodes.

BATC NFM not-covered processes and activities

These BAT conclusions do not address the following activities or processes:

— Iron ore sintering. This is covered in the BAT conclusions for Iron and Steel production **- IS**.

— The production of sulphuric acid based on SO2 gases from non-ferrous metals production. This is covered in the BAT conclusions on Large Volume Inorganic Chemicals-Ammonia, Acids and Fertilisers –**LVIC**.

— Foundries covered in the BAT conclusions for the Smitheries and Foundries Industry **- SF**.

Other relevant BREFs

-Energy Efficiency (ENE) for General aspects of energy efficiency
-Common Waste Water and Waste Gas Treatment/Management Systems in the Chemical Sector (CWW) for Waste water treatment techniques to reduce emissions of metals to water
-Large Volume Inorganic Chemicals-Ammonia, Acids and Fertilisers (LVIC-AAF) for Sulphuric acid production
-Industrial Cooling Systems (ICS) for Indirect cooling with water and/or air
-Emissions from Storage (EFS) for Storage and handling of materials
-Economics and Cross-media Effects (ECM) for Economics and cross-media effects of techniques
-Monitoring of Emissions to Air and Water from IED installations (ROM)
-Waste Treatments Industries (WT) for Waste handling and treatment
-Large Combustion Plants (LCP) for Combustion plants generating steam and/or electricity
-Surface Treatment Using Organic Solvents (STS) for Non-acid pickling
-Surface Treatment of Metals and Plastics (STM) for Acid pickling

BATC GENERAL CONSIDERATIONS

Best Available Techniques

-The techniques listed and described in BAT conclusions are

neither prescriptive nor exhaustive.

-Other techniques may be used that ensure **at least an equivalent level of environmental protection**.

-Unless otherwise stated, the BAT conclusions are **generally applicable**

-Emission levels to air associated with BAT = Associated **E**mission **L**evels

BAT-AELs for emissions to air refer to standard conditions:

-dry gas,

-temperature of 273,15 K,

-pressure of 101,3

BATC GENERAL CONSIDERATIONS

Applied averaging periods for emissions to air

- **Daily average**: Average over a period of 24 hours of valid half-hourly or hourly averages obtained by **continuous** measurements
- **Average over the sampling period** : Average value of **3 consecutive measurements** of **at least 30 minutes each.**
- For **batch processes**: average of a representative number of measurements taken over the total batch can be used.

Applied averaging periods for emissions to water

- **Daily average :** Average over a **sampling** period of **24 hours** taken as a flow-proportional composite sample or
- a **time-proportional** composite sample provided that sufficient flow stability is demonstrated.
- For **discontinuous flows**: a different sampling procedure yielding representative results (e.g. spot sampling) can be used.

GENERAL BAT CONCLUSIONS - BATCs

=>Any relevant the **8 process-specific** BATCs apply **in addition** to **general** BATCs

-Environmental management systems (EMS)

- commitment of the management, including senior management;
- definition of an environmental policy that includes the continuous improvement of the installation by the management;
- planning and establishing the necessary procedures, objectives and targets, in conjunction with financial planning and investment;
- checking performance and taking corrective action;
- monitoring and measurement ;
- review of the EMS and its continuing suitability, adequacy and effectiveness by senior management;

GENERAL BAT CONCLUSIONS - BATCs

Energy management 1

BAT is to use a combination of the techniques given below

->where applicable ; ga - generally applicable

-Energy efficiency management system (e.g. ISO 50001) -> ga

-Regenerative or recuperative burners -> ga

-Heat recovery (e.g. steam, hot water, hot air) from process waste heat ->pyrometallurgical processes

-Regenerative thermal oxidiser ->when abatement of a combustible pollutant is required

-Preheat the furnace charge, combustion air or fuel using the heat recovered from hot gases from the melting stage ->for roasting or smelting of sulphide ore/-concentrate and for other pyrometallurgical processes

-Raise the temperature of the leaching liquors using steam or hot water from waste heat recovery ->for alumina or hydrometallurgical processes

-Use hot gases from the launder as preheated combustion air -> for pyrometallurgical processes

-Use oxygen-enriched air or pure oxygen in the burners to reduce energy consumption by allowing autogenous smelting or the complete combustion of carbonaceous material ->for furnaces that use raw materials containing sulphur or carbon

GENERAL BAT CONCLUSIONS - BATCs

Energy management 2

-Dry concentrates and wet raw materials at low temperatures ->when drying is performed

-Recover the chemical energy content of the carbon monoxide produced in an electric- or shaft-/blast furnace by using the exhaust gases as a fuel (after the removal of metals) in other production processes or to produce steam/hot water or electricity ->for exhaust gases with a CO content > 10 vol-%.

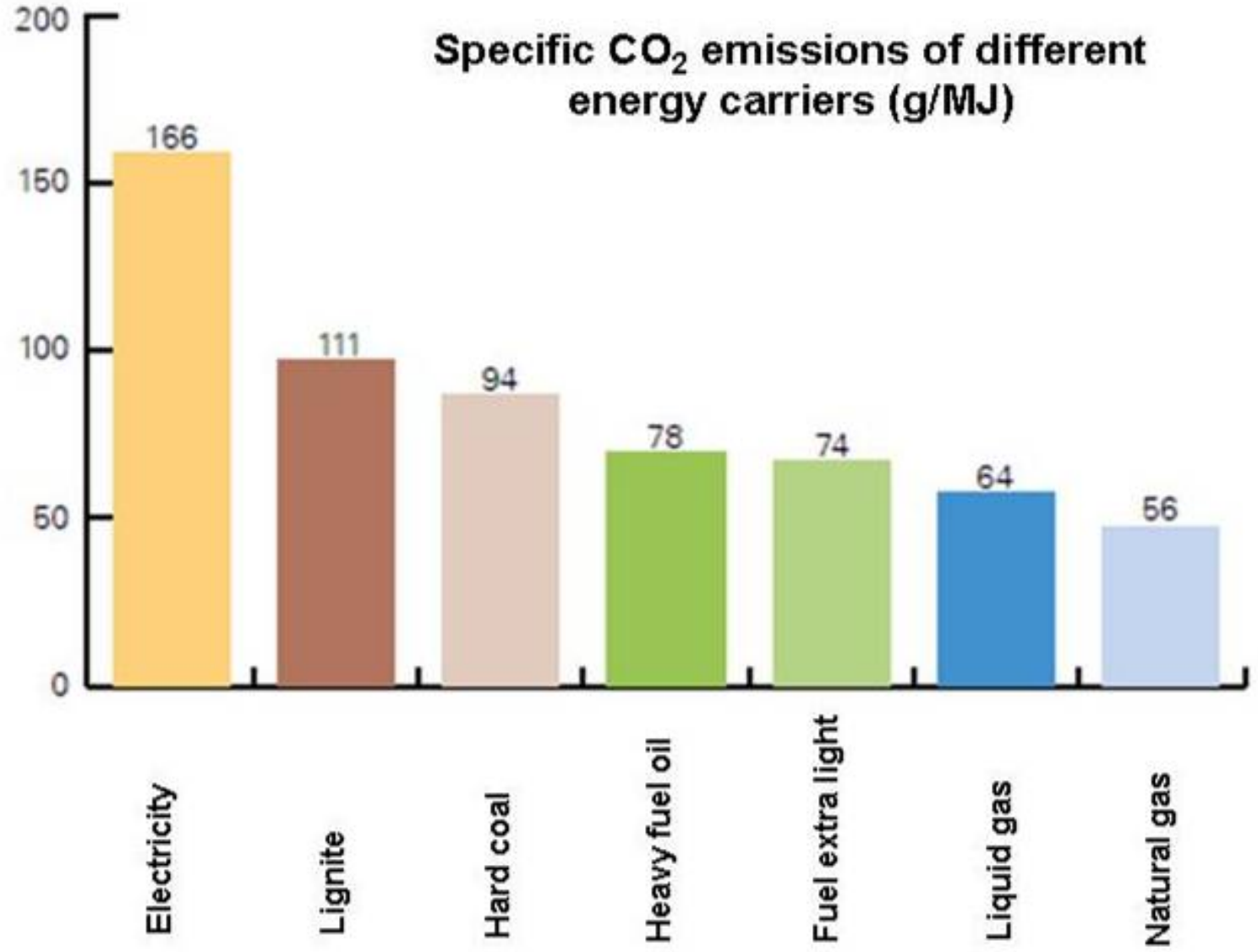
-Recirculate the flue-gas back through an oxy-fuel burner to recover the energy contained in the total organic carbon present ->ga

-Suitable insulation for high temperature equipment (steam and hot water pipes) ->ga

-Use the heat generated from the production of sulphuric acid from sulphur dioxide to preheat gas directed to the sulphuric acid plant; or to generate steam and/or hot water ->only for NFM plants with integrated production of sulphuric acid or liquid SO2

-Use high efficiency electric motors equipped with variable-frequency drive for equipment such as fans -> ga

-Use control systems that automatically activate the air extraction system or adjust the extraction rate depending on actual emissions -> ga


Specific CO_2 emissions of different energy carriers (g/MJ)
200
150
100
50
0
166
111
94
78
74
64
56
Electricity
Lignite
Hard coal
Heavy fuel oil
Fuel extra light
Liquid gas
Natural gas

GENERAL BAT CONCLUSIONS - BATCs

Process control 1

In order to improve overall environmental performance, BAT is to ensure **stable** process operation using a process control system together with a combination of the techniques given below.

-Inspect and select input materials according to the process and the abatement techniques applied

-Good mixing of the feed materials to achieve optimum conversion efficiency and minimum emissions and rejects

-Feed weighing and metering systems

-Processors to control material feed rate, critical process parameters and –conditions, including the alarm, combustion conditions and gas additions

-On-line monitoring of the furnace temperature, furnace pressure and gas flow

-Monitor the critical process parameters of the air emission abatement plant such as gas temperature, reagent metering, pressure drop, ESP current and voltage, scrubbing liquid flow and pH and gaseous components (e.g. O2 , CO, VOC)

GENERAL BAT CONCLUSIONS - BATCs

Process control 2

-Control dust and mercury in the exhaust gas before transfer to the sulphuric acid plant (only for plants with integrated production for sulphuric acid or liquid SO2)

-On-line monitoring of vibrations to detect blockages and possible equipment failure

-On-line monitoring of the current, voltage and electrical contact temperatures in electrolytic processes

-Temperature monitoring and control at melting and smelting furnaces to prevent the generation of metal- and metal oxide fumes through overheating

-Processor to control the reagents feeding and the performance of the waste water treatment plant, through on-line monitoring of temperature, turbidity, pH, conductivity and flow

-apply a maintenance management system which especially addresses the performance abatement systems as part of the environmental management system

GENERAL BAT CONCLUSIONS - BATCs

Diffuse emissions - general approach

- prevent or, where this is not practicable, reduce diffuse emissions to air and water
- BAT is to collect diffuse emissions as much as possible **nearest to the source** and treat them
- implement an action plan on diffuse dust emissions, as part of the environmental management system that incorporates both of the following measures:

  a. identify the most relevant diffuse dust emission sources (using e.g. EN 15445);

  b. define and implement appropriate actions and techniques to prevent or reduce diffuse emissions over a given time frame.

GENERAL BAT CONCLUSIONS - BATCs

Diffuse emissions 1 - from the storage, handling and transport of raw materials

-Enclosed buildings or silos/bins for storing dust-forming materials such as concentrates, fluxes and fine materials

-Covered storage of non-dust-forming materials (e.g. concentrates, fluxes, solid fuels, bulk materials and coke) and secondary materials that contain water-soluble organic compounds

-Sealed packaging of dust-forming materials or secondary materials that contain water-soluble organic compounds

-Covered bays for storing material which has been pelletised or agglomerated

-Use water sprays and fog sprays with/without additives such as latex for dust-forming materials

-Dust/gas extraction devices placed at the transfer and tipping points for dust-forming materials

-Certified pressure vessels for storing chlorine gas or mixtures that contain chlorine

-Tank construction materials that are resistant to the contained materials

GENERAL BAT CONCLUSIONS - BATCs

Diffuse emissions 2 - from the storage, handling and transport of raw materials

-Reliable leak detection systems and display of tank's level, with an alarm to prevent overfills

-Store reactive materials in double-walled tanks or tanks placed in chemical-resistant bunds of the same capacity and use a storage area that is impermeable and resistant to the material stored

-Design storage areas so that any leaks from tanks and delivery systems are intercepted and contained in bunds (capacity of largest storage tank at least)

- delivery points within the bund to collect any spilled material

-Use inert gas blanketing for the storage of materials that react with air

-Collect and treat emissions from storage with an abatement system designed to treat the compounds stored.

-Collect and treat any wash water before discharge

-Regular cleaning of the storage area and, when needed, moistening with water

GENERAL BAT CONCLUSIONS - BATCs

Diffuse emissions 3 - from the storage, handling and transport of raw materials

-Place the longitudinal axis of the heap parallel to the prevailing wind direction in the case of outdoor storage

-Protective planting, windbreak fences or upwind mounts to lower the wind velocity in the case of outdoor storage

-Use oil and solid interceptors for the drainage of open outdoor storage areas.

-Use of concreted areas that have kerbs or other containment devices for the storage of material that can release oil, such as swarf

-Enclosed conveyors or pneumatic systems to transfer and handle dust-forming concentrates and fluxes and fine-grained material

-Covered conveyors to handle non-dust-forming solid materials

-Extraction of dust from delivery points, silo vents, pneumatic transfer systems and conveyor transfer points, and connection to a filtration system

-Closed bags or drums to handle materials with dispersible or water-soluble components

-Suitable containers to handle pelletised materials

GENERAL BAT CONCLUSIONS - BATCs

Diffuse emissions 4 - from the storage, handling and transport of raw materials

-Sprinkling to moisten the materials at handling points
-Minimise transport distances
-Reduce the drop height of conveyor belts, mechanical shovels or grabs
-Adjust the speed of open belt conveyors (< 3,5 m/s)
-Minimise the speed of descent or free fall height of the materials
-Place transfer conveyors and pipelines in safe, open areas above ground so that leaks can be detected quickly and damage from vehicles and other equipment can be prevented.
-If buried pipelines are used for non-hazardous materials, document and mark their course and adopt safe excavation systems
-Automatic resealing of delivery connections for handling liquid and liquefied gas
-Back-vent displaced gases to the delivery vehicle to reduce emissions of VOC
-Wash wheels and chassis of vehicles used to deliver or handle dusty materials
-Use planned campaigns for road sweeping
-Segregate incompatible materials (e.g. oxidising agents and organic materials)
-Minimise material transfers between processes

GENERAL BAT CONCLUSIONS - BATCs

Diffuse emissions - from metal production 1

BAT is to optimise the efficiency of off-gas collection and treatment by using a combination of the techniques given below. ga= generally applicable

-Thermal or mechanical pretreatment of secondary raw material to minimise organic contamination of the furnace feed –>ga

-Use a closed furnace with a properly designed dedusting system or seal the furnace and other process units with an adequate vent system ->restricted by safety constraints (e.g. type/design of the furnace, risk of explosion)

-Use a secondary hood for furnace operations such as charging and tapping ->restricted by safety constraints (e.g. type/design of the furnace, risk of explosion)

-Dust or fume collection where dusty material transfers take place (e.g. furnace charging and tapping points, covered launders) –>ga

GENERAL BAT CONCLUSIONS - BATCs

Diffuse emissions - from metal production 2

-Optimise the design and operation of hooding and ductwork to capture fumes arising from the feed port and from hot metal, matte or slag tapping and transfers in covered launders ->for existing plants may be limited by space and plant configuration restrictions

-Furnace/reactor enclosures such as 'house-in-house' or 'doghouse' for tapping and charging operations ->for existing plants may be limited by space and plant configuration restrictions

-Optimise the off-gas flow from the furnace through computerised fluid dynamics studies and tracers –>ga

-Charging systems for semi-closed furnaces to add raw materials in small amounts ->ga

-Treat the collected emissions in an adequate abatement system ->ga

GENERAL BAT CONCLUSIONS - BATCs

Monitoring of emissions to air

-monitor the stack emissions to air in accordance with

-EN standards (list see no. 1.1.5 BATC NFM)

-ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality, if EN standards are not available

-**continous**, (mainly dust, NOx, SO2, TVOC ;for sources of high emissions)

-**once per year**

GENERAL BAT CONCLUSIONS - BATCs

Mercury emissions

-Use raw materials with a low mercury content, including by cooperating with providers in order to remove mercury from secondary materials.

-Use adsorbents (e.g. activated carbon, selenium) in combination with dust filtration

- BAT-AEL BAT-associated emission levels for mercury emissions to air from a pyrometallurgical process using raw materials containing mercury

Mercury and its compounds, expressed as : **Hg 0,01-0,05 mg/Nm 3**

- (1) As a daily average or as an average over the sampling period.
- (2) The lower end of the range is associated with the use of adsorbents (e.g. activated carbon, selenium) in combination with dust filtration

GENERAL BAT CONCLUSIONS - BATCs

Sulphur dioxide emissions

reduce emissions of SO2 from off-gases with a high SO2 content and avoid generation of waste from the flue-gas cleaning system by recovering sulphur by producing sulphuric acid or liquid SO2.

=>Only applicable to plants producing copper, lead, primary zinc, silver, nickel and/or molybdenum.

NOx emissions

prevent NOx emissions to air from a pyrometallurgical process by

- -Low-NO X burners
- -Oxy-fuel burners
- -Flue-gas recirculation back through the burner to reduce the temperature of the flame in the case of oxy-fuel burners

GENERAL BAT CONCLUSIONS - BATCs

Emissions to **water, including** their **monitoring**

-prevent or reduce the generation of waste water; ga= generally applicable

-Measure the amount of fresh water used and the amount of waste water discharged –>ga

-Reuse waste water from cleaning operations (including anode and cathode rinse water) and spills in the same process -> ga

-Reuse weak acid streams generated in a wet ESP and wet scrubbers ->depending on the metal and solid content of the waste water

-Reuse waste water from slag granulation -> depending on the metal and solid content of the waste water

-Reuse surface run-off water -> ga

-Use a closed circuit cooling system ->ga

-Reuse treated water from the waste water treatment plant ->may be restricted by the salt content

-segregate uncontaminated waste water streams from waste water streams requiring treatment

GENERAL BAT CONCLUSIONS - BATCs

Monitoring of water

BAT is to

- use ISO 5667 for water sampling
- monitor the emissions to water at the point where the emission leaves the installation
- at least once per month
- in accordance with EN standards (list see No. 1.1.9 BATC NFM)
- If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.

GENERAL BAT CONCLUSIONS - BATCs

Water and waste water

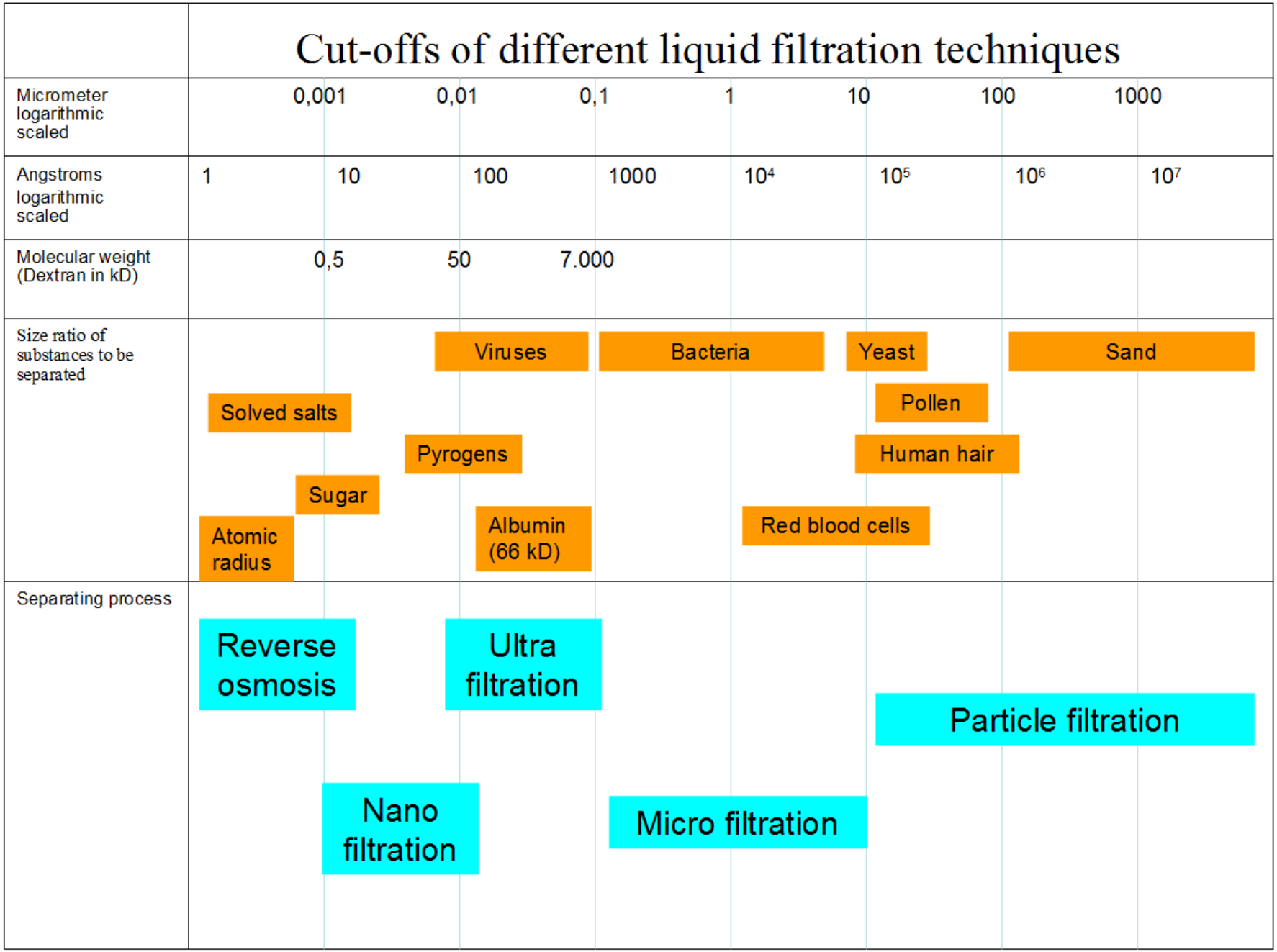
-treat leakages from the storage of liquids and

-treat waste water from non-ferrous metals production

-remove metals and sulphates by using a combination of

- Chemical precipitation ->ga
- Sedimentation ->ga
- Filtration ->ga
- Flotation ->ga
- Ultrafiltration ->only applicable to specific streams in non-ferrous metals production
- Activated carbon filtration ->ga
- Reverse osmosis ->only applicable to specific streams in non-ferrous metals production

Cut-offs of different liquid filtration techniques



BAT –AELs for direct emissions to a receiving water body (ex installation)

BAT-AEL (mg/l) (daily average)						
Parameter	Production of					
	Copper	Lead and/or Tin	Zinc and/or Cadmium	Precious metals	Nickel and/or Cobalt	Ferro-alloys
Silver (Ag)	NR			≤ 0,6	NR	
Arsenic (As)	≤ 0,1 (1)	≤ 0,1	≤ 0,1	≤ 0,1	≤ 0,3	≤ 0,1
Cadmium (Cd)	0,02–0,1	≤ 0,1	≤ 0,1	≤ 0,05	≤ 0,1	≤ 0,05
Cobalt (Co)	NR	≤ 0,1	NR		0,1-0,5	NR
Chromium total (Cr)	NR					≤ 0,2
Chromium (VI) (Cr(VI))	NR					≤ 0,05
Copper (Cu)	0,05-0,5	≤ 0,2	≤ 0,1	≤ 0,3	≤ 0,5	≤ 0,5
Mercury (Hg)	0,005–0,02	≤ 0,05	≤ 0,05	≤ 0,05	≤ 0,05	≤ 0,05
Nickel (Ni)	≤ 0,5	≤ 0,5	≤ 0,1	≤ 0,5	≤ 2	≤ 2
Lead (Pb)	≤ 0,5	≤ 0,5	≤ 0,2	≤ 0,5	≤ 0,5	≤ 0,2
Zinc (Zn)	≤ 1	≤ 1	≤ 1	≤ 0,4	≤ 1	≤ 1

NR: Not relevant

(1) In the case of a high arsenic content in the total input of the plant, the BAT-AEL may be up to 0,2 mg/l.

GENERAL BAT CONCLUSIONS - BATCs

Noise

reduce noise emissions, use one or a combination of the techniques given below.

- Use embankments to screen the source of noise
- Enclose noisy plants or components in sound-absorbing structures
- Use anti-vibration supports and interconnections for equipment
- Orientation of noise-emitting machinery
- Change the frequency of the sound

GENERAL BAT CONCLUSIONS - BATCs

Odour

reduce odour emissions, BAT is to use one or a combination of the techniques given below.

- Appropriate storage and handling of odorous materials ->ga
- Minimise the use of odorous materials ->ga
- Careful design, operation and maintenance of any equipment that could generate odour emissions ->ga
- Afterburner
- filtration techniques, including biofilters

Structure of Specific BAT CONCLUSIONS - BATCs

-Energy management

-for the various Production steps

- -BAT (abatement) techniques for diffuse emissions
- -BAT (abatement) techniques for channelled emissions
- -Applicability
- -Range of BAT-**A**ssociated **E**mission **L**evels –**BAT-AEL**s
  - for relevant emissions like dust, organic compounds, (TVOC, PCCD/F), inorganic compounds (NO2, SO2, NH3, HCl, HF, etc), metals
  - ➔value of levels depending e.g. on applied technique, applicability, new installation, substantial change
- -BAT for soil and groundwater
- -BAT for waste water
- -BAT for waste

Copper

Specific BAT- Conclusions BATCs **Cu**

-BAT-AEL for dust emissions to air from copper production

Dust : 2-5 mg/Nm3

-BAT-AEL for emissions to air of TVOC from the pyrolytic treatment of copper turnings, drying, smelting, melting of secondary raw materials

TVOC : 3-30 mg/Nm3; (low range with thermal oxidiser)

-BAT-AEL for PCDD/F emissions to air from the pyrolytic treatment of copper turnings, smelting, melting, fire refining and converting operations in secondary copper production

PCDD/F : ≤ 0,1 ng I-TEQ/Nm3; sampling period of six hours.

-BAT-AEL for SO 2 emissions to air from primary and secondary copper production

SO2 : 50 – 500 mg/Nm3; Primary copper production

SO2 : 50 – 300 mg/Nm3; Secondary copper production

Aluminium

BAT anode production

BAT-AELs for dust and BaP (as an indicator of PAH) emissions to air from a **paste plant**

- Hot pitch storage, paste mixing, cooling and forming
- Removing coke dust from operations such as coke storage and grinding

  Dust: 2- 5 mg/Nm3

- Hot pitch storage, paste mixing, cooling and forming

  BaP: 0,001 – 0,01

Specific BAT- Conclusions BATCs **anode production**

BAT- AEL for dust and BaP (indicator of PAH) emissions to air from a **paste plant** for anode production

- **Dust: 2-5 mg/Nm3**
- **BaP : 0,001-0,01 mg/Nm3**

BAT-AEL for dust, BaP , fluoride emissions to air from a **baking plant** in an anode production plant

- **Dust : 2-5 mg/Nm3**
- **BaP : 0,001-0,01 mg/Nm3**
- **HF : 0,3-0,5 mg/Nm3;** integrated with primary alu smelter
- **HF : 3 mg/Nm3** ; stand-alone anode production plant
- **Total fluorides : ≤ 0,8 mg/Nm3**

BAT **primary** aluminium production

In order to reduce dust emissions from the storage, handling and transport of raw materials, BAT is to use a **bag filter**

BAT-associated emission levels for dust from the storage, handling and transport of raw materials

Dust : ≤ 5-10

BAT **primary** aluminium production

In order to reduce **dust, metal, fluoride** emissions to air from **electrolytic cells**, BAT is to use **one** of the techniques given below.

- **Dry scrubber** using **alumina** as the adsorbent agent followed by a **bag filter**

  ->ga –generally applicable

- **Dry scrubber** using **alumina** as the adsorbent agent followed by a **bag filter and a wet scrubber**

  -> may be limited due to high amounts of waste and waste water generated

BAT **primary** aluminium production

In order to prevent or reduce **dus**t and **meta**l emissions to air from **melting** and **molten metal treatment** and **casting** in primary aluminium production, BAT is to use **one or both** of the techniques given below.

- Use of liquid metal from electrolysis and solid, uncontaminated aluminium (free of substances such as paint, plastic or oil)
- Bag filter

BAT-associated emission levels for dust emissions to air from melting and molten metal treatment and casting in primary aluminium production

Dust: 2 – 25 mg/Nm3 ; low value with bag filter

BAT **primary** aluminium production

In order to reduce emissions to air from **electrolytic**

cells, BAT is to use **one or both** of the techniques

given below.

- Use of low-sulphur anodes ->generally applicable
- Wet scrubber -> may be limited due to the high amounts of waste and waste water generated

BAT- AEL for **SO2** emissions to air from **electrolytic cells**

SO2: ≤ 2,5-15 kg/t Alu; low value with wet scrubber

high value with low sulphur anodes

Anodes containing less than 1,5 % **S** can be produced; minimum **S** content of 0,9 % as a yearly average is required

BAT **primary** aluminium production

In order to reduce **perfluorocarbon** emissions to air from primary aluminium production, BAT is to use **all** of the techniques given below.

- Automatic multiple point feeding of alumina
  ->generally applicable
- Computer control of the electrolysis process based on active cell databases and monitoring of cell operating parameters ->ga
- Automatic anode effect suppression ->not applicable to Søderberg cells

In order to reduce **CO** and **PAH** emissions to air from primary aluminium production using the Søderberg technology, BAT is to **combust** the **CO and PAH** in the cell exhaust gas.

BAT **primary** aluminium production

In order to prevent the generation of **waste water**, BAT is to reuse or recycle cooling water and treated waste water, including rainwater, within the process.

->Generally applicable to new plants and major upgrades. May be limited due to water quality and/or product quality requirements.

In order to reduce the **disposal of spent pot lining**, BAT is to organise operations on site so as to facilitate its **externa**l recycling, such as in cement Manufacturing, in the salt slag recovery process, as a carburiser in the steel or ferro-alloy industry or as a secondary raw material (e.g. rock wool), pending on the end consumer's requirements.

Specific BAT- Conclusions BATCs **primary Al** production

BAT-AEL for dust and fluoride emissions to air from **electrolytic cells**

- **Dust : 2-5 mg/Nm3**
- **HF : ≤ 1,0 mg/Nm3**
- **Total fluorides : ≤ 1,5 mg/Nm3**

BAT-AEL for the total emissions of dust and fluoride to air from the **electrolysis house** (collected from the electrolytic cells and roof vents)

Dust : ≤ 1,2 kg/t Alu for existing installation

≤ 0,6 kg/t Alu for new installation

Total fluorides: ≤ 0,6 kg/t Alu for existing installation

≤ 0,35 kg/t Alu for new installation

as average of a year

Specific BAT- Conclusions BATCs **primary Al** production

BAT-AEL for dust and fluoride emissions to air from **electrolytic cells**

- **Dust : 2-5 mg/Nm3**
- **HF : ≤ 1,0 mg/Nm3**
- **Total fluorides : ≤ 1,5 mg/Nm3**

~~BAT-AEL for SO2 emissions to air from **electrolytic cells**~~

- ~~**SO2 : ≤ 2,5-15 kg/t Al** ; mass of liquid Al per year~~

~~BAT-AEL for dust emissions to air from **melting,** molten metal **treatment, casting** in primary aluminium production~~

- ~~**Dust : 2-25 mg/Nm3**~~

BAT for Aluminium production

secondary aluminium

Specific BATCs **secondary Al** production – **channelled dust emissions**

dust and metal emissions from

-swarf drying ,

-removal of oil and organic compounds from the swarf,

-crushing, milling and dry separation of non-metallic constituents and metals other than aluminium,

-storage, handling and transport , BAT is to use a bag filter.

BAT- AEL for dust emissions to air from above mentioned steps

Dust : ≤ 5 mg/Nm3

Specific BATCs **secondary Al** production – **furnace processes**

For prevention or reduction of dust and metal emissions to air from furnace

processes such as

-charging,

-melting,

-tapping

-molten metal treatment

BAT : **bag filter**

BAT-AEL for emissions to air:

Dust: 2-5 mg/Nm3

Dust: 25 mg/Nm3 (only uncontaminated raw material; dust emissions below 1 kg/h as average per year)

Specific BATCs **secondary Al** production – **organic compounds**

For reduction of emissions to air of **organic compounds and PCDD/F** from the **thermal tre**atment of **contaminated** secondary **raw materials** (e.g. swarf) and from the **melting furnace**

BAT : bag filter in combination with at least one of the techniques below.

- Select and feed the raw materials according to the furnace and the abatement techniques used
- Internal burner system for melting furnaces
- Afterburner
- Rapid quenching
- Activated carbon injection

BAT-AEL for emissions to air for organic compounds from above mentioned production steps

TVOC: ≤ 10-30 mg/Nm3

PCDD/F: ≤ 0,1 ng I-TEQ/Nm 3

Specific BATCs **secondary Al** production – acid emissions

Reduction of emissions to air of **HCl, Cl 2, HF** from the **thermal treatment** of contaminated secondary raw materials (e.g. swarf), the **melting furnace**, and **remelting** and **molten metal treatment**, BAT is to use **one or a combination** of the techniques given below.

- Select and feed the raw materials according to the furnace and the abatement techniques used
- Ca(OH) 2 or sodium bicarbonate injection in combination with a bag filter
- Control of the refining process, adapting the quantity of refining gas used to remove the contaminants present into the molten metals
- Use of dilute chlorine with inert gas in the refining process

BAT-AEL for emissions to air from above mentioned process steps

HCl : ≤ 5-10 mg/Nm3
Cl 2 : ≤ 1 mg/Nm3
HF : ≤ 1 mg/Nm3

Specific BATCs **secondary Al** production –**emissions from slag recycling**

prevent or reduce **diffuse** emissions from the salt slag recycling process, use one or both of the techniques below.

- Enclose equipment with gas extraction connected to a filtration system
- Hood with gas extraction connected to a filtration system

reduce (channelled)dust and metal emissions to air from crushing and dry milling associated with the salt slag recovery process, use a **bag filter**.

BAT-AEL for dust and metal emissions from slag recycling

Dust: 2-5 mg/Nm3

Specific BATCs **secondary Al** production –gaseous emissions from slag recycling

In order to reduce gaseous emissions to air from **wet milling** and **leaching** from the salt slag recovery process, BAT is to use one or a combination of the techniques given below.

- Activated carbon injection
- Afterburner
- Wet scrubber with H2SO4 solution

BAT-AEL for gaseous emissions for wet milling and leaching of slag

NH3 : ≤ 10 mg/Nm3

PH3 : ≤ 0,5 mg/Nm3

H2S : ≤ 2 mg/Nm3

Specific BATCs **secondary Al** production – raw material

Specific BAT- Conclusions BATCs **secondary Al** production

~~BAT- AEL for dust emissions to air from the **swarf** drying, removal of oil and organic compounds from swarf; crushing, milling, dry **separation** of non- metallic constituents and metals; storage, handling, transport~~

- ~~**Dust : ≤ 5 mg/Nm3**~~

BAT- AEL for dust emissions to air from **furnace processes** such as **charging, melting, tapping and molten metal treatment**

- **Dust : 2 – 5 mg/Nm3**

Specific BAT- Conclusions BATCs **secondary Al** production

BAT-AEL for emissions to air of TVOC and PCDD/F from the **thermal treatment** of contaminated secondary raw materials (e.g. swarf) and from the **melting furnace**

- **TVOC: ≤ 10-30 mg/Nm3**
- **PCDD/F : ≤ 0,1 ng I-TEQ/Nm3**; six hours sample

BAT- AEL emissions to air from **thermal treatment** of contaminated secondary raw materials (e.g. swarf), **melting furnace**, **remelting , molten metal treatment**

- **HCl: ≤ 5-10 mg/Nm 3**
- **Cl 2: ≤ 1 mg/Nm 3**
- **HF: ≤ 1 mg/Nm 3**

Specific BAT- Conclusions BATCs **secondary Al** production

BAT –AEL for gaseous emissions to air from **wet milling, leaching** from the salt slag recovery process

- NH 3: ≤ 10 mg/Nm 3
- PH 3: ≤ 0,5 mg/Nm 3
- H2S : ≤ 2 mg/Nm 3

- Copper

Specific BAT- Conclusions BATCs for **Cu** production

BAT-AEL for dust from following production stages

- Reception, storage, handling, transport, metering, mixing, blending, crushing, drying, cutting and screening of raw materials, pyrolytic treatment of copper turnings in primary and secondary copper production

  Dust: 2-5 mg/Nm3

- Concentrate drying in primary copper production

  Dust: 3-5 mg/Nm3

- Primary copper smelter and converter (emissions other than those that are routed to the sulphuric acid or liquid SO2 plant or power plant)

  Dust: 2-5 mg/Nm3

Specific BAT- Conclusions BATCs for **Cu** production

BAT-AEL for dust from following production stages

- Secondary copper smelter and converter and processing of secondary copper intermediates (emissions other than those that are routed to the sulphuric acid plant) : **dust: 2-4 mg/Nm3**

- Secondary copper holding furnace : **dust: ≤ 5 mg/Nm3**

- Copper-rich slag furnace processing: **dust: 2-5 mg/Nm3**

- Anode furnace (in primary and secondary copper production): **dust: 2-5 mg/Nm3**

- Anode casting (in primary and secondary copper production): **dust: ≤ 5-15 mg/Nm3**

- Copper melting furnace: **dust: 2-5 mg/Nm3**

Specific BAT- Conclusions BATCs for **Cu** production

- **BAT-AEL** for emissions to air of **TVOC** from the **pyrolytic treatment** of copper turnings, **drying**, **smelting** and **melting** of **secondary** raw materials

  TVOC: 3-30 mg/Nm3; low value with RTO

- **BAT-AEL** for **PCDD/F** emissions to air from the **pyrolytic treatment** of copper turnings, **smelting**, **melting**, **fire refining, converting operations** in **secondary** copper production

  PCDD/F: ≤ 0,1 ng I-TEQ/Nm 3; six hours sample

- BAT-AEL for **SO2** emissions to air (other than those that are routed to the sulphuric acid or liquid SO2 plant or power plant) from primary and secondary copper production Parameter

  SO2: 50-500 mg/Nm3; for **primary** copper production

  SO2: 50-300 mg/Nm3 ; for **secondary** copper production

Specific BAT- Conclusions BATCs in **primary and secondary Pb/ Sn** production

BAT- AEL from **raw material preparation**; **battery preparation** (crushing, screening and classifying)

- **Dust : ≤ 5** mg/Nm3

BAT-AEL from **charging, smelting, tapping, remelting, refining**

- **Dust : 2-4** mg/Nm3
- **Pb: ≤ 1** mg/Nm3

BAT-AEL from **charging, smelting, tapping**

- **SO2: 50-350** mg/Nm3

Specific BAT- Conclusions BATCs in **primary and secondary Pb/ Sn** production

BAT-AEL from the **raw material drying, smelting**

- **TVOC : 10-40** mg/Nm3; secondary Pb/Sn production

BAT- AEL from **smelting** of **secondary** Pb/Sn raw materials

- **PCDD/F: ≤ 0,1 ng I-TEQ/Nm3;** secondary production

ZINK

Specific BAT- Conclusions BATCs for **primary Zn** production

BAT-AEL from handling and storage of **raw materials**, **dry roaster feed preparation**, **dry roaster feeding** and **calcine processing**

- **Dust :** **≤ 5** mg/Nm3

BAT-AEL from **leaching, leaching purification, electrolysis;**
for **arsane and stibane emissions** from **purification**

- **Zn :** **≤ 1** mg/Nm3
- **H2SO4:** **< 10** mg/Nm3
- **Sum of AsH 3 and SbH 3: ≤ 0,5** mg/Nm3

BAT-AEL from **pyrometallurgical zinc** production

- **Dust:** **2-5** mg/Nm3
- **SO 2:** **≤ 500** mg/Nm3

Specific BAT- Conclusions BATCs for **secondary Zn** production

BAT-AEL from **pelletising, slag processing**

- **Dust:** **≤ 5** mg/Nm3

BAT-AEL from **melting of metallic, mixed metallic/oxidic streams**, **slag fuming furnace , Waelz kiln**

- **Dust:** **2-5** mg/Nm3
- **TVOC :** **2-20 mg/Nm3**
- **PCDD/F :** **≤ 0,1 ng I-TEQ/Nm 3**
- **HCl :** **≤ 1,5** mg/Nm3
- **HF:** **≤ 0,3** mg/Nm3

BAT-AEL from the **melting, alloying and casting** of zinc **ingots** and **zinc powder** production

- **Dust:** **≤ 5** mg/Nm3

Specific BAT- Conclusions BATCs for **Cd** production

BAT-AEL for **cadmium** emissions from **pyrometallurgica**l cadmium production and the **melting, alloying and casting of cadmium** ingots

- **Dust : 2-3 mg/Nm3**
- **Cd: ≤ 0,1 mg/Nm3**

Precious metals

Specific BAT- Conclusions BATCs for **precious metals** production

BAT-AEL from all dusty operations, such as **crushing, sieving, mixing, melting, smelting, incineration, calcining, drying and refining**

- **Dust: 2-5** mg/Nm3

BAT-AEL from a **hydrometallurgica**l operation involving **dissolving/ leaching** with nitric acid

- **NO2: 70-150** mg/Nm3

BAT-AEL from a **hydrometallurgical** operation, including associated incineration, calcining and drying operations

- **SO2: 50-100** mg/Nm3
- **HCl : ≤ 5-10** mg/Nm3
- **Cl2: 0,5-2** mg/Nm3

Specific BAT- Conclusions BATCs for **precious metals** production

BAT-AEL from a **hydrometallurgica**l operation using ammonia or ammonium chloride

- **NH3: 1-3** mg/Nm3

BAT-AEL from a **drying** operation where the **raw materials** contain **organic compounds, halogens or other PCDD/F precursors**, from **incineration** operation, from a **calcining** operation

- **PCDD/F: ≤ 0,1** ng I-TEQ/Nm3; six hours sample

Ferro Alloys

Specific BAT- Conclusions BATCs for **Ferro-Alloys** production

BAT-AEL for

- storage, handling ,transport of solid materials;
- pretreatment operations such as metering, mixing, blending and degreasing;
- tapping, casting, packaging
- crushing, briquetting, pelletising and sintering
- open or semi-closed submerged arc furnace
- Closed submerged arc furnace or closed plasma dust process
- refractory-lined crucible for the production of ferro-molybdenum and ferro-vanadium

Dust: **2-5** mg/Nm3

BAT-AEL from **furnace** producing ferro-alloys

PCDD/F : **≤ 0,05** ng I-TEQ/Nm3 ; six hours sample

Nickel/Cobalt

Specific BAT- Conclusions BATCs for **Ni/Co** production

BAT-AEL from the handling and storage of raw materials, material pretreatment processes (such as ore preparation and ore/concentrate drying), furnace charging, smelting, converting, thermal refining, nickel powder and briquette production when processing sulphidic ores

Dust: 2-5 mg/Nm3

BAT-AEL from the atmospheric or pressure leaching processes

Ni: ≤ 1 mg/Nm3

Cl2: ≤ 1 mg/Nm3

BAT-AEL from the nickel matte refining process using ferric – chloride -Fe(III)- with chlorine

Ni : ≤ 1 mg/Nm3

Carbon / Graphite

Specific BAT- Conclusions BATCs for **CARBON AND/OR GRAPHITE** production

BAT-AEL from the storage, handling and transportation of coke and pitch; mechanical processes (such as grinding), graphitising, machining

Dust: **2-5** mg/Nm3

BaP: **≤ 0,01** mg/Nm3 ; indicator for PAH

BAT-AEL from the production of **green paste and green shapes ;**

BAT-AEL from **impregnation**

Dust: **2-10** mg/Nm3

BaP: **0,001-0,01** mg/Nm3; low->coke adsorber + bag filter
high->afterburner

Specific BAT- Conclusions BATCs for **CARBON AND/OR GRAPHITE** production

BAT-AEL from **baking and rebaking**

Dust: **2-10** mg/Nm3

BaP: **0,005-0,015** mg/Nm3

BAT-AEL for **dust** and **BaP** (indicator of PAH) emissions to air from **impregnation**

Dust : **2-10** mg/Nm3

BaP : **0,001-0,01** mg/Nm3

BAT-AEL from **mixing, baking** and **impregnation**

TVOC: **≤ 10-40** mg/Nm3