Introduction to Best Available Techniques (BAT) and Best Environmental Practices (BEP)

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Provision of services related to training, assessment and reduction of PCDD/Fs releases from metallurgical industries in Turkey

Iskenderun Anemon Hotel, Turkey, 22-23 March, 2017

Introduction to BAP and BET

- Environmental management
- BAT/BEP and POPs
- SC BAT
- Formation of UPOPs
- BAT/BEP Guidances
- Criteria for determination
- BAT
- BREFs
- Destruction of POPs
- BAT in metalurgy sector
- Metalurgy in Turkey

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Environmental management - general principles

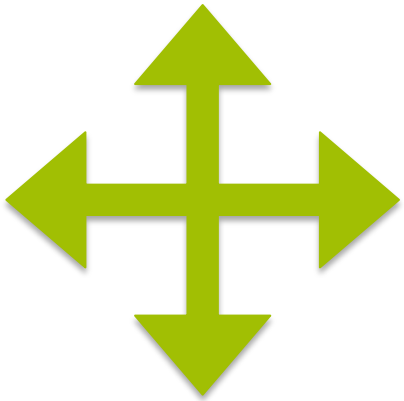
- Sustainable development
- Sustainable consumption

- Development and implementation of environmental management systems
- Precautionary approach
- Internalizing environmental costs and polluter pays
- Pollution prevention
- Integrated pollution prevention and control
- Co-benefits of controlling other pollutants
- Cleaner production
- Life cycle analysis and management

The issue of environmental protection is as old as mankind itself

Water contamination

Wastes

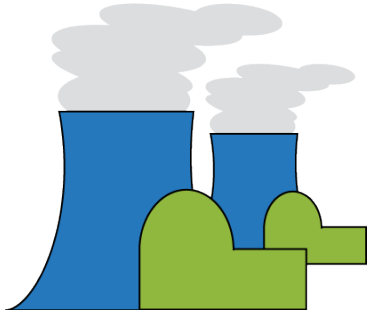


Emission, immision

Soil contamination

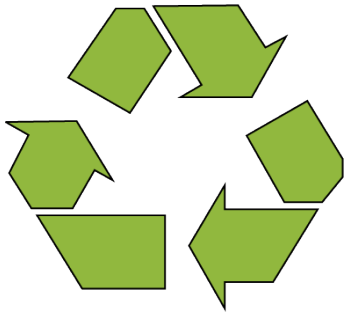
Modern history of environmental protection

50´s – "dilution"

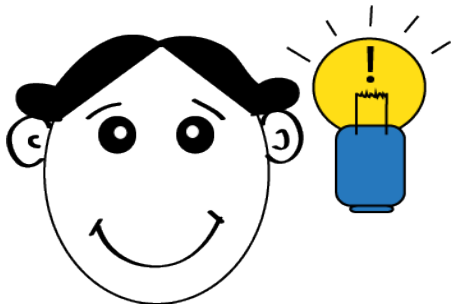


60´s - "cleaning"

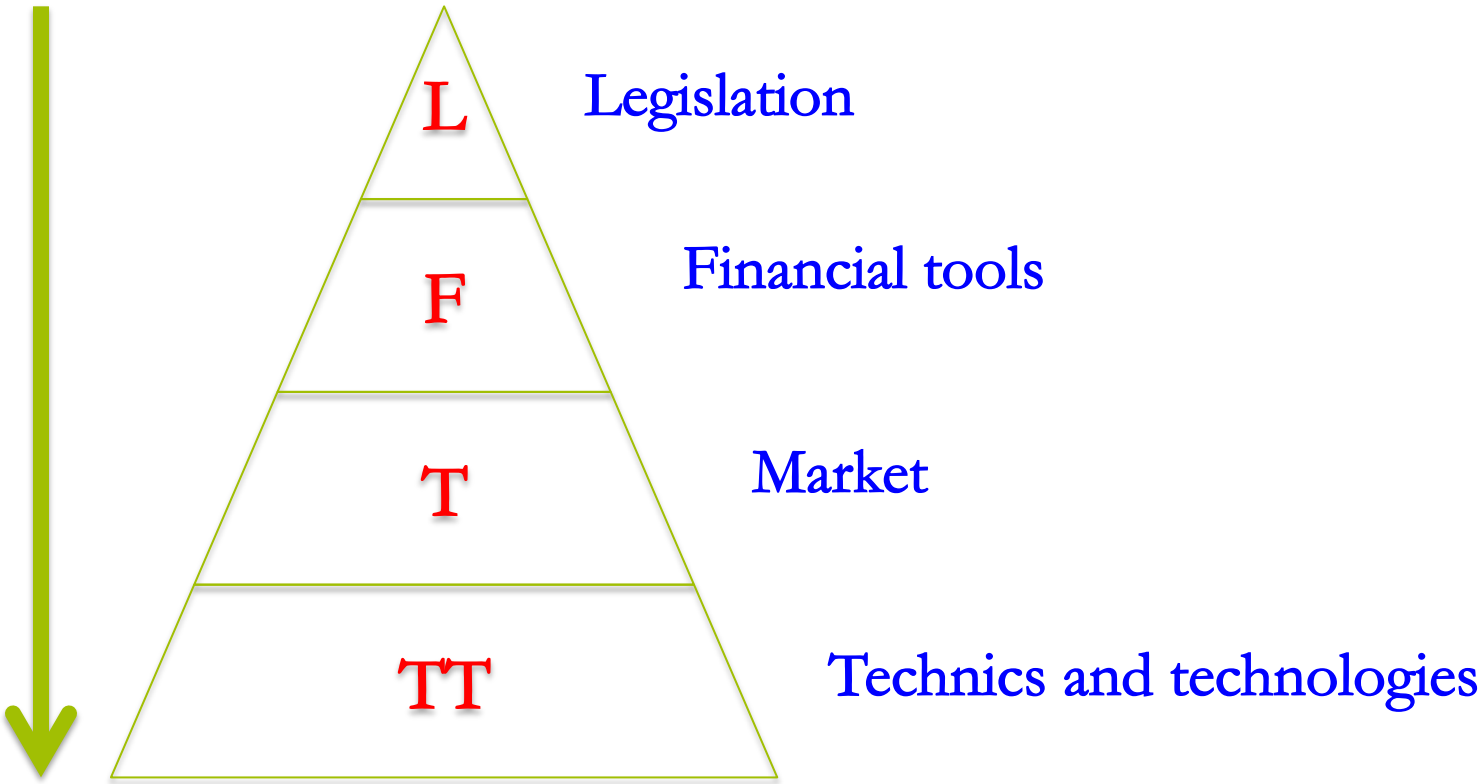
70´s - "recyclation"



80´s - "prevention" (EMS)



Presence – turn of 20. a 21. century (LF3T)



Definitions

Integrated pollution prevention and control

This principle aims to achieve integrated prevention and control of pollution arising from large-scale industrial activities.

It lays down measures designed to prevent or, where that is not practicable, to reduce emissions in the air, water and land from these activities, including measures concerning waste, in order to achieve a high level of protection of the environment taken as a whole.

Sustainability – what it is?

- None of products is absolutely sustainable.
- Product can be more or less sustainable.
- It is possible to define sustainability as an approach.
- People can act sustainable.

Main principles of preventive environmental prevention

Prevention	It is easier to prevent environmental damage than to deal with this later or suffer the consequences
Caution	Constantly review and monitor long-term effects on the human population and the environment (even at first glance harmless)
Integration	Environmental impacts and measures must be examined in context and would have considered integrally in all stages of implementation

Definitions

Internalizing environmental costs and polluter pays

National authorities should endeavor to promote the internalization of environmental costs and the use of economic instruments, taking into account the approach that the polluter should, in principle, bear the cost of pollution, with due regard to the public interest and without distorting international trade and investment.

Pollution prevention

The use of processes, practices, materials, products or energy that avoid or minimize the creation of pollutants and waste, and reduce overall risk to human health or the environment.

Cleaner production (CP)

The **UNEP** definition of **Cleaner Production** (CP) is:

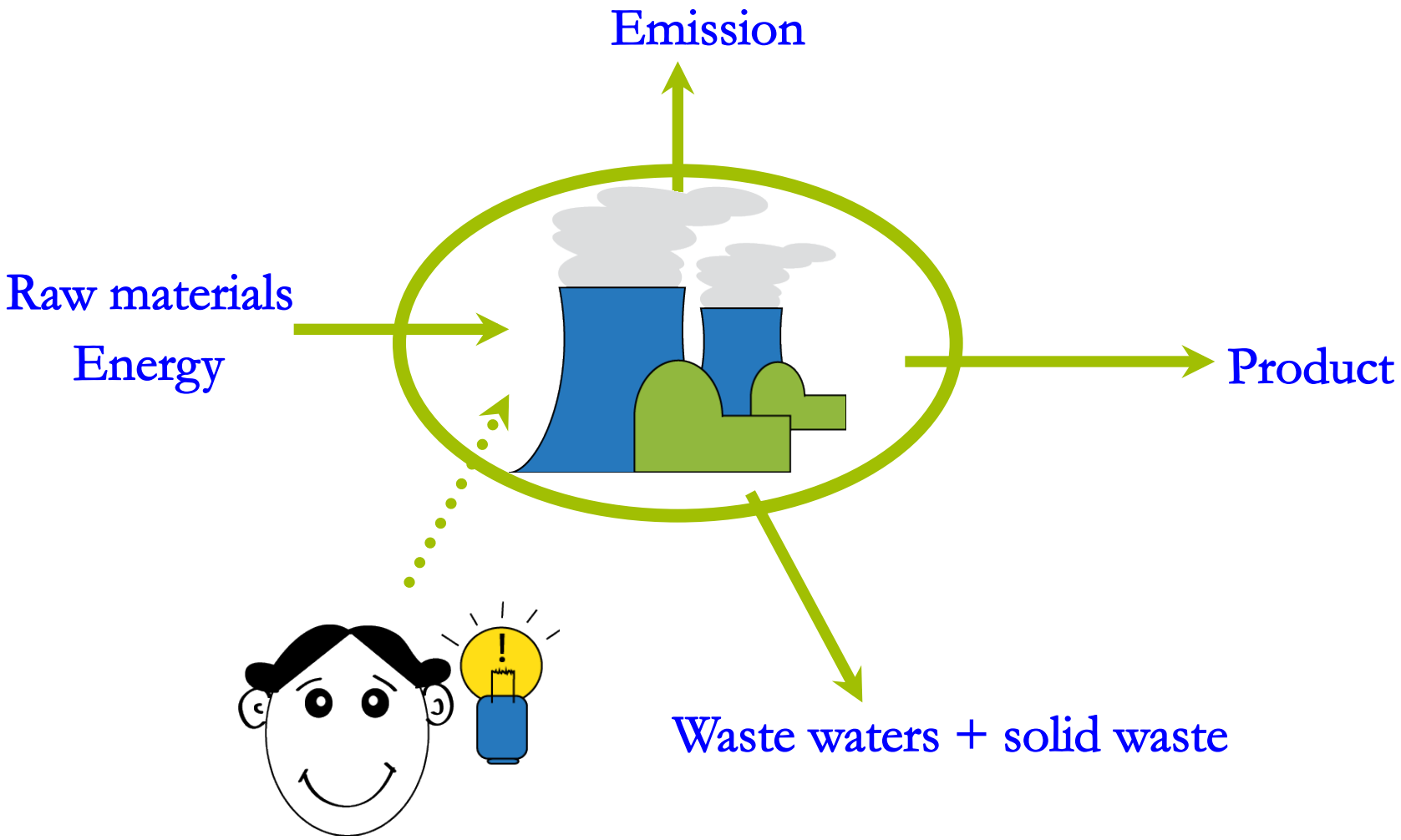
"The continuous application of an integrated preventive environmental strategy to processes and products so as to reduce risk s to humans and the environment"

"Cleaner production is a preventive, company-specific environmental protection initiative. It is intended to minimize waste and emissions and maximize product output.

By analyzing the flow of materials and energy in a company, one tries to identify options to minimize waste and emissions out of industrial processes through source reduction strategies.

Improvements of organization and technology help to reduce or suggest better choices in use of materials and energy, and to avoid waste, waste water generation, and gaseous emissions, and also waste heat and noise."

Material and energy balance of system



Definitions

Development and implementation of environmental management systems

A structured approach for determining, implementing and reviewing environmental policy through the use of a system which includes organizational structure, responsibilities, practices, procedures, processes and resources.

Environmental management

Target: Active access pf enterprise to monitor, control and gradually reducing the impact of its activities on the environment.

- ISO 14 000 – international norm on EMS
- EMAS – Eco-Management and Audit Scheme Environmental Protection (EU only) - make a statement on the state of environment to public

Main principles of EMS

Environmental - environmental aspects of organisation activities

Management - creating conditions for the achievement of common goals - a modification of the control system, the principle of continuous improvement

System - system approach - considering the interaction between an organization and external environment

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IP and UP POPs

- Unintentionally produced (UP): Dioxins/furans (byproducts in thermal processes)
- Intentionally produced (IP): Polychlorinated pesticides, transformer/capacitor oils (PCB), polybrominated flame retardants, …

Elimination of stockpiles (IP) - destruction (conservation)

Elimination of byproducts (UP) - prevention and destruction

Decontamination (IP + UP) - remediation of soils, sludges, water, sediments, …

BAT what does mean?

- Best Available Techniques
- Best Available Technology
- Best practicable means
- Best practicable environmental option
- Best Available Control Technology (US Clean Air Act)

BAT

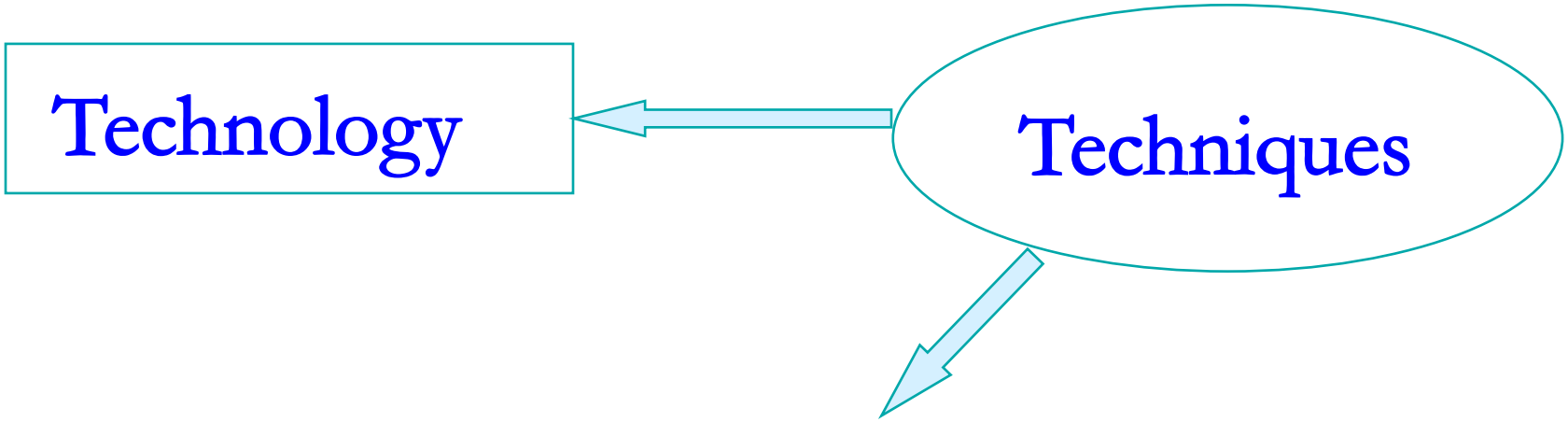
- Best practicable means term was used for the first time in UK national primary legislation in section 5 of the Salmon Fishery Act 1861

- The principle was used for the first time in Public Health Leeds Act in 1848 (UK), and later in the Alcali Act 1863 (UK)

- The BAT concept was first time used in the 1992 OSPAR Convention (Paris) for protection of marine environment of North-East Atlantic for all types of industrial installations and. It was called BATNEEC (Best Available Technology not entailing Excessive Costs)

- BATNEEC replaced by BAT in 1996 (Directive 61)

BAT - Best Available Techniques

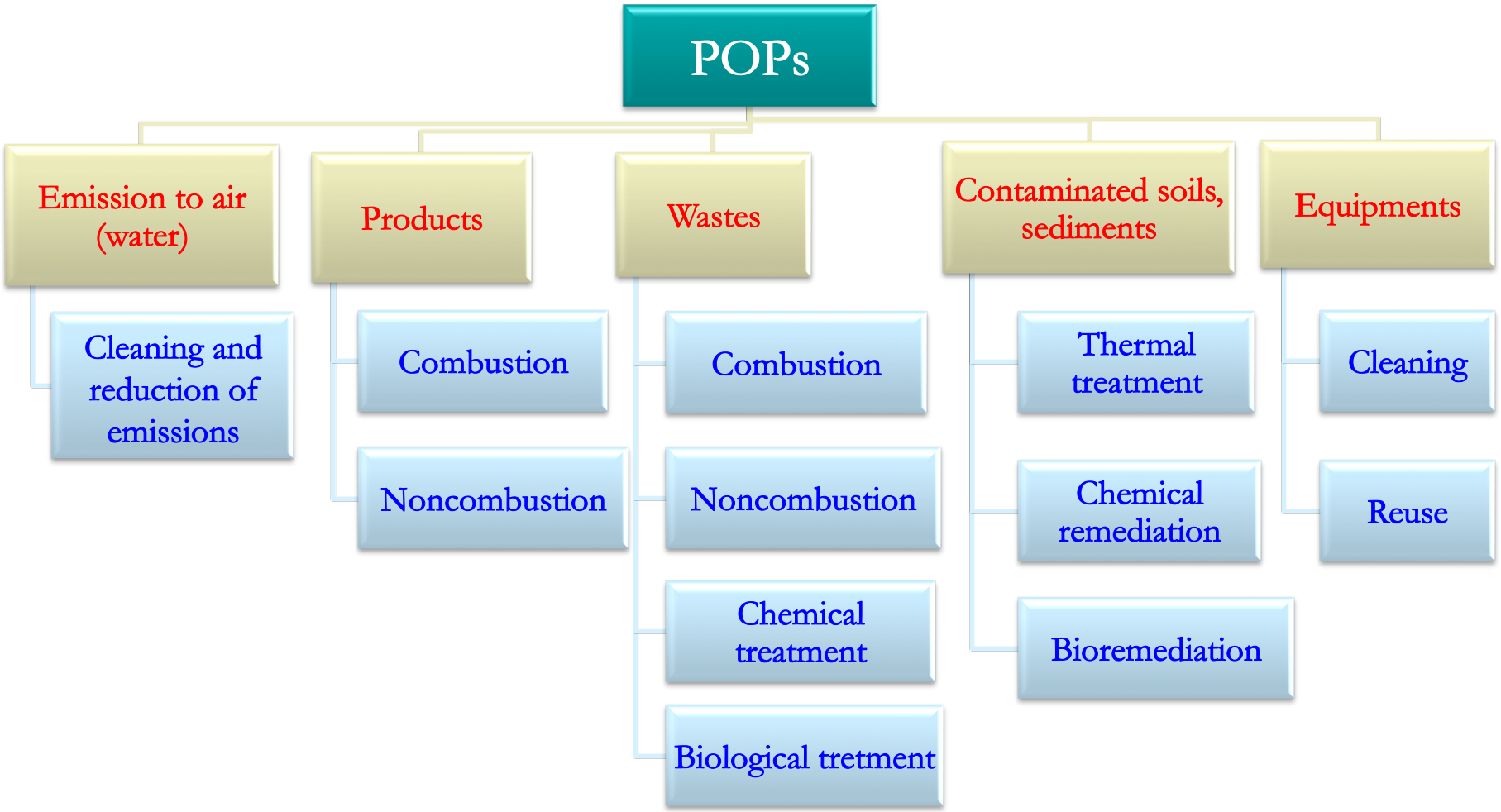


Way how the IPPC installation is:

- designed,
- maintained,
- operated,
- monitored,
- closed

(managed) ☞ EMS

POPs BAT/BEP strategy



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Continued reduction: Article 5 Annex C

Measures to reduce or eliminate releases from unintentional production

- Develop and implement an action plan to evaluate and address releases
- Promote alternatives and BAT/BET for priority sources of releases
  - When applying BAT/BEP, Parties to consider guidelines adopted by COP

BAT/BEP - Definitions

Best available techniques (BAT)

means the most effective and advanced stage in the development of activities and their methods of operation which indicate the practical suitability of particular techniques for providing in principle the basis for release limitations designed to prevent and, where that is not practicable, generally to reduce releases of chemicals listed in Part I of Annex C and their impact on the environment as a whole.

In this regard:

BAT/BEP - Definitions

- Techniques includes both the technology used and the way in which the installation is designed, built, maintained, operated and decommissioned;

- Available techniques means those techniques that are accessible to the operator and that are developed on a scale that allows implementation in the relevant industrial sector, under economically and technically viable conditions, taking into consideration the costs and advantages; and

- Best means most effective in achieving a high general level of protection of the environment as a whole;

BAT/BEP - Definitions

Best environmental practices (BEP)

means the application of the most appropriate combination of environmental control measures and strategies

The concept of best available techniques is not aimed at the prescription of any specific technique or technology, but at taking into account the technical characteristics of the installation concerned, *its geographical location and the local environmental conditions*

Stockholm Convention, Article 5 paragraph (f)

Stockholm Convention, Annex C, Part V, section B.

BAT/BEP- available guidance

- In the Stockholm Convention
  - Annex C: General guidance on prevention and release reduction measures
  - Guidelines on BAT/BEP: Draft guidelines available at http://www.pops.int/documents/meetings/bat_bep
  - UNEP Toolkit (overview of technologies from obsolete to BAT)
- In the UNECE CLRTAP POPs Protocol
  - Annex V: BAT to control emissions of POPs from major stationary sources
  - http://www.unece.org/env/lrtap
- EU/ BAT Reference Documents (BREF)

  http://eippcb.jrc.es

Economic and social implications

- Economic and social conditions in a country will determine what are "best" available techniques and "best" environmental practices

- Large scale processes (cement kilns, sinter plants, power plants…) BAT/BEP will be similar world-wide

- Small scale processes (crematoria, home heating/cooking, motor vehicles, waste burning…) technologies vary from country to country

- Determining what is "BAT/BEP" needs to include analysis of economic feasibility

"Best" = best option that is economically feasible under the socio-economic conditions present

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Formation of PCDDs/Fs during combustion processes - summary

Destruction of PCDDs/Fs in combustion chambers round 900 °C and higher, but they can be produced again after the combustion zone – secondary production

- Temperature window - 250 – 400 °C
- Oxidative atmosphere
- Matrix (flyash)
  - Destructed carbon structures
  - Cu compounds
  - Hydrogen donors
  - Sources of chlorine

POPs formation mechanisms

Understanding the POPs formation mechanisms is a key to sound unintended POPs by-product management:

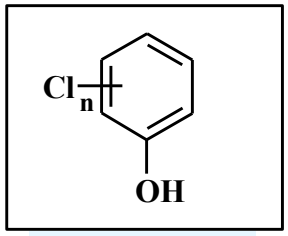
- Gas phase formation from precursors at T= 300 – 800 (rearrangement, de-chlorination, free-radical condensation...)
- Solid-phase de-novo synthesis at T= 200 – 500 °C (residual carbon, HCl, O_2, H_2O, metals)
- Undestroyed "pass through" POPs originally in the raw material (due to inefficient combustion)

Management of releases targeted to reduction of CO and particulate matter releases will reduce also POPs releases

Key considerations to manage POPs by-products

- Good burning conditions (3t-temperature, time, turbulence; oxygen …) result in minimum PIC, hence low CO and POPs releases ⇨ improve burning conditions
- Preventing of de-novo synthesis ⇨ avoid reformation window 200 - 500 °C
- POPs do adsorb in the flue gas on the surface of solid particles with preference of the smallest fraction ⇨ dust removal
- POPs are micro-contaminants; reducing macro-contaminants usually takes care also for POPs reduction
  ⇨ synergic effect of measures to control other pollutants

Precursor reactions

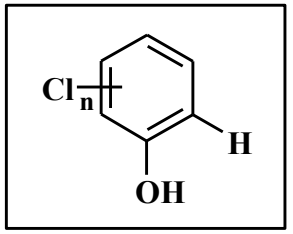


Phenols

Adsorption

Desorption

Dechlorination



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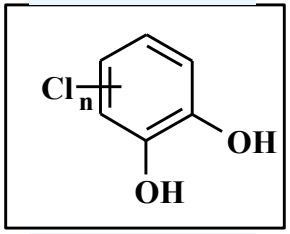
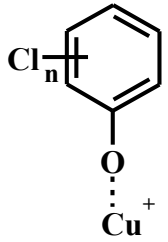
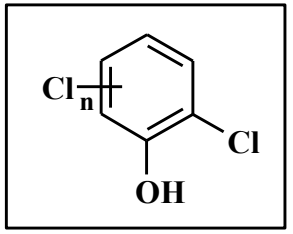


Catechols

Hydroxylation



Chlorination

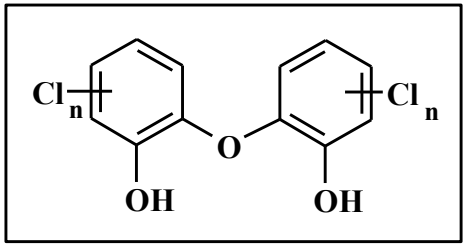


Phenols

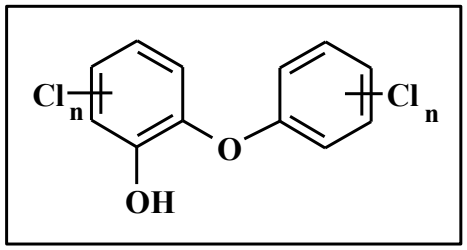
Condensation

Ullmann II

Ullmann I



Diphenylethers



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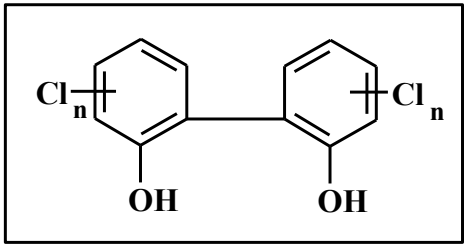
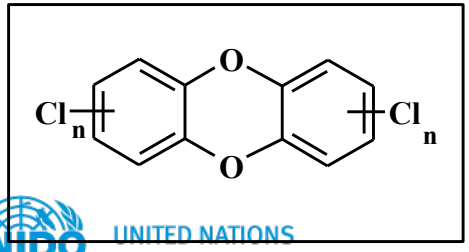


Biphenyls

Cyclization

Cyclization

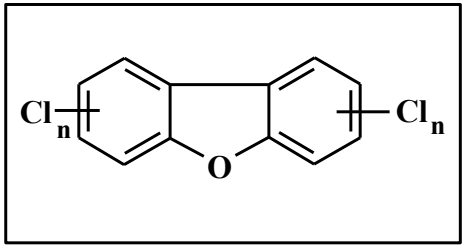
Cyclization



PCDDs

-HCl

- H_2O



PCDFs

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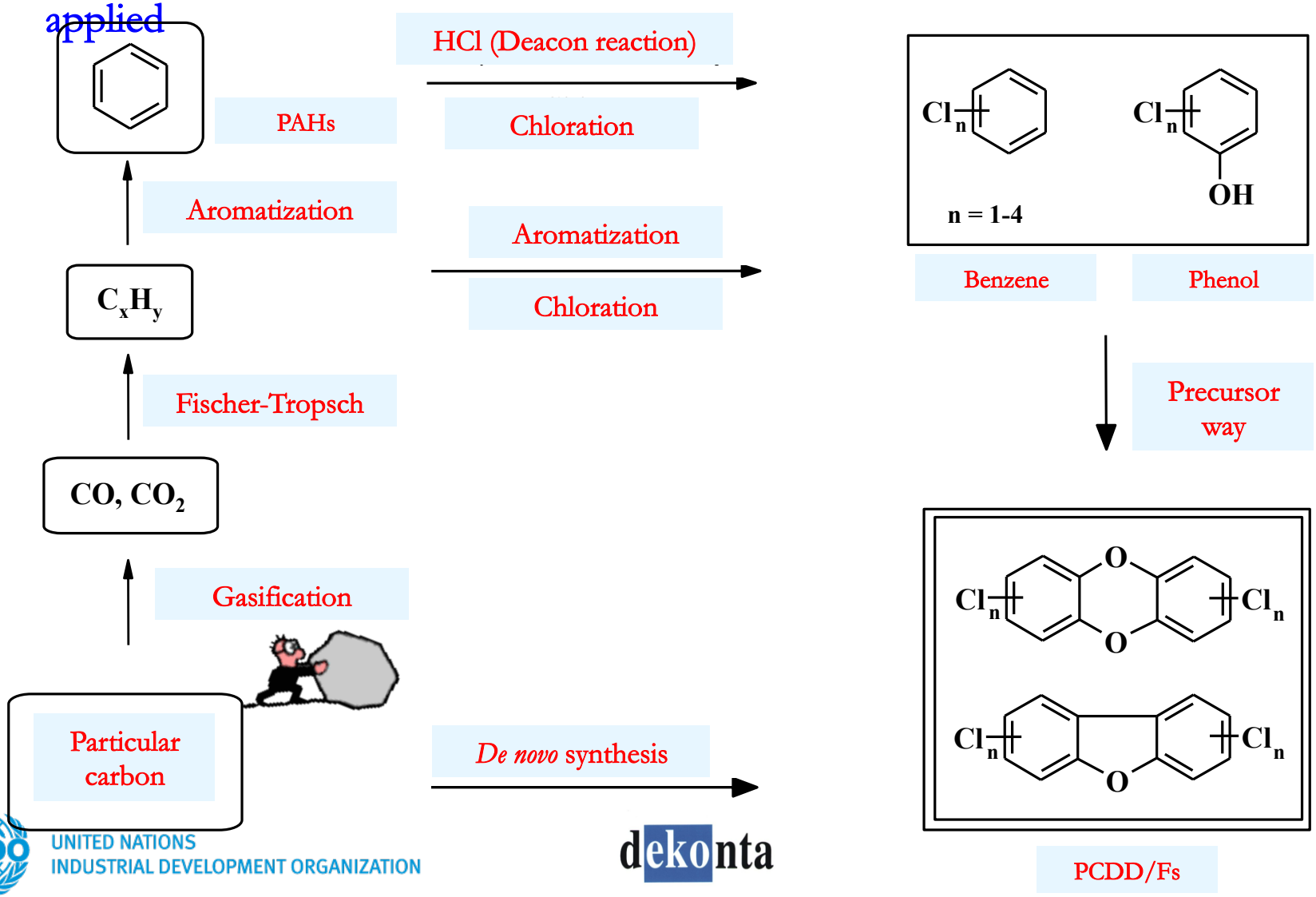
Pathways of PCDDs/Fs and PAHs formation during the combustion processes

Reactions where the mechanisms of homogennic and heterogennic reactions are applied



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Stockholm Convention - Waste-related provisions

Recognizing the following considerations:

(a) Disposal of wastes with a high POP content, including waste stockpiles, should be a priority;

(b) Availability of treatment capacity;

(c) Limit values within national legislation are relevant;

(d) Availability of analytical methods; and

(e) Lack of knowledge and data;

the following provisional definitions for low POP content should be applied:

(a) PCBs: 50 mg kg^{-1}

(b) PCDDs and PCDFs: 15 μg TEQ kg^{-1}

(c) Aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, HCB, mirex and toxaphene: 50 mg kg^{-1} for each

(d) PBDEs: 50 mg kg^{-1}

Sound management of POPs by-products

Sound management of POPs by-products ➡
= sound management of their release sources
PROCESS SPECIFIC MANAGEMENT

Basic possible approaches:

- ⑤ Alternatives (alternatives with similar usefulness but avoiding POPs releases)
- ⑤ Primary measures (targeted onto the process-BAT, BEP, cleaner technologies)
- ⑤ Secondary measures (end-of-pipe- BACT)

Management of releases targeted to a particular pollutant will influence releases of other pollutants

Timetable for POPs by-products

- Establish an action plan within 2 years after entry into force of the Convention for the Party;
- A review of the strategies in the action plan to achieve the goals every 5 years;
- Phase in the requirements of BAT identified for new sources as soon as possible but not later than 4 years after entry into force
- These dates are part of the Convention and not negotiable
- Linkage to Article 7 on National Implementation Plans

Proposed requirements for sound disposal of POPs

Destruction and/or irreversible transformation of POPs wastes must achieve a destruction efficiency (DE)/ destruction and removal efficiency (DRE) of 99.9999%

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First session
Geneva, 28 April to 2 May 2003

Item 5 (d) of the provisional agenda*

DRAFT TECHNICAL GUIDELINES ON THE ENVIRONMENTALLY SOUND MANAGEMENT OF PERSISTENT ORGANIC POLLUTANTS AS WASTES

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BAT/BEP Guidance

GUIDELINES ON BEST AVAILABLE TECHNIQUES AND PROVISIONAL GUIDANCE ON BEST ENVIRONMENTAL PRACTICES RELEVANT TO ARTICLE 5 AND ANNEX C OF THE STOCKHOLM CONVENTION ON PERSISTENT ORGANIC POLLUTANTS, DECEMBER 2006

HTTP://CHM.POPS.INT/PROGRAMMES/BAT/BEP/GUIDELINES/TABID/187/LANGUAGE/EN-US/DEFAULT.ASPX

Revised Draft Guidelines on best available techniques and provisional guidance on best environmental practices relevant to Article 5 and Annex C of the Stockholm Convention on Persistent Organic Pollutants

Structure

The document consists of six main sections:

- Sections I – IV : General in nature
- Sections VI-VII: source specific

Structure of document

Section I - Introduction

- purpose and structure of the document;
- a brief description of the characteristics and risks of chemicals listed in Annex C of the Stockholm Convention;
- directly relevant provisions of the Stockholm Convention, Article 5 and Annex C;
- a summary of required measures under these provisions; and
- relationship of these provisions to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal.

Structure of document

Section II – Consideration of alternatives in the application of BAT

- provides guidance on consideration of alternatives, including:
  - The Stockholm Convention and new sources
  - An approach to consideration of alternatives
  - information on other considerations of the Stockholm Convention (health, safety, environmental, social and economic, Annex C);

Structure of document

Section III - general guidance, applicable principles and descriptions of considerations that cut across multiple source categories

Section IV - a compilation of the summaries provided for each category sources in sections V and VI.

Structure of document

Section V & VI - contain specific guidelines for each source category listed in Part II and Part III of Annex C of the Stockholm Convention. For each of the source-specific guidelines, the following information is provided:

- Process description;
- Sources of chemicals listed in Annex C;
- Primary and secondary measures;
- Performance standards;
- Performance reporting;
- Relevant case studies.

BAT/BEP Guidance

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(II) WASTE MANAGEMENT CONSIDERATIONS

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SUMMARIES OF SECTION VI: SOURCE CATEGORIES INCLUDED IN PART III OF ANNEX C

BAT/BEP Guidance

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BAT/BEP Guidance

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(V) PRIMARY BASE METALS SMELTING

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VI.D FOSSIL FUEL-FIRED UTILITY AND INDUSTRIAL BOILERS

VI.E FIRING INSTALLATIONS FOR WOOD AND OTHER BIOMASS FUELS

BAT/BEP Guidance

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VI.K Shredder plants for the treatment of end-of-life vehicles

VI.L Smouldering of copper cables

VI.M Waste oil refineries

Structure of document

References and bibliographic information are provided for each of the guidelines.

The complete list of references and bibliographic information for the guidelines and guidance is available at: www.pops.int

Levels of destruction and irreversible transformation

Recognizing the following considerations:

(a) Both destruction efficiency (DE) and destruction removal efficiency (DRE) are a function of the initial POP content and do not cover formation of unintentionally produced POPs during destruction or irreversible transformation;

(b) DE is an important criterion for helping to assess technologies for destruction and irreversible transformation, but can be difficult to measure in a reproducible and comparable manner, especially on a regular basis;

(c) DRE considers only emissions to air;

(d) BAT and BEP set safe design and operating conditions, including expected destruction efficiencies, in particular circumstances on a technology by technology basis;

Levels of destruction and irreversible transformation

(e) BAT and BEP have not been identified for all disposal methods;
(f) Existence of pertinent national legislation and international rules, standards and guidelines;
(g) Lack of knowledge and data;

Levels of destruction and irreversible transformation

The following provisional definition for levels of destruction and irreversible transformation, based upon absolute levels (i.e., waste output streams of treatment processes) should be applied:

(a) Atmospheric emissions:

PCDDs and PCDFs: 0.1 ng TEQ Nm^{-3};

All other POPs: pertinent national legislation and international rules, standards and guidelines, examples of pertinent national legislation can be found in annex II;

Determined according to national or international methods and standards.

TEQ as referred to in annex C, part IV, paragraph 2, of the Stockholm Convention, but only for PCDDs and PCDFs.

Levels of destruction and irreversible transformation

Calculated on the basis of the mass of the POP content within the waste, minus the mass of the remaining POP content in the gaseous, liquid and solid residues, divided by the mass of the POP content within the waste, i.e.,

DE = (POP content within waste – POP content within gas, liquid and solid residual) / POP content within the waste

Levels of destruction and irreversible transformation

Calculated on the basis of mass of the POP content within the waste, minus the mass of the remaining POP content in the gaseous residues (stack emissions), divided by the mass of the POP content within the wastes, i.e.,

DRE = (POP content within waste – POP content within gas residual) / POP content within the waste.

TEQ as referred to in annex C, Part IV, paragraph 2 of the Stockholm Convention, but only for PCDDs and PCDFs. Nm^3 refers to dry gas, 101.3 kPa and 273.15 K. Standardization at 11 per cent O_2.

Levels of destruction and irreversible transformation

(b) Aqueous releases: pertinent national legislation and international rules, standards and guidelines, examples of pertinent national legislation can be found in annex II;

(c) Solid residues: POP contents should be below the low POP contents defined in section A above of this chapter.

However, if the POP content of unintentionally produced PCDD/PCDFs is above the low POP content defined in section A, the solid residues should be treated in accordance with section IV.G.

In addition, technologies for destruction and irreversible transformation should be operated in accordance with BAT and BEP.

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- Metalurgy in Turkey

Criteria for determining best available techniques

1. The use of low-waste technology
2. The use of less hazardous substances
3. The furthering of recovery and recycling of substances generated and used in the process and of waste, where appropriate
4. Comparable processes, facilities or methods of operation which have been tried with success on an industrial scale
5. Technological advances and changes in scientific knowledge and understanding
6. The nature, effects and volume of the emissions concerned

Criteria for determining best available techniques

7. The commissioning dates for new or existing installations
8. The length of time needed to introduce the best available technique
9. The consumption and nature of raw materials (including water) used in the process and energy efficiency
10. The need to prevent or reduce to a minimum the overall impact of the emissions on the environment and the risks to it
11. The need to prevent accidents and to minimise the consequences for the environment
12. Information published by public international organisations.

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Resource Efficient and Cleaner Production (RECP)

- broadening of the definition of CP to include resource efficiency which is a key element of the transitions towards Green Industry and Green Economy
- RECP continuously applies integrated and preventive strategies to processes, products and services. This increases efficiency and reduces risks to humans and the environment.
- Production Efficiency – through optimization of productive use of natural resources (materials, energy, water) at all stages of the production cycle
- Environmental Management - through minimization of the adverse impacts of industrial production systems on nature and the environment
- UNIDO-UNEP Programme on RECP

ESTs – Environmentally Sound Technologies

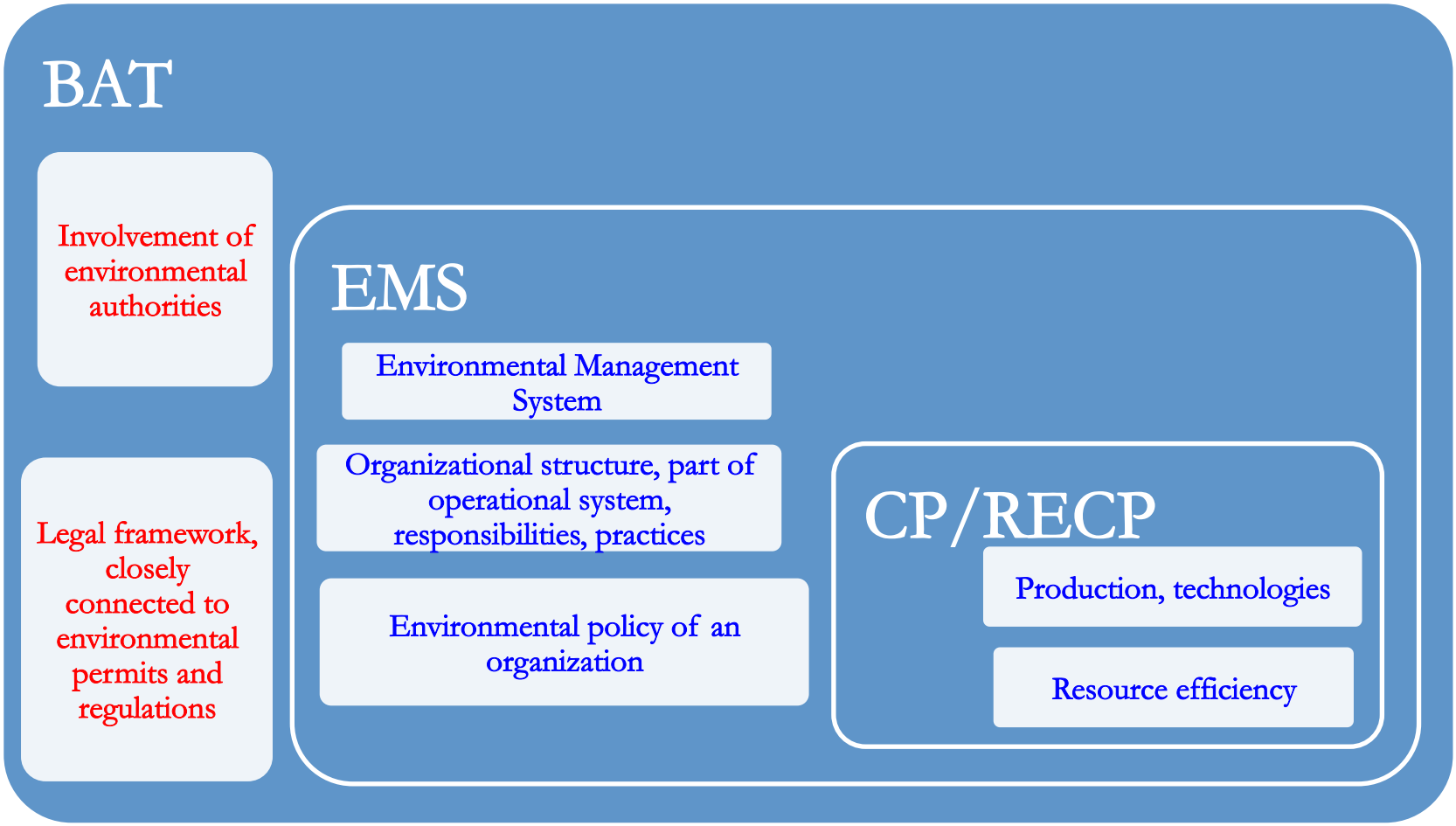
Technologies that have the potential for significantly improved environmental performance relative to other technologies

ESTs are not just "individual technologies, but total systems which include know-how, procedures, goods and services, and equipment as well as organizational and managerial procedures".

This requires both the human resource development and local capacity building aspects of technology choices. There is also the need to ensure that ESTs are compatible with nationally determined socio-economic, cultural and environmental priorities and development goals.

Source: UNEP International Environmental Technology Center

Framework for BAT/CP at an installation



BAT basis

- BAT concept was clearly defined for the first time in the article 2 point 11 of EU IPPC Directive 96/61 on September 24th 1996 (see slides 4 and 5),

- Article 16 has determined the information exchange according BAT:

Commission will organize information exchange among EU members and releavant industry sector. Appropriate report will be published every 3 years.

BAT information exchange body

The European Integrated Pollution Prevention and Control (IPPC) Bureau was set up in 1997, within the Institute for Prospective Technological Studies (IPTS), to organise an exchange of information between Member States and industry on Best Available Techniques (BAT), associated monitoring and developments in them.

EIPPCB is located in Sevilla (Spain).

BAT information exchange body

The objectives of the whole information exchange are:

- to accomplish a comprehensive exchange of information and views and through the publication of reference documents to help to redress any technological imbalances in the European Community,
- to promote the worldwide dissemination of limit values and techniques used in the Community,
- to assist Member States in the efficient implementation of IPPC Directive.

Determination of BAT

Annex IV determination of BAT to consider:

- The use of low-waste technology,
- The use of less hazardous substances,
- The furthering of recovery and recycling of substances generated and used in the process and of waste, where appropriate,
- Comparable processes, facilities or methods of operation, which have been tried with success on an industrial scale,
- Technological advances and changes in scientific knowledge and understanding,
- The nature, effects and volume of the emissions concerned,
- The commissioning dates for new or existing activities

BAT/BEP - Definitions

Determination of BAT to consider:

- The length of time needed to introduce the best available techniques,
- The consumption and nature of raw materials (including water) used in the process and their energy efficiency,
- The need to prevent or reduce to a minimum the overall impact of the emissions on the environment and the risks to it,
- The need to prevent accidents and to minimize the consequences for the environment,
- The information published by the Commission of the European Communities pursuant to any exchange of information between Member States and the industries concerned on best available techniques, associated monitoring, and developments in them, or by international organizations, and such other matters as may be prescribed.

BAT – where to fund?

BREFs – BAT reference documents - (33 BREFs and ~50 BAT guidances)

National guidances of industrial chambers

Law (IPPC landfills)

Other sources

EBRD

www.ebrd.com/enviro/index

Word Bank

http://wbln0018.worldbank.org/essd/essd.nsf

UK Environmental Agencies

http: //www.environment-agency.gov.uk

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BAT References documents = BREF

- BREFs are the BAT Reference documents being a result of an exchange of information organized by The European Integrated Pollution Prevention and Control (IPPC) Bureau

- BREF is a guidance for IPPC permit writers

- EIPPCB carries on its work through Technical Working Groups (TWGs) comprising nominated experts from EU Member States, EFTA countries, Accession countries, industry and environmental NGOs

BAT References documents = BREF

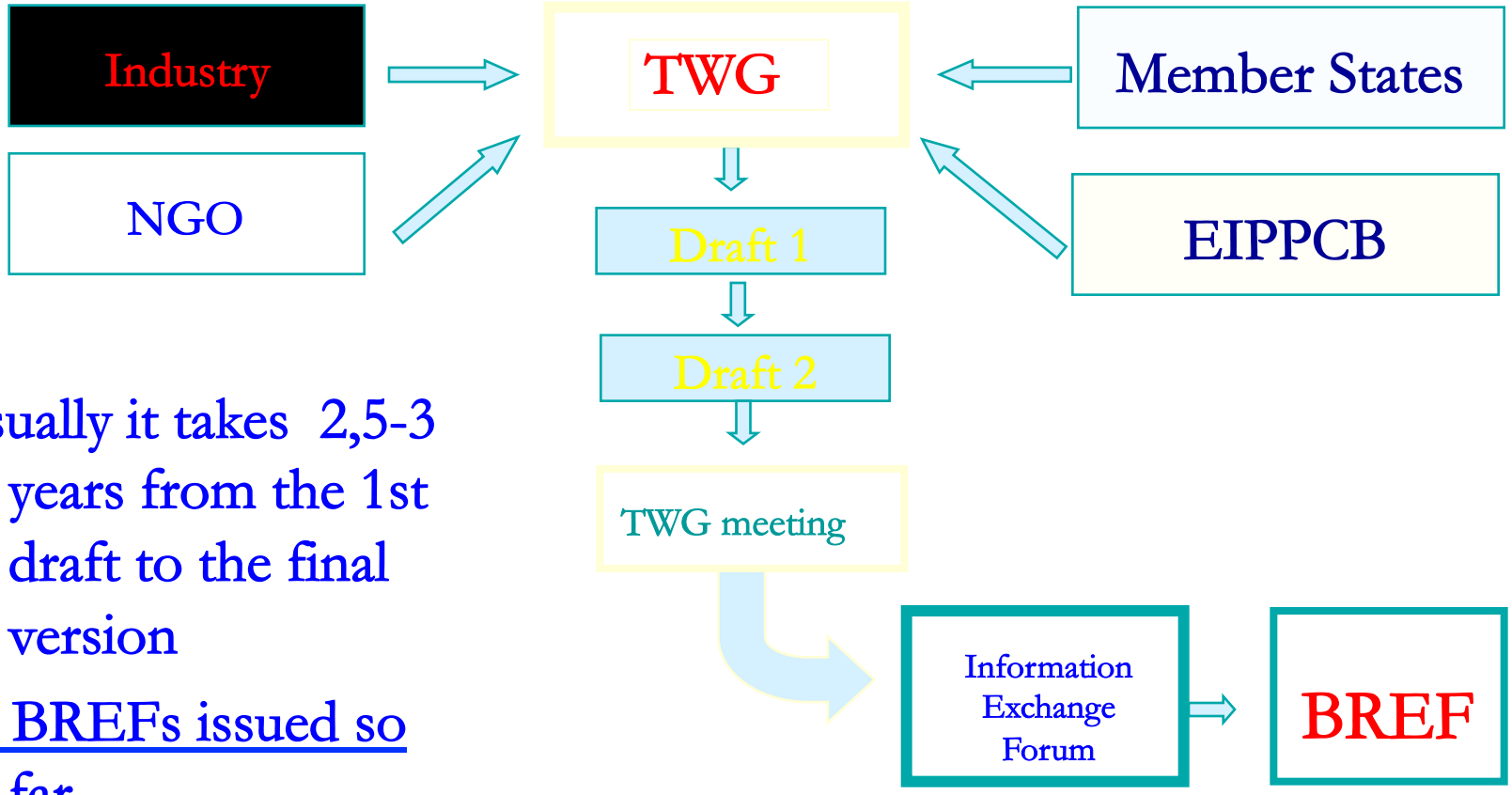
BREF's are not:

- binding law act,
- explanation of IPPC Directive,
- specification of obligatory emission limits value (ELV),
- list of all required environmental limits and aspects (local conditions are not taken under consideration).

Structure of BREF

- Executive summary
- Preface
- Scope
- General – structure of the industry
- Applied processes and techniques
- Current emission and consumption levels
- Techniques to consider in the determination of BAT
- Best Available Techniques (BAT)
- Emerging techniques
- Concluding remarks
- References
- Glossary
- Annexes

BREF - information exchange



Usually it takes 2,5-3 years from the 1st draft to the final version

33 BREFs issued so far

BAT References documents

Actual information's about BAT find on EIPPCB web:

http://eippcb.jrc.es

- EIPPCB work schedule
- Contacts to the TWG members
- Other documents linked to BREF and BREF preparation
- Complete BREF documents
- You can downloaded BREF docs. (Eng. version)

(Official Journal of the European Union L 334/17 DIRECTIVES

DIRECTIVE 2010/75/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 24 November 2010
on industrial emissions (integrated pollution prevention and control)
(Recast)
(Text with EEA relevance)

Updated general technical guidelines for the environmentally sound management of wastes consisting of, containing or contaminated with persistent organic pollutants (POPs)

The Industrial Emissions Directive

Directive 2010/75/EU on industrial emissions (integrated pollution prevention and control)

Industrial production processes account for a considerable share of the overall pollution in Europe (for emissions of greenhouse gases and acidifying substances, wastewater emissions and waste).

In order to take further steps to reduce emissions from such installations, the Commission adopted its proposal for a Directive on industrial emissions on 21 December 2007.

The Industrial Emissions Directive

The IED is the successor of the IPPC Directive and in essence, it is about minimising pollution from various industrial sources throughout the European Union.

Operators of industrial installations operating activities covered by Annex I of the IED are required to obtain an integrated permit from the authorities in the EU countries.

About 50 000 installations were covered by the IPPC Directive and the IED will cover some new activities which could mean the number of installations rising slightly.

The Industrial Emissions Directive

The IED is based on several principles, namely:

(1) an integrated approach
(2) best available techniques,
(3) flexibility,
(4) inspections and
(5) public participation.

The integrated approach means that the permits must take into account the whole environmental performance of the plant, covering e.g. emissions to air, water and land, generation of waste, use of raw materials, energy efficiency, noise, prevention of accidents, and restoration of the site upon closure. The purpose of the Directive is to ensure a high level of protection of the environment taken as a whole.

The Industrial Emissions Directive

The permit conditions including emission limit values (ELVs) must be based on the Best Available Techniques (BAT), as defined in the IPPC Directive.

BAT conclusions (documents containing information on the emission levels associated with the best available techniques) shall be the reference for setting permit conditions.

To assist the licensing authorities and companies to determine BAT, the Commission organises an exchange of information between experts from the EU Member States, industry and environmental organisations.

This work is co-ordinated by the European IPPC Bureau of the Institute for Prospective Technology Studies at the EU Joint Research Centre in Seville (Spain).

This results in the adoption and publication by the Commission of the BAT conclusions and BAT Reference Documents (the so-called BREFs).

Stockholm Convention on POPs

- Parties are to take measures so that POPs wastes are:
  "Disposed of in such a way that the persistent organic pollutant content is destroyed or irreversibly transformed so that they do not exhibit the characteristics of persistent organic pollutants or otherwise disposed of in an environmentally sound manner when destruction or irreversible transformation does not represent the environmentally preferable option …" (Article 6, L (d) (ii))

- Further, measures are to be taken so that POPs wastes are:
  "Not permitted to be subject to disposal operations that may lead to recovery, recycling, reclamation, direct reuse or alternative uses of persistent organic pollutants." (Article 6 (d) (iii))

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Destroying technologies for POPs

Based on oxidative processes

- High-temperature incineration
- Cement kilns
- Super-critical water oxidation
- Molten salt oxidation
- Electrochemical oxidation
- Advanced oxidative process

Destroying technologies for POPs

Based on reductive processes

- Catalytic hydrogenation
- Solvated electron technology
- Sodium reduction
- Dehalogenation processes
  - Base catalyzed dechlorination
  - Alkaline polyethylene glycolate (APEG) process
- Gas-phase chemical reduction
- Molten metal pyrolysis
- Ball milling

Non-combustion technologies

True non-combustion

- Reductive
- w/o oxygen

- Reduction with hydrogen and donors of hydrogen
- Reduction with metals and other reductants
- Mediated Electrochemical Oxidation

Alternative air oxidation

- Flameless
- Pyrolysis
- Indirect

- High temperature air oxidation: molten media, SCWO, and plasma arc technologies

Destroying technologies for POPs

Based on other processes

- Plasma arc
- Photochemical degradation

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Secondary copper production

Secondary copper smelting involves copper production from sources that may include copper scrap, sludge, filter-dust, slags, computer and electronic scrap, shredder material and drosses from refineries.

Processes involved in copper production are feed pretreatment, smelting, alloying and casting.

Factors that may give rise to chemicals listed in Annex C of the Stockholm Convention include the presence of catalytic metals (of which copper is a highly effective example); organic materials in feed such as oils, plastics and coatings; incomplete combustion of fuel; and temperatures between 250 °C and 500 °C.

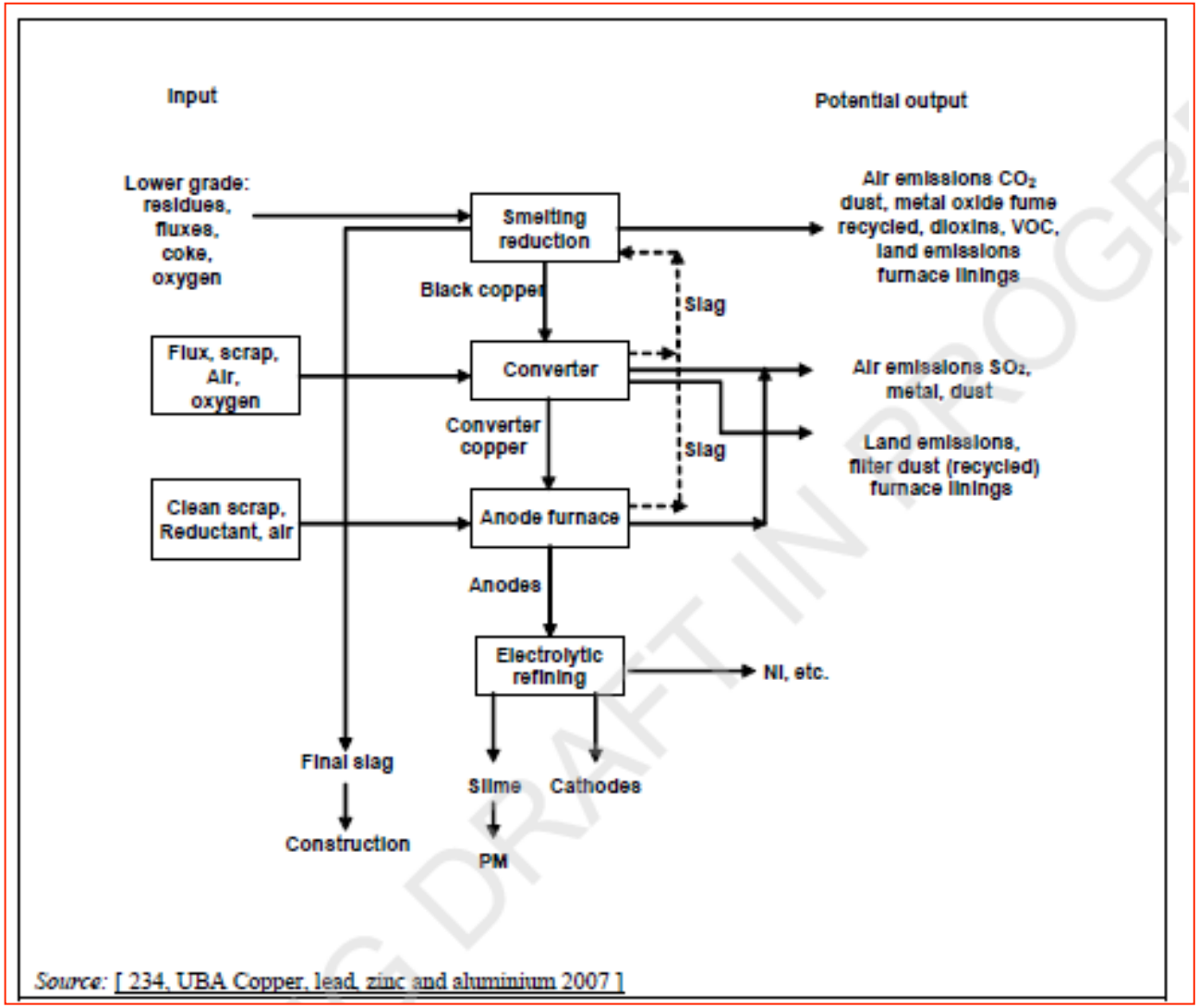
Secondary copper production

Best available techniques include:

- presorting,
- cleaning feed materials,
- maintaining temperatures above 850 °C,
- utilizing afterburners with rapid quenching,
- activated carbon adsorption and
- fabric filter dedusting.

PCDD/PCDF performance levels in air emissions associated with best available techniques and best environmental practices for secondary copper smelters are ≤ 0.1 ng I-TEQ/Nm^3 (at operating oxygen concentrations).

Secondary copper production



Source: [234, UBA Copper, lead, zinc and aluminium 2007]

Smoldering of copper cables

- Purpose: Recovering of scrap copper

- BAT/BACT: mechanical cable chopping, stripping or high temperature incineration (> 850 °C), residence time, excess oxygen, with APC

- "Open burning is not an environmentally acceptable solution for any kind of waste" (UNEP 2001)
  - Oxygen starved conditions
  - Low temperatures 250-700 °C
  - Cu is catalyzing PCDD/PCDF formation

Alternatives

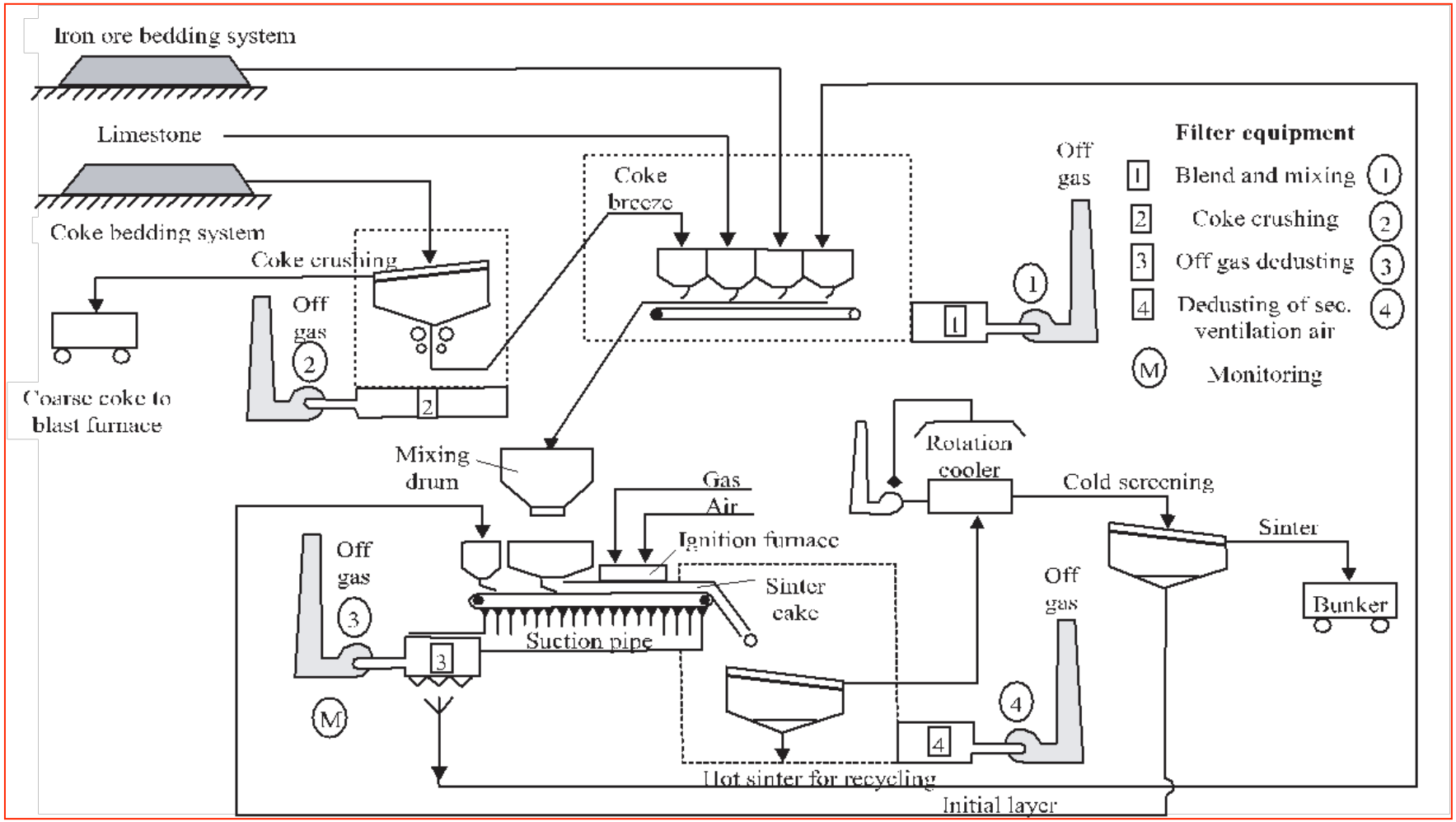
- Cable chopping
  - Requires pre-sorting
  - Granulation (filtering is necessary)
  - Density/electrostatic separation (metal looses may occur)
- Cable stripping
  - Cheaper than chopping/lower throughput/lower cost
  - Presorting of the cables
  - Complete recovery
  - Rates: 60 m/min; 1.1 $kg.min^{-1}$; cable diameter 1.6 mm-150 mm
- High temperature incineration
  - To treat cables unsuitable for stripping or chopping

Sinter plants in the iron and steel industry

Sinter plants in the iron and steel industry are a pretreatment step in the production of iron whereby fine particles of iron ores and, in some plants, secondary iron oxide wastes (collected dusts, mill scale) are agglomerated by combustion.

Sintering involves the heating of fine iron ore with flux and coke fines or coal to produce a semi-molten mass that solidifies into porous pieces of sinter with the size and strength characteristics necessary for feeding into the blast furnace.

Process diagram of sinter plant



Sinter plants in the iron and steel industry

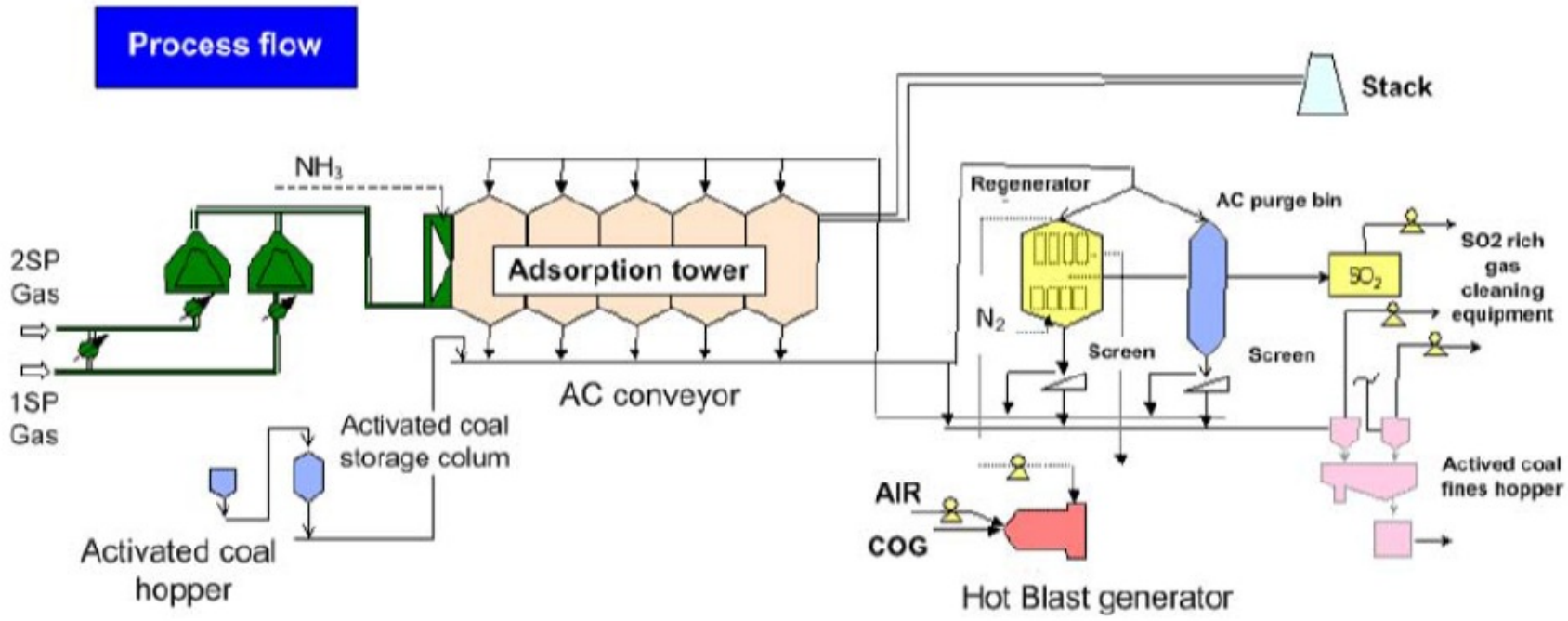
Primary measures identified to prevent or minimize the formation of PCDD/PCDF during iron sintering include the stable and consistent operation of the sinter plant, continuous parameter monitoring, recirculation of waste gases, minimization of feed materials contaminated with persistent organic pollutants or contaminants leading to formation of such pollutants, and feed material preparation.

Sinter plants in the iron and steel industry

Secondary measures identified to control or reduce releases of PCDD/PCDF from iron sintering include:

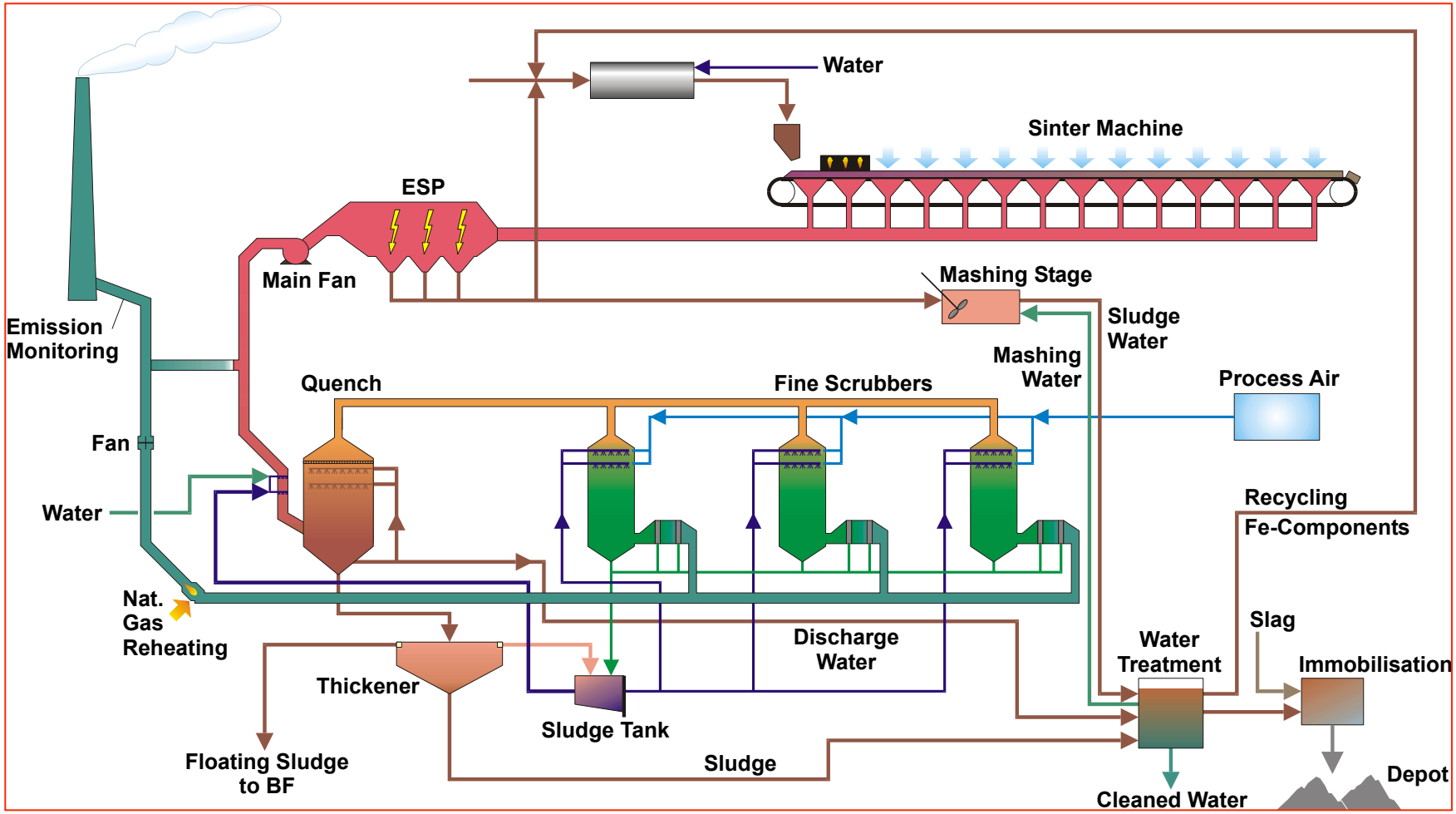
- adsorption/absorption (for example, activated carbon injection),
- suppression of formation using urea addition,
- and high-efficiency dedusting,
- as well as fine wet scrubbing of waste gases combined with effective treatment of the scrubber wastewaters and disposal of wastewater sludge in a secure landfill.

The regenerative activated carbon (RAC) process



Source: [268, SHI 2006] [314, Eurofer 2007]

Process diagram of a sinter plant using a wet scrubbing system



Sinter plants in the iron and steel industry

Chemicals listed in Annex C appear to be formed in the iron sintering process mainly via de novo synthesis.

PCDF generally dominate in the waste gas from sinter plants.

The PCDD/PCDF formation mechanism appears to start in the upper regions of the sinter bed shortly after ignition, and then the dioxins, furans and other compounds condense on cooler burden beneath as the sinter layer advances along the sinter strand towards the burn-through point.

Sinter plants in the iron and steel industry

A strong correlation exists between the concentrations of PCDD/F and WHO-12 PCB (expressed in terms of I-TEQ values), such that the contribution of WHO-12 PCB to the overall I-TEQ concentration is typically 9 – 10 % of PCDD/F.

The close relationship found between PCDD/F and PCB concentrations suggests that there is a common link between the formation of these compounds.

Sinter plants in the iron and steel industry

PCDD/PCDF performance levels in air emissions associated with best available techniques and best environmental practices for an iron sintering plant are < 0.05 - 0.2 ng I-TEQ/Nm^3 (bag filter) and < 0.2 – 0.4 ng I-TEQ/Nm^3 (advanced electrostatic precipitator) when bag filters are not applicable (at operating oxygen concentrations).

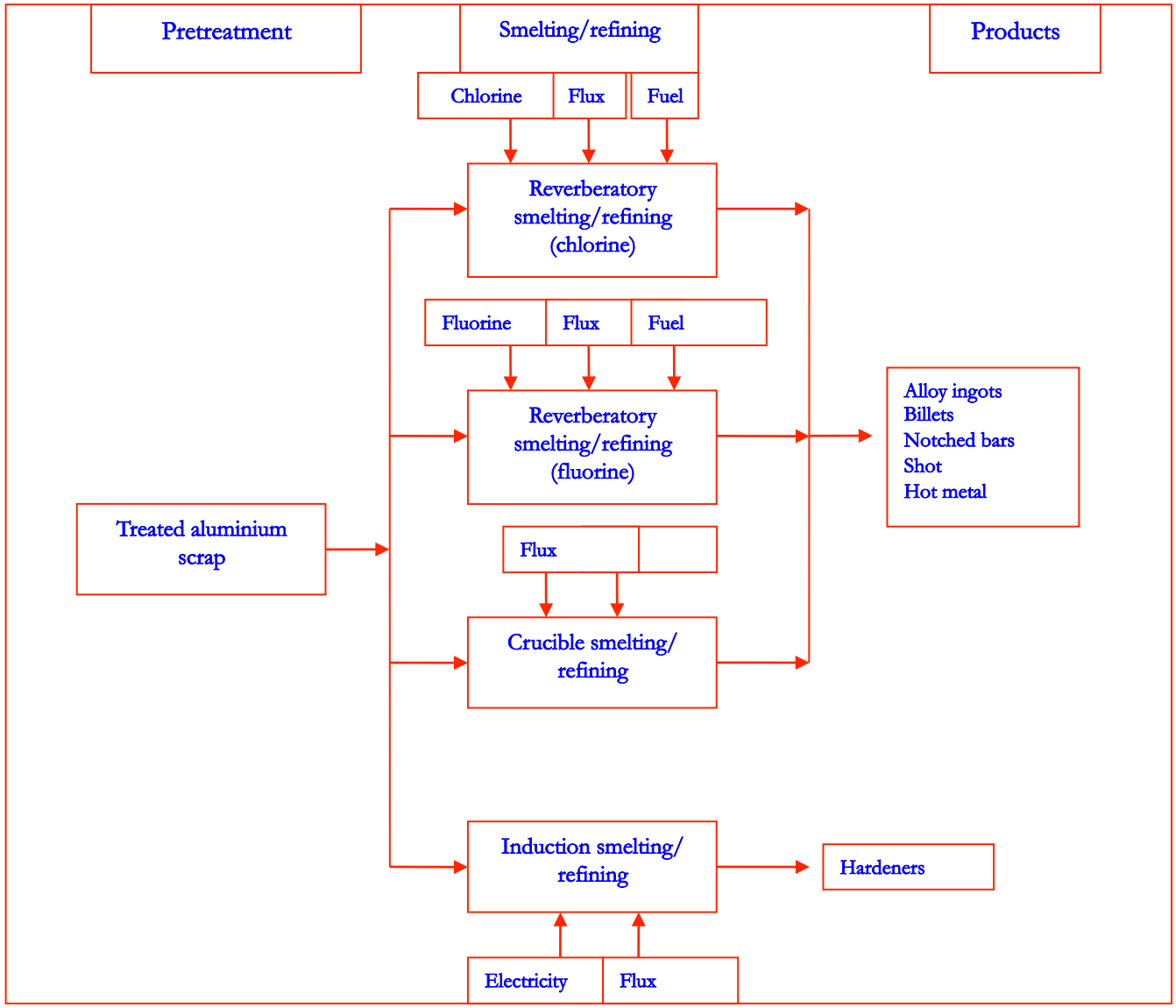
Secondary aluminum production

Secondary aluminium smelting involves the production of aluminium from used aluminium products or process waste to recover metals by pretreatment, smelting and refining.

Fuels, fluxes and alloys are used, while magnesium removal is practised by the addition of chlorine, aluminium chloride or chlorinated organics.

Chemicals listed in Annex C of the Stockholm Convention probably result from demagging additions, incomplete combustion, organics in the feed, chlorine compounds and formation in the system at temperatures between 250 °C and 500 °C.

Secondary aluminum production



Secondary aluminum production

Best available techniques include:

- high-temperature advanced furnaces,
- oil- and chlorine-free feeds (if alternatives are available),
- afterburners with rapid quench or internal burner systems,
- activated carbon adsorption and dedusting fabric filters,
- as well as avoiding the use of hexachloroethane for the removal of magnesium from the melt (demagging) and maintaining careful control over demagging in general.

PCDD/PCDF performance levels in air emissions associated with best available techniques and best environmental practices for secondary aluminium smelters are ≤ 0.1 ng I-TEQ/Nm^3 (at operating oxygen concentrations).

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Metalurgy in Turkey

Turkey is among the 10 biggest crude steel producing countries in the world.

In 2012, the iron and steel industry's contribution to the GDP of Turkey was 1.08%, which is an increase compared to 1% in 2006.

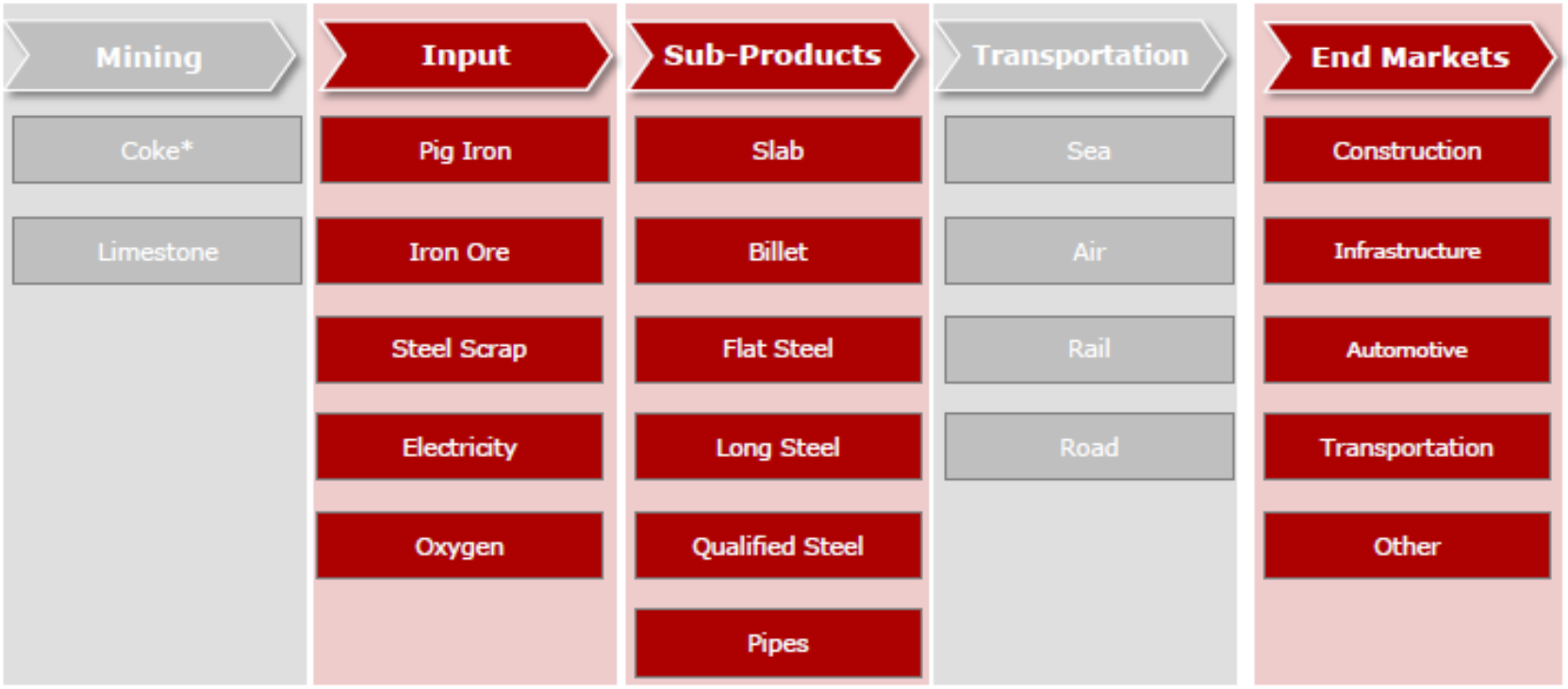
The iron and steel industry had a growth rate of more than 5% in 2012.

Crude steel production is expected to grow and reach 47 million tons in 2017.

Iron ore sintering is made in three large integrated iron and steel production plant: Erdemir, Isdemir and Kardemir.

Capacity expansion and new plant capacity will reach more than 7 million tons between the years 2013 and 2015.

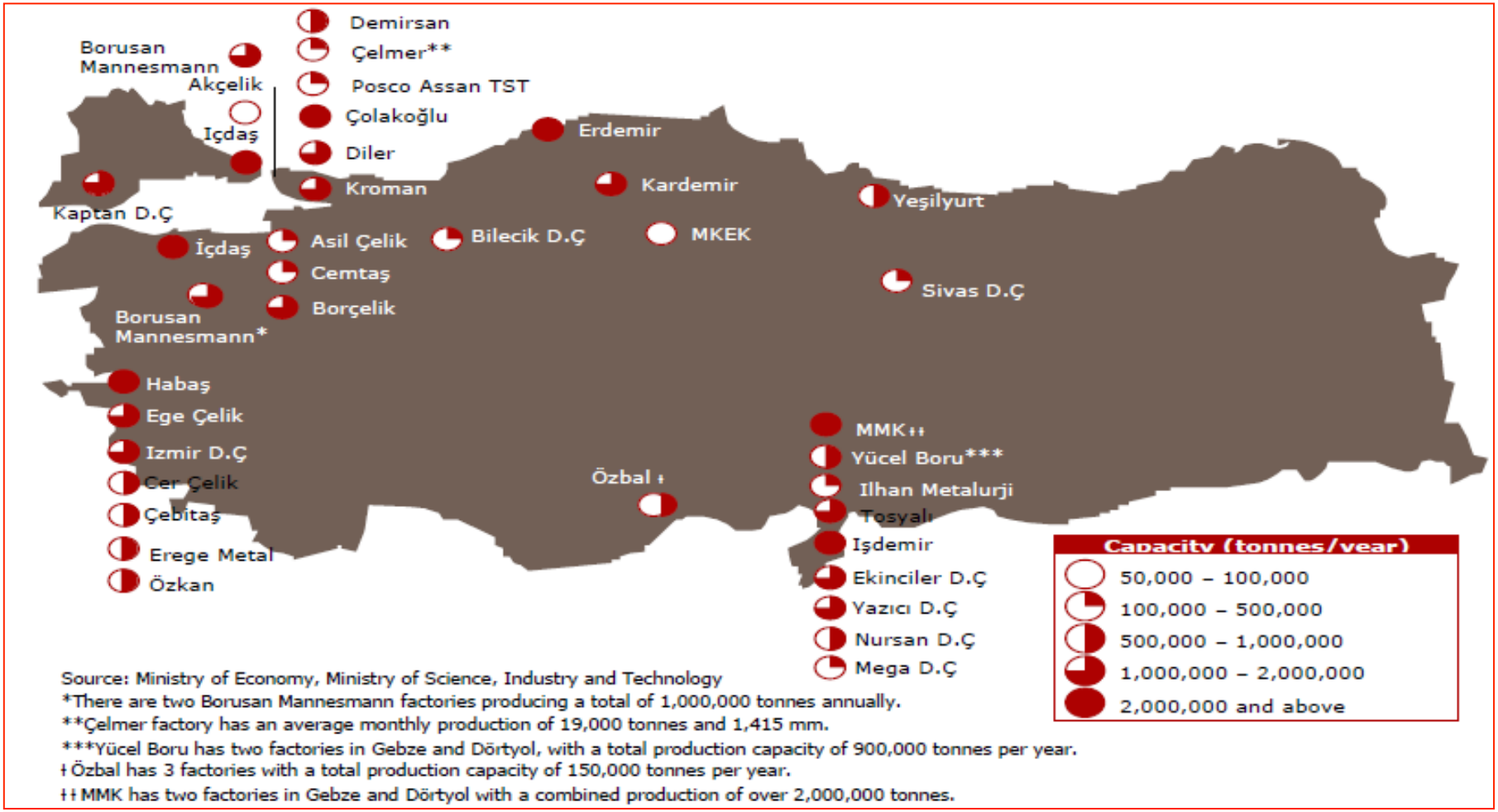
Iron and Steel Industry Value Chain in Turkey



* Coke in the form of coking coal

Source: Deloitte Turkey. Member of Deloitte Touche Tohmatsu Limited.

Steel Plant Capacities and Locations in Turkey 2013



Source: Ministry of Economy, Ministry of Science, Industry and Technology
*There are two Borusan Mannesmann factories producing a total of 1,000,000 tonnes annually.
**Çelmer factory has an average monthly production of 19,000 tonnes and 1,415 mm.
***Yücel Boru has two factories in Gebze and Dörtyol, with a total production capacity of 900,000 tonnes per year.
ǂ Özbal has 3 factories with a total production capacity of 150,000 tonnes per year.
ǂǂ MMK has two factories in Gebze and Dörtyol with a combined production of over 2,000,000 tonnes.

The Iron and Steel Industry in Turkey. Study published by the Investment Support and Promotion Agency of Turkey and Deloitte Ltd. December 2013

Estimated number of IPPC installations in Turkey in the ferrous and non ferrous metal industries, 2013

Sectoral identifier: IPPC category number and name	Number of installations
2.1. Metal ore (including sulphide ore) roasting or sintering installations	15
2.2. Installations for the production of pig iron or steel (primary or secondary fusion) including continuous casting, with a capacity exceeding 2.5 tons per hour	157
2.3. Installations for the processing of ferrous metals:	326
2.4. Ferrous metal foundries with a production capacity exceeding 20 tons per day	49
2.5.a production of non-ferrous crude metals from ore, concentrates or secondary raw materials by metallurgical, chemical or electrolytic processes	185
2.5.b smelting, including the alloyage, of non-ferrous metals, including recovered products, (refining, foundry casting, etc.) with a melting capacity exceeding 4 tons per day for lead and cadmium or 20 tons per day for all other metals	259
2.6. Installations for surface treatment of metals and plastic materials using an electrolytic or chemical process where the volume of the treatment vats exceeds 30 m^3.	177
Total of the above categories within the identified capacity limits	1 168

Regulatory Impact Assessment (RIA) of introducing IPPC/IED to Turkey. Technical Assistance Service for IPPC – Integrated Pollution Prevention and Control in Turkey. Project Identification No: EuropeAid/129470/D/SER/TR. Contract No: TR0802.04-02/001. June 2013. Authors: Peter Futo, Ian MacLean and Carlos Cisneros.

Estimated unintentional release of POPs (UPOPs) by the sector "Ferrous and Non-Ferrous Metal Production" Turkey, 2013

	Source categories	Production	Annual release				
Cat.		t/a	g TEQ/a	g TEQ/a	g TEQ/a	g TEQ/a	g TEQ/a
	Ferrous and Non-Ferrous Metal Production		Air	Water	Land	Product	Residue
a	Iron ore sintering	8 010 561	40.05	0.00	0.00	0.00	8.01
b	Coke production	4 098 024	0.12	0.00	0.00	0.00	0.00
c	Iron and steel production plants and foundries	37 350 698	80.65	0.00	0.00	0.00	399.96
-	Hot-dip galvanizing plants	1 200 000	0.02	0.00	0.00	0.00	1.20
d	Copper production	262 305	9.42	0.13	0.00	0.00	118.63
e	Aluminum production	221 000	13.32	0.00	0.00	0.00	39.60
f	Lead production	38 000	3.04	0.00	0.00	0.00	0.00
g	Zinc production	40 000	9.40	0.00	0.00	0.00	0.03
h	Brass and bronze production	280 000	0.22	0.00	0.00	0.00	0.00
i	Magnesium production	0	0.00	0.00	0.00	0.00	0.00
j	Thermal Non-ferrous metal production (e.g.. Ni)	0	0.00	0.00	0.00	0.00	0.00
k	Shredders	0	0.00	0.00	0.00	0.00	0.00
l	Thermal wire reclamation and e-waste recycling	0	0.00	0.00	0.00	0.00	0.00
	Ferrous and Non-Ferrous Metal Production		156.24	0.13	0.00	0.00	567.43

Source: Annexes of NIP 2014: National Implementation Plan of Persistent Organic Pollutants (POPs) Management in Turkey. Published by the Ministry of Environment and Urbanization. UPOP Inventory compiled by Dr. Aykan Karademir, University of Kocaeli, Dept. of Environmental Engineering.

Availability of BAT – BEP techniques in Turkish steel and iron industry

Selected Best Available Techniques	Basic Oxygen Furnace, BOF	Electric Arc Furnace, EAF	Secondary metallurgy
Minimization of feed materials contaminated with persistent organic pollutants or contaminants leading to formation of such pollutants	5	4	4
Stable and consistent operation of the sinter plant, maintaining temperatures above 850°C,	4	n.a.	n.a.
Fume and gas collection, recirculation of waste gases	4	4	4
Afterburners with quenching (rapid cooling),	4	3	4
Adsorption, e.g. with activated carbon	1	2	2
High-efficiency dedusting, fabric filter dedusting	5	5	5
Continuous parameter monitoring	5		5

Teşekkür Ederim

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

dekonta