UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

REPORT for

"Assessment of the Regulatory Gaps for U-POPs" and "BAT/BEP Training for Priority Industrial Sectors" related to "POPs Legacy Elimination and POPs Release Reduction Project"

Turkey

GEF Project ID: 4601, UNIDO SAP ID: 140288

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Abbreviations

BAT	Best Available Techniques
BAT-AEL	Best Available Techniques Associated Emission Level
BAT-AEPL	Best Available Techniques Associated Environmental Performance Level
BEP	Best Environmental Practices
ELV	Emission Limit Value
HBCDD or HBCD	Hexabromocyclododecane
HCB	Hexachlorobenzene
MoE	Ministry of Economy
MoEU	Ministry of Environmental and Urbanization
MoFAL	Ministry of Food, Agriculture and Livestock
MoFWA	Ministry of Forestry and Water Affairs
MoH	Ministry of Health
MoLSS	Ministry of Labour and Social Security
NIP	National Implementation Plan
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Bipenyl
PCDD/F	Polychlorinated dibenzo-p-dioxins and Polychlorinated dibenzofurans
POP	Persistent Organic Pollutant
TEQ	Toxic Equivalency
TNA	Training Needs Assessment
ToR	Terms of Reference
u-POP	Unintentional Persistent Organic Pollutant
UNIDO	United Nations Industrial Development Organization

1. Introduction

This Report is prepared to fulfil the requirements under the ISA Contract Ref. No. 20496 for the "POPs Legacy Elimination and POPs Release Reduction Project (Component 2) (Project No. 140288)".

The Terms of Reference (ToR) of the Contract covers the following activities:

Activity 3.2.2 – Training Delivered on BAT/BEP in 10 Priority Industrial Sectors

Activity 3.3.1 – Assessment of the Regulatory Gaps with Reference to Stockholm Convention Requirements and the EU-IPPC Regulation and Proposed Amendments

Chapter II and Chapter II present the outputs of the Activity 3.2.2 and Activity 3.3.1, respectively.

2. Activity 3.3.1 – Assessment of the Regulatory Gaps with Reference to Stockholm Convention Requirements and the EU-IPPC Regulation and Proposed Amendments

The objectives of the Activity 3.3.1 are as follows:

- Assess technical and regulatory gaps of national air pollution control regulation on U-POPs and existing standards in Turkey with reference to SC and EU BAT/BEP standard (including proposed amendments to the existing regulation) as well as reports developed by international organization and other projects, such as the EU. Guidelines on BAT and guidance on BEP developed by Stockholm Convention secretariat will also be considered during the assessment.
- Design a comprehensive report detailing, formal requirements, technical aspects and gaps of the current air pollution control regulation for key sectors involved in the project, regulatory requirements, enforcement needs, measures, modalities, monitoring and reporting in order to support Turkey's objectives under the Stockholm Convention.
- Ensure coordination with MoEU and some of main industrial representatives such as ferrous and non-ferrous metal industry as the priority u-POPs emitting sectors for the finalization of the report.

Therefore, the main outputs under Activity 3.3.1 are:

Output 1 – An Inventory of u-POPs Emissions in Turkey

Output 2 – Best Available Techniques for the Control of u-POPs Emissions

Output 3 – Technical and regulatory gaps of national air pollution control regulation on u-POPs and existing standards in Turkey.

To reach these outputs, in the next sub-section; firstly the Stockholm Convention and its main objectives are presented. Then, the Convention on Long-range Transboundary Air Pollution (CLRTAP) is briefly discussed to present its aims and also the measures identified to cut the emissions of POPs. After stating the EU's Industrial Emissions Directive and its relevant measures and national framework, a technical and regulatory gap analysis is provided.

2.1. Legal Framework for the Control of U-POPs Emissions and Gap Analysis

2.1.1. Stockholm Convention

The Stockholm Convention on Persistent Organic Pollutants which was adopted by the Conference of Plenipotentiaries on 22 May 2001 in Stockholm, Sweden is a global treaty to protect human health and the environment from POPs which are known to stay in the environment for long periods, and to have some harmful impacts on human health or on the environment. Due to their physicochemical properties, these chemicals are widely distributed geographically, accumulate in the fatty tissue of living things and can cause to serious health effects. Given these properties, POPs represent a global problem. In response to this global problem, the Stockholm Convention, which was entered into force in 2004, necessitates elimination or reduction of the release of POPs into the environment.

The chemicals of the Stockholm Convention are listed in annexes A, B and C. The production and use of chemicals listed in Annex A must be eliminated, the production and use of chemicals listed in Annex B must be restricted, and the unintentional production of chemicals in Annex C must be minimized and ultimately eliminated (Table 1).

During many anthropogenic activities, as undesired side effect, unintentional production of persistent organic pollutants (u-POPs) takes place. Measures to reduce or eliminate releases from unintentional production are the subject of Article 5 of the Stockholm Convention. Article 5 of the SC requires Parties to develop, within two years of entry into force for them, an action plan to identify, characterize and address the release of chemicals listed in Annex C, Part I. Currently listed are PCDD and PCDF, as well as hexachlorobenzene (HCB) and polychlorinated biphenyls (PCB) when produced unintentionally.

To facilitate implementation of Article 5, Parties recognized the need for a harmonized framework for elaboration of comparable release inventories of Annex C chemicals, and for detailed state-of the-art guidelines on BAT and guidance on BEP.

Table 1. The chemicals of the Stockholm Convention

Annex A (Prohibition)		**Annex B (Restriction)**	**Annex C (Reduction)**
Aldrin **(P)**	Beta Hexachlorcyclohexane **(P)**	DDT **(P)**	Polychlorinated dibenzo-p-dioxin (PCDDs) **(UP)**
Chlordane **(P)**	Lindane **(P)**	Perfluorooctane sulfonic acid, its salts and perfluorooctane sulfonyl fluoride **(IC)**	Polychlorinated dibenzofurans (PCDFs) **(UP)**
Chlordecone **(P)**	Mirex **(P)**		Hexachlorobenzene (HCB) **(UP)**
Dieldrin **(P)**	Pentachlorbenzene **(P) (IC)**		Pentachlorobenzene **(UP)**
Endrin **(P)**	Polychlorinated biphenyls (PCBs) **(IC)**		Polychlorinated biphenyls (PCBs) **(UP)**
Heptachlor **(P)**	Technical endosulfan and its related isomers **(P)**		
Hexabrombiphenyl **(IC)**	Tetrabromodiphenyl ether and pentabromodiphenyl ether **(IC)**		

Annex A (Prohibition)		**Annex B (Restriction)**	**Annex C (Reduction)**
Hexabromodiphenyl ether and Heptabromdiphenyl ether **(IC)**	Toxaphene **(P)**		
Hexachlorobenzene (P) **(IC)**	Hexabromcyclododecane **(IC)**		
Alpha Hexachlorcyclohexane **(P)**			

(P) Pesticide
(IC) Industrial Chemical
(UP) Unintentional Production

The types of measures that may be promoted or required as BAT to reduce or eliminate the release of Annex C chemicals can be categorized as follows:

- shifting to alternative processes;
- primary measures that prevent the formulation of chemicals listed in Annex C; and
- secondary measures that control and reduce the release of those chemicals.

The application of BAT for chemicals listed in Annex C of the Stockholm Convention will often have various co-benefits. Conversely, measures to protect human health and the environment from other pollutants will also help to reduce and eliminate chemicals listed in Annex C.

Source categories by which PCDD/Fs, HCB and PCBs are unintentionally formed and released are given in Part II and Part III of Annex C of the Stockholm Convention and include large point sources (such as waste incinerators and sinter plants) as well as small sources (such as residential combustion sources and crematoria).

The structure and content of the “Guidelines on BAT and Provisional Guidance on BEP” relevant to Article 5 and Annex C of the Stockholm Convention on POPs is as follows:

Section I – Introduction

Includes the 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 an explanation of the relationship of these provisions to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal.

Section II – Consideration of Alternatives in the Application of BAT

Provide guidance on consideration of alternatives, including a checklist that may be used in applying BAT to new sources, and information on other considerations of the Stockholm Convention.

Section III – BAT and BEP: Guidance, Principles and Cross-cutting Considerations

Include general guidance, applicable principles and descriptions of considerations that cut across multiple source categories.

Section IV – Compilation of Summaries from the Source Categories included in Sections V and VI

Compilation of the summaries provided for each category source in sections V and VI.

Section V and VI – Guidance/Guidelines by Source Categories: Source Categories in Part II of Annex C and Source Categories in Part III of Annex C

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 levels;
- Performance reporting;
- Case studies.

The guidelines can be used by different audiences that are involved in the implementation of the Stockholm Convention at the national level, such as policy makers, regulatory authorities, engineers, other technical users, other stakeholders and interested parties.

The industrial activities included in Part II and Part III of Annex C of the Stockholm Convention is given below. The description of the industrial activities is presented in Appendix 3.

<u>Source categories – Part II of Annex C</u>

PCDD/Fs, HCB and PCBs are unintentionally formed and released from thermal processes involving organic matter and chlorine as a result of incomplete combustion or chemical reactions. The following industrial source categories have the potential for comparatively high formation and release of these chemicals to the environment:

V.A. Waste Incinerators

(I) Municipal solid waste, hazardous waste and sewage sludge

(II) Medical waste

V.B. Cement Kilns Firing Hazardous Waste

V.C. Production of Pulp Using Elemental Chlorine or Chemicals Generating Elemental Chlorine

V.D. Thermal Processes in the Metallurgical Industry

(I) Secondary copper production

(II) Sinter plants in the iron and steel industry

(III) Secondary aluminium production

(IV) Secondary zinc production

Source categories – Part III of Annex C

PCDD/Fs, HCB and PCBs may also be unintentionally formed and released from the following source categories, including:

VI.A. Open Burning of Waste, Including Burning of Landfill Sites

VI.B. Thermal Processes in the Metallurgical Industry Not Mentioned in Annex C Part II

(I) Secondary lead production

(II) Primary aluminium production

(III) Magnesium production

(IV) Secondary steel production

(V) Primary base metals smelting

VI.C. Residential Combustion Sources

VI.D. Fossil Fuel-Fired Utility and Industrial Boilers

VI.E. Firing Installations for Wood and Other Biomass Fuels

VI.F. Specific Chemical Production Processes Releasing Chemicals Listed in Annex C

VI.G. Crematoria

VI.H. Motor Vehicles, Particularly Those Burning Leaded Gasoline

VI.I. Destruction of Animal Carcasses

VI.J. Textile and Leather Dyeing (with Chloranil) and Finishing (with Alkaline Extraction)

VI.K. Shredder Plants for the Treatment of End-Of-Life Vehicles

VI.L. Smouldering of Copper Cables

VI.M. Waste Oil Refineries

2.1.2. CLRTAP-POPs Protocol

The Convention on Long-Range Transboundary Air Pollution (CLRTAP) is another protocol that covers the production, use, emissions and disposal of POPs. It was signed in June 1988 by 39 countries and the EU, to regulate the global POPs activities under the auspices of the United Nations Environment Programme (UNEP).

The aim of the CLRTAP Protocol is that Parties shall reduce the release and long-rane transport of POPs emissions. To this end, the Parties are to develop policies and strategies to combat the discharge of air pollutants through exchanges of information, consultation, research and monitoring.

The CLRTAP protocol divides the regulated chemicals into three annexes. The production and use of pesticides and industrial chemicals given in Annex I are banned (Table 2). For pesticides and industrial chemicals listed in Annex II, there are listed use exemptions. Annex III lists POPs to be controlled through applications of best available techniques and best environmental practices.

Table 2. The chemicals of the CLRTAP-POPs Protocol

Annex I (Elimination)		**Annex II** (Restriction of use)	**Annex III** (Reduction of emissions)
Aldrin **(P)**	Mirex **(P)**	DDT **(P)**	Polycyclic aromatic hydrocarbons
Chlordane **(P)**	Pentachlorbenzene **(P, IC)**	Hexachlorocyclohexanes **(P)**	Polychlorinated dibenzo-p-dioxin (PCDDs) **(UP)**
Chlordecone **(P)**	Perfluorooctane sulfonate **(IC)**	Perfluorooctane sulfonate **(IC)**	Polychlorinated dibenzofurans (PCDFs) **(UP)**
Dieldrin **(P)**	Polychlorinated biphenyls (PCBs) **(IC)**		Hexachlorobenzene (HCB)
DDT **(P)**	Polychlorinated naphthalenes **(IC)**		Polychlorinated biphenyls (PCBs) **(UP)**
Endrin **(P)**	Short-chain chlorinated paraffins (SCCPs) **(IC)**		
Heptachlor **(P)**	Tetrabromodiphenyl ether and pentabromodiphenyl ether **(IC)**		
Hexabrombiphenyl **(IC)**	Toxaphene **(P)**		
Hexabromodiphenyl ether and Heptabromdiphenyl ether **(IC)**	Hexabromcyclododecane **(IC)**		
Hexachlorobenzene (P) **(IC)**			
Hexachlorobutadiene (IC)			
Hexachlorcyclohexanes **(P)**			

(P) Pesticide
(IC) Industrial Chemical
(UP) Unintentional Production

2.1.3. Requirements under the EU Industrial Emissions Directive (formerly the IPPC Directive)

Directive 2010/75/EU on industrial emissions (IED) is the main EU instrument regulating pollutant emissions from industrial installations. The IED aims to achieve a high level of protection of human health and the environment taken as a whole by reducing harmful (agro-) industrial emissions across the EU, in particular through application of BAT.

Around 50,000 installations are covered by the IED and these are required to operate in accordance with permits issued by Member State competent authorities. The permits have to include emission limit values (ELVs) for polluting substances based on BAT, as defined in Article 3(10) of the IED. BAT is described for each sector in the BAT Reference Documents, the so called BREFs.

The BAT Conclusions is a document containing the parts of a BREF with conclusions on BAT and their associated environmental performance levels (BAT-AEPLs), including the associated emission levels (BAT-AELs).

The BAT Conclusions under the IED are adopted by the Commission as implementing acts. The IED gives a more enhanced role to the BAT Conclusions in the permitting of industrial installations by requiring them to serve as the reference for competent authorities when setting or revising permit conditions of IED installations. The aim of this is to ensure improved environmental performance through a more consistent uptake of BAT across the EU.

Turkey has not yet established an integrated permitting system based on the concept of BAT. However, the existing Regulation on Environmental Permits and Licenses (Official Gazette No. 29115, dated September 10, 2014) brings an integrated approach to permitting process by taking into account potential environmental impacts to all types of receiving environment. A draft by-law on Integrated Environmental Permitting has been prepared by the MoEU transposing Chapters I and II of the IED which covers the previous IPPC Directive.

The only legal instrument on integrated pollution prevention and control in Turkey is the “Communique for the Integrated Pollution Prevention and Control in the Textile Industry”.

As exemplified in Section 2.4.1 for the sinter plants, at times the local ELVs can go beyond EU BAT-AELs. Upon full implementation of the IPPC Directive and the concept of BAT, potential discrepancies and excessive costs of compliance will be avoided.

The MoEU plans to shift to the integrated permitting system in a stepwise fashion. For this purpose two projects have been kicked-off in December 2015 for the identification of current situation and requirements of automotive and cement industries that will be subject to integrated permitting. The full implementation of Chapters I and II of the IED (i.e. the IPPC Directive) is foreseen to be by 2018. Some BREFs have already been translated into Turkish (textile, cement, I&S, LCP etc.).

As an output of an EU Twinning Project (Spain-Poland-Turkey) "National Sectoral BAT Guidelines" have been prepared for the textile industry, electric arc furnace I&S installations, refineries and coal and lignite burning large combustion plants[1].

"Guidances on Integrated Permitting" for the operators and the MoEU experts have also been prepared by the EU Twinning Project (Spain-Poland-Turkey)[2].

The BAT Conclusions for the glass, iron and steel, cement-lime and magnesium oxide and tanning industries published under the IED have been translated into Turkish[3].

Major industrial sectors such as the iron and steel, textile, chemicals and refinery are closely following and participating to IPPC related projects as well as cleaner and sustainable production projects. These sectors have high level of understanding of the BAT concept. There

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[1] Turkey Ministry of Environment and Urbanisation. National BAT Sector Guides. Retrieved from, http://www.csb.gov.tr/projeler/ippceng/index.php?Sayfa=sayfa&Tur=webmenu&Id=9009.

[2] Turkey Ministry of Environment and Urbanisation. Integrated Environmental Permit procedure: guides for operator and for Competent Authority. Retrieved from, http://www.csb.gov.tr/projeler/ippceng/index.php?Sayfa=sayfa&Tur=webmenu&Id=9008.

[3] T.C. Çevre ve Şehircilik Bakanlığı. BREF/MET’lerle ilgili Türkçe Dökümanlar. Retrieved from, http://www.csb.gov.tr/projeler/ippc/index.php?Sayfa=sayfa&Tur=webmenu&Id=9294.

have been BAT implementation projects done in the textile and the iron and steel industries. As abovementioned, two projects have also been kicked-off in December 2015 for the identification of existing situation and requirements of automotive and cement industries that will be subject to integrated permitting.

2.1.4. *Turkish Legislation on POPs*

Stockholm Convention underlies the Current Turkish Legislation on POPs. Adoption of the Convention was on 22 May 2001 at the Conference of Plenipotentiaries on the Stockholm Convention on Persistent Organic Pollutants, Stockholm, 22-23 May 2001. In accordance with its article 24, the Convention has been opened for signature at Stockholm by all States and by regional economic integration organizations on 23 May 2001 at the Stockholm City Conference Centre/Folkets Hus, and at the United Nations Headquarters in New York from 24 May 2001 to 22 May 2002. Turkey has signed the Convention on 23 May 2001. Following the procedure, Stockholm Convention was put into force on October 14, 2009 after Ratification of Stockholm Convention in the Turkish Grand National Assembly by means of the Stockholm Convention ratified by Law No.5871 on Ratification of Stockholm Convention on Persistent Organic Pollutants dated April 14, 2009. Stockholm Convention is constructed on reduction and elimination of releases of POPs in order to protect human health and the environment. There are a number of control actions stated by Stockholm Convention to ultimately eliminate releases of POPs. Pesticides, industrial chemicals and the unintentionally produced by-products are the in the list of the Convention. The initial 12 POP substances are aldrin, chlordane, dieldrin, endrin, heptachlor, hexachlorobenzene, mirex, toxaphene, PCBs, DDT, PCDD/Fs. In 2009 nine more chemicals were added by the Conference of Parties: chlordecone, hexabromobiphenyl, alpha-hexachlorocyclohexane, betahexachlorocyclohexane, lindane (gama-hexachlorocyclo-hexane), tetrabromodiphenyl, pentabromodiphenyl ethers, hexabromodiphenyl and heptabromodiphenylethers, perfluorooctane sulfonic acid and its salts (or perfluorooctanesulfonyl fluoride). In 2011, commonly used technical endosulfan and appropriate isomers was added to the list of chemicals in Annex A of the Convention, removal with specific exemptions. HBCDD or HBCD, a widely used chemical, was the 23rd substance in the list and banned under the Stockholm convention[4].

The PCDD/F emissions to air were considered for the first time in 2004 under the Regulation on Control of Industrial Air Pollution. The current version of this Regulation (Official Journal No: 27277 dated 3 July 2009) sets an emission limit value (ELV) of 0.1 ng/Nm^3 for PCDD/F emissions and requires all relevant measures (without specifying explicitly what the potential measures are) to be taken in order to meet this limit value. This ELV is applicable for all potential sectors and does not differentiate emission levels amongst different sectors. Thus, the derivation of this ELV is not based on the use of sectoral BATs and is a “one fits for all” type of limit value. As exemplified above for the sinter plants, at some circumstances the ELVs can even go beyond BAT-AELs.

This ELV is also valid for PCBs, polybromateddibenzodioxins, polybromateddibenzofurans, polyhalogenateddibenzodioxins and polyhalogenateddibenzofurans. The ELV is applicable for all potential sectors and does not differentiate emission levels amongst different sectors. As will

[4] Turkey Ministry of Environment and Urbanism, Legal Gap Analysis on POPs Regulation in Turkey, Retrieved from, http://www.csb.gov.tr/db/kok/editordosya/Legal%20GAP%20Analysis_En.pdf.

be discussed later, this approach results in ELVs that go beyond best available techniques (BAT) associated emission levels (BAT-AELs).

There is also a draft for POPs: "Regulation on POPs". The aim of the regulation is to protect human health and environment from negative effects of POPs. It includes terms on banning of production, distribution and application of POPs, restriction and elimination of POPs and wastes containing POPs. The distribution, production and usage of the chemicals listed in Appendix 4 is banned. The distribution, production and usage of tetrabromodiphenyl ether, pentabromodiphenyl ether, Hexabromodiphenyl ether, heptabromodiphenyl ether, perfluorooctane sulfonic acid, its salts and perfluorooctane sulfonyl fluoride , PCBs, HBCDD, hexachlorobutadiene, polychlorinated naphthalenes are restricted with on some specific exemptions. The reduction of PCDD/F, hexachlorobenzene, PCBs, PAHs and pentachlorobenzene emissions is aimed by using sector-specific BAT/BEP applications. Concentrations limits for many POPs are stated in the regulation. Based on the regulation, the toxic equivalency factors for PCDD/F is as presented in .

Table 3 [5].

Table 3. TEQ values for PCDD/F

PCDD	TEQ
2,3,7,8-TeCDD	1
1,2,3,7,8-PeCDD	1
1,2,3,4,7,8-HxCDD	0,1
1,2,3,6,7,8-HxCDD	0,1
1,2,3,7,8,9-HxCDD	0,1
1,2,3,4,6,7,8-HpCDD	0,01
OCDD	0,0003
PCDF	TEQ
2,3,7,8-TeCDF	0,1
1,2,3,7,8-PeCDF	0,03
2,3,4,7,8-PeCDF	0,3
1,2,3,4,7,8-HxCDF	0,1
PCDD	TEQ
1,2,3,6,7,8-HxCDF	0,1
1,2,3,7,8,9-HxCDF	0,1
2,3,4,6,7,8-HxCDF	0,1
1,2,3,4,6,7,8-HpCDF	0,01
1,2,3,4,7,8,9-HpCDF	0,01
OCDF	0,0003

As a Party to the Stockholm Convention, Turkey has POPs-related laws, regulations and communiqués which partly mention the terms on POPs. A more inclusive regulation on POPs is in preparation. After signing the Stockholm Convention, Turkey has taken considerable steps to make regulations based on the Convention. The detailed information about POPs relevant legislation and Turkish legislation on POPs is given in the next sections.

There are POPs-related laws, regulations and communiqués as listed below.

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[5] Turkey Ministry of Environment and Urbanization, Legal Gap Analysis on POPs Regulation in Turkey, Retrieved from, http://www.csb.gov.tr/db/kok/editordosya/Legal%20GAP%20Analysis_En.pdf.

Legislation of MoEU:

- Environmental Law published in the Official Journal dated 11.08.1983, No. 2872
- By-law on Control of PCB and PCTs published in the Official Journal dated 27.12.2007, No. 26739
- By-law on Inventory and Control of Chemicals published in the Official Journal dated 26.12.2008, No. 27092
- By-law on Classification, Packaging and Labeling of Dangerous Substances and Preparations published in the Official Journal dated 26.12.2008, No. 27092
- By-law of Safety Data Sheets for Hazardous Substances and Preparations published in the Official Journal dated 26.12.2008, No. 27092
- Regulation on Restriction of Manufacturing, Placing on the Market and Use of Certain Hazardous Substances, Preparations and Articles published in the Official Journal dated 26.12.2008, No. 27092
- By-law on Control of Hazardous Wastes published in the Official Journal dated 14.03.2005, No. 25755
- By-law on Control of Waste Oils published in the Official Journal dated 30.07.2008, No. 26952
- By-Law on Control of Waste Electrical and Electronic Equipment published in the Official Journal dated 22.05.2012, No. 28300
- By-law on the General Principles of Waste Management published in the Official Journal dated 05.07.2008, No. 26927
- By-law on Landfill of Wastes published in the Official Journal dated 26.03.2010, No. 27533
- By-law on the Incineration of Wastes published in the Official Journal dated 06.10.2010, No. 27721
- By-law on Control of Pollution Caused by Dangerous Substances in Aquatic Environment published in the Official Journal dated 26.11.2005, No. 26005
- By-law on Control of Soil Pollution and Sites Contaminated by Point Sources published in the Official Journal dated 08.06.2010, No. 27605
- By-law on Control of Air Pollution Arising from Industrial Facilities published in the Official Journal dated 03.07.2009, No. 27277

Legislation of MoE

- Notification on Auditing of Import of Chemicals that are Controlled for Environmental Protection published in the Official Journal dated 31.12.2013, No. 28868

The legislation of MoH:

• Cosmetic By-law published in the Official Journal dated 23.05.2005, No. 25823

• By-law on Biocidal Products published in the Official Journal dated 31.12.2009, No. 27449 and amendment to By-law on Biocidal Products published in the Official Journal dated 12.03.2014, No. 28939.

Legislation of MoFAL:

• Law on Veterinary Services, Plant Health, Food and Feed published in the Official Journal dated 11.06.2012, No. 5996

• By-law on Control of Pesticides published in the Official Journal dated 20.05.2011, No. 27939 (Banned Pesticides Directive 79/117/EEC)

• By-law on the Certification of Pesticides published in the Official Journal dated 25.03.2011, No. 27885 (Pesticide Authorisation Directive 91/414/EEC)

• By-law on Sale and Storage of Pesticides published in the Official Journal dated 10.03.2011, No. 27870

• Turkish Food Codex By-law on Contaminants published in the Official Journal dated 29.12.2011, No. 28157

Legislation of MoLSS:

• By-law on the Prevention and Reduction of the Effects of Major Industrial Accidents published in the Official Journal dated 30.12.2013, No. 28867

Legislation of MoFWA:

• By-Law on Surface Water Quality Management published in the Official Journal dated 30.11.2012, No. 28483

2.2. U-POPs Emissions in Turkey

The basis for Turkey's approach to address the POPs issue is its National Implementation Plan (NIP) which defines the baseline situation in terms of POPs legacies and priorities related to the on-going management of POPs issues.

The first NIP was developed in the 2004-2007 period, issued and adopted by the Government in 2008 as the basis of a national program to addressing priority POPs issues, revised with additional data in 2010 and formally submitted to the Stockholm Convention Secretariat in April 2011. One of the priority issues identified in the first NIP was addressing u-POPs release reduction through implementation of BAT/BEP. A second NIP was prepared by UNIDO in 2014 as part of Stockholm Convention requirements but has not yet been submitted to the Stockholm Convention Secretariat.

The draft "NIP for POPs Management in Turkey" was prepared as part of the EU Technical Assistance Project "Implementation of the POPs Regulation" TR2010/0327.03-01/001 - EuropeAid/132428/D/SER/TR" and published in August 2014. This draft document was prepared based on the most recent draft NIP prepared in 2014 by UNIDO.

The U-POPs inventory results for Turkey as included in the draft NIP (UNIDO, 2014) is given in Table 4.

Table 4. 2010 (revised) and 2013 u-POPs Inventory Results for Turkey (UNIDO, 2014)

Category	Source Category	2010 u-POPs Inventory (revised) (g TEQ/y)					2013 u-POPs Inventory (g TEQ/y)				
		Air	Water	Land	Product	Residues	Air	Water	Land	Product	Residues
1	Waste Incineration	62.8	0.0	0.0	0.0	1.3	0.0	NA	NA	NA	2.8
2	Ferrous and Non-ferrous Metal Production	624.7	0.0	0.0	0.0	675.4	156.2	0.1	NA	NA	567.4
3	Power Generation and Heating/Cooking	59	0.0	0.0	0.0	13	60.5	ND	NA	NA	31.2
4	Production of Mineral Products	10	0.0	0.0	0.3	0.1	11.2	NA	NA	0.2	2.7
5	Transportation	21.5	0.0	0.0	0.0	0.0	2.6	NA	NA	NA	NA
6	Uncontrolled Combustion Process	151	0.0	96	0.0	0.0	78.4	ND	76.8	NA	NA
7	Production of Chemicals, Consumer Goods	0.0	5.3	0.0	72.5	23.3	0.3	7.5	ND	87.4	15.3
8	Miscellaneous	0.0	0.0	0.0	0.0	0.1	NA	NA	NA	NA	0.1
9	Disposal/Landfilling	0.0	6.5	0.0	2.2	180	NA	6.1	NA	1.6	193.2
10	Identification of Hot Spots	0.0	0.0	0.0	0.0	0.0	NA	NA	NA	13.7	NA
Total (1-10)		**929**	**11.8**	**96**	**75**	**893.2**	**309.1**	**13.7**	**76.8**	**102.9**	**812.7**
Grand Total		**2,005**					**1,315**				

According to 2010 U-POPs inventory, the largest sector for air release was the ferrous and non-ferrous metal production (624.7 g TEQ/y) with over half coming from copper production and a quarter from iron and steel production. Other significant major contributors were the production of mineral products, primarily cement kilns (245.6 g TEQ/y), power generation or heating (143.3 g TEQ/y), uncontrolled combustion process (151 g TEQ/y), waste incineration (62.8 g TEQ/y) and transport (21.5 g TEQ/y). Main releases via solids originate from the metal industry mainly in ashes (675.4 g TEQ/y).

A comparison of the 2010 and 2013 u-POPs inventory results show that the total emissions have reduced significantly. Emissions to air which had the highest portion in 2010 survey results has also reduced significantly from 929 g TEQ/y to 309.1 g TEQ/y. The ferrous and non-ferrous metal industry is responsible for the majority of the emissions to air comprising 50% of the total emissions to air and approximately 12% of the estimated total PCDD/F emissions. The 2013 survey results revealed that residues have the highest annual release and ferrous and non-ferrous metal industry being the majority of it.

The draft NIP (UNIDO, 2014) also includes unintentional PCB emissions from various industries based on measurements or emissions factors as given in Table 5.

Table 5. Unintentional PCB Emissions in Turkey (UNIDO, 2014)

Industry	**Release to Air (kg/y)**
Iron and steel (*)	89-2,800
Steel production	579.3
Copper production	306.7
Coal combustion	22.03
Zinc production	9.00
Pig iron production	3.00
Medical waste incineration	0.18
Cement production	0.06
Source (except for the iron and steel industry): Kuzu, S.L., et al., *Estimation of atmospheric PCB releases from industrial facilities in Turkey*. Atmos. Pollut. Res. 2013, **4**(4): 420-426. (*) Odabasi, M., Bayram, A., Elbir, T., Seyfioglu, R., Dumanoglu, Y., Bozlaker, A., Demircioglu, H., Altıok, H., Yatkın, S., Cetin, B. *Electric Arc Furnaces for Steel-Making: Hot Spots for Persistent Organic Pollutants,* Environ. Sci. Technol., 2009, **43**: 5205-5211.	

2.2.1. Turkish Legislation on POPs - the Regulatory Gaps

As a signatory to the Stockholm Convention, there are a number regulations and legislations adopted and implemented on POPs in order to comply with the convention's liabilities. Table 6 presents the compliance of Turkish Legal Framework with Stockholm Convention's legal and institutional liabilities of Parties and the relevant gaps.

The uPOPs related EU directives and the corresponding Turkish Legislation is presented in Table 7.

Table 6. Turkish Legislations on uPOPs in accordance with Stockholm Convention's Legal Liabilities [6]

Article	No	Requirement		Fulfillment	Related Legislation	Gap
3	1.a	Prohibit and/or take the legal and administrative measures necessary to eliminate	**i.** production and use of the chemicals listed in Annex A	• Prohibition of the manufacture and use of PCBs • Prohibition of the production of PCBs	• By-law on Manufacturing, Placing on the Market and Use of Certain Hazardous Substances, reparations and Articles • By-law on Control of Waste Electrical and Electronic Equipments • By-law on Control of PCBs and PCTs	Production and industrial use of hexachlorobenzene is not prohibited by legal instruments.
			ii. import and export of the chemicals listed in Annex A	• Prohibition of the import of PCBs • Prohibition of the import and export of wastes containing POPs • Prohibition of the import of PCBs and hexabromobiphenyl	• By-law on Control of PCBs and PCTs • By-law on Control of Hazardous Wastes • By-law on Control of Waste Electrical and Electronic Equipments • Notification on Auditing of Import of Chemicals that are Controlled for	There is no regulation controlling the export of Annex A industrial chemicals. However, the export of wastes containing these chemicals is prohibited. The only legal instrument on the export of products is "Regulation on Export". The regulation states that the export of products whose export is subject to prior consent due to the international agreements is controlled.

[6] Ministry of Environment and Urbanization, National Implementation Plan of Persistent Organic Pollutants (POPs) Management in Turkey, 2014.

Article	No	Requirement		Fulfillment	Related Legislation	Gap
					Environmental Protection	
3	2.a	Take the necessary measures to ensure that a chemical listed in Annex A or Annex B is imported only	i. for the purpose of environmentally sound disposal	• Prohibition of the import of wastes containing POPs unless they can be used as raw materials in the production processes • Prohibition of the import of PCBs	• By-law on Control of Wastes • By-law on Control of PCBs and PCTs	Although the import of POPs containing wastes is regulated, there is no regulatory instrument covering the import of POPs other than PCBs as pure chemicals.
			ii. for a use or purpose or products. which is permitted for that Party under Annex A or Annex B			
5	a	Develop an action plan to identify, characterize and address the release of Annex C chemicals.	**i.** evaluation of the current and projected releases; source inventory and release estimates	-	-	
			ii. evaluation of the effectiveness of the existing legislation	-	-	
			iii. strategies to meet the obligations of the Convention	-	-	
			iv. awareness raising activities	-	-	
			v. periodic review of the activities	-	-	
			vi. a schedule for the implementation of the action plan	-	-	

Article	No	Requirement		Fulfillment	Related Legislation	Gap
5	b	Promote the application of available, feasible and practical measures to reduce the releases	-	-	-	There is no action or plan to promote the application of measures.
5	c	Promote the development and use of substitute materials to prevent the formation of Annex C chemicals	-	-	-	There is no action or plan to promote the application of measures.
5	d,e	Promote the use of best available techniques and best environmental practices to control and eliminate the production and releases of Annex C chemicals	-	-	-	There is no action or plan to promote the application of measures.
6	1.a	**ii.** products and articles in use and wastes containing Annex A/B/C chemicals	-	-	By-law on Control of PCBs and PCTs By-law on the General Principles of Waste Management	• By-law on Control of PCBs and PCTs states provisions on the inventory of PCB containing equipments and wastes. The ministry developed an inventory system for PCBs. However, the system is not in use currently. • On the other hand, By-law on the General Principles of Waste Management requires the identification of characteristics of the wastes which are given in the Annex III A of the by-law. But, these requirements are not adequate to determine whether a waste contains POPs or not. • There is not a comprehensive strategy or plan or legislation

Article	No	Requirement		Fulfillment	Related Legislation	Gap
						allowing the identification of POPs containing products and wastes.
6	1.d	Take measures to ensure that POPs containing wastes are	**i.** handled, collected, transported and stored in an environmentally soundly manner **ii.** disposed appropriately or environmentally soundly considering the international regulations on hazardous waste management **iii.** not permitted to be disposed of in such a way that can be resulted in the recovery, reuse, recycling and reclamation of the POPs **iv.** not transported across international boundaries without considering the international rules and regulations	The principles are stated by the Bylaw on Control of Hazardous Wastes for the control of hazardous wastes not specifically for all POPs, only PCBs, PCDD/Fs are included.	• By-law on General Principles of Waste Management • By-law on Control of Hazardous Wastes	The hazardous waste categories given in the Annex III A of By-law on Control of Hazardous Wastes does not include all the POPs. Therefore, the Annex III A of the by-law should be updated.
6	1.e	Endeavour to develop appropriate strategies to identify the contaminated sites	By-law on Control of Soil Pollution and Sites Contaminated by Point Sources sets forth the principles of identification of the contaminated sites and "Contaminated Sites	By-law on Control of Soil Pollution and Sites Contaminated by Point Sources sets forth the principles of identification of the contaminated sites and "Contaminated Sites Information System" has been developed accordingly.	By-law on Control of Soil Pollution and Sites Contaminated by Point Sources	"Contaminated Sites Information System" is not in use and there is not a system to identify contaminated sites and no control mechanism has been developed.

Article	No	Requirement		Fulfillment	Related Legislation	Gap
			Information System" has been developed accordingly.			
7	1	Develop, update an review a national implementation plan in line with the provisions of the Convention		First national implementation plan has been submitted to the secretariat in 2011 and the second NIP has been submitted in November 2016.		-
7	3	Integrate national implementation plans in sustainable development strategies of the company	-		-	Turkey does not have a chemicals management policy and the activities listed in the NIP have not been taken into account when determining the development strategies.
9	1	Undertake information exchange on reduction/elimination of the production, use and release of POPs and alternatives of POPs	-	-	-	The revised NIP of POPs of Turkey emphases the importance of information exchange for sound management of chemicals and proposes an action plan for efficient information exchange on POPs in Turkey. The action plan aims to ensure that all stakeholders are involved in all aspects of the management of these chemicals.
10	1	Enhance the awareness of public and decision makers on POPs issue	-	-	-	As part of the projects, training and informing seminars have been held and will be held.
10	5	Develop mechanisms to collect information on estimates of annual quantities of POPs like pollutant release and transfer registers	-	-	-	Turkey does not have a PRTR system.

Article	No	Requirement		Fulfillment	Related Legislation	Gap
11	1	Encourage research, development and monitoring activities on POPs	-	Although they are not specific to POPs, Turkish Scientific and Technical Research Council provides support to research activities.	-	The actions required to implement the Convention are not included in the national programs.
15	1	Report to the Conference of Parties on the measures taken to implement the Convention and the effectiveness of these measures	-	-	-	There is no reporting mechanism regarding the implementation of the Convention. But reporting is carried out electronically according to the format on the Convention's website
15	2	Provide statistical data to the secretariat on the production, import, export of POPs	-	-	-	There is not a permanent inventory system to collect data on the production, use, import and export of POPs.
16	2	Conduct monitoring studies to obtain meaningful data for evaluating the effectiveness of the Convention	-	-	-	The monitoring studies conducted in Turkey are not representative and organized. Most of them are limited to specific places and the duration of monitoring is not sufficient. Turkey has to develop a comprehensive monitoring plan and be a part of global or regional monitoring activities conducted by international organizations.

Table 7. EU Legislations on uPOPs and Related Turkish Legislation

Regulation	Number & Date	Scope	Related Turkish Legislation
Industrial Emissions Directive	2010/75/EU 24.11.2010	Preventing, reducing and eliminating pollution with an integrated approach	-
Council Directive on the Disposal of Polychlorinated Biphenyls and Polychlorinated Terphenyls	96/59/EC 16.09.1996	Disposal of polychlorinated biphenyls and polychlorinated terphenyls	By-law on the Control of Polychlorinated Biphenyls and Polychlorinated Terphenyls
Regulation on Export and Import of Dangerous Chemicals	689/2008 17.06.2008	Control of export and import of certain dangerous chemicals	By-law on the Inventory and Control of Chemicals
Regulation on Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)	1907/2006 18.12.2006	Regulating the registration, restriction and certification of the chemicals	By-law on Inventory and Control of Chemicals, By-law on Classification, Packaging and Labeling of Dangerous Substances and Preparations
Council Regulation on Persistent Organic Pollutants and Amending Directive 79/117/EEC	850/2004/EC 29.04.2004	Providing legal basis for the control of production, use and placing on the market of POPs listed in the Convention and Aarhus Protocol and minimization of the releases of these pollutants to the environment	-

2.3. Features of priority industrial sectors

2.3.1. Iron and Steel Sector

Manufacturers producing end product from raw steel operate in Marmara, Aegean, Mediterranean, Black Sea and Central Anatolia Region and the majority of them are located in Marmara, Aegean, Mediterranean coastline in Turkey. Today in our country about 150 company operates in the iron and steel industry. Among these companies, there are electric steel plants, which have capacities ranging between 50.000 ton and 3.500.000 ton, and integrated plants whose total capacities are 8.500.000 ton. Other companies serve as rolling plants and steel service centres. In rolling plants, billets are purchased and profile, wire rod, rebar and round construction iron are produced from purchased billets. In steel service centres, purchased rolled flat products are cut by order. By year 2013, 10 of 31 installed plants in iron and steel are located in Mediterranean Region, 9 of them in Marmara Region, 7 of them in Aegean Region, 3 of them in Black Sea Region and 2 of them in Central Anatolia Region. By year 2013, 12 of said plants' raw steel capacities are 2 million ton and over, 7 of them in the capacity, ranging between 1-2 million ton, 6 of them in the capacity of ranging between 500 thousand-1 million ton and 6 of them in the capacity of ranging between 50 thousand-500 thousand ton (Figure 1).

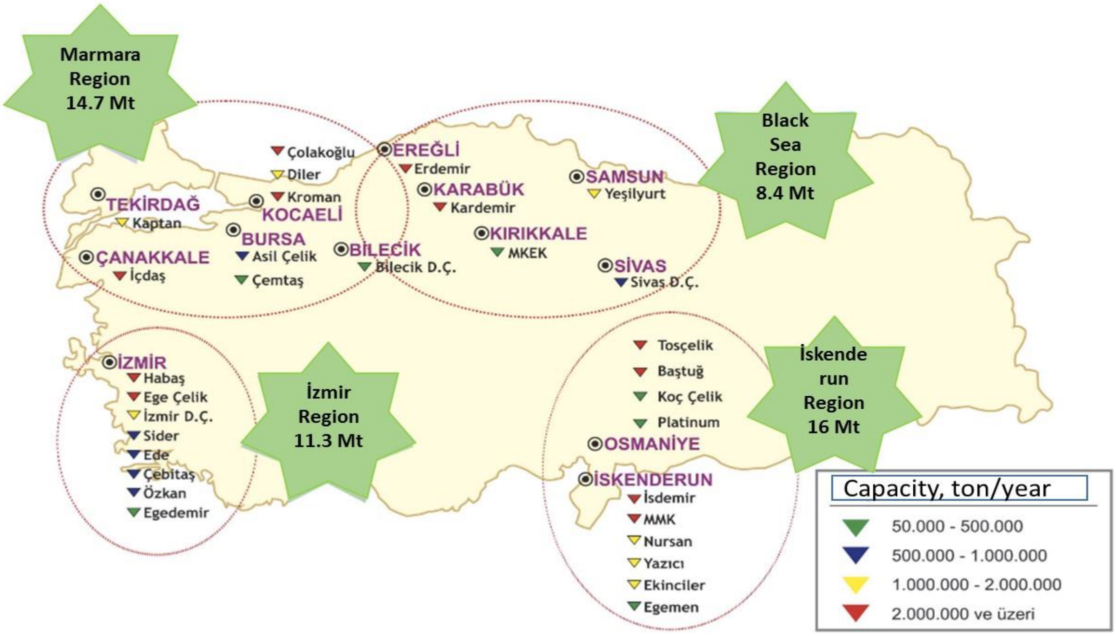

Figure 1. Distribution of Iron and Steel Industry Capacities[7]

2.3.2. Secondary Lead Production

According to the Ministry of Environment and Urbanization, there are 16 licensed accumulator recycling plants in our country as of June 2016. The total waste accumulators collected in Turkey in the year of 2012 is reported as 59,5 thousand tons, from which 35,7 thousand tons of lead were recovered [8]. The amount of accumulators collected has increased to around 64 thousand tons in 2013[8]. This number could seem likely low by comparison to 100 thousand ton of accumulator entering to home market, but the number of collected waste accumulator has increased for years and has increased to 71,4 tons in 2015 (Figure 2).

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[7] Iron and Steel Map of Turkey Turkish Steel Producers Association, 2015. Retrieved From http://www.dcud.org.tr/en/page.asp?id=30

[8] T.C. Bilim, Sanayi ve Teknoloji Bakanlığı Sanayi Genel Müdürlüğü, 2014.

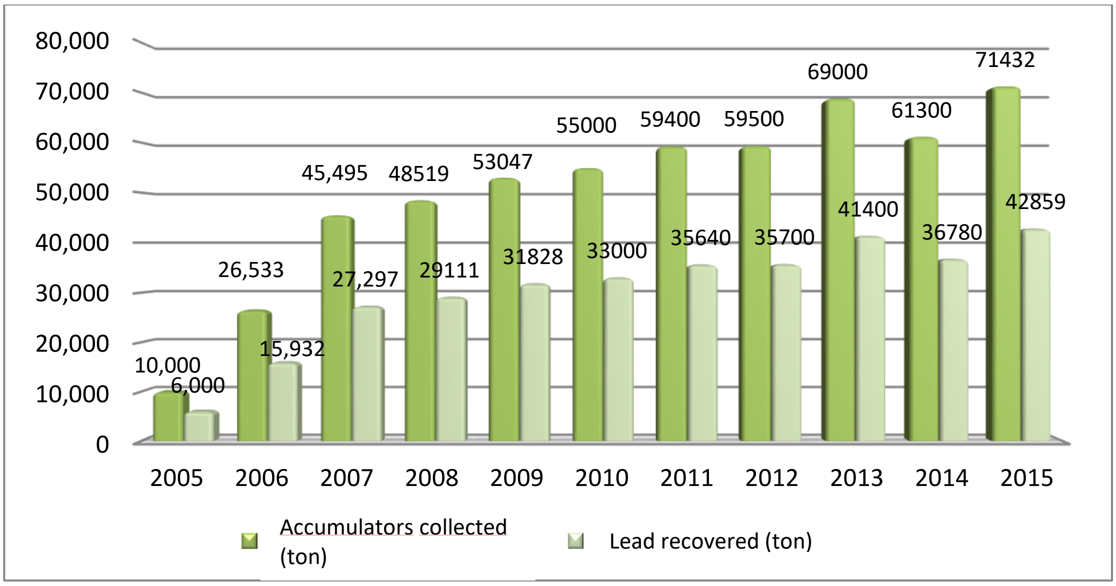

Figure 2. Waste accumulator collection and recycling amounts[8]

As is seen in Figure 2, there is a rate that can be considered as constant between collected waste accumulator amounts and recovered lead amounts. When this rate is calculated for each year, it seems to be about 60%. If recycling processes are carried out effectively, the rate changes depending on lead content of accumulators. Best Available Techniques Reference Document (BAT) of The European Commission for Non-Ferrous Metal Industry, defines the amount of lead in one accumulator as between 60-75% by mass (European Commission, 2001). When viewed from this aspect, the waste accumulator recycling industry in Turkey is considered to be working with good yield.

2.3.3. Secondary Copper Production

Copper is a base metal like nickel, zinc, aluminum, lead, etc., and is vital for many industrial activities such as building construction, power generation and transmission, electronic product manufacturing, and the production of industrial machinery and transportation vehicles. Copper is resistant to corrosion; and conducts heat and electricity efficiently; as a result, it is vital for the appliances, heating and cooling systems, and telecommunications links used every day in homes and businesses.

Copper is either produced from its ores (primary processing) or scrap copper (secondary processing). In recycling copper, scrap copper and its alloys are pre-treated and then smelted (Figure 8). Metal pre-treatment includes cleaning and concentrating the copper. Concentrating is done manually or mechanically and includes sorting, stripping, shredding and magnetic separation. The metal can be further refined using pyrometallurgical methods or hydrometallurgical methods. The concentrated metal is then smelted.

Air emissions from furnace include particulates, sulfur oxides, nitrogen oxides, Co, and PCDD/Fs. Particulate air emissions are usually captured using emissions control equipment, usually include iron and copper oxides. In addition, secondary copper processing produces air emissions from the removal of excess oils and cutting fluids. These air emissions are usually captured using baghouses. After-burners may also be used to fully combust products.

Total global copper production from mines amounted to an estimated 18.7 million metric tons in 2015[9]. Major copper producers are Chile, China and Peru. Globally, it is estimated that about 30% of new copper products are made from recycled copper[10]. As seen in Figure 3, in the last years world refining capacity increased drastically, as compared to the previous 15 year average. In parallel, there observed an increase in both primary and secondary Cu production in Turkey.

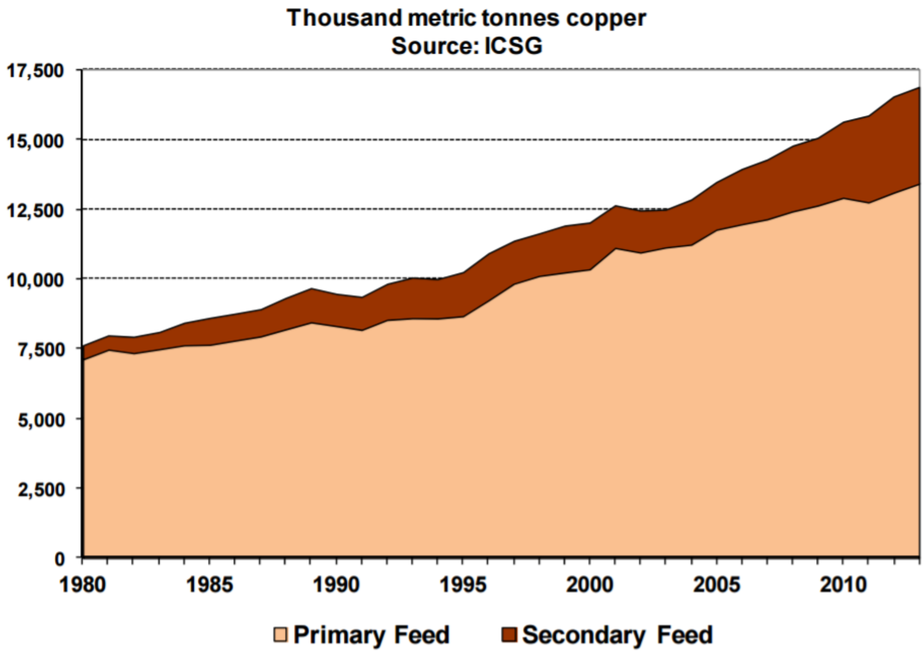

Figure 3. World Copper Production

[9]STATISTA. Statics and Facts About Copper. Retrieved From, https://www.statista.com/topics/1409/copper/

[10]The University of York. The Essential Chemical Industry, 2013. Retrieved From, http://www.essentialchemicalindustry.org/metals/copper.html

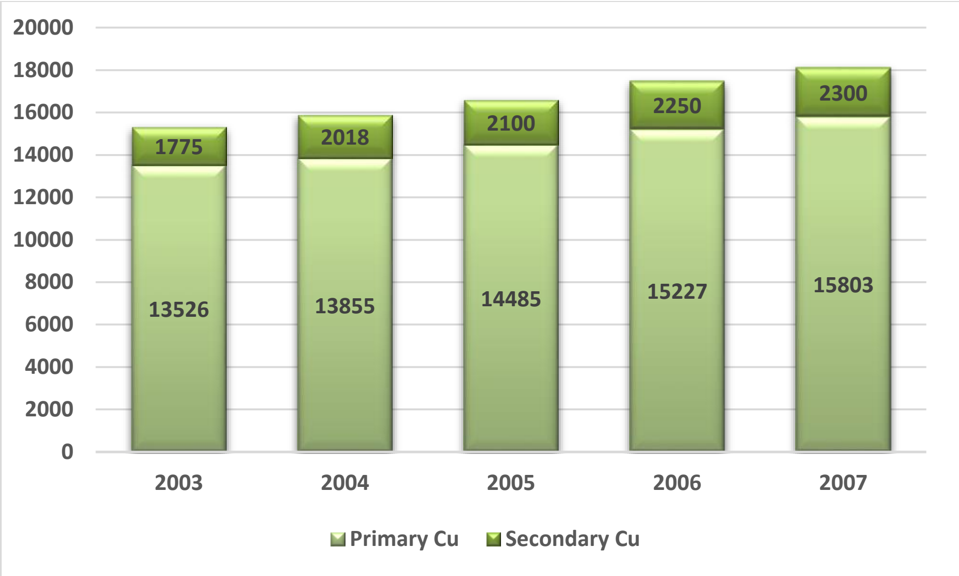

Figure 4. Copper production in Turkey (1ooo ton)[11]

2.3.4. Aluminium Production

Aluminium entered to Turkey's economy in 1950's and with introduction of aluminium to the economy, a new sector was originated. The production of aluminium in Turkey was started with construction of Seydişehir Eti Aluminium Plant for production of primary aluminium in 1967. The company was privatized in 2005. In our country, this plant is the only plant producing primary aluminium. Besides, there are many private sector companies producing secondary aluminium and semi or end products (about 1500 companies). Table 8 shows the changes of aluminium products between 2007-2011.

When domestic demand and consumption of aluminum analyzed, it is seen that aluminum is most consumed material after steel in our country. According to data from year 2011, per capita consumption of aluminum reached the level of 10.5 kg. But this value is relatively low as compared with the EU and OECD countries (respectively, 22 kg and 33 kg).

When examining aluminum import and export data, about 90 % of raw material need of industry is imported, because of raw aluminum is produced only in Seydişehir plant. On the other hand, significant amount of the finished products is exported. Turkey exports more than 50% of produced aluminum products[12] [13]

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[11]TÜBİTAK Metal Teknoloji Platformu Oluşturma Çalıştayı (2007). Bakır Bugünü ve Geleceği. Retrieved from, https://www.tubitak.gov.tr/tubitak_content_files/PLATFORMLAR/metal/24subat2007/sunum/Metal_Teknoloji_Platformu_Bakir_Sektoru_Sarkuysan.pdf.

[12] Türkiye Odalar ve Borsalar Birliği. (2012). Türkiye Demir ve Demir Dışı Metaller Meclisi Sektör Raporu 2011. Accesse on: 19.06.2016. Retrieved from, http://www.tobb.org.tr/Documents/yayinlar/TOBB_demir_rapor_kitap_2012.pdf.

[13] Demirci, K. M. (b.d.). Dünya Alüminyum Ticaretinde Türkiye'nin Yeri. Türk Mühendis ve Mimar Odaları Birliği, Metalurji Mühendisleri Odası. Access on: 20.06.2016.
Retrieved from, http://www.metalurji.org.tr/dergi/dergi161/d161_1729.pdf.

Table 8. Al Production in Turkey (ton)[14]

Production	2007	2008	2009	2010	2011	% change (10/09)	% change (11/10)
Primary Aluminium (7601)	63.000	61.000	30.000	54.000	56.000	80,0	3,7
Secondary Aluminium (7602)	80.000	94.000	120.000	150.000	165.000	25,0	10,0
Extrusion (7604)	235.000	265.000	230.000	275.000	290.000	19,6	5,5
Flat Products (plate-roll) (7606)	146.281	140.584	135.230	198.016	224.000	46,4	13,1
Foil (7607)	39.504	43.173	50.721	60.000	65.000	18,3	8,3
Conductor (7605-7614)	35.000	33.150	50.000	70.000	85.000	40,0	21,4
Casting	112.150	122.000	96.500	128.000	150.000	32,6	17,2

2.3.5. Secondary Zinc Production

Shortage of zinc in the market caused a drastic increase in demand from developed and emerging countries for zinc, causing price increases that are leading the primary zinc industry to consider scrap zinc as an alternative. In fact, the secondary zinc production is growing in the World because processing of such zinc secondary materials presents very important advantages, such as:

- Recycled zinc tends to be less expensive
- Zinc secondary materials generally contain no sulphur
- Since secondary zinc contain less iron than concentrate, their use also reduces the cost of iron removal and disposal
- Processing scrap zinc is less energy intensive than sulphide concentrates.

Lead blast-furnace slag often contains sufficient zinc to make recovery profitable. In both cases zinc oxide in the slag is reduced to metallic zinc (vapor) by carbon, oxidized by secondary air, and carried out in the furnace gases for recovery of zinc oxide dust[15].

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[14] Türkiye Odalar ve Borsalar Birliği. (2012). Türkiye Demir ve Demir Dışı Metaller Meclisi Sektör Raporu 2011. Access on: 19.06.2016. Retrieved from, http://www.tobb.org.tr/Documents/yayinlar/TOBB_demir_rapor_kitap_2012.pdf.

[15] European Dioxin Inventory – Results. Secondary Zinc Production. Retrieved from, http://ec.europa.eu/environment/archives/dioxin/pdf/stage1/seczinc.pdf.

The granulated blast-furnace slag is mixed with other zinc intermediates (steel dusts, etc.) and solid fuel reductant; and fed to Zn recovery rotary kilns where it travels down the kiln and is heated to reaction temperature by combustion gases from a burner at the discharge end. A mixture of coal dust and air is injected through tuyeres into a liquid blast-furnace slag at 1150 - 1250 °C in a waterjacketed furnace.

Usually secondary zinc smelters are with dust removing installations like baghouses. No special abatement measures exist with respect to PCDD/F emissions.

2.3.6. Magnesium Production

Magnesium is the one of the most abundant elements in the Earth and 2% of the minerals found in the earth's crust contain magnesium. There are different types of magnesium ore such as magnesite, dolomite and carnallite. Also seawater, well and lake brines and bitterns are sources of magnesium and magnesium compounds[16].

It has increasingly a potential primarily in the automotive industry, due to light weight and high strength features of magnesium. Magnesium is used at defense, electronics, aircraft, and white sale industries. Magnesium metal has found a growing percentage of usage especially in the last 10 years. Although there are various challenges in the magnesium production, difficulties are eliminated with developing technology. Thermal reduction and electrolytic methods are two main magnesium production methods. Nowadays, thermal methods have been used more widely. Among the thermal methods, silicothermic method, aluminothermic method, magnatherm process and pidgeon process have become prominent. Thermal processing method is performed at high temperatures (1200^{o}C over). Magnesium metal is obtained as vapor with using metalothermic reduction reactions. Thermal processes are performed under vacuum and magnesium metal is condensed from the vapor phase. After reduction process, refining process is applied for removing impurities. In electrolytic method, anhydrous magnesium chloride is used as salt electrolyte and magnesite is used as raw material. Before feeding to electrolytic cells, leaching with HCl, purification and dehydration pre-treatments are applied.[17]

Magnesium reserves are highly concentrated in Russia, China and Korea. In China 800,000 tons primary magnesium is produced and total world production is 910,000 tons in 2013. Almost all the world's primary magnesium is produced in China. Russia, Israel and Kazakhstan are other significant producers, respectively 30,000, 28,000, 21,000 tons production in 2013[17]. In our country, raw material of magnesium metal is abundant and Turkey's first primary magnesium production plant was constructed in 2014 and was started to production in 2015.

"Esan primary magnesium plant" consists of crushing and screening, calcination, raw material preparation, reduction, refining, retort foundry, solar power plant units. Pidgeon method is used in the plant. The plant has 15,000 ton capacity and currently, magnesium alloy and ingot

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[16] USGS. Magnesium Statistics and Information. Access on:24.12.2016. Retrieved from, https://minerals.usgs.gov/minerals/pubs/commodity/magnesium/.

[17]Istanbul Sanayi Odası (2013). Termal Yöntemlerle Magnezyum Üretİm Teknolojisinin Geliştirilmesi. Access on: 24.12.2016. Retrieved from, http://www.iso.org.tr/sites/1/upload/files/Termal_Yontemlerle_Magnezyum_Uretim_teknolojisinin_gelistirilmesi-238.pdf.

are produced in the plant[18]. In our country 3500-7000 tons of magnesium per year is imported for meeting magnesium demand[17].

2.4. Best Available Techniques for the Control of u-POPs Emissions

2.4.1. Integrated Iron and Steel Works

In integrated steelworks, the blast furnace is the main operational unit where the primary reduction of oxide ores takes place leading to liquid iron, also called 'hot metal'. Modern high performance blast furnaces require physical and metallurgical preparation of the burden. The two types of iron ore preparation plants are the sinter plants and the pellet plants. Pellets are nearly always made from one well-defined iron ore or concentrate at the mine and are transported in this form. Sinter is generally produced at the ironworks from pre-designed mixtures of fine ores, residues and additives.

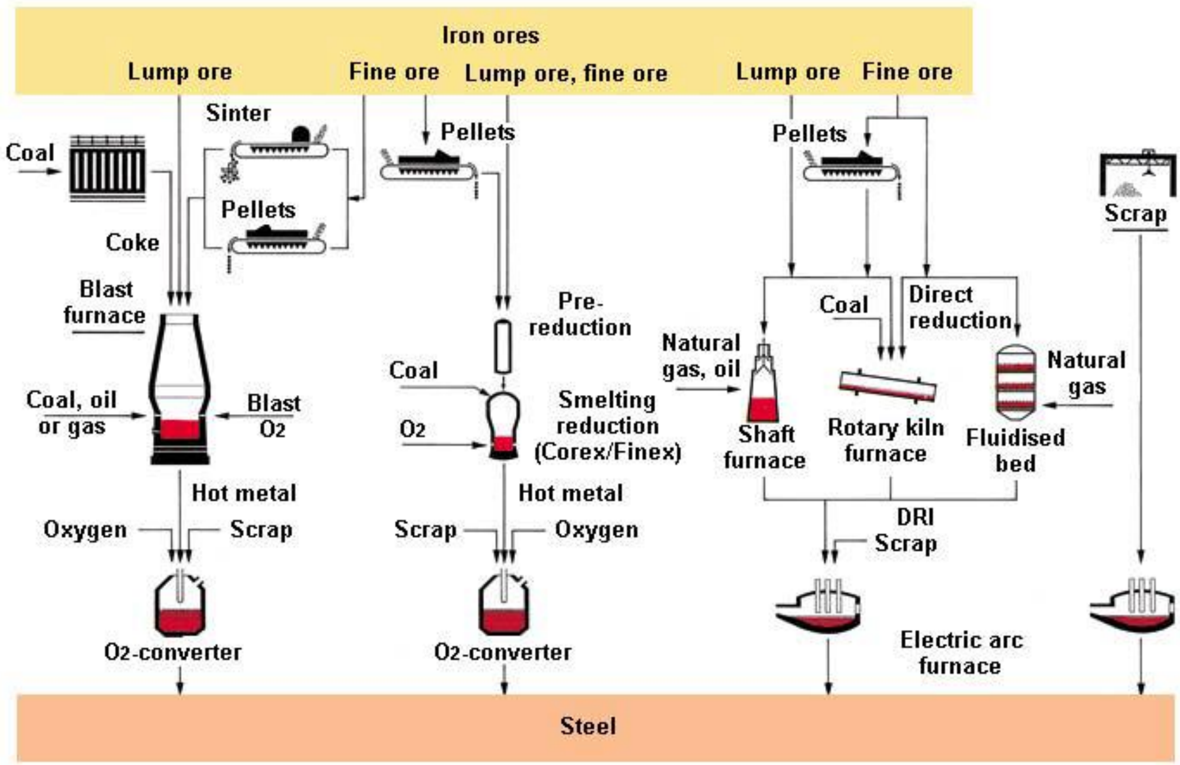

Figure 5. Crude Steel Production Methods [19]

[18] ESAN Mg Plant. Access on : 24.12.2016. Retrieved from, http://www.esanmagnezyum.com/.

[19] EC, Reference Document on Best Available Techniques in the Non Ferrous Metals Industries December, 2001.

2.4.1.1. General BAT in Integrated Iron-Steel Industry

Most of the POPs formed during Iron-Steel production are released during sintering. For the source category "sinter plants in the iron and steel industry", the Stockholm Convention Guidelines on BAT/BEP includes the following primary and secondary measures to reduce PCDD/F emissions to air from sinter plants and the BAT-associated emission levels.

Primary Measures

- Stable and consistent operation of the sinter strand
- Continuous parameter monitoring
- Recirculation of off-gases
- Feed material selection
- Feed material preparation
- Urea injection

Secondary Measures

Removal techniques:

- Adsorption/absorption and high-efficiency dedusting
- Fine wet scrubbing system

General measures:

- Removal of particulate matter from sinter off-gases
- Hooding of the sinter strand

According to the **BAT Conclusions**[20] under the Directive 2010/75/EU for the iron and steel industry, the following BAT-AEL is achievable:

- PCDD/F performance levels in air emissions associated with **BAT** and **BEP** for an iron sintering plant are **<0.2 ng I-TEQ/Nm^3** (at operating oxygen concentrations).

It should be noted that the PCDD/F ELV as given in the Turkish Regulation on Control of Industrial Air Pollution (0.1 ng/Nm^3) is stricter than the BAT-AELs reported under the Stockholm Convention Guidelines for BAT/BEP and EU BAT conclusions for the iron and steel industry. Thus, under the current Turkish legislation, the sinter plants are required to meet stricter ELVs as compared to the Stockholm Convention and EU BAT-AELs.

BAT 7 under IED 2010/75/EU suggests some methods to decrease formation and release of PCDD/Fs and PCBs and some other pollutants.

[20] Commission Implementing Decision of 28 February 2012 establishing BAT conclusions under Directive 2010/75/EU of the European Parliament and of the Council on industrial emissions for iron and steel production. Retrieved from, http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32012D0135&from=EN.

2.4.1.2. BAT Conclusions under IED 2010/75/EU

BAT Conclusions for Sinter Plants

Air emissions

Since POPs can be released to air with dust, **BAT** related to reduction and control of dust emissions are also considered.

- **BAT** for primary emissions from sinter strands is to prevent and/or reduce emissions of PCDD/F and PCB by using one or a combination of the following techniques:
  - Avoidance of raw materials which contain polychlorinated PCDD/F and PCB or their precursors as much as possible
  - Suppression of PCDD/F formation by addition of nitrogen compounds
  - Waste gas recirculation

- **BAT** for primary emissions from sinter strands is to reduce emissions of PCDD/F and PCB by the injection of adequate adsorption agents (coals, selected cokes, charcoals and specially-prepared carbon absorbents have been tested) into the waste gas duct of the sinter strand before dedusting with a bag filter or advanced electrostatic precipitators when bag filters are not applicable.

  The **BAT-AEL** for polychlorinated dibenzodioxins/furans (PCDD/F) is **<0.05 – 0.2 ng I-TEQ/Nm^3** for the bag filter and **<0.2 – 0.4 ng-I-TEQ/Nm^3** for the advanced electrostatic precipitator, both determined for a 6 – 8 hour random sample under steady-state conditions.

- **BAT** for blending/mixing is to prevent or reduce diffuse dust emissions by agglomerating fine materials by adjusting the moisture content.

- **BAT** for primary emissions from sinter plants is to reduce dust emissions from the sinter strand waste gas by means of a bag filter.

  BAT for primary emissions for existing plants is to reduce dust emissions from the sinter strand waste gas by using advanced electrostatic precipitators when bag filters are not applicable.

  The **BAT-AEL** for dust is **<1 – 15 mg/Nm^3** for the bag filter and **<20 – 40 mg/Nm^3** for the advanced electrostatic precipitator (which should be designed and operated to achieve these values), both determined as a daily mean value.

- **BAT** for secondary emissions from sinter strand discharge, sinter crushing, cooling, screening and conveyor transfer points is to prevent dust emissions and/or to achieve an efficient extraction and subsequently to reduce dust emissions by using a combination of the following techniques:

  I. hooding and/or enclosure
  II. an electrostatic precipitator or a bag filter.

The **BAT-AEL** for dust is **<10 mg/Nm³** for the bag filter and **<30 mg/Nm³** for the electrostatic precipitator, both determined as a daily mean value.

Water and Wastewater

- **BAT** for treating the effluent water from sinter plants where rinsing water is used or where a wet waste gas treatment system is applied, with the exception of cooling water prior to discharge by using a combination of the following techniques:
    - Heavy metal precipitation
    - Neutralisation
    - Sand filtration.

2.4.1.3. Electric Arc Furnace Steelmaking and Casting

The direct smelting of recycled steel (mainly scrap) is performed in electric arc furnaces. The process requires considerable amounts of high-current low-voltage electrical energy and causes substantial emissions to air, wastes and by-products (mainly filter dust and slag). The emissions to air from the arc furnace consist of mainly iron oxide dust and heavy metals, and persistent organic pollutants (e.g. PCB and PCDD/F). Slag produced during melting steel scrap also contains PCB and PCDD/F.

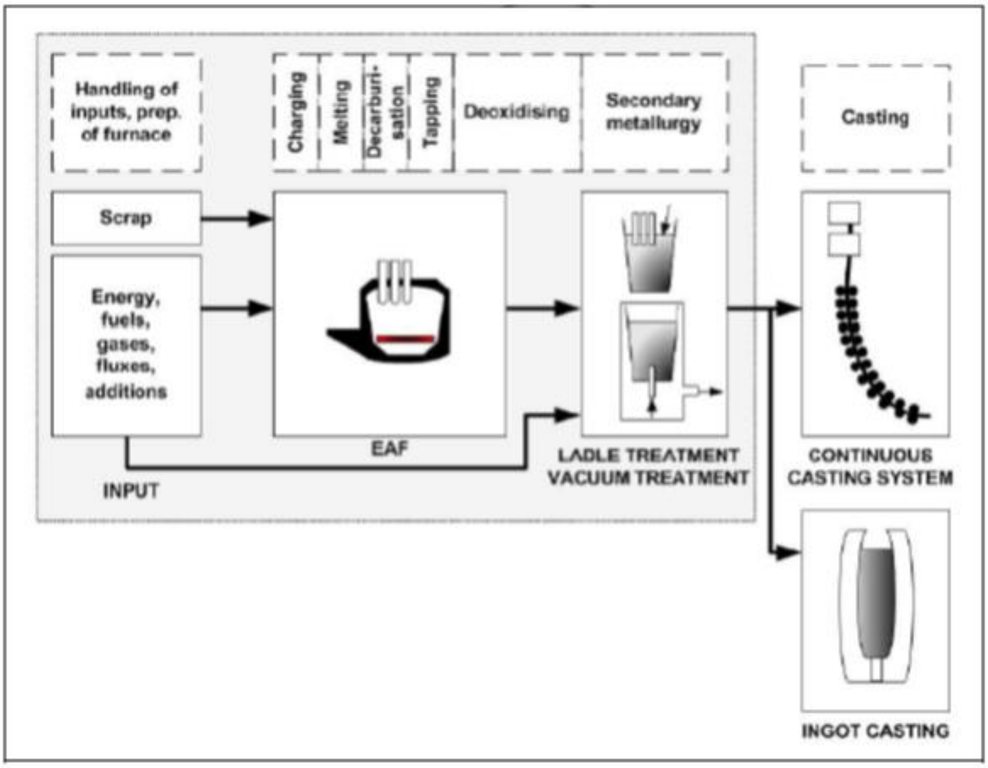

Figure 6. Electric Arc Steel Production [21].

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[21] EC, Reference Document on Best Available Techniques in the Non Ferrous Metals Industries December, 2001

2.4.1.3.1. General BAT

Primary Measures

- Increasing the quality of raw materials
- Improvement of electric arc furnace process
- Use of continuous measurements for dust emissions from large electric arc furnaces.

Secondary Measures

- Efficient collection of gas and dust
- Use of bag filters
- Use of external post combustion
- Injection of absorbents

2.4.1.3.2. BAT Conclusions for Electric Arc Furnace Steelmaking and Casting

Air emissions

- **BAT** for the electric arc furnace (EAF) primary and secondary dedusting (including scrap preheating, charging, melting, tapping, ladle furnace and secondary metallurgy) is to achieve an efficient extraction of all emission sources by using one of the techniques listed below and to use subsequent dedusting by means of a bag filter:
    I. a combination of direct off-gas extraction (4th or 2nd hole) and hood systems
    II. direct gas extraction and doghouse systems
    III. direct gas extraction and total building evacuation (low-capacity EAF may not require direct gas extraction to achieve the same extraction efficiency).

The overall average collection efficiency associated with BAT is >98 %. The **BAT-AEL** for dust is < 5 mg/Nm^3, determined as a daily mean value.

- **BAT** for EAF primary and secondary dedusting (including scrap preheating, charging, melting, tapping, ladle furnace and secondary metallurgy) is to prevent and reduce polychlorinated dibenzodioxins/furans (PCDD/F) and polychlorinated biphenyls (PCB) emissions by avoiding, as much as possible, raw materials which contain PCDD/F and PCB or their precursors (see BAT 6 and 7) and using one or a combination of the following techniques, in conjunction with an appropriate dust removal system:
    I. Appropriate post-combustion
    II. (In existing plants, circumstances like available space, given off-gas duct system, etc. need to be taken into consideration for assessing the applicability)
    III. Appropriate rapid quenching
    IV. Injection of adequate adsorption agents into the duct before dedusting.

The **BAT-AEL** for PCDD/F is **< 0.1 ng I-TEQ/Nm³** based on a 6-8 h random sample during steady-state conditions.

- **BAT** for on-site slag processing is to reduce dust emissions by using one or a combination of the following techniques:

    I. Efficient extraction of the slag crusher and screening devices with subsequent offgas cleaning, if relevant
    II. Transport of untreated slag by shovel loaders
    III. Extraction or wetting of conveyor transfer points for broken material
    IV. Wetting of slag storage heaps
    V. Use of water fogs when broken slag is loaded.

In the case of using BAT I, the **BAT-AEL** for dust is **< 10-20 mg/Nm³**, determined as the average over the sampling period (discontinuous measurement, spot samples for at least half an hour).

2.4.2. Secondary Lead Production

Major sources of secondary lead are scrap lead-acid automotive batteries (automotive, motive power and stand by), cable coverings, pipes, sheets and lead bearing metals. Solder, a tin-based lead-alloy, may be recovered from the processing of circuit boards. The smelting of lead involves several elements that mostly includes; a source of carbon (petroleum coke or charcoal) and energy, and neutralizing agents such as caustic soda, soda ash, or limestone, oxides and certain fluxing agents to capture sulphur and improve lead recovery. Lead scrap is processed in blast furnaces for hard lead or rotary reverberatory furnaces for fine particles.

The presence of small amounts of chlorine in the secondary raw materials leads to formation of PCDD/F. The formation of PCDD/F in the combustion zone and in the cooling part of the off-gas treatment system (de novo synthesis) may be possible in some processes, particularly if plastic components are included in the secondary materials that are fed into the process. The formation of PCDD/F is an environmental issue and the destruction of PCDD/F is being pursued.

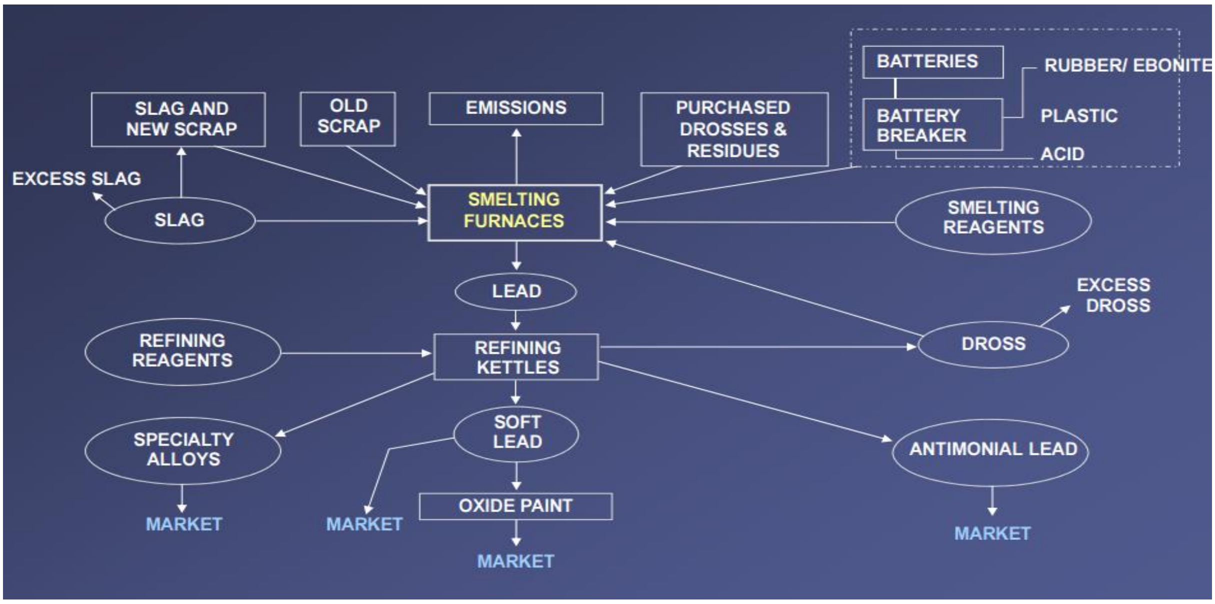

Figure 7. Diagram of lead refining processes[22]

2.4.2.1. General BAT

Primary Measures

- Decomposition of raw materials prior to processing
- Stable and consistent operation of processes
  - Furnace temperature should be at least 850 ^{O}C or higher
  - Continuous monitoring of optimum process parameters in order to reduce PCDD/F emissions

Secondary Measures

- Use of bag filter for the emissions from drying process in secondary lead production

Table 9. Emission from drying process after use of bag filter

Pollutant	Unit	Min.	Avg.	Max.
PCDD/F	I-TEQ ng/Nm^3	0.18	0.18	0.18

- Use of afterburners to remove PCDD/F

  At the blast furnace of Umicore Hoboken, afterburning of the process gases results in stack outputs of < 0.005 ng I-TEQ/Nm^3 for PCDD/PCDF

[22] Secondary Lead Smelting (2016, December 10). Retrieved from, https://trainex.org/osc2012/uploads/543/OSC_2012_Ind_Process_04_Lead_Smelting.pdf.

Table 10. Performance data for a shaft furnace with an afterburner

Parameter	Unit	Content
PCDD/F	ng I-TEQ/Nm^3	< 0.1

- Use of a regenerative thermal oxidiser (RTO) to reduce PCDD/F

- Prevention and reduction of PCDD/F air emissions
    - Reducing the organic and/or halogen (e.g. Cl, Br) content in the feed materials.
    - Using optimum combustion conditions.
    - Using charging systems that allow small additions of raw materials into semi-closed furnaces.
    - Thermal destruction of dioxins in the furnace at high temperatures (> 850 °C).
    - Oxygen injection in the upper zone of a furnace.
    - Avoiding exhaust systems with high dust coatings at temperatures of > 250 °C.
    - Applying a post-combustion chamber, afterburner or RTO
    - Rapid quenching of the off-gases in a temperature range between 400 °C and 200 °C.
    - Injection of adsorption agent (e.g. activated carbon, lignite coke, lime) before dedusting.
    - Use of an efficient dust collection system.

- Use of bag filter and venture wet scrubber to prevent or reduce PCDD/F emissions from remelting, refining, and casting secondary lead production

2.4.2.2. BAT Conclusions for Secondary Lead Production

Air Emissions

- **BAT** for monitoring of PCDD/F emissions to air

- In order to reduce PCDD/F emissions to air from the smelting of secondary lead and tin raw materials, **BAT** is to use one or a combination of the techniques given below.

Table 11. Techniques for reducing PCDD/F emissions to air from the smelting of secondary lead

	Technique	Applicability
A	Select and feed the raw material according to the furnace and the abatement techniques used	Generally applicable
B	Charge systems to add raw materials in small portions	Only applicable for semi-closed systems

C	Internal burner system	Only applicable for melting furnaces
D	Afterburner or regenerative afterburner	Generally applicable
E	Avoid exhaust systems with high dust coating at temperatures > 250 °C	Generally applicable
F	Rapid quenching to avoid formation of PCDD/F by de novo synthesis	Generally applicable
G	Injection of absorption agent combined with a filtration system	Generally applicable
H	Use of efficient dust collection system	Generally applicable
I	Use of oxygen injection in the upper zone of the furnace	Generally applicable
J	Optimise combustion conditions for the abatement of emissions of organic compounds	Generally applicable

The BAT-AEL for PCDD/F is **≤ 0.1 ng I-TEQ/Nm^3** based on a sampling period at least six hours.

2.4.3. Secondary Copper Production

Secondary copper is produced by pyrometallurgical processes. The process stages used depend on the copper content of the secondary raw material, its size distribution and the other constituents[23,24]. The main stages of secondary copper production are smelting, converting, fire-refining, slag treatment and the elctrorefining and processing of pure alloy scrap. The smelting stage is generally the main source of PCDD/F in the secondary copper production.

[23] Traulsen H., ‘Plant Information – Copper industry (Draft)’ , Copper Expert Group, 1998.
[24] Rentz, O. et al., Report on BAT in German Copper Production (Final Draft), University Karlsruhe (DFIU), 1999.

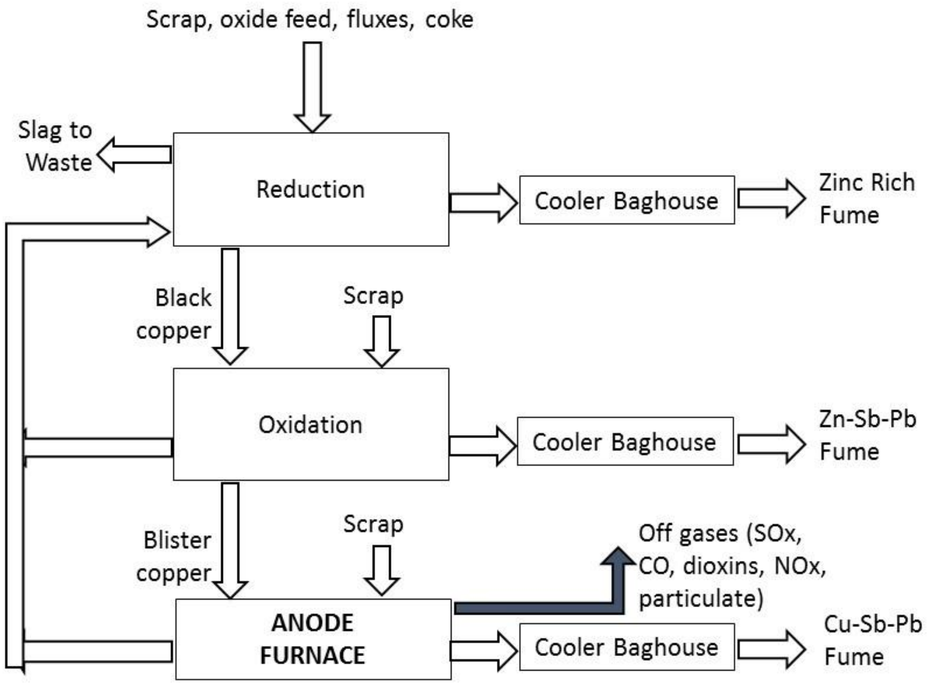

Figure 8. Simplified flow sheet of secondary copper smelting

2.4.3.1. General BAT

Primary Measures

- Decomposition of raw materials prior to processing
- Stable and consistent operation of processes
    - Furnace temperature should be at least 850 ºC or higher
    - Continuous monitoring of optimum process parameters in order to reduce PCDD/F emissions

Secondary Measures

- Use of afterburner+bag filter to reduce PCDD/F emissions from turning dryers
- Control of fugitive emissions
- Absorption with active carbon

2.4.3.2. BAT Conclusions for Secondary Copper Production

Air Emissions

- In order to reduce PCDD/F emissions to air in secondary copper production from the pyrolytic treatment of copper turnings, smelting, melting, fire refining and converting operations in secondary copper production, **BAT** is to use one or a combination of the techniques given below.

Table 12. Techniques to reduce PCDD/F emissions to air

	Technique
A	Select and feed the raw material according to the furnace and the abatement techniques used
B	Optimise combustion conditions for the abatement of emissions of organic compounds
C	Use of charging systems, for a semi-closed furnace, to give small additions of raw material
D	Thermal destruction of PCDD/F in the furnace at high temperatures (> 850 °C)
E	Use of oxygen injection in the upper zone of the furnace
F	Internal burner system
G	Use of post-combustion chamber or afterburner or regenerative afterburner
H	Avoid exhaust system with high dust coating for temperatures > 250 °C
I	Rapid quenching
J	Injection of absorption agent in combination with efficient dust collection system

The **BAT-AEL** for PCDD/F is **≤ 0.1 ng I-TEQ/Nm^3** based on a sampling period at least six hours.

2.4.4. Aluminium Production

2.4.4.1. Primary Aluminium Production

Primary aluminum refers to aluminum produced directly from mined ore. The ore is refined and electrolytically reduced to elemental aluminum.

Primary aluminum production generally consists of two stages: the production of alumina from bauxite and the production of primary aluminum from alumina. Two important processes in primary aluminum production are Bayer and Hall-Heroult processes. The last process is casting.

Primary aluminum production is not a significant source for PCDD/F emissions, but PCDD/F can be released in some electrolytic processes due to use of graphite-based electrodes.

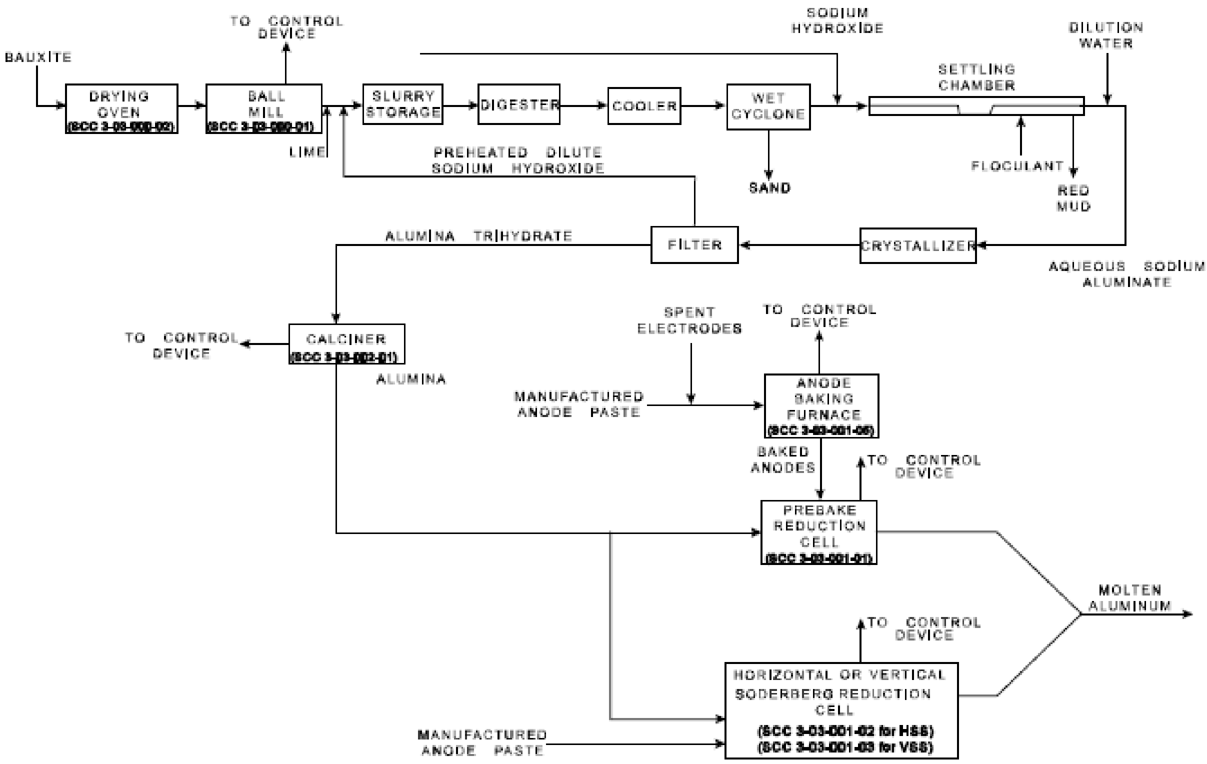

Figure 9. Diagram of Aluminum Production Process[25]

[25] US EPA., Primary Aluminum production – Metallurgical Industries. Retrieved from, https://www3.epa.gov/ttnchie1/ap42/ch12/final/c12s01.pdf.

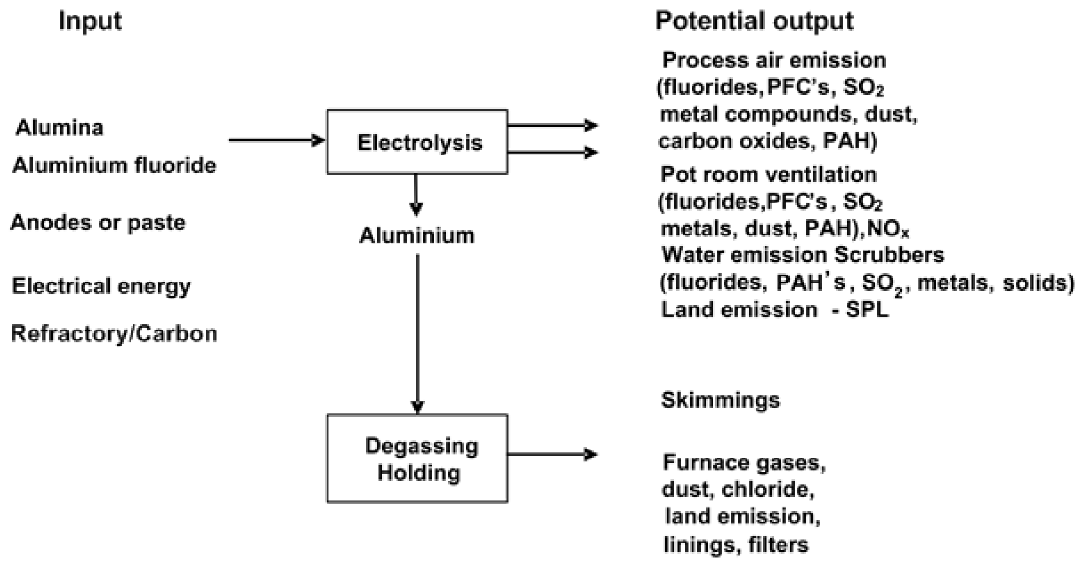

Figure 10. Input and output from primary aluminum production [26]

2.4.4.1.1. General BAT

There is no suggestion for any specific BAT to reduce PCDD/F emissions from primary aluminum production under IED 2015/75/EU.

2.4.4.2. Secondary Aluminum Production

Secondary aluminium is produced from the scrap melting. Two main features of secondary aluminium production are the diversity of raw materials encountered and correspondingly the variety of furnaces used[27]. Typical process steps include pretreatment, charging, melting, skimming, holding, treating the molten metal, and casting (Figure 11).

[26] Al Input., European Aluminum Association Input to Revision, 2008.
[27] ALFED, Secondary Aluminum Refining and Remelting, 1998.

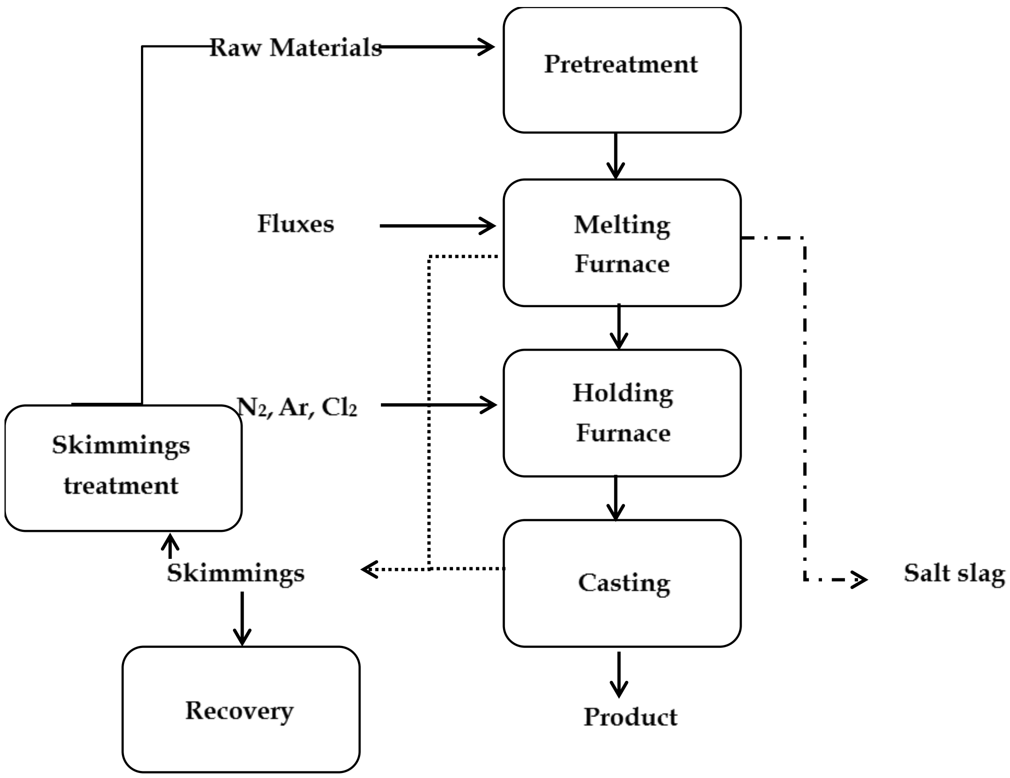

Figure 11. Diagram of secondary aluminum production process

PCDD/F can be released to the air from melting and treatment furnaces. The formation of PCDD/F in the combustion zone and in the cooling part of the off-gas treatment system (de novo synthesis) may be possible. Dust, which is resulted from the composition of input material and incomplete combustion of fuel, can contain PCDD/F. In addition, the production of smoke is due to the presence of organic carbon and the presence of chloride and may lead to the formation of PCDD/F which will then also be associated with the particles.

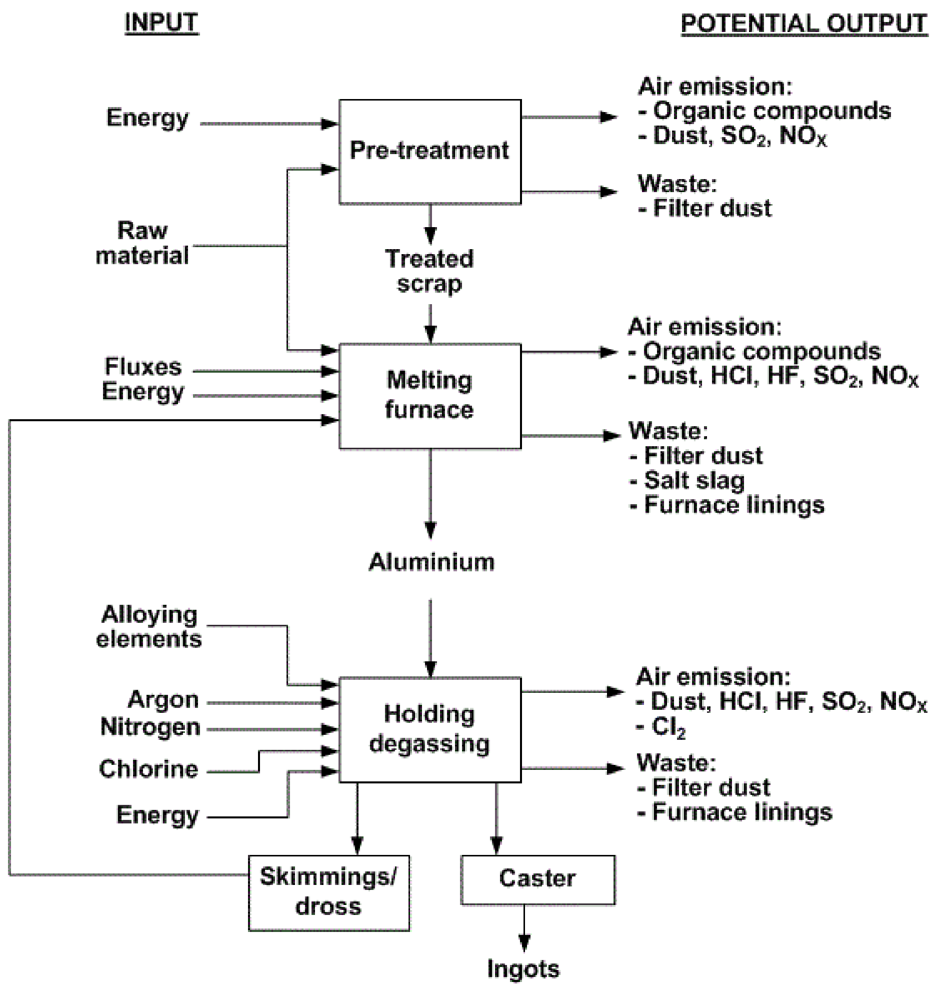

Figure 12. Input and output from secondary aluminum production

2.4.4.2.1. General BAT

Primary Measures

- Separation of Input before processing
    - Removal of oil, organic materials, plastics and chlorinated materials
        - Centrifugation and drying using a rotary drummer
- Use swarf dryer, afterburner, lime injection and bag filter to remove PCDD/F from swarf before the melting stage
- Stable and consistent operation of processes
    - Furnace temperature should be at least 850 °C or higher
    - Continuous monitoring of optimum process parameters in order to reduce PCDD/F emissions
- Removal of magnesium during melting (demagging)

Secondary Measures

- Techniques to remove oil and organic compounds (including PCDD/F) from swarf before the melting stage
  - Centrifugation
  - Drying using a rotary dryer
- High efficiency dust removal
- Use of afterburner or internal burner system to reduce PCDD/F emissions from the melting furnace
- Absorbent agents to reduce the air emissions of acid gases and organic carbon, including PCDD/F
  - Active carbon injection
  - Lime or sodium bicarbonate injection
- Filter coated with catalyzer
- Use of bag filters to reduce dust and PCDD/F emissions from the melting process

2.4.4.2.2. BAT Conclusions for Secondary Aluminum Production

Air Emissions

- In order to prevent or reduce emissions to air, **BAT** is to remove oil and organic compounds from the swarf before the smelting stage using one or both of the techniques given below.

	Technique	Applicability
a	Centrifugation	Only applicable to highly oil-contaminated swarf
b	Drying	Generally applicable. For swarf highly contaminated by oil, centrifugation is applied before the drying

- **BAT** is to use a bag filter to reduce dust and PCDD/F emissions
  The **BAT-AEL** for PCDD/F is from 0.002 **ng I-TEQ/Nm^3** to 0.15 **ng I-TEQ/Nm^3.**

- In order to reduce the emissions to air of organic compounds and PCDD/F from the thermal treatment of contaminated secondary raw materials (e.g. swarf) and the melting furnace, **BAT** is to use a bag filter in combination with one or a combination of the techniques given below.
  - Select and feed the raw material according to the furnace and the abatement techniques used
  - Internal burner system (only applicable for melting furnaces)
  - Afterburner
  - Rapid quenching
  - Activated carbon injection

  The **BAT-AEL** for PCDD/F is **≤ 0.1 ng I-TEQ/Nm^3** based on a sampling period at least six hours.

2.4.5. Secondary Zinc Production

Secondary zinc first undergoes a separation process. Magnetic separation, sink-float and hand sorting are usually used to remove the zinc from unwanted components. After separation, the zinc is melted with new scrap from brass plants, rolling zinc clippings or die casting. The zinc is melted in a kettle, crucible, reverberatory furnace or electric induction furnace. Flux is used to trap impurities and produces dross that is skimmed from the surface of the molten zinc. The zinc is then either poured into molds or sent to refiners. High quality scrap from dross, diecastings, and other zinc rich sources usually can be remelted without further refinement. The recovered metal can become galvanized brighten or alloy materials in copper, aluminum, magnesium, iron, lead, cadmium or tin production. Zinc helps to make the metals stronger[28].

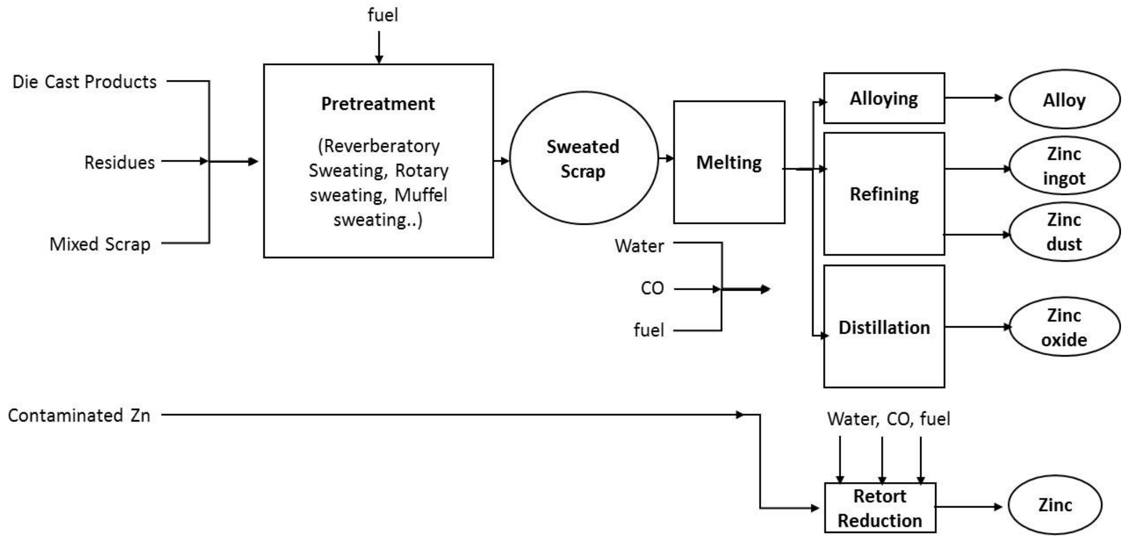

Figure 13. Process flow diagram of secondary zinc production[28]

PCDD/F and VOCs may be present if secondary materials are used that contain PCDD/F or are contaminated with organic materials. PCDD/F generally is emitted from roasting, pyrometallurgical treatments and casting.

The formation of PCDD/F in the combustion zone and in the cooling part of the off-gas treatment system (de novo synthesis) may be possible in some processes particularly if plastic components are included in the secondary materials that are fed into a process[29].

2.4.5.1. General BAT

Primary Measures

- Separation of process inputs
- Stable and consistent operation of processes

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[28] USEPA, Profile of the Nonferrous Metals Industry, EPA 310-R-95-010.

[29] Austria M168, Medienübergreifende Umweltkontrolle in ausgewählten Gebieten Monographien, M-168, Wien,, 2004

- Furnace temperature should be at least 850 OC or higher
- Continuous monitoring of optimum process parameters in order to reduce PCDD/F emissions

Secondary Measures

- Techniques to prevent and reduce emissions, including PCDD/F, from melting in rotary Waelz kilns
  - Dust chamber
  - Bag filter
  - Adsorbent addition
  - Regenerative thermal oxidizer (RTO)
- Use of afterburner
- Active carbon absoption

2.4.5.2. BAT Conclusion for Secondary Zinc Production

Air Emissions

- In order to reduce dust and metal emissions to air from the melting of metallic and mixed metallic/oxidic streams, and from the slag fuming furnace and the Waelz kiln, **BAT** is to use a bag filter.
- In order to reduce TVOC and PCDD/F emissions to air from the melting of metallic and mixed metallic/oxidic streams, and from the slag fuming furnace and the Waelz kiln, **BAT** is to use one or a combination of the techniques given below.
  - Injection of adsorbent (activated carbon or lignite coke) followed by a bag filter and/or ESP
  - Thermal oxidizer
  - Regenerative Thermal Oxidizer (may not be applicable due to safety reasons)
- The **BAT-AEL** for PCDD/F is **≤ 0.1 ng I-TEQ/Nm^3** based on a sampling period at least six hours.

2.4.6. Magnesium Production

There are two major process routes utilized for production of magnesium metal. The first process recovers magnesium chloride from the raw materials and converts it to metal through molten salt electrolysis. The second type of process involves reducing magnesium oxide with ferrosilicon or aluminium at high temperatures.

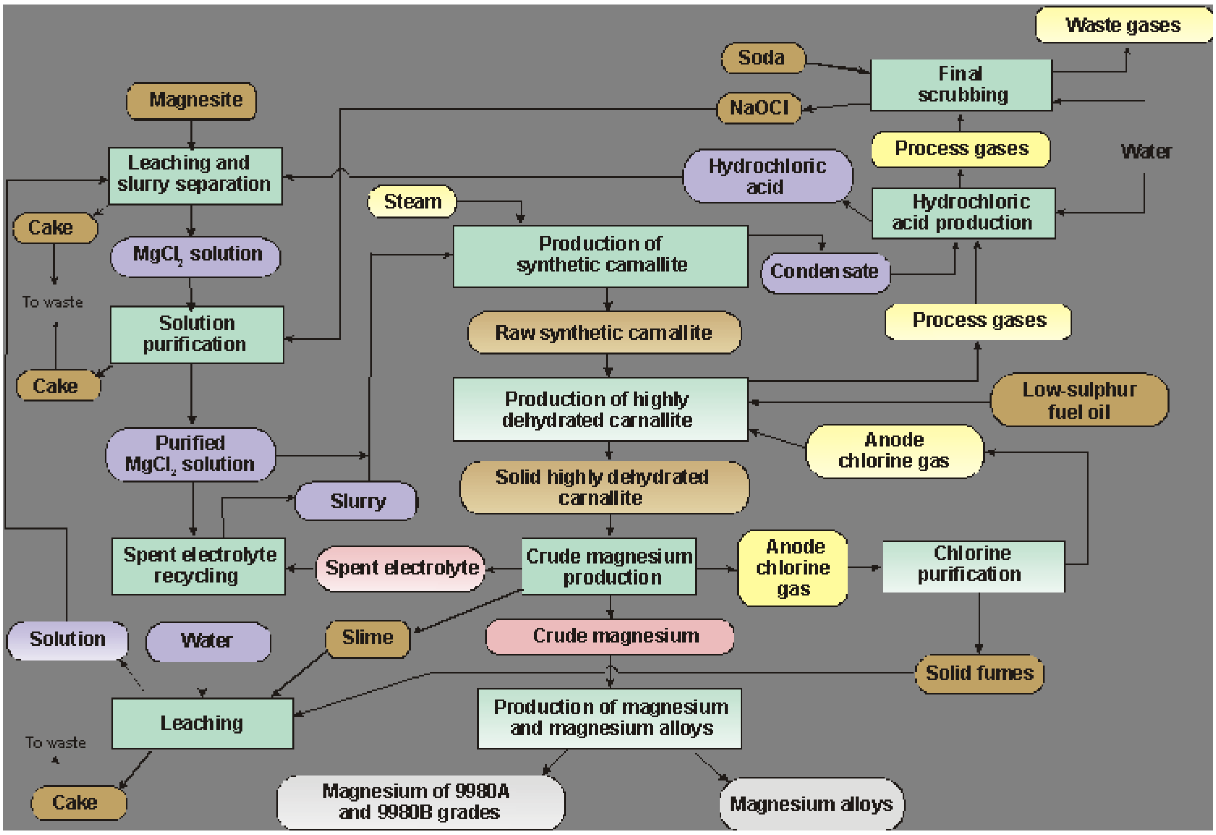

Figure 14. Flow Diagram of Magnesium production process from magnesium oxide resources

The main process causing the formation of PCDD/F is a furnace converting pellets of MgO and coke to magnesium chloride ($MgCl_2$) by heating in a Cl_2 atmosphere at 700°C – 800°C [30]. The purification of MgO using HCl and graphite blades ("chlorination") or electrolysis of $MgCl_2$ using graphite electrodes are also possible other sources of PCDD/PCDF formation[31].

2.4.6.1. General BAT

Primary Measures

- Substituting the graphite by nongraphite anodes, possibly metal anodes

Secondary Measures

Air emissions

- Treatment of off-gases by cleaning of the off-gas from the chlorinators in a series of wet scrubbers and wet electrostatic precipitators before incineration, and using bag filters to clean and remove entrained salts from the magnesium electrolysis process

[30] Oehme M., Larssen S. and Brevik E.M., "Emission Factors of PCDD/CDF for Road Vehicles Obtained by a Tunnel Experiment.", Chemosphere 23:1699-1708, 1991.
[31] UNEP, Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases, UNEP, Geneva, 2005.

- Use of activated carbon: In the Cogburn magnesium project, there are two chlorinated hydrocarbon removal systems; both are based on activated carbon removal of chlorinated hyrdocarbons in liquid effluents.

Water and Waste Water

- Treatment of effluents using techniques such as nanofiltration and use of specially designed containment for solid residues and effluents.

2.4.6.2. BAT Conclusions for Magnesium production

There is no BAT conclusions for aluminum production based on available Stockholm Convention documents. Performance levels as associated with best available techniques for PCDD/F for different Magnesium production processes are not available.

3. Activity 3.2.2 –Training

3.1. Scope of the Training

The objectives of the training activity are as follows:

1. Assess training needs among the target group in order to identify knowledge gaps to be addressed. This includes consultation and liaising with MoEU and some of main industrial representatives such as ferrous and non-ferrous metal industry as the priority u-POPs emitting sectors.

2. Design innovative training material on BAT/BEP application at industrial scale with the aim of reducing overall u-POPs emissions. The material should include both the features of each industrial sector and process in industry with a focus on ferrous and non-ferrous metal industry as the priority u-POPs emitting sectors. The training material should also reflect upon other priority sectors and include success story examples from similar projects of UNIDO and other national, regional and global examples as well. Guidelines on BAT and guidance on BEP developed by Stockholm Convention secretariat will also be considered during development of training material.

3. Conduct 2 days training consistent with the project's objectives and ensuring high-quality delivery. Follow up on the conducted training by assessing the knowledge of participants and prepare training assessment report on the discussions, outcomes and recommendations of the training sessions.

Therefore, the three main outputs under Activity 3.2.2 are:

Output 1 – Training Needs Assessment Report

Output 2 – Training Material

Output 3 – Training Assessment Report

3.2. Training Needs Assessment

Effective training depends on knowing what is required for the trainees to ensure that the resources invested in training are focused at topics where training is needed and a positive return on the training investment is guaranteed. The training needs assessment (TNA) is considered to be a vital prerequisite for any effective training programme or event. Within the scope of the projects, a TNA was made after consultation and liaison with the Ministry of Environment and Urbanization (MoEU) and the main industrial representatives such as the ferrous and non-ferrous metal industry as the priority u-POPs emitting sectors with the need of identifying the "gap" between knowledge required and current knowledge. Before proceeding further with the preparation of the training material, a survey form (

Appendix 1) was prepared and send to industrial representatives (of the target sub-sectors under the ferrous and non-ferrous metal industry) and selected employees of the Ministry of Environment and Urbanization.

The results from this survey are presented in Table 13. As presented, 2/3 of the respondents have not participated in any training programs related to the Stockholm Convention. But, most of them have been involved in some related work. Half of the respondents were familiar with the subject of BAT/BEPs for reducing u-POPs; but only 1 responded the question of "have you ever used these guidelines?" as "yes". More than 2/3 of the respondents replied that his/her organization made investments for the reduction and control of u-POPs. In parallel, many responded that they have knowledge about the control of u-POPs emissions.

An overall assessment of the responses revealed that although most of the respondents have not attained any training on u-POPs, they were with some background on the subject and in need of knowledge about BAT/BEPs application for the control of u-POPs. Based on this information, the outline of the training material was assembled and the training document was prepared.

Table 13. The results from training need survey

Question	"Yes" answers	"No" answers
Have you participated in any training programs related to the Stockholm Convention?	**6**	**12**
Did you attend any other activity in the scope of the Stockholm Convention, which was conducted by the Ministry of Environment and Urbananization, relating to scope of your industry?	**3**	**14**
Do you know Best Available Techniques(BAT)/Best Environmental Practice (BEP) guidelines which are prepared for reducing u-POPs (e.g. dioxin/furan) in the scope of Stockholm Convention relating to your industry?	**9**	**8**
If you know, have you ever used these guidelines?	**1**	**7**
In the scope of your organization, were any work and/or investment made for the reduction and control of u-POPs?	**3**	**13**
If your answer is yes, what kind of works and/or investments was made?	1. We worked about using alternative materials instead of PCBs contained in transformers. 2. Studies were done at İzaydaş.	

Question	"Yes" answers	"No" answers
Do you know Best Available Techniques Reference Documents (BREF), which were published for industries in the scope of The European Union (EU) Industrial Emissions Directive (2010/75/EU)?	**6**	**10**
If your answer is yes, when and how often do you use?	1. In case of need, it is used as reference source, there is no specific period. 2. In several training and meeting which I was participated, mentioned about BREFs, but I have no use for these documents.	
Do you know the emission limit values for dioxin/furan which were determined in the scope of The European Union (EU) Industrial Emissions Directive (2010/75/EU)?	**3**	**13**
If your answer is "yes", within the scope of your organization/institution, what do you see when you compare aforementioned emission limit values with local regulatory requirements?	**-**	**-**
If any work or investment was made in your organization/institution within the scope of BREF in last 1 year, can you explain the scope?	1. I do not have any knowledge about this subject. 2. Istanbul Provincial Directorate of Environment and Urbanization	
In your organization/institution, are you in need of special information about reduction and control of emissions of the u-POPS (e.g. dioxin/furan)?	**5**	**8**
If your answer is yes, please define.	1. We calculate air pollutants for Turkey. So we need data about dioxin-furan and other heavy metals. 2. Sharing information about de-oiling techniques of oil scales in the world could be beneficial. 3. I need information about u-POPs emissions under general heading. I have not participated any workshop or platform about this topic.	

3.2.1. Objectives of the TNA

The objectives of the training need assessment done was:

- To identify individuals' current level of competence, skill or knowledge of the industrial representatives such as the ferrous and non-ferrous metal industry as the priority u-POPs emitting sectors, in the area of u-POP emissions
- To identify their technical training needs.
- To identify what the general content of training should be.
- To do implementation arrangements for BAT/BEP demonstrations for priority source categories.
- To ensure that the relevant priorities in the country are taken into account, that duplication of effort is avoided and use of scarce resources is maximised.

3.2.2. Questionnaire

A simple questionnaire was developed and administered to (

Appendix 1) staff from the Ministries and the industrial representatives such as the ferrous and non-ferrous metal industry. The questionnaire was designed in such a way that basic information could be acquired on the training needs of the individual.

3.3. Training Material

The training workshop included the following topics:

- Understanding Stockholm Protocol
- Understanding cleaner production
- Understanding BAT/BEPs in priority non-ferrous industrial sectors
- Case studies on the adaptation of BAT/BEPs.

Electronic versions of the training materials used is provided as an annex to the Report.

3.4. Trainers and facilitators

The following trainers lectured during the training programme:

Table 14. Name and Institutions of Trainers

Name	Institution
Dr. Ülkü Yetiş	National Expert on U-POPs, Main Trainer
Derya Sarıoğlu	Ministry of Environment and Urbanization
Zeliha Ünaldı	United Nations

Mr. Şenol Ataman facilitated the opening and closing sessions. Dr. Ülkü Yetiş facilitated the discussions in cooperation with the technical staff of the MoEU.

3.5. Date and Venue of the Training Programme

The training was held on December 7-8, 2016 in Ankara, at Holiday Inn Hotel.

3.6. Final Beneficiaries

The training was arranged mainly for the technical staff of the MoEU, related ministries and the technical staff of several of the ferrous and non-ferrous metal industries in Turkey which will be able to apply learned knowledge in their operations and for the benefit of the local community.

3.7. Program of the Training

The training was arranged as a two-day workshop mainly covering the topics in accordance with the ToR, which can be useful for all participants. Also considered was the possible future benefits of the training to the assistants and co-workers of the participants. See Table 15 for the entire program of the training.

3.8. Logistics

All the logistics was arranged by UNIDO Team.

The training was held in Turkish language.

3.9. Participants of the Training

The participants involved in the training are shown in Appendix 2. As shown, the target group were identified as the personnel of the MoEU and the engineers from the non-ferrous metal industries. In essence, the participants represented a wide cross-section of relevant ministries and national agencies ranging from the environment, agriculture, forestry, water and health offices. Of the 56 participants, about 10% was from the non-ferrous metal industries.

Table 15. Program of the training

DAY 1		
09:30 -10:00	Registration	
10:00 - 10:45	Opening Speech	, Bursev Doğan Artukoğlu, Şenol Ataman
10:45 - 11:00	Coffee Break	
11:00 - 12:30	The Stockholm Convention, u-POPs	Dr. Ülkü Yetiş
12:30 - 13:30	Lunch	
13:30 - 14:30	Activities carried out by the Ministry of Environment and Urbanization about the control u-POPs Emission – Air Quality Management	Derya Sarıoğlu The Ministry of Environment and Urbanization
14:30 – 15:30	Cleaner Production – BAT/BEP	Dr. Ülkü Yetiş
15:30 – 15:45	Coffee Break	
15:45 – 17:00	Reducing emissions of u-POPs - BAT/BEPs – Part I	Dr. Ülkü Yetiş
DAY 2		
9:30 – 10:00	Registration	
10:00 – 11:15	Reducing emissions of u-POPs –BAT/BEPs – Part I	Dr. Ülkü Yetiş
11:15 - 11:30	Coffee Break	
11:30 - 12:30	Gender Equality	Zeliha Ünaldı United Nations
12:30 - 13:30	Lunch	
13:30 - 14:45	BAT/BEP Case Studies	Dr. Ülkü Yetiş
14:45 - 15:00	Coffee Break	
15:00 - 16:00	BAT/BEP Case Studies	Dr. Ülkü Yetiş
16:00 - 16:30	Discussions	
16:30	Closure	Şenol Ataman

3.10. Training Assessment

In this part of the report, an assessment of the training delivered on BAT/BEPs in priority industrial sectors is provided.

In the overall, the trainees have found the trainers, training materials, and training methods satisfactory. At the end of the training sessions, several of the participants expressed their opinion about the course and stated that the training was beneficial for them.

Conclusions

The followings have been deduced from the training programme and its overall evaluation:

- The training was successful in overall;
- The trainers were evaluated knowledgeable on the subjects;
- The training methods used by the trainers were effective;
- Training materials distributed were appreciated by the participants;
- Logistics were good.

Lessons learned

- The scope of the training was quite wide with the active involvement of participants.
- The participants were willing to learn about the Convention and the control of u-POPs.

4. Final Statement

Turkey requires to modify the existing legislation/the legal framework to fulfil its obligations under the Stockholm Convention for POPs and CLRTAP/POPs Protocol. Moreover, it needs to develop an action towards the active cooperative involvement of the several ministries dealing with POPs in implementing the Stockholm Convention. As indicated in NIP, the identification of competent authorities, relevant authorities and stakeholders and their participation/involvement in management process on the implementation of the legal requirements need to be regulated in order to have their active participation in the management of POPs.

According to NIP, the inclusion of public and stakeholder participation in the future implementation of the Stockholm Convention is another necessity. The active participation of trainees from a wide variety of national stakeholder institutions to the training delivered under this task, has indicated that the uPOPs and their harmful effects are well acknowledged and awareness raising activities carried out by the Ministry of Environment and Urbanization have served their purpose. Needless to say, these activities should continue in a periodic manner to serve to the full successful implementation of the NIP and in turn the Stockholm Convention in Turkey.

The full successful implementation of the Convention, of course, also requires all POPs relevant organizations/institutions to have and invest adequate financial and human resources for their programs.

APPENDICES

Appendix 1. Questionnaire used for Training Need Assessment

REPORT for

“Assessment of the Regulatory Gaps for U-POPs” and “BAT/BEP Training for Priority Industrial Sectors” related to “POPs Legacy Elimination and POPs Release Reduction Project”

Turkey

Activity 3.2.2. Best Available Techniques (BAT)/ Best Environmental Practices (BEP) Training in Priority Sectors

Study of Training Needs Analysis Questionnaire

This questionnaire is organized for determining training needs of projected industry representatives to participate in Best Available Techniques (BAT)/ Best Environmental Practices (BEP) Training in Priority Sectors in December 7-8, 2016, in the scope POPs Legacy Elimination and POPs Release Reduction Project. In the direction of needs in your statements, regulating of the content of training program and performing the training usefully are aimed.

Priority industries includes identified sectors as having highest u-POPs release in the scope of Stockholm Convention. These sectors are identified within the scope of National Implementation Plans that have been conducted under Stockholm Convention.

Thank you for your participation in the questionnaire. We are glad to see you in the training that will be held in Ankara.

Best Regards,

UNIDO Project Team

A. Participant Information

Name-Surname:………………………………………….

Industry: ………………………………………

Working institutions / organizations:…………………………………

Job Title: ………………………………………………………………………………………

B. The Scope of Training

1. Have you participated in any training programs related to Stockholm Convention?
   ☐ Yes ☐ No

2. Did you attend a work in the scope of the Stockholm Convention, which was conducted by the Ministry of Environment and Urban Planning, relating to scope of your industry?

☐ Yes ☐ No

3. Do you know Best Available Techniques(BAT)/Best Environmental Practice guidelines which were prepared for reducing u-POPs (e.g. dioxin/furan) in the scope of Stockholm Convention relating to your industry?

   ☐ Yes ☐ No

   If you know, have you ever used these guidelines?

   ☐ Yes ☐ No

4. In the scope of your organization, were any work and/or investment made for the reduction and control of u-POPs?

   ☐ Yes ☐ No

   If your answer is yes, what kind of works and/or investments was made?

   ………

   ………

5. Do you know Best Available Techniques Reference Documents (BREF), which were published for industries in the scope of The European Union (EU) Industrial Emissions Directive (2010/75/EU)?

   ☐ Yes ☐ No

   If your answer is yes, when and how often do you use?
   ………

6. Do you know the emission limit values for dioxin/furan which were determined in the scope of The European Union (EU) Industrial Emissions Directive (2010/75/EU)?

   ☐ Yes ☐ No

   If your answer is yes, within the scope of your organization/institution, what do you see when you compare aforementioned emission limit values with local regulatory requirements?
   ………

   ………

7. If any work or investment was made in your organization/institution within the scope of BREF in last 1 year, can you explain the scope?

……..

………

8. In the scope of your organization/institution, do you need information in special title about reduction and control of emissions of the u-POPS (e.g. dioxin/furan)?

☐ Yes ☐ No

If your answer is yes, please define.

………

……

Appendix 2. List of Participants

No	Name	Last Name	Institution	City	Title
1	Şenol	Ataman	UNIDO	Ankara	Technical Coordinator
2	Eylem	Dogan Subası	UNIDO	Ankara	Deputy Technical Coordinator
3	Bursev	Doğan Artukoğlu	Ministry of Environment and Urbanization, Priority Chemicals Management Division	Ankara	Head of Priority Chemicals Management Division
4	Ertan	Öztürk	Ministry of Environment and Urbanization, Priority Chemicals Management Division	Ankara	Environment and Urbanization Expert
5	Ahmet	Daşkın	Ministry of Environment and Urbanization, Priority Chemicals Management Division	Ankara	Environment and Urbanization Expert
6	Zeynep	Leloğlu	Ministry of Environment and Urbanization, Priority Chemicals Management Division	Ankara	Chemical Engineer
7	Eylem Özlem	Nalbantoğlu	Ministry of Environment and Urbanization, Priority Chemicals Management Division	Ankara	Environment and Urbanization Expert
8	Tuğba	İlban	Ministry of Environment and Urbanization, Provincial Directorate of Zonguldak	Zonguldak	Environmental Engineer
9	Müge	Cebeci	KARDEMİR Iron and Steel Inc.	Karabük	Chief Engineer, Environmental Management System
10	Ruşen	Bağ	KARDEMİR Iron and Steel Inc.	Karabük	Chief Engineer, Sinter Plant
11	Ahmet	Türküm	Ministry of Environment and Urbanization, Provincial Directorate of Kocaeli	Kocaeli	Division Head
12	Yasemin	Güler	Ministry of Environment and Urbanization, Provincial Directorate of Kocaeli	Kocaeli	Environmental Engineer
13	Gökhan	Öktem	Ministry of Environment and Urbanization, Provincial Directorate of Kocaeli	Ankara	Environment and Urbanization Expert
14	Gizem	Mert	Ministry of Environment and Urbanization, Provincial Directorate of Ankara	Ankara	Engineer

No	Name	Last Name	Institution	City	Title
15	Ersin	Demirbağ	Ministry of Environment and Urbanization, Provincial Directorate of Ankara	Ankara	Engineer
16	Esra	Hasballıoğlu	ER-BAKIR Copper Inc.	Denizli	Engineer
17	İsmail	Yalı	ER-BAKIR Copper Inc.	Denizli	Engineer
18	Oya	Aslan Bayram	Ministry of Environment and Urbanization, Provincial Directorate of Hatay	Hatay	Environmental Engineer
19	Funda	Filiz	Ministry of Environment and Urbanization, Air Quality Department	Ankara	Division Head
20	Evrim	Doğan Öztürk	Ministry of Environment and Urbanization, Air Quality Department	Ankara	Environment and Urbanization Expert
21	Canan Esin	Köksal	Ministry of Environment and Urbanization, Air Quality Department	Ankara	Environment and Urbanization Expert
22	Ülkü Füsun	Ertürk	Ministry of Environment and Urbanization, Air Quality Department	Ankara	Division Head
23	Derya	Sarıoğlu	Ministry of Environment and Urbanization, Air Quality Department	Ankara	Chemist
24	Turgut Giray	Isıyel	Ministry of Environment and Urbanization, Provincial Directorate of Hatay	İzmir	Chemical Engineer
25	İbrahim Murat	Kargın	Ministry of Environment and Urbanization, Provincial Directorate of İzmir	İzmir	Chemist
26	Yunus	Ayvacı	Ministry of Environment and Urbanization, Provincial Directorate of Denizli	Denizli	Environmental Engineer
27	Uğur	Geniş	Ministry of Environment and Urbanization, Provincial Directorate of Karabük	Karabük	Environmental Engineer
28	Dr. Elife	Çopur Fakraden	State Hydraulic Works	Ankara	Chemist
29	Aysun	Saraç	İZAYDAŞ – Izmit Waste and Residue Treatment, Incineration and Recycling	Kocaeli	Chief, Environmental Management System

No	Name	Last Name	Institution	City	Title
30	Şule	Bektaş	Ministry of Environment and Urbanization, Directorate General of Environmentaş Impact Assessment, Permit and Inspection	Ankara	Environment and Urbanization Expert
31	Ebru	Olgun	Ministry of Environment and Urbanization, Directorate General of Environmentaş Impact Assessment, Permit and Inspection	Ankara	Environment and Urbanization Expert
32	Özge	Özgün	İSDEMİR Iron and Steel Inc.	İskenderun	Chemical Engineer
33	Ziya	Başatan	İSDEMİR Iron and Steel Inc.	İskenderun	Chief Engineer, Sinter Plant
34	Funda	Cihan	Ministry of Environment and Urbanization, Provincial Directorate of İstanbul	İstanbul	Engineer
35	Rabia	Konak	Ministry of Environment and Urbanization, Provincial Directorate of İstanbul	İstanbul	Engineer
36	Hayriye	Venedik	Ministry of Environment and Urbanization, Provincial Directorate of İstanbul	İstanbul	Engineer
37	Dilek	Korkut	Ministry of Environment and Urbanization, Provincial Directorate of İstanbul	İstanbul	Engineer
38	Cemal	Kaplan	Ministry of Environment and Urbanization, Provincial Directorate of İstanbul	Samsun	Environmental Engineer
39	Dr. Semin	Altuntaş	Ministry of Environment and Urbanization, Provincial Directorate of İstanbul	Samsun	Chemical Engineer
40	Meral	Kabukçuoğlu	Ministery of Science, Industry and Technology	Ankara	Chemical Engineer
41	Yüksel	Söyleriz	Ministry of Health	Ankara	Chemical Engineer
42	Esra	Şıltu	Ministry of Forestry and Water Affairs	Ankara	Expert
43	Fatih	Ekşi	Eti Bakir Samsun Plant	Samsun	Engineer
44	Fatih	Macit	Eti Bakir Samsun Plant	Samsun	Engineer
45	Mert	Demirdelen	Ministry of Labour and Social Security	Ankara	Expert
46	Mehmet	Dinç	Ministry of Environment and Urbanization, Provincial Directorate of Bilecik	Bilecik	Environmental Engineer

No	Name	Last Name	Institution	City	Title
47	Barış	Güzel	TÜBİTAK	Kocaeli	Researcher
48	Aslı	Çelik	Arslan Alüminyum	Bilecik	Engineer
49	Murat	Negiz	Arslan Alüminyum	Bilecik	Engineer
50	Erhan	Sarıoglu	Ministry of Environment and Urbanization, Directorate General of Environmentaş Impact Assessment, Permit and Inspection	Ankara	Division Head
51	Zafer	Topçu	Ministry of Environment and Urbanization, Directorate General of Environmentaş Impact Assessment, Permit and Inspection	Ankara	Chemical Engineer
52	Hüseyin	Demircan	Ministry of Environment and Urbanization, Directorate General of Environmentaş Impact Assessment, Permit and Inspection	Ankara	Biologist
53	Ahmet	Göktaş	Ministry of Environment and Urbanization, Directorate General of Environmentaş Impact Assessment, Permit and Inspection	Ankara	Environment and Urbanization Expert
54	Abdulkadir	Güven	Küçükarslanlar Copper Zinc Company	Trabzon	Engineer
55	Zeynep	Malkaz	Turkish Steel Producers Association	Ankara	Environmental Engineer

Appendix 3. Industrial Activities Mentioned Annex C of the Stockholm Convention

Sector	NACE Rev 2 Code	Sector Description
Source Categories in Part II of Annex C of the Stockholm Convention		
Thermal Processes in the Metallurgical Industry (i) Secondary Copper Production (ii) Sinter Plants in the I&S Industry (iii) Secondary Aluminium Production (iv) Secondary Zinc Production	(i) 24.44 - Copper production (ii) 24.10 - Manufacture of basic iron and steel and of ferro-alloys (iii) 24.42 - Aluminium production (iv) 24.43 - Lead, zinc and tin production	(i) Secondary copper smelting involves copper production from sources that may include copper scrap, sludge, computer and electronic scrap, 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. (ii) 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. (iii) 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 practiced 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. (iv) Secondary zinc smelting involves the production of zinc from materials such as dusts from copper alloy production and electric arc steel making, and residues from steel scrap shredding and galvanizing processes. Production processes include feed sorting, pretreatment cleaning, crushing, sweating furnaces to 364°C, melting furnaces, refining, distillation and alloying. Contaminants in the feed (including oils and plastics), poor combustion and temperatures between 250°C and 500°C may give rise to chemicals listed in Annex C of the Stockholm Convention.
Source Categories in Part III of Annex C of Stockholm Convention		
Thermal Processes in the Metallurgical Industry Not Mentioned in Annex C Part II (i) Secondary Lead Production (ii) Primary Aluminium Production (iii) Magnesium Production (iv) Secondary Steel Production (v) Primary Base Metals Smelting	(i) 24.43 - Lead, zinc and tin production (ii) 24.42 - Aluminium production (iii) 24.45 - Other non-ferrous metal production (iv) 24.10 - Manufacture of basic iron and steel and of ferro-alloys	(i) Secondary lead smelting involves the production of lead and lead alloys, primarily from scrap automobile batteries, and also from other used lead sources (pipe, solder, drosses, lead sheathing). Production processes include scrap pretreatment, smelting and refining. (ii) Primary aluminium is produced directly from the mined ore, bauxite. The bauxite is refined into alumina through the Bayer process. The alumina is reduced into metallic aluminium by electrolysis through the Hall-Héroult process (either using self-baking anodes – Söderberg anodes – or using prebaked anodes). Contamination with PCDD and PCDF is possible through the graphite-based electrodes used in the electrolytic smelting process. (iii) Magnesium production process from magnesium oxide resources; The Pidgeon process (thermal reduction process)

		(iv) Secondary steel is produced through direct smelting of ferrous scrap using electric arc furnaces. The furnace melts and refines a metallic charge of scrap steel to produce carbon, alloy and stainless steels at non-integrated steel mills. Ferrous feed materials may include scrap, such as shredded vehicles and metal turnings, or direct reduced iron. In addition scrap may be added to other melting furnaces in the foundry and primary iron and steel sectors. (v) Primary base metals smelting involves the extraction and refining of nickel, lead, copper, zinc and cobalt. Generally, primary base metals smelting facilities process ore concentrates. Most primary smelters have the technical capability to supplement primary concentrate feed with secondary materials (e.g. recyclables). Production techniques may include pyrometallurgical or hydrometallurgical processes. Chemicals listed in Annex C of the Stockholm Convention are thought to originate through high-temperature thermal metallurgical processes; hydrometallurgical processes are therefore not considered.

Appendix 4. POPs subjected to banning in Turkey

Compound	CAS No	EC No
DDT	50-29-3	200-024-3
Chlordane	57-74-9	200-349-0
Hexachlorocyclohexane including Lİndane	58-89-9 319-84-6 319-85-7 608-73-1	200-401-2 206-270-8 206-271-3 210-168-9
Dieldrin	60-57-1	200-484-5
Endrin	72-20-8	200-775-7
Heptachlor	76-44-8	200-962-3
Endosulfan	115-29-7 959-98-8 33213-65-9	204-079-4
Hexachlorobenzene	118-74-1	200-273-9
Chlordecone	143-50-0	205-601-3
Aldrin	309-00-2	206-215-8
Pentachlorobenzene	608-93-5	210-172-5
Mirex	2385-85-5	219-196-6
Toxaphene	8001-35-2	232-283-3
Hexabromobiphenyl	36355-01-8	252-994-2