TECHNICAL ASSISTANCE FOR IMPLEMENTATION OF THE PERSISTENT ORGANIC POLLUTANTS REGULATION IN TURKEY.
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Sectoral Impact Assessment (SIA) of implementing the EU Persistent Organic Pollutants Regulation in Turkey

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Prepared by Dr. Peter Futo, Senior Short Term Expert

Mr. Arda Karluvari, Local Expert.

Team Leader: Prof. RNDr. Ivan Holoubek, CSc.

Table of Contents

Detailed Table of Contents

1. Executive Summary

This Sectoral Impact Assessment Report has the following functions: (a) to identify those industrial and service sectors that are predominantly affected by the upcoming introduction and enforcement of the EU POPs Regulation in Turkey, (b) to describe the present situation of these sectors with special respect to those techniques which are associated with use or emission of POPs and (b) to give projections on some of the expected impacts of this regulatory change on these sectors.

Policy implications. Introducing the POPs Regulation implies the implementation of the 15 Activities of the Action Plan which has been detailed in the NIP 2014 document. This includes a wide range of Government activities such as raising awareness, drafting chemical safety legislation, developing the associated Government agencies, enforcing the above regulations and inspecting compliance in co-operation with a wide range of Government bodies and industrial stakeholders. The Government has sufficient time and a wide room for maneuvering in designing and implementing the measures associated with the introduction of the EU POPs Regulation. There are open possibilities of selecting optimal policy alternatives regarding (a) the timing of the transposition of EU POPs regulation and (b) the preferences and / or subsidies to be given for small and medium sized industries. The benefits of this evolving policy area will materialize in terms of improvements of public health, better environmental performance, better access to overseas markets for Turkish products, improved international image of Turkey. The costs of the ambitious implementation programme will be financed by the international community, by the budget of the Turkish Government and by the affected industrial stakeholders.

The summary of expected impacts on the investigated sectors goes as follows.

Waste management. The stakeholders affected mostly by the POPs regulation in waste management are municipalities, public and private waste management companies. It is to be assumed, that with the gradual spreading of waste incineration in Turkey, the waste management sector will have to invest heavily into POPs pollution abatement techniques and decontamination measures. The major cost items of dioxin reducing technologies in hazardous waste incinerators are activated carbon injection systems and bag filters. Further significant investments will be needed for collecting and destroying PCBs containing equipment by selectively applying the techniques of retrofilling, recycling and incineration. Another task of waste management services associated with POPs is the treatment of flame-retardant containing wastes – textile products, upholstery, wall panels that may have ended up on landfills or may reach waste facilities some time in the future. The enforcement of the POPs regulation has the potential to generate additional business and income for the environment protection sector, in particular for waste management firms, but the increased demand for SC-compliant disposal and treatment of wastes will be matched by additional costs to other sectors.

Agriculture, fisheries and food processing. Since all POP-pesticides identified by the Stockholm Convention are banned in Turkey, an introduction of the EU POPs Regulation will not have substantial impacts on farming. However, impacts are to be expected in the identification of residues such as stockpiles and contaminated areas, and in the monitoring of food supply for POPs residues with the help of laboratories. The major cost items are associated with the identification and destruction of stockpiles and residues of POPs containing pesticides and with the improvement of food safety laboratory capacities, with special respect to the designation of private food laboratories for POPs measurement. The elimination of POPs pesticides residues for the environment and from the food chain will bring benefits in terms of improved food safety, improved "clean and green" image of Turkey´s agricultural products.

Metallurgy. Metallurgy companies have recently made significant investments recently to abate dioxin/furan emissions, but it is to be assumed, that the industry will have to invest significantly more into UPOPs pollution abatement techniques than other manufacturing industries. The bulk of the additional needed investment will have to go into Flue Gas Treatment systems and waste management practices. Plants applying BOF (Basic Oxygen Furnace) technology will have to invest significantly more than plants applying EAF (Electric Arc Furnace) technology, both in the ferrous and non-ferrous metallurgy sub-sectors. In most cases these investments will be necessary not only for satisfying the requirements of the EU POPs Regulation, but also for improving compliance with the IED (previously: IPPC) Directive.

Electric Power Generation, Transmission and Distribution. The main reason of why this sector has been selected for investigation is the fact, that it is in these industries that the biggest amount of PCB containing transformers and other PCBs containing electric equipment are used and stockpiled. In large, well-controlled fossil fuel-fired power plants, the formation of dioxin, furan and other persistent organic pollutants is low, because combustion efficiency is usually high, the process is stable and the fuels used are generally homogeneous. Combustion plants will have to invest substantial amounts into pollution abatement techniques due to IPPC/ IED By-law and the POPs By-law, but it is not possible to separate the cost consequences of these regulations. Electricity companies stockpile large amount of PCBs containing equipment, and the cost of collection and destruction will be high. Nevertheless, it is recommended for the Government to increase competition in the field of environmental services and specifically to facilitate the entry of new firms in the field of collecting and disposing of PCBs containing equipment.[1] An immediate consequence of such measures will be a healthy competition of designated and controlled firms that will reduce the fee of environmental services, and will facilitate the enforcement of the existing PCBs related regulations[2] and of the future POPs Bylaw.

[1] Publications and stakeholder interviews show that Izaydas, the public hazardous waste incineration company has effectively a monopoly on the disposal of PCB containing equipment in Turkey. See e.g. page 34 of the document "International POPs Elimination Project. Fostering Active and Efficient Civil Society Participation in Preparation for Implementation of the Stockholm Convention. Country Situation Report on POPs in Turkey. By Sebnem Melis Yarman and Bumerang. Turkey, April 2006. Source: http://ipen.org/sites/default/files/documents/5tur_turkey_country_situation_report-en.pdf

[2] "By-Law on Control of Polychlorinated Biphenyls and Polychlorinated Terphenyls" published in the Official Gazette dated 27.12.2007

Chemical Industry. The major cost item for the chemical industry will be to reduce unintentionally emitted by-products (dioxin, furan, PAHs, etc.) of certain chemical processes, e.g. of PVC production. Cost will appear in waste management in the first place, because most UPOPs are emitted in the residues of the chemical processes. The Stockholm Convention's BAT/BEP procedures have been partly introduced in the sector, but further development is needed. The major benefit items are connected with the research, development and sales of new alternative, POPs-free chemicals. The need to replace intentionally produced industrial POPs in articles with alternatives is both a cost and a benefit for the chemical industry. In particular, the production of alternatives to brominated fire retardants in isolation materials (HBCD in XPS), packaging materials (HBCD in EPS) and firefighting foams (PFOS) will be a clear benefit for innovative companies producing or importing these alternatives, but it will be a cost burden for firms which will have to purchase and apply expensive alternative compounds in their products.

Cement industry. The specific cost items attributable to UPOPs reduction in case of waste co-incineration technology are as follows: cost of pre-treatment processes of input material, organization of operational conditions for the complete destruction of organics and installing efficient flue gas treatment systems with special respect to dioxin control. During the last decade the Turkish cement industry implemented substantial investments for flue gas treatment especially for reduction of dust and NO_x parameters. As a side effect or collateral benefit, also POPs emissions, in particular dioxin emissions were lowered. The emission values are very low and satisfy the limit values defined in By-law on Waste Incineration and By-law on Industrial Air Pollution Control. Therefore in the cement industry there is no need for investment of a special process for reduction of POPs related emissions.

Textile industry. The primary sources of PCDD/Fs contamination in textiles and leather goods are the chemicals applied in the respective production or finishing stages of the respective production technology. Chemicals used for bleaching and dyeing the final textile products and protecting them from fungi might be contaminated with POPs. Fire retardants used for carpets, upholstery and other products may include POPs. In the textile sector of Turkey the biggest environmental cost will be associated with the introduction of wastewater treatment facilities according to the IPPC BAT/BEP techniques specific for this sector. In comparison to the cost of the above mentioned IPPC-compliant wastewater treatment facilities, it will be somewhat less expensive to address the specific environmental concerns associated with POPs, i.e. to introduce pollution abatement technologies suitable for eliminating POPs – PCDD/Fs emissions, and to substitute POP brominated flame retardants with less harmful substances.

2. Aims and methods of SIA activity

Sectoral Impact Assessment is part of Activity 3 of the POPs T.A. Project, and its aims have been described in the ToR and in the Inception Report of the present Project[3].

SIA is a research and consulting activity which identifies the sectors and stakeholders affected by the regulation, defines policy options and collects data about the present activities leading to POPs emissions, and about expected impacts of the relevant policy decisions. The results of the SIA results serve as inputs to the subsequent Regulatory Impact Assessment (RIA) activity.

SIA is a fact-finding activity in sectoral detail. This means that for each investigated sector those presently ongoing industrial, agricultural and service activities should be shown that lead to use and emission of POPs, and inferences should be made to the expected impacts of complying with the main obligations of the Stockholm Convention[4] and the EU POPs Regulation[5].

Cost and benefit items for which information is available and accessible are identified at a qualitative level. This means that in the SIA component of the research the mechanisms leading to costs and benefits are assessed and explained.

SIA facilitates consultations between the Government of Turkey and stakeholders of the economy and of the society that are affected by the transposition, introduction and enforcement of the EU POPs regulation.

[3] Technical Assistance for Implementation of the Persistent Organic Pollutants Regulation in Turkey. Project Identification No: EuropeAid/132428/D/SER/TR. Contract No: TR0327.03-01/001. Inception Report.

[4] These obligations are explained in the document "Guidance on Calculation of Action Plan Costs for Specific Persistent Organic Pollutants".

[5] Regulation (EC) No 850/2004 and its amendments: the Commission Regulation (EU) No 757/2010 of 24 August 2010 and Commission Regulation (EU) No 756/2010 of 24 August 2010.

The methodology of the present SIA research is based on the general impact assessment guideline of the EU[6] (applicable for any policy area), on the sectoral competitiveness and impact assessment guide of the EU[7] (applicable for any policy area), on the POPs-specific method of socio-economic impact assessment recommended by the SC[8] and on the POPs-specific cost assessment guideline of the SC[9].

Method. SIA investigation was based on the following information sources:

- *Desk* research was an important source of information, which included the study of statistical sources, research articles, SC and EU guidelines, official documents and reports, analogous impact assessment studies and stakeholder consultation documents[10] made by the European Commission or by Governments of various EU Member States.
- *The field research* contained a questionnaire-based survey for companies; another questionnaire based survey for sectoral experts, and various site visits and interviews in companies and professional associations.[11]

[6] Commission Impact Assessment Guidelines, 2009. Source: http://ec.europa.eu/smart-regulation/impact/commission_guidelines/commission_guidelines_en.htm

[7] Operational Guidance for Assessing Impacts on Sectoral Competitiveness within the Commission Impact Assessment System - A "Competitiveness Proofing" Toolkit for use in Impact Assessments. (DG Enterprise and Industry, 2012). Source: http://ec.europa.eu/smart-regulation/impact/key_docs/docs/sec_2012_0091_en.pdf

[8] Draft guidance on socio-economic assessment for national implementation plan development and implementation under the Stockholm Convention. 2007. Source: http://chm.pops.int/Implementation/NIPs/Guidance/GuidanceonSocioEconomicAssessment/tabid/3168/

[9] Guidance on Calculation of Action Plan Costs for Specific Persistent Organic Pollutants, 2012. Published jointly by SSC, UNEP, UNIDO, UNITAR.

[10] Consultation on Update of the European Union's Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants (POPs). Source: http://ec.europa.eu/environment/consultations/pops_en.htm .

[11] The questionnaires and the responses to them, moreover the memos of the interviews / site visits are in the Appendix of this document.

3. Assessing the impacts by sectors/stakeholders

3.1. Waste management

3.1.1. Waste disposal in Turkey with special respect to POPs

TurkStat has published the major statistical figures on waste disposal and recovery.

Waste Disposal and Recovery Facilities, Turkey, 2012[12]

Facility type		Number of facilities	Waste treated (million tons / year)
Waste Disposal Facilities		**83**	**24.22**
	Controlled landfill sites	*80*	*24.17*
	Incineration plants	*3*	*0.05*
Waste Recovery Facilities		**589**	**10.23**
	Composting plants	*6*	*0.15*
	Co-incineration plants	*32*	*0.54*
	Other recovery facilities	*551*	*9.53*

The basic characteristics of various waste streams in Turkey goes as follows.

Municipal Solid Waste Management. Altogether 25.9 million tons of municipal solid waste (MSW) was collected in 2012. The most common disposal methods are: sending waste to landfills (59.9%) and dumpsites (37.8%)[13]. The number of landfills increased from 15 to 69 in 9 years. According to the plans, 32 new MSW landfills are to be constructed.

Specific challenges of landfills associated with POPs are as follows:

- *Brominated flame retardants (BFR) in landfills and dumpsites.* These sites, scattered all over the country may be potentially contaminated with POP-PBDEs and other BFRs, that have been used mostly in textiles, furniture and electric equipment. Further research is required (a) to identify all the sectors and locations involved and (b) to estimate the associated cost of collection and destruction.
- *Leachates*[14]. Turkish legislation does not require the monitoring of any POPs in leachates flowing from landfills, but the interviewed experts[15] assume that the POPs concentration of the fluid is low.

[12] Source: "Waste Disposal and Recovery Facilities Statistics, 2012. Published by Turkstat, http://www.turkstat.gov.tr/PreHaberBultenleri.do?id=16177.

[13] Turkish statistical system differentiates between landfills (Düzenli Depolama) and local dumpsites (Belediye Çöplügü).

[14] Leachate in this context is water or any other liquid that passed through the landfill.

[15] See the interview made at ISTAC in the Annex of this document.

Landfill regulations. The legal environment of POPs management in case of landfills is determined by the following regulations:

- The *By-law* on *Landfill of waste* (No:27533 2012/03) defined the following Landfill Classes : Class I: Hazardous Waste[16], Class II: Municipal / Non-hazardous Waste and Class III: Inert waste[17]. Class III has an acceptance criterion of maximum PCBs content: 1 mg/kg. The other two landfill classes have no direct POPs limit.
- Moreover, Turkey is signatory of the "Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal"[18] since 1994, and also signed the Amendment to the Basel Convention in 2003. This implies that in particular, Turkey must comply with the stipulations on POPs of that Convention, with special respect to the PCBs, PCDD/Fs and POP pesticide content of wastes.

Sewage Sludge Management. Sewage sludge is under responsibility of municipality but not managed as municipal waste. Till 2015, sewage sludge with 50% dry matter can be sent to municipal landfills and treated as Class II waste. There are POPs limit values defined for sludge in By-law on Agricultural Use of Sewage Sludge. There exists only one sewage sludge incineration plant in Turkey.[19] An increase in sludge treatment projects like incineration, co-incineration, composting, etc is to be expected in the near future. The respective cost assessment will have to take into consideration the cost of preventing UPOPs emission in case of sludge incineration and co-incineration.

Composting. The relevant Turkish regulation[20] defines no POPs related limit value for composting, but interviews with expert stakeholders[21] have highlighted that there is a need to stipulate such limit values.

[16] Definition: Hazardous waste is waste that poses substantial or potential threats to public health or the environment. Characteristic hazardous wastes are materials that are known or tested to exhibit one or more of the following four hazardous traits: ignitability (i.e., flammable), reactivity, corrosivity, toxicity. Listed hazardous wastes are materials specifically listed by regulatory authorities as a hazardous waste which are from non-specific sources, specific sources, or discarded chemical products. For more information see: http://ec.europa.eu/environment/waste/hazardous_index.htm

[17] Inert waste is waste which is neither chemically or biologically reactive and will not decompose. Examples of this are sand, drywall, and concrete. This has particular relevance to landfills as inert waste typically requires lower disposal fees than biodegradable waste or hazardous waste. For more information see: http://ec.europa.eu/environment/waste/landfill_index.htm

[18] http://www.basel.int/Portals/4/Basel%20Convention/docs/text/BaselConventionText-e.pdf

[19] GASKİ (Gaziantep Water and Sewerage Administration) Sewage Sludge Thermal Drying and Incineration Plant (300 tons/day). Moreover, BUSKİ (Bursa Water and Sewerage Administration) Sewage Sludge Incineration Plant is in tendering procedure. (Will have 400 tons/day capacity)

[20] See By-law on Control of Soil Pollution.

[21] See the memo if the interview with ISTAC Istanbul Environmental Protection and Waste Processing Corporation in the Annex of this document.

Hazardous Waste (HW) Management. In Turkey in 2012 altogether 21 692 companies used the Hazardous Waste Notification System (TABS) and 806 000 tons of hazardous waste was produced. Out of this 55 000 tons of HW was treated in incineration and co-incineration plants. There exist 2 hazardous waste incineration plants in Turkey.[22] Moreover, 33 cement and lime production plants are licensed for co-incineration.[23]

Medical Waste Management. The quantity of medical waste disposed of is 84 000 tons/year. The main medical waste treatment method in Turkey is autoclaving[24]. The sterilized wastes are sent to landfill after shredding. The technique has no impact on PCDD/Fs emissions. There exits 42 sterilization plants giving service to 79 provinces. Medical waste incineration takes place in 2 plants.[25] The By-law on Control of Medical Waste has changed on 21 March 2014, which used to declare that provinces producing more than 10 tons /day medical waste must install medical waste incineration plants)

PCBs contaminated equipment[26]. The main characteristics of the build-up and disposal of this highly toxic waste stream in Turkey are as follows.

- *The challenge.* Although no PCBs are manufactured in Turkey, many were imported to be used in industrial applications. The use of PCBs was banned in 1995. In spite of the fact that between the years 1997 and 2007 a fairly large portion of PCBs containing equipments has been disposed off[27], large amounts[28] of waste containing PCBs are inventoried in the Environmental Information System (EIS). Electricity companies possess large quantities of phased out PCB oil containing transformers and face a great challenge when storing this type of equipment.[29]
- *Legal environment.* The By-law[30] on Control of PCBs and PCTs stipulates that all wastes containing more than 50 ppm of PCBs (50 mg/kg) are considered to be PCBs, and that all PCB and PCB contaminated equipment are to be disposed of.

[22] IZAYDAŞ (35 000 tons/year) and PETKIM (17 500 tons/year).
[23] For much more details on unintentional POPs emission of co-incinerating cement plants see the chapter on cement industry of this document.
[24] Autoclaving is the exposure of waste to saturated steam under pressure in a pressure vessel or autoclave. Minimum requirement for the treatment cycle is 121°C for 30 minutes.
[25] Izaydas (Izmit Waste and Residue Treatment, Incineration and Recycling Co Inc) incinerates only pathological wastes. Istanbul Metropolitan Municipality owns a 24 tons/day medical waste incineration plant (operated by ISTAC A.Ş., i.e Istanbul Environmental Protection and Waste Processing Corporation).
[26] For much more details on PBD containing equipment see the chapter on the electric industry in this document.
[27] 3 655 tons of PCB containing material and equipment has been incinerated in IZAYDAS and 15 531 tons of PCB containing material and equipment has been exported abroad to be disposed off
[28] In 2011, 450 tons of PCBs were registered.
[29] Interview with MSG-MESS Integrated Recovery and Energy Co.
[30] By-law on Control of Polychlorinated Biphenyls and Polychlorinated Terphenyls. 21. January 2007. Full implementation date of the By-Law is 2025. Harmonises the EU Directive 96/59/EC issued in 1996 on the destruction of PCBs.

- *Enforcement practice and cost.* There is no infrastructure for integrated disposal of PCBs contaminated equipment in Turkey. [31] As of now, the exportation of transformers is the only solution. The transformer has to be emptied before exportation. The PCBs oil and the metal case and circuits are separately transported and disposed. The cost of thermal treatment of special waste: 500 - 800 € /ton. Total cost of exportation to EU including transportation and notification: 1 500 – 1 800 € / ton. In Turkey the only company ready to collect this type of hazardous waste is Izaydas[32]. The fee of disposal to be paid by companies to Izaydas is very high. The collected samples are transported to European waste disposal facilities. These efforts can be interpreted as compliance with the PCB legislation[33] in force.

End of life Vehicles –Shredder. There exists 9 licensed end of life vehicle treatment facilities in Turkey. PCDD/Fs and PCBs released from shredder plants are from oils, dielectric fluids, and other materials contained in these vehicles. Generally the emissions are very low. Measures to prevent accidental fires should be in place at shredder plants. PUR foams in vehicles contain PBDEs. No limit value is identified yet for PBDEs in waste management. These wastes are currently landfilled and recycled.

Waste Electrical and Electronic Equipment (WEEE) Management. Today Turkey deals with 539 000 tons of WEEE yearly[34], which increases at an average growth per year by 5%. Currently, formal collection and treatment of WEEE is less than 1% of the total EEE. Scrap dealers and various informal operators collect and treat WEEE. These agents usually treat WEEE without environmental and health concerns, creating significant environmental harm, health problems and labor safety risks for themselves and the population. Municipal household wastes, including waste of electrical equipment are sorted manually by workers in sorting plants for recycling [35]. There are 10 licensed plants for treatment of WEEE. The plants only collect WEEE, dismantle the parts or feed to shredder. Usage of PBDEs is banned by limiting production of EEE with PBDEs content above 0.1% (1 000 ppm)[36]. PBDEs is mainly found in ABS plastics. No limit values are defined for waste management, therefore these wastes are currently landfilled and recycled. There is no refinery for recovery of precious metals from circuit boards. Some WEEE is being exported mainly to China.

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[31] İzmit Purifying, Incinerating and Recycling Of Wastes And Residues Inc. Website: http://www.izaydas.com.tr . Annual Report in English: http://www.izaydas.com.tr/files/IZAYDAS%20Annual%20Report%202010.pdf.

[32] İzmit Purifying, Incinerating and Recycling Of Wastes And Residues Inc. Website: http://www.izaydas.com.tr . Annual Report in English: http://www.izaydas.com.tr/files/IZAYDAS%20Annual%20Report%202010.pdf.

[33] "By-Law on Control of Polychlorinated Biphenyls and Polychlorinated Terphenyls" published in the Official Gazette dated 27.12.2007.

[34] Regulatory Impact Assessment of the EU Waste Electrical and Electronic Equipment (WEEE) Directive (2002/96/EC). Authors: Sayman, Rıfat Ünal (lead author) Regional Environmental Center (REC) Turkey, Akpulat, Onur Regional Environmental Center (REC) Turkey, Cordova-Novion, Cesar Jacobs, Cordova & Associates.

[35] Interview with MSG-MESS Integrated Recovery and Energy Co.

[36] See Appendix 2 of "Regulation on the Control of Waste Electrical and Electronic Equipments". Tuesday, 22 May 2012, Official Gazette, Number: 28300, Regulation of Ministry of Environment and Urban Development: Source: http://turkey.erp-recycling.org/weee_law.

POPs in Turkish stockpiles and contaminated sites[37]. A large amount of POPs can be found in stockpiles, wastes and contaminated sites. Some lessons learnt from the POPs Inventory are as follows:

- *Pesticides.* There is no known POPs stockpile other than the 2 700 tons HCHs (hexachlocyclohexanes) stockpile located in Derince, Kocaeli province. The stockpile will be disposed of between 2014 and 2017, in the framework of a project financed by GEF.
- *PFOS.* There are no data available on PFOS wastes, stockpiles and PFOS contaminated sites.
- *UPOPs.* There is very limited information on the historical activities that have caused or could have caused PCDD/Fs contamination, and similarly there is a lack of information on the contamination levels in various environments (including air, soil, water or sediments) in Turkey. Possibly contaminated sites are as follows:
    - on the present and former locations of chlor-alkali production [38]
    - on the present and former locations of chloranil, PCP and dye production,
    - on the present and former locations of the metallurgy industry,[39]
    - on the locations of registered fires that broke out in chemistry plants,
    - in and around mining facilities[40] of kaolinic and ball clay[41].

Construction / demolition waste. The Action Plan of NIP 2014 stipulates[42] that a periodical update of the inventory of brominated flame retardants such as insulation materials and PUR foams, and that an assessment of the respective waste flows is also necessary.

[37] Source of information: NIP 2014: National Implementation Plan of Persistent Organic Pollutants (POPs) Management in Turkey. Ministry of Environment and Urbanization of Turkey. August 2014. Authors: Prof. RNDr. Ivan Holoubek, CSc., Assoc. Prof. İpek İmamoğlu, Ph.D., Gülün Egeli, M.Sc., Esra Şıltu, M.Sc. in co-operation with: Ms. Bursev Doğan Artukoğlu, Mr. Ahmet Daşkın, Mr. Mahmut Osmanbaşoğlu, Mr. Ertan Öztürk.

[38] Located predominantly in Aliağa (Izmir Province) and in Körfez (Kocaeli Province)

[39] Located predominantly in four regions, i.e., west part of Black Sea region, Marmara Region, İzmir and İskenderun-Osmaniye Region.

[40] Located predominantly in in the areas of İstanbul (Şile, Kemerburgaz), Balıkesir (Düvertepe, Gönen), Bursa (Mustafakemalpaşa), Eskişehir (Mihalıççık), Çanakkale (Çan), Kütahya (Emet), Nevşehir (Avanos) and Bilecik (Söğüt).

[41] According to recent research results, dioxin contained in clay is of natural origin. Source: "Summary of Evidence for the Possible Natural Formation of Dioxins in Mined Clay Products" By Joseph Ferrario, Christian Byrne, David Cleverly. 20th International Symposium on Halogenated Environmental Organic Pollutants & POPS, 2000. Downloaded from http://www.epa.gov/ncea/pdfs/dioxin/dei/newclay5.pdf

[42] See "Activity 4: Production, import and export, use, stockpiles, and wastes of brominated flame retardants" in NIP 2014.

3.1.2. Waste incineration and its unintentional POPs emission in Turkey

Waste incinerators burning hazardous or municipal wastes which contain chlorine can exhibit high dioxin concentrations[43].

Estimated quantity of unintentionally emitted dioxin and furan by waste incineration. Turkey 2013.[44]

	Source Groups	Annual Releases (g TEQ/a)					
Group		Air	Water	Land	Product	Residue	Total
1	Waste Incineration	62.8	0	0	0	1.3	64.1

In Turkey there are three waste incinerators[45]: two hazardous waste incinerators in Izmit, Kocaeli and Aliaga, İzmir, and one medical waste incinerator in Kemerburgaz, Istanbul. According to new legislation, after 2014 municipalities producing more than 10 tons/day of medical waste must install an incineration plant[46].

More detailed data on the above mentioned plants are as follows:

- The hazardous waste incinerator in Izmit, Kocaeli started to operate in 1997. The incineration capacity of this plant is 35 000 ton/year. The amount of wastes combusted is given as 33 374 tons for 2012[47].
- The medical waste incinerator (ISTAÇ) constructed by the Istanbul Municipality and working in Odayeri/Gediktürk with a capacity of 24 tons/day, burning 8 760 ton per year medical wastes[48] The emission of dioxin/furan controlled every 6 months. The sampling job is outsourced and the measurements are done at Tubitak. The measurement range is around 0.02 - 0.06 ng/Nm^3, which is slightly less than 0.1 ng/Nm^3 limit value. If wet scrubbers were installed, the measurement values could be improved down to 0.001 ng/Nm^3. Fly ash from bag filters is landfilled in the hazardous waste landfill of ISTAC. This includes the injected active carbon filled with dioxin/furan.

In general, the existing Turkish waste incinerators have good air pollution control systems at the present, and PCDDs/Fs levels measured in the flue gas are lower than the emission limit of 0.1 ng TEQ Nm^{-3}. Therefore contaminated sites via deposition from air releases are not expected. Fly ashes and other residues of the incinerators are disposed to landfills designed for industrial wastes.

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[43] Dioxins and Furans in the Chemical Industry. By Dr. Arseen Seys. Source: http://www.chem.unep.ch/pops/POPs_Inc/proceedings/stpetbrg/seys.htm

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

[45] Source: NIP 2014: National Implementation Plan of Persistent Organic Pollutants (POPs) Management in Turkey. Ministry of Environment and Urbanization of Turkey. August 2014.

[46] Interview ISTAC Istanbul Environmental Protection and Waste Processing Corp

[47] IZAYDAS Annual Activity Report (in Turkish)
http://www.izaydas.com.tr/files/2012_yillik_faaliyet_raporu.pdf

[48] ISTAC website (in Turkish) (http://www.istac.com.tr/hizmetler/tibbi-atiklar/tibbi-atiklarin-yakilarak-bertarafi.aspx)

3.1.3. POP abatement techniques in waste management [49]

Operating conditions of incineration plants. Modern incinerator plants can be designed and operated to achieve nearly complete destruction of the combustible portion of the waste with very low emission. The following practical measures should be adopted to reduce emission of dioxin and furan by municipal solid waste/hazardous waste incinerators.

- Proper segregation of waste. PVC in garbage affects the amount of dioxin formation. A minimization of chlorine input is required.
- Avoid combustion of wet garbage, as the wet garbage produces more dioxin.
- Good combustion chamber design to optimize the supply of air for achieving more complete destruction of waste.
- The flue gas resulting from the combustion process is raised to a temperature to 850°C for at least 2 seconds in municipal waste incinerator or to a temperature of 1 100°C for at least 2 seconds for hazardous waste incinerators for destruction of dioxin in the flue gas.
- Quick cooling of flue gas to minimize dioxin reformation between 200°C to 400°C.
- Regular cleaning of boiler tubes to prevent the build up of fly ash, which can serve as a catalyst for dioxin reformation.
- Facilities for injection of activated carbon by powered injection system, which is operated in parallel with the alarm warning system to capture any dioxin, if reformed, for treatment.
- Regular monitoring of combustion products including dioxin emissions.
- Suspension of waste feeding operation to allow urgent trouble shooting and problem-fixing, in cases of abnormal air emission or incinerator temperature.

Landfills. In a landfill, the waste is deposited in layers in prepared cells and compacted to decrease its volume. It is then covered, at least daily, with a suitable soil-like material to deter vermin, flies, birds and other scavengers[50]. İf compared to waste incinerators, landfills and dumpsites are considered to contribute much less emissions of chemicals listed in Annex C of the Stockholm Convention. Nevertheless, environmental, public health, nuisance and animal health issues should be considered. The following POPs-related risks are associated with landfills[51]:

- the burning of landfill sites,
- the presence of substances or wastes liable to spontaneous combustion,
- the presence of substances or wastes which, in contact with water, emit flammable gases;
- halogenated organic compounds formed during the burning of landfill gas

[49] This chapter is based on the BAT-BEP Guide of the Stockholm Convention and on the following document: "Waste Management: Current Situation and Guidance on POPs" Power Point presentation by Arda Karluvali, Rast Engineering Services Ltd. Technical Assistance for Implementation of the Persistent Organic Pollutants Regulation EuropeAid/132428/D/SER/TR. 7th Training of Trainers. Hotel Ilıca Çeşme, İzmir, Turkey, 26-30/05/2014.

[50] SC BAT-BEP Guide.

[51] SC BAT-BEP Guide.

- halogenated organic compounds becoming dissolved in water in the landfill site producing toxic leachate flowing to the groundwater and surface waters.

Treatment solutions for PCB-containing transformers. The PCBs transformer decontamination and rehabilitation process goes as follows.

- *Retrofilling.* Transformers that are in good electrical condition, whose initial PCBs content is less than 500 ppm, can be rehabilitated. After being emptied and decontaminated, the transformers are filled with a new oil that is free of PCBs.
- *Recycling.* Transformers that cannot be rehabilitated are decontaminated and then used for recovery.
- *Incineration.* PCBs waste elimination process. The oils and waste contaminated with PCBs are incinerated in a kiln at 1 200°C.

3.1.4. Impact assessment considerations

The stakeholders affected mostly by the POPs regulation in waste management are municipalities, public and private waste management companies. It is to be assumed, that the waste management sector will have to invest heavily into POPs pollution abatement techniques and decontamination measures.

Availability of cost information. There is no comprehensive or summarised cost information on the investment needs of the waste management sector industry for abating POPs emission. Some examples of the sporadic, "anecdotal" evidence on this issue are as follows.

The major cost items of dioxin reducing technologies in hazardous waste incinerators are as follows[52]

- *Activated carbon injection system.* In its medical waste incinerator ISTAC installed an *activated carbon injection system* for control of dioxin/furan. The investment cost was 100 000 € and the operation cost is around 10 000 €/year.
- *Activated carbon bed.* Another technology used in industry for dioxin/furan emissions is *activated carbon bed*. The investment cost would in that case be around 300 000 – 400 000 € and the operation costs 50 000 €/year.
- *Bag filter*. The investment cost of *bag filter,* which is installed for catching dust emissions, is around 500 000 € and the operation cost is 5€/m^3 of medical waste. It is necessary to apply bag filters even in the absence of POPs, therefore this cost can not be justified by preventing POPs. On the other hand, in the presence of dioxin/furan, the capacity of the bag filter shall be increased. In this case the estimated additional investment cost for is 200 000 € (100 000 for increasing the capacity of the bag filter and 100 000 for installing an activated carbon injection system) and the operation cost is 30 000 €/year.

[52] Source: Interview at ISTAC, see Annex of this document.

In case of a planned hazardous waste incinerator, the following cost information for POPs pollution abatement techniques was obtained[53]:

- Investment cost of a flue gas treatment system with a bag filter: 50 million €
- Installation of an activated carbon system costs around 5 million €.

Further significant investments will be needed for collecting and destroying PCBs containing equipment by selectively applying the techniques of retrofilling, recycling and incineration. However, the cost of this future investment should be attributed both to the existing PCB Regulation in force[54] and to the future POPs Bylaw.

Additional investments will be needed for treating brominated flame-retardant containing wastes such as textile products, upholstery, wall panels that may have ended up on landfills or may reach waste facilities some time in the future.

Benefits. The enforcement of the POPs regulation has the potential to generate additional business and income for the environmental protection sector, in particular for waste management firms. Increased demand for SC-compliant disposal and treatment of wastes will be matched by additional costs to other sectors; therefore these impacts are distributional in nature, rather than genuinely incremental.

3.2. Agriculture, fisheries and food processing

3.2.1. Capacities and activities of the sector in Turkey

Agriculture. The size of areas used for agricultural production was almost 39 million hectares in 2009 which approximately the half of the country. Turkey is the major net exporter of fruit and vegetables to the European Union. Exports of agricultural products accounted for about 9 percent of total exports in 2005. In 2004, Turkey ranked among the top 10 exporters of several agricultural products, including hazelnuts, cherries, and apricots[55]. In 2010 Turkey exported agricultural products with a value of 2 895 million euros[56].

Fisheries[57]. Turkey has a large capacity of fisheries resources. The total fish production was 653 080 tons in 2010, out of which 167 141 tons were produced by aquaculture farms. In 2010 in Turkey there were 1 587 inland fish farms and 348 marine fish farms. Approximately 25 000 people are employed in the sector. The main representatives of the stakeholders are various associations[58] and 16 Producer Organizations.

[53] Interview with MSG-MESS Integrated Recovery and Energy Co.
[54] "By-Law on Control of Polychlorinated Biphenyls and Polychlorinated Terphenyls" published in the Official Gazette dated 27.12.2007.
[55] The World Bank (2007): Integrating Environment into Agriculture and Forestry Progress and Prospects in Eastern Europe and Central Asia
[56] European Commission (2009): Turkey country profile, Agriculture and Enlargement
[57] Country Report Country Report on Fisheries and Aquaculture. By Hayri Deniz – National Coordinator Ministry of Food Agriculture and Livestock. Year: after 2010. Source: http://www.eurofish.dk/pdfs/Istanbul-presentations/Countries/Turkey.pdf
[58] e.g. Aquaculture Association, Fish Farmer Association, Fish Promotion Association.

The Food and Beverages Industry. According to the 2002 survey of TurkStat on working places, in the food and beverage manufacturing sector a total of 247 769 employees work in a total of 30 649 enterprises. Out of this, 31.5% of the employees in the sector are employed in bread, fresh oven products and cake production sub-sector. The food and beverage sector's capacity to provide employment is higher compared to other sectors. The food sector, unlike the other sectors, is distributed more homogeneously between regions. Production will be frequently located in regions where vertical integration (agriculture-industry cooperation) is well established[59].

According to the data issued by the Industry Database of Union of Chambers and Commodity Exchanges of Turkey (TOBB), the number of active companies in the food and beverage industry in 2008 was 22 092. The majority of the Turkish food and beverage sector is formed of SMEs, which are mostly privately held[60]. According to other data sources the number of food establishments in Turkey is 27 000, most of these companies are SMEs, but two thousands of these enterprises are relatively modern and big plants. The top three sub-sectors are Cereals, Fruit & Vegetable and Milk & Dairy[61].

Statistical Overview of Food and Beverages Industry in Turkey[62]

The share of Food and Beverages industry within the whole manufacturing industry

Indicator	Value in %
Share regarding its total assets (2008)	11.08
Share regarding its production (2006)	9.67
Share regarding employment (2008)	9.07
Share regarding its import (2009)	2.62
Share regarding its export (2009)	6.22

[59] Source: Turkish Industrial Strategy Document 2011-2014 (Towards EU Membership). Published in 2010 by the Ministry of Industry and Trade of the Republic of Turkey.

[60] Source: Turkish Food & Beverage Industry Report. Prepared by Deloitte. Published by the Investment Support and Promotion Agency of Turkey. Republic of Turkey Prime Ministry, July 2010.

[61] TurkishFoodIndustry & Food Chain Sustainability in Turkey. By Assoc. Prof.Cesarettin ALASALVAR, TÜBİTAK Marmara Research Centre, Food Institute, Turkey

[62] Source: Turkish Industrial Strategy Document 2011-2014 (Towards EU Membership). Published in 2010 by the Ministry of Industry and Trade of the Republic of Turkey.

The Turkish food and drink sector employs more than 328 thousand registered workers and technical staff in more than 34 thousand enterprises which are mostly SMEs[63]. Two thousand of these enterprises are relatively modern and big plants. The sector is composed of a wide range of sub-sectors, with a large variety of products produced and many different technologies used.

Number of enterprises by sub-sectors of the Food and Drink Industry[64]
Turkey, 2009

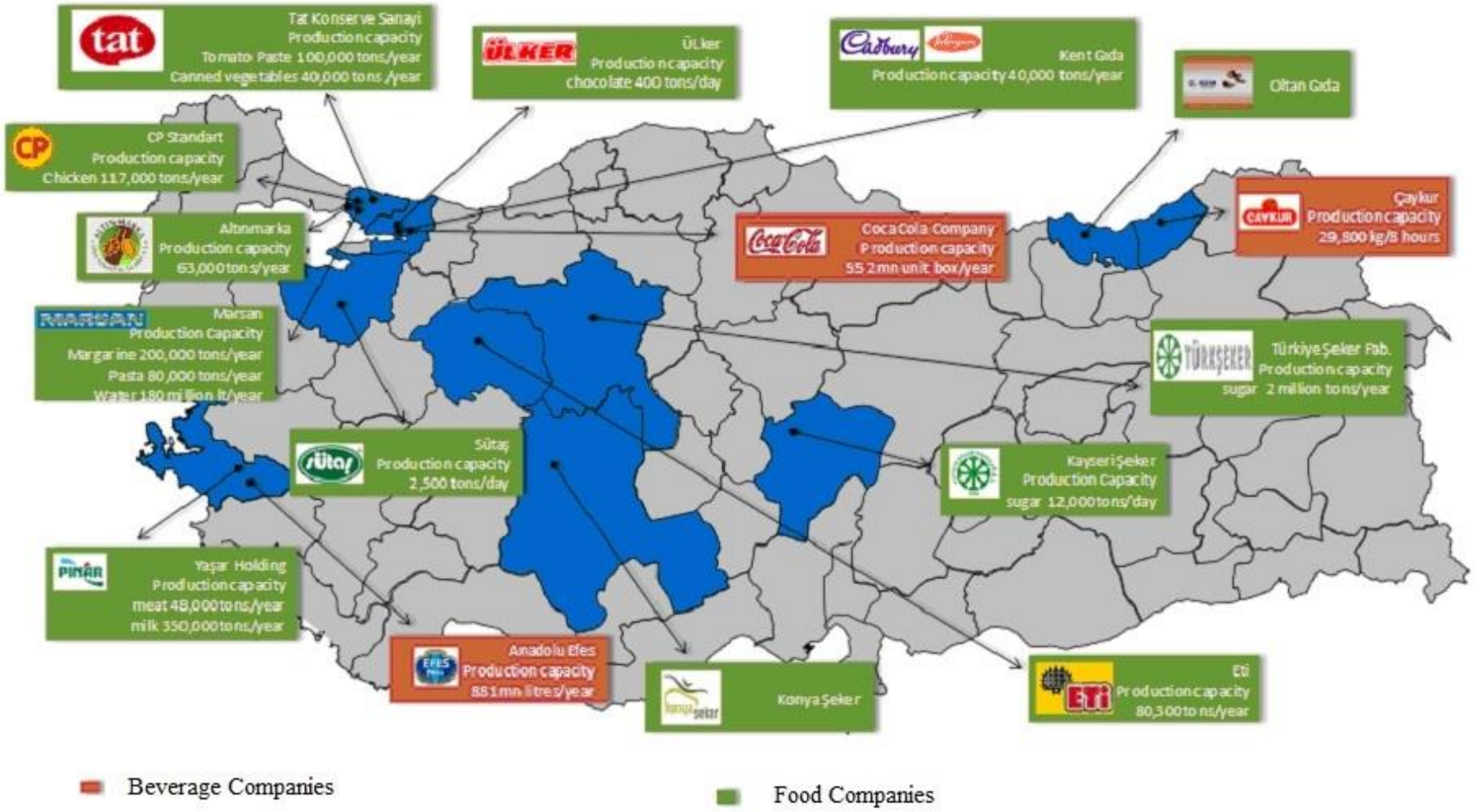
Sectors	Number of enterprises	Share (%)
Fruit and Vegetable Processing	4 118	23.68
Processed Bakery Products	3 394	19.52
Other Food Products	1 777	10.22
Milk and Dairy Products	1 772	10.19
Flour and Bakery Products	1 498	8.61
Confectionary. Cocoa and Chocolate	1 313	7.55
Animal and Vegetable Oils and Fats	1 176	6.76
Meat and Meat Products	746	4.29
Animal Feed Industry	735	4.23
Sugar Production and Refining	326	1.87
Fisheries Processing	152	0.87
Mineral Waters	149	0.86
Alcoholic Drinks Industry	140	0.81
Soft Drinks	95	0.55
Total	17 391	100.00

Source: TOBB, Industry Database, February 2010.

[63] Turkish Food and Drink Sector Inventory, 2010. Statistics published in this document is based on TurkStat and TOBB numbers. Published by the Federation of Food and Drink Industry Associations in Turkey. Downloaded from: http://www.tgdf.org.tr/english/resimler/2010envantereng.pdf.

[64] Source: Inventory of Turkish Food and Drink Industry, 2009. Issued by the Federation of Turkish Food and Drink Industry Associations of Turkey.

Capacities of key players in the Food and Beverage Sector of Turkey[65]



[65] Source: Turkish Food & Beverage Industry Report. Prepared by Deloitte. Published by the Investment Support and Promotion Agency of Turkey. Republic of Turkey Prime Ministry, July 2010.

Wider[66] *environmental concerns and techniques in the food industry.* The major environmental challenge to the food industry is to implement those investments which are necessary (a) to manage solid and liquid wastes and (b) to reduce stack gas emissions[67]. The IPPC BREF for the Food, Drink and Milk Industries[68] describes over 370 "techniques to consider in the determination of BAT", both "process-integrated" and "end-of-pipe" techniques. Many address the issues of minimising water consumption and contamination; energy consumption and minimising the use of raw materials with the consequent minimization of waste production. Specific techniques are described e.g. on food storage, on refrigeration techniques with minimal energy consumption and food degradation. Best Available Techniques are described in two "tiers":

- Tier 1 contains horizontal techniques, such as Equipment and installation cleaning, Waste water treatment, Accidental releases, etc.
- while Tier 2 contains "Additional BAT" techniques for specific sub-sectors such as the fruit and vegetable sector, etc.

The consumption of non-POP pesticides in Turkey and its consequences. Nowadays, more than 60 kinds of high economic importance cultural-crops are grown all around Turkey. According to a training material made by the Ministry of Agriculture and Rural Affairs in 2009, the consumption of plant protection products is approximately 50 000 t/year; that includes 47% insecticides, 24% herbicides, 16% fungicides and 13% of other groups. 40% of the pesticides are used in Adana, Icel and Antalya and 25% of them are used in Izmir, Manisa and Aydin region.[69] Publications as late as in 2007 stated that pesticides caused regularly mass deaths of fishes, frogs and waterfowl in wetlands of Turkey[70].

POPs related challenges and environmental technologies in the food industry. There are no[71] specific BAT-BEP techniques designed for the reduction and elimination of POPs in the food industry. The document defines the tolerable daily intake (TDI) for chemicals contributing to TEQ (such as dioxin and furan) for humans as 1 to 4 pg[72]/kg body weight/day. The document also calls for actions to avoid contamination of the food chain by pollutants resulting from specific activities, such as open burning of waste, disposal of animal carcasses and others.

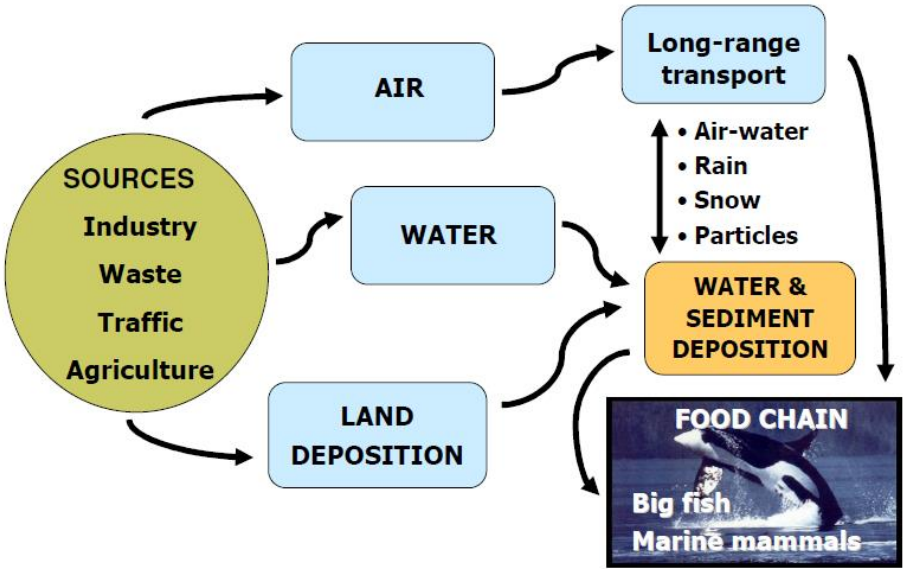
[66] In the context of the present study, wider environmental concerns means those environmental issues facing the sector, which are not related, or not directly related to POPs.
[67] Source: Turkish Industrial Strategy Document 2011-2014 (Towards EU Membership). Published in 2010 by the Ministry of Industry and Trade of the Republic of Turkey.
[68] Integrated Pollution Prevention and Control. Reference Document on Best Available Techniques in the Food, Drink and Milk Industries. August 2006. Size: 682 pages.
[69] Sakine Ugurlu (2009): Pesticide risk assessment and management in Turkey. Ministry of Agriculture and Rural Affairs
[70] Zafer Ayas (2007): Review on DDT and its residues in Turkey's wetlands, Journal of Environmental Biology
[70] Source: Ministry of Environment and Urbanization (2014): National Implementation Plan of Persistent Organic Pollutants (POPs) Management in Turkey.
[71] Guidelines on best available techniques and provisional guidance on best environmental practices relevant to Article 5 and Annex C of the Stockholm Convention on Persistent Organic Pollutants. Published by the Secretariat of the Stockholm Convention and UNEP. Geneva, Switzerland, 2008.
[72] Pg = picogram = 10^{-12} gram.

3.2.2. The relevance of POPs in the sector

POPs are present in the whole food chain and agricultural products are used in several other sectors such as textile industry. POP-pesticide residues have been found in the fat of fish and animals, as well as in human breast milk in many countries. Humans are generally exposed to POPs pesticides through their food supply. Scientific evidence shows that human exposure to individual POPs is associated with cancer, neurobehavioral impairment, immune system biochemical alterations and possibly dysfunction, reproductive dysfunction, shortened period of lactation, and diabetes.

Biomagnification. POPs go through the whole food chain and accumulate in the body fat of living organisms reaching a relatively much higher concentration in animals and humans on the top of food chain. This process is called "biomagnification." When POPs found in small quantities at the bottom of the food chain, they can pose a significant hazard to predators at the top, leading to significant impacts even in the case of small releases[73].

POPs' route in the environment[74]



Stakeholders in agriculture in relation with POPs. The major stakeholders of the sector are as follows:

- agricultural firms,
- fisheries
- food processing firms,
- traders of agricultural products,
- food safety and other laboratories.

[73] US EPA (2002): Persistent Organic Pollutants: A Global Issue, A Global Response
[74] Source: UNEP in WHO (2008): Persistent Organic Pollutants (POPs), Children's Health and the Environment Training Package

3.2.3. History of POP pesticide application in Turkey

After the 1940s, POPs pesticides were used in Turkish agriculture. However, gradually all agricultural POPs listed in the Stockholm Convention have been banned, starting from the 1970s onward. In particular, the timeline of licensed POPs pesticides that have been banned goes as follows:

- 1971: Dieldrin ban;
- 1978: DDT, α- Hexachlorocyclohexane, β- Hexachlorocyclohexane restriction;
- 1979: Aldrin, Chlordane, Heptachlor, Endrin ban;
- 1985: Lindane, DDT, α- Hexachlorocyclohexane, β- Hexachlorocyclohexane ban;
- 1989: Toxaphene ban;
- 2009: Endosulfan ban.
- Mirex has never been licensed in Turkey[75].

After the ban on POPs pesticides the Ministry of Agriculture and Rural Affairs (MARA) established an inventory of producers and retailers of pesticides as one of the precautions.[76]. Moreover, investigations have been launched about potential illegal use, but (according to a study published in 2007) no illegal use of these substances had been found[77]. However, other investigations show extensive DDT contamination in some agricultural fields[78], and high prevalence of DDT as impurity in some legitimately sold pesticides such as Dicofol[79].

Storage of POPs pesticides residues. Registration Committee of MARA register agricultural pesticides and monitors registered pesticides from their production or import to their consumption. According to the first evaluation of the National Implementation Plan (NIP), Turkey had 10 930 kg of DDT and 2 700 tons of HCB in stocks. These DDT stocks were not stored in good conditions[80]. The latest NIP states that approximately 2 700 tons of HCHs (Hexachlocyclohexanes) and DDT were stored in barrels in Derince, Kocaeli (disposed in 2006)[81].

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

[76] Ali Müfit Bahadir and Gheorghe Duca (2009): The Role of Ecological Chemistry in Pollution Research and Sustainable Development

[77] Ebru Mehmetli, Bogdana Koumanova (2007): The Fate of Persistent Organic Pollutants in the Environment. Proceedings of the NATO Advanced Research Workshop on the Fate of Persistent Organic Pollutants in the Environment, Istanbul, Turkey, 25-27 April 2007

[78] DDX Profiles in Agricultural Fields Used for Cucurbit Production in Sakarya, Turkey. By Mehmet Isleyena, Pinar Sevima & Meltem Uslana. In: Soil and Sediment Contamination: An International Journal. Volume 22, Issue 6, 2013.

[79] Contents and sources of DDT impurities in dicofol formulations in Turkey. By Turgut C, Gokbulut C, Cutright TJ. Environ Sci Pollut Res Int. 2009 March.

[80] Ebru Mehmetli, Bogdana Koumanova (2007): The Fate of Persistent Organic Pollutants in the Environment. Proceedings of the NATO Advanced Research Workshop on the Fate of Persistent Organic Pollutants in the Environment, Istanbul, Turkey, 25-27 April 2007

[81] Ministry of Environment and Urbanization (2014): Annexes of National Implementation Plan of Persistent Organic Pollutants (POPs) Management in Turkey

Registration of Pesticides. Pesticides' registration processes are carried out by the General Directorate of Protection and Control of MARA. The Directive of Registration concerns the method and principles of registration of plant protection products in Turkey[82]. Nevertheless, according to anecdotic evidence, it is very likely that there is some smuggling and illegal use of not registered pesticides like Dieldrin, Aldrin, etc. The main reason is that they are very potent and very cheap[83].

Residues of POP-pesticides in Turkey. The current situation of agricultural chemicals is described in the National Implementation Plan of Persistent Organic Pollutants (POPs) Management in Turkey. According to the NIP, special attention has to be done to old storage and illegal storage of pesticides. Different actions are set up in NIP, in order to conduct a thorough inventory of contaminated areas with an analysis of ecological risks, to evaluate the necessity of decontamination, along with an economic evaluation. This is closely connected with the valid inventory of all these problems and the development and completion of the database of hotspots, old stockpiles, and contaminated areas[84].

Pesticide contamination in Turkey. As of 2014 there is no ongoing systematic monitoring program on the determination of releases, health risks and emission statements of POPs in Turkey. However analysis has been taken to detect pesticides in natural environment. According to the 2014 NIP of Turkey, pesticide residues were found in the sea water. Organochlorine pesticide residues were detected in natural fresh water bodies in Central Anatolia. A total of 13 organochlorine pesticides and their residues have been measured in water and in sediment from different lakes such as Tuz Lake or Bolluk Lake. Moreover, HCH[85], Aldrin, Heptachlor, DDT and DDE[86] were detected at high levels in soil samples[87]. Further research is necessary to find out, whether these high levels were caused by historic use, i.e. by use before the ban of POP-pesticides, or are indirect evidence of more recent and illegal use.

The NIP Action Plan on POP-Pesticides. The Action Plan of the 2014 NIP has addressed the current challenges on POPs-pesticides:

- Updating the inventory of old agrochemical stores, deposits and loads and contaminated sites and update the database by 2015.
- Continuous control on old interim storage sites and dumping sites, improvement the efficiency of inspections and maintenance of storage sites in order to prevent accidents, leaking and exposure by 2015.
- Actions to clean, empty and demolish POPs pesticides storage buildings using the BAT/BEP procedures, development of safe temporary storage if needed by 2018.

The last pesticide stock left in Turkey is planned to be disposed until 2017 as a component of "Elimination of POPs Stocks and Reducing Releases Project" financed by GEF[88].

[82] Sakine Ugurlu (2009): Pesticide risk assessment and management in Turkey. Ministry of Agriculture and Rural Affairs

[83] Interview with Turkish Food Safety Association, Gıda Güvenliği Derneği, GGD 05.03.2014

[84] Source: NIP 2014: National Implementation Plan of Persistent Organic Pollutants (POPs) Management in Turkey. Ministry of Environment and Urbanization of Turkey. August 2014.

[85] Hexachlorocyclohexanes

[86] Dichlorodiphenyldichloroethylene

[87] Ministry of Environment and Urbanization(2014): Annexes of National Implementation Plan of Persistent Organic Pollutants (POPs) Management in Turkey

[88] Source: NIP 2014: National Implementation Plan of Persistent Organic Pollutants (POPs) Management in Turkey. Ministry of Environment and Urbanization of Turkey. August 2014.

3.2.4. Turkish food safety and POPs

Turkish food safety legislation is satisfactory, almost fully harmonized with EU legislation, although problems in implementation still exist. [89] The following regulations are relevant for food safety of animal products, with special respects to fish health and the safety of fish products[90].

- Law No. 5996 regulates in general veterinary services, plant health, food and feed, covering the production, processing, and distribution of foodstuffs, is the main law addressing food safety. Under the Law, trade in or distribution of unsafe foodstuffs, i.e. foodstuffs that can be considered harmful to human health or unsuitable for consumption, is prohibited.
- The Regulation on Turkish Food Codex covers quality and hygienic issues of foodstuff, additives, aromatic substances, pesticides and veterinary drug residues, foodstuff contaminants, package and labelling, storage and transport rules, sampling and methods for analysis. The Regulation Concerning Food Safety and Checking and Control of Food Quality covers rules and procedures of production, processing and distribution phases of food, and substances and materials contacting foodstuff, provisions on the minimum technical and hygienic requirements, checking, controlling and monitoring of food. The Annex of this document contains the table of Maximum Residue Level (MRL) for various kinds of foods (e.g. fish, milk products and baby food) given in Turkish Food Codex Contaminants regulation (date: 29.12.2011; no: 28157), in which dioxin and PCB residues are explicitly mentioned.
- The main legislation regulating food safety in fisheries and aquaculture is the Fisheries Regulation Official Gazette dated 10.03.1995 and No: 22223.
- Regulation on Wholesale and Retail Sale Places of Fishery Products addresses control and inspection procedures of fish markets, including their minimum technical and hygiene conditions.
- Law No. 5996 of 2010 on Veterinary Services, Plant Health, Food and Feed is the framework law on aquatic animal diseases and disease control.

The major enforcing institution for food safety of animal products is the Directorate for Food and Control (DGFC) of MoFAL, which is the competent authority for animal disease control. The Ministry has the authority to order to take any actions to protect aquaculture production areas and fish health. The Bornova Veterinary Control and Research Institute is the designated national reference laboratory responsible for coordinating diagnostic standards and methods, fish health surveillance, and diagnostic services. There are also university laboratories and MoFAL Fisheries Institute laboratories in various regions.

[89] Interview with Turkish Food Safety Association, Gıda Güvenliği Derneği, GGD 05.03.2014
[90] Source: http://www.fao.org/fishery/legalframework/nalo_turkey/en#tcNB00FE

Food safety monitoring in Turkey is weaker than in the EU. There is a market surveillance system of food safety. The major laboratory is the reference laboratory of Ministry of Food, Agriculture and Animal Husbandry (MFAH). A serious problem of the monitoring practice is that there is no transparent reporting system: while aggregate results of food safety monitoring are regularly published, no individual measurement made by the above mentioned reference laboratory is publicly available. Consequently, stakeholders do not learn the results of monitoring activities, cannot see the magnitude of problem and cannot make any comments on solution of the problem. The Ministry has a plan for monitoring pollution (in particular dioxin) in foods, but this plan is not public.[91]

Measurement of dioxin in food is very costly, because the Maximum Residue Level (MRL) of dioxin is very low for food and at this level the measurement is difficult. There is a need for improving the laboratory capacity for measuring dioxin in food. The market of dioxin measurement is not accessible for private labs in Turkey. Private laboratories do not receive subsidies from the Government. There are authorized labs for import and export activities but not for market surveillance. A healthy competition between public and private laboratories would decrease the cost of measurement[92].

3.2.5. Impact assessment considerations

Since all POP-pesticides identified by the Stockholm Convention are banned in Turkey, an introduction of the EU POPs Regulation will not have substantial impacts on farming. However, impacts are to be expected in the identification of residues such as stockpiles and contaminated areas, and in the monitoring of food supply for POPs residues with the help of laboratories.

Cost of actions. Cost items must be identified and cost magnitudes must be estimated in order to ensure proper execution of action plans. The major cost items are the following:

- Identification and destruction of stockpiles and residues of POPs containing pesticides
- Improvement of private food safety laboratory capacities for POPs measurement
- Designation of private food laboratories for POPs measurement.

[91] Source: interview with Turkish Food Safety Association, Gıda Güvenliği Derneği, GGD 05.03.2014
[92] Source: interview with Turkish Food Safety Association, Gıda Güvenliği Derneği, GGD 05.03.2014

Benefits of actions. The elimination of POPs pesticides residues from the environment and from the food chain brings various health and environment related benefits. The main economic benefit is the improved image of Turkey´s agricultural products ("clean and green"), which may lead to additional export of agricultural products and increased profits of food producers. The nature of benefits to be expected from eliminating POPs pesticide residues from the environment can be readily illustrated by those publications, which point to the levels of pesticides in fish species[93], human blood, human milk[94] [95] [96] and human fat[97] of the Turkish population in various regions of the country. The above-mentioned publications can be used to identify the baseline situation and the desired direction of improvement in public health. The extent of health benefits will also depend on effectiveness of the current food safety monitoring system, i.e. on its ability to identify contaminated food and to track and eliminate the causes of contamination.

3.3. Metallurgy

3.3.1. Iron and steel industry in Turkey: a summary of sectoral information[98]

Turkey is among the 10 biggest crude steel producing countries in the world. In 2012, the iron and steel industry's contribution to the GDP of Turkey was 1.08%, which is an increase compared to 1% in 2006. The iron and steel industry had a growth rate of more than 5% in 2012. Crude steel production is expected to grow and reach 47 million tons in 2017. Iron ore sintering is made in three large integrated iron and steel production plant: Erdemir, Isdemir and Kardemir. Capacity expansion and new plant capacity will reach more than 7 million tons between the years 2013 and 2015.

Steel is used in many metal-intensive sectors including buildings and construction, automotive, machinery and home appliances. Turkey's construction sector uses 40% of steel that is produced in Turkey. 20% of the steel used in the Turkish automotive industry is produced in Turkey. Iron and steel industry had the second largest export share coming in after the automotive industry in 2012. Between 2007 and 2012 exports grew by 7%, surpassing USD 17 billion in 2012. The BOF (Basic Oxygen Furnace) method accounts for only 26% of Turkish steel production, whereas the rest is produced by the EAF (Electric Arc Furnace) method.

There are approximately 150 companies within the iron and steel industry. Among these, there are electric arc furnace facilities with capacities ranging from 50 000 tons to 3.5 million tons and integrated facilities with a total capacity of 8.5 million tons. Other facilities operate by purchasing billet from outside the country and produce profile, wire rod, ribbed and round rebar.

[93] Levels of organochlorine pesticides, polychlorinated biphenyls and polybrominated diphenyl ethers in fish species from Kahramanmaras, Turkey. By Ozlem Erdogrua, Adrian Covaci, Paul Schepens. Environment International 31 (2005) 703– 711

[94] Polychlorinated Biphenyl and Organochlorine Pesticide Levels in Human Breast Milk from the Mediterranean city Antalya, Turkey. By Ismet Cokm Cigdem Yelken, Emre Durmaz, Mine Uner, Barıs Sever, Funda Satır-Published online: 22 February 2011, Bull Environ Contam Toxicol (2011) 86:423–427.

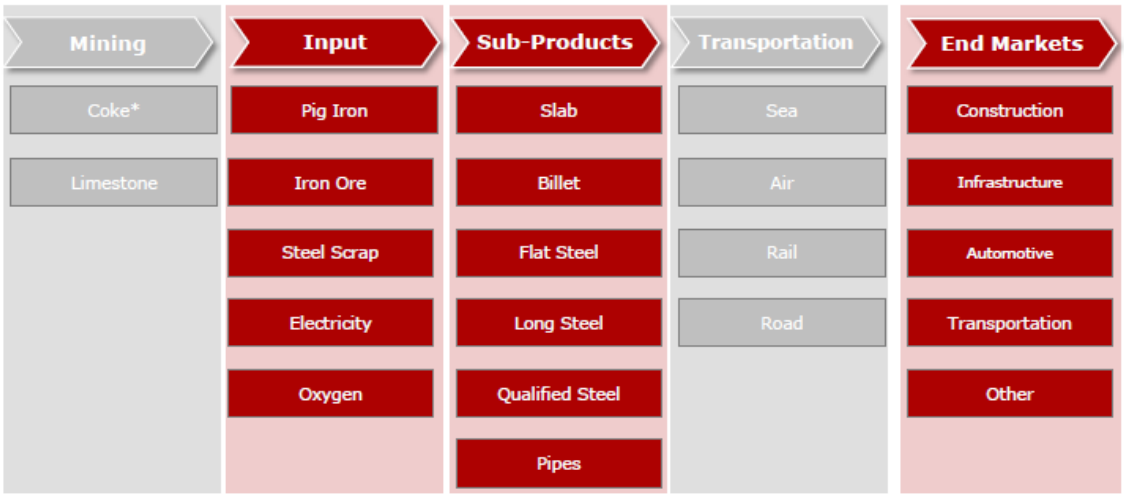
[95] Analysis of human milk to assess exposure to PAHs, PCBs and organochlorine pesticides in the vicinity Mediterranean city Mersin, Turkey. By Ismet Çok, Birgul Mazmanci, Mehmet A. Mazmanci, Cafer Turgut, Bernhard Henkelmann, Karl-Werner Schramm. Environment International 40 (2012) Pages 63–69.

[96] Levels of organohalogenated persistent pollutants in human milk from Kahramanmaras region, Turkey. By Ozlem Erdogrul, Adrian Covaci, Naciye Kurtul, Paul Schepens. Environment International 30 (2004) 659– 666

[97] Polychlorinated biphenyl levels in adipose tissue of primiparous women in Turkey. By Ismet Coka, M. Hakan Satiroglub. Environment International 30 (2004) 7 – 10

[98] "The Iron and Steel Industry in Turkey." Study published by the Investment Support and Promotion Agency of Turkey and by Deloitte Turkey, Member of Deloitte Touche Tohmatsu Limited. December 2013.

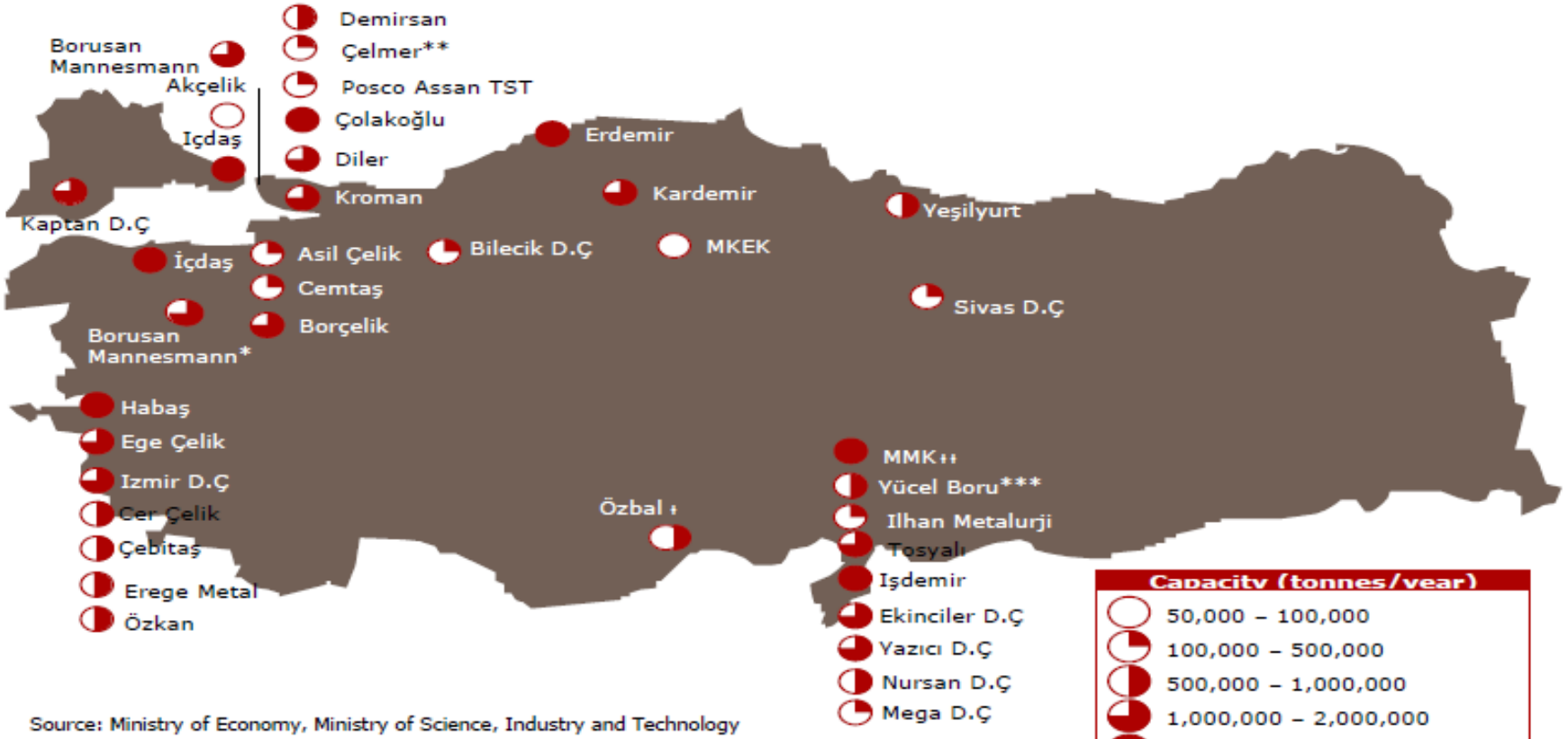
Iron and Steel Industry Value Chain[99]



* Coke in the form of coking coal

[99] Source: Deloitte Turkey. Member of Deloitte Touche Tohmatsu Limited.

Steel Plant Capacities and Locations. Turkey 2013.[100]



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

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

Besides sinter plants in the iron and steel industry, other major sub-sectors of the Turkish metallurgy industry are also affected by POP legislation, such as

- secondary copper production,
- secondary aluminum production
- secondary zinc production.

According to the IPPC inventory compiled in 2013-2014, Turkey operates more than 1 000 installations in the metallurgy sector.

Estimated number of IPPC installations in Turkey in the ferrous and non ferrous metal industries, 2013[101]

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

3.3.2. SC Obligations relevant for metallurgy

Thermal processes in the metallurgical industry have the potential for comparatively high formation and unintentional release of dioxins, furans, HCB and PCBs as a result of incomplete combustion or chemical reactions. This is the major SC Obligation to comply with in this sector.

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

Formation and abatement of dioxin / furan in metallurgy[102]. PCDD/Fs are formed by gas-phase reactions of chlorinated precursors with carbon sources. Processes prone to PCDD/Fs formation include combustion processes, ore sintering, metal smelting and pyro-metallurgical processes. The condition of dioxin/furan formation is the presence of chlorine in the input materials (such as some ores and metals) or in the fuels (commercial coke has, for example, a chlorine content of around 0.05 % by mass).

The primary measures identified to prevent or minimize the formation of PCDD/Fs are as follows:

- avoidance of raw materials which contain PCDD/Fs and PCBs or their precursors as much as possible
- suppression of PCDD/Fs formation by addition of nitrogen compounds like ammonia waste gas recirculation.

3.3.3. POP pollution by the metallurgy industry in Turkey

UPOPs Inventory. According to the estimation of the 2013 UPOP inventory[103] for Turkey, the metal industry is responsible for the emission of annually approximately 723.8 g TEQ of dioxin/furan, which amounts to 55% of the full amount of dioxin/furan emitted in Turkey.

The most important lessons from UPOPs Inventory regarding the metallurgical sectors are as follows (see next Table):

- According to the UPOPs Inventory, in Turkey more than half of the grand total of unintentionally emitted POPs originates from the ferrous and non ferrous metal industry, whereby iron and copper production processes are the biggest polluters.
- Although specific dioxin/furan emission (i.e. PCDD/Fs per ton of production) is the highest in non-ferrous metal production, in absolute numbers the biggest amount of dioxin/furan is emitted by the iron and steel industry.
- The majority of POPs emitted by the metallurgy sector ends up in the residues of the production process, the rest of POPs emitted by the sector pollutes the air, and the UPOP emissions polluting waters, soil and the products of the sector are negligible. This finding is in stark contrast with the fact that most pollution abatement efforts taken by the metallurgy industry address the reduction of air pollution, while waste management efforts are of secondary importance.

The sector also has the obligation to register and eliminate the use of PCB containing electrical equipments, such as transformers and capacitors.

[102] The source of technological information is the following PPT document: Metallurgy Industry: Guidence on POPs. By Arda Karluvali, Rast Engineering Services Ltd. Technical Assistance for Implementation of the Persistent Organic Pollutants Regulation EuropeAid/132428/D/SER/TR. 7th Training of Trainers. Hotel Ilıca Çeşme, İzmir, Turkey, 26-30/05/2014.

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

Estimated unintentional release of POPs (UPOPs) by the sector "Ferrous and Non-Ferrous Metal Production".[104] Turkey, 2013.

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

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

Additionally, Turkish metallurgy plants unintentionally emit a large quantity of PCBs into the atmosphere.

The magnitude of unintentional PCB emissions from various sub-sectors of the metallurgy industry in Turkey[105]

Industry	Release to air kg per year
Steel production	579.3
Copper production	306.7
Zinc production	9.0
Pig iron production	3.0

3.3.4. Pollution abatement technology in the Turkish iron and steel sector

The most widely used dioxin / furan control methods in iron and steel plants are: raw material control and efficient dust collection systems. The control of input raw material is an extremely important procedure, not only for dioxin-furan emissions reduction, but also for efficient combustion, in terms of energy savings and ensured steel quality. Due to regulatory considerations, efficient dust collection systems are widely used.

As of the whole iron and steel industry, the following pollution abatement techniques are present:[106]

- Raw material control: 90% of plants,
- Efficient dust collection system: 100% of plants;
- Afterburners: 70% of plants;
- Quenching: 35% of plants;
- Activated carbon application: 8% of plants.

[105] Kuzu, S.L., et al., Estimation of atmospheric PCB releases from industrial facilities in Turkey. Atmos. Pollut. Res. 2013, 4(4): 420-426., also quoted in NIP 2014

[106] Source: Information obtained from sectoral expert, see Appendix.

Availability of BAT – BEP techniques[107] [108]in Turkish steel and iron industry*.

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

* Technique has been introduced in what percentage of plants? 1=Nowhere 2= Only in the most up-to-date plants, 3=Approximately in half of plants 4=Quite widespread 5= In every plant

Let us focus our attention now on *EAF[109] plants.* During the summer months of 2014 the Turkish Steel Producers Association[110] conducted a survey[111] on the availability of dioxin/furan abatement technology in companies that apply the Electric Arc Furnace (EAF) method[112]. Information was obtained altogether from a total of 20 EAF and one induction furnace[113] plant. The responding plants reported a total of 35 million tons of steel production in 2012.

In the responding 21 plants, the following pollution abatement techniques and practices are applied.

- Five plants reported regular PCDD/Fs measurements (every 2 years) and the measured values are below the legal limits.
- Bagfilter dust collection system is used in 19 plants.
- Jet-pulse type dust collection system is used in 2 plants.

[107] The table contains a selection of BATs listed in the following source document: "Commission Implementing Decision of 26 March 2013 establishing the best available techniques (BAT) conclusions under Directive 2010/75/EU of the European Parliament and of the Council on industrial emissions for the production of cement, lime and magnesium oxide (notified under document C(2013) 1728)"

[108] The table contains a selection of BATs listed in the following source document: "Commission Implementing Decision of 26 March 2013 establishing the best available techniques (BAT) conclusions under Directive 2010/75/EU of the European Parliament and of the Council on industrial emissions for the production of cement, lime and magnesium oxide (notified under document C(2013) 1728)"

[109] EAF = Electric Arc Furnace

[110] Türkiye Çelik Üreticileri Derneği, www.dcud.org.tr .

[111] The detailed results of the survey are in the Annex of this document.

[112] An electric arc furnace (EAF) is a furnace that heats charged material by means of an electric arc. An electric arc, or arc discharge, is an electrical breakdown of a gas that produces an ongoing plasma discharge, resulting from a current through normally nonconductive media such as air. For more information see: "BAT Guide for electric arc furnace iron & steel installations", www.csb.gov.tr/db/ippceng/icerikbelge/icerikbelge866.pdf

[113] An induction furnace is an electrical furnace in which the heat is applied by induction heating of metal. For more information see: "BAT Guide for electric arc furnace iron & steel installations", www.csb.gov.tr/db/ippceng/icerikbelge/icerikbelge866.pdf

- Afterburner (secondary combustion) chambers exist in 15 facilities.
- The sucked gas is burned in controlled manner in 11 plants.
- Scrap preheating is available only in 4 plants.
- In 10 plants, the contaminated (oily) scraps are checked.
- The scrap is cleaned before melting in 6 plants.
- Rapid cooling (trombone cooler, quenching tower) system is available in 7 facilities.
- Lignite/activated carbon injection before bagfilter is applied in 2 facilities

3.3.5. Attitudes and opinions of metallurgy firms on POPs regulation

The Company Survey. In 2014 the POPs T.A. Project conducted a questionnaire based online survey among Turkish companies about their awareness of POPs, the associated pollution abatement technologies and costs, moreover about their expectations to the Government. The questionnaire and the full text of the responses of the six metallurgy firms are available in the Annex of this document.

The respondent firms. All six responding firms are big (employ more than 250 persons), with the exception of one medium sized firm. The main production technologies used in the responding firms is electric arc furnace, induction furnace and continuous casting. The typical products of the responding companies are billet steel, construction steel, ribbed steel and alloy steel.

Environmental issues in linkages with Governmental, judicial and non-governmental organizations. All six respondent firms have claimed that their relation with environmental authorities is good. They possess either a Temporary Operating Certificate or an Environmental Permit. None of the respondent firms has been sued or made legally responsible for poor pollution control. The responding firms have received no information from chambers or industrial associations on POPs.

Awareness and information. Out of the 6 respondents, 4 have claimed to be aware of POPs, and 2 said they are not aware of the term. The main source of information on POPs is the Ministry of Environment and Urbanization and the Official Gazette the Stockholm Convention on Persistent Organic Pollutants. Four out of the six metallurgy firms expect more guidance/training in administrative and technical requirements on POPs, and mostly from the Ministry of Environment and Urbanization and its Provincial Directorates, the Ministry of Science, Industry and Technology; TTGV (Turkish Technology Development Foundation).

POP pollution and BATs. Two firms (out of the six) have confirmed that dioxin / furan is released by their company and it is a problem, e.g PCDD/Fs is emitted during the melting of scrap metal. The problem could be solved by ensuring the quality of supplied scrap and by washing and preheating of scrap. Only two out of six respondents have claimed that they are aware of POPs related Best Available Techniques, and the sources of information were the 2010 Publications of the Ministry of Environment and Urbanization. The BATs which are relevant for solving the POPs problem of their firm is (a) Dust Collection System (Bag Filter) and (b) Scrap preheating.

Relevant cost in the past. Among the cost items of the environmental expenditures of the respondents dominate the items of (a) preventing air pollution and (b) waste management. The cost of wastewater management has been reported by the responding firms as relatively small. Only one out of these six firms has reported a significant investment into POPs related pollution abatement BAT: it was a dust collection system with bag filter, installed in 2008, costing 7 million dollars. The 5 other respondents did not invest and do not plan to invest into POPs related pollution abatement technique.

Expected benefits. Companies generally do not expect significant additional incomes or advantages as a result of POPs reduction/elimination. The only advantage mentioned by one respondent was the increase of prestige among the general public.

Expected costs. The survey of the Turkish Steel Producers Association presented in the previous sub-chapter shows that the expected compliance costs will be relatively high in the metallurgy sector. However, according to the expectations of most metallurgy firms accessed by the Company Survey, the enforcement of the POPs regulation will not influence significantly negatively the competitiveness of their companies.

Recommendations on when and how to introduce POPs Regulation. Companies recommend a transition period and the time limit should be decided by agreement with sector representatives. One respondent recommended 6 years of transition period. Incentives, grants should facilitate the introduction of the necessary procedures and techniques.

3.3.6. Impact assessment considerations

It is to be assumed, that the metallurgy industry will have to invest significantly into POPs pollution abatement techniques. The magnitude of investments needed has been shown by case studies. For example, Erdemir Group, the largest steel manufacturer in Turkey and the third largest Steel Producer of European Union[114], invested more than half a million EUR for flue gas treatment in 2007 in plants using basic oxygen furnace (BOF) technology[115].

Availability of cost information. There is no comprehensive or summarised cost information on the investment needs of metallurgy industry for abating POPs emission. However, there is a selection of sporadic, "anecdotal" evidence on this issue.

Some members of the Turkish Steel Producers Association were able to estimate the cost of their recent investments for the abatement of dioxin/furan emissions:

- Control of raw materials: 40 million TL (total of 4 reporting companies);
- Fume and gas collection, recirculation of waste gases: 135 million TL (total of 6 reporting companies)
- Afterburners and quenching: 80 million TL (total of 6 reporting companies);
- High efficiency dust removal for 120 million TL (total of 9 reporting companies)

[114] Source: http://en.erdemir.com.tr/Media/detail.aspx?SectionID=PXMlxQx4Q1iatYVmCYNgfA%3d%3d&ContentID=C5LIU6PXdPsVtvZn9CMpGw%3d%3d

[115] Source: interview with MSG-MESS Integrated Recovery and Energy Co. For more details see the memo of this interview in the Annex of this document.

Some of the above investments, e.g. the control of raw materials for chlorine containing compounds, were targeting specifically the reduction of dioxin / furan. One the other hand, some other items of investment, e.g. dust removal has served primarily compliance with IPPC/IED, whereby the reduction of UPOPs was a co-benefit.

There are also international experiences regarding cost assessment, e.g. on UK[116], Scotland[117], New Zealand[118], and other cost estimations.

3.4. Electric Power Generation, Transmission and Distribution

3.4.1. The stakeholders[119]

The main reason of why the electric power generation, transmission and distribution industries have been selected as a sector to be investigated in the SIA study is the fact that it is these industries which use and stockpile the biggest amount of PCBs containing transformers and other PCBs containing electric equipment. Moreover, combustion processes of this industry act as sources of UPOPs.

Supply chain of the electricity industry

The key players of the electricity market in Turkey are as follows.

- *Companies.* In 2010 the state-owned generation company EUAS (Electricity Generation Co.Inc.) owned c.a. 54 percent of the total installed capacity. The rest of electricity generation capacity was owned by a wide range of private companies. Besides EUAS the other main players in the electricity market are TETAS (Türkiye Elektrik Ticaret ve Taahhüt A.Ş., electricity wholesale), TEIAS (Turkish Electricity Transmission Company, transmission) and TEDAŞ (Türkiye Elektrik Dağıtım Anonim Şirketi, Turkey Electricity Distribution Company). Electricity transmission is state monopoly. The operator[120] is a part of TEİAŞ[121]. Electricity distribution is under an ongoing privatisation process: there are 21 distribution regions under Turkish privatization portfolio, out of which by 2010 in 8 regions the respective Distribution Companies were privatised[122].

[116] Cost Curves for the Abatement of Heavy Metal, PAH and Dioxin Emissions. A report produced for the Department for Environment, Food & Rural Affairs, the National Assembly for Wales, the Scottish Executive and the Department of the Environment in Northern Ireland. 2002.
[117] Dioxin Emissions from Regulated Processes. Scottish Environment Protection Agency. A Report By Enviros Consulting Limited: June 2008:
[118] The Cost-Effectiveness of Reductions in Dioxin Emissions to Air from Selected Sources. Economic Analysis for Section 32 of the Resource Management Act. A report prepared for the Ministry for the Environment of New Zealand. Janice C. Wright, Philip Millichamp, Sinclair Knight Merz and Simon J. Buckland. August 2001.
[119] This chapter is mainly based on the following document: "The Energy Sector: A Quick Tour for the Investor". Author: Deloitte Turkey. Published by the Investment Support and Promotion Agency of Turkey, November 2013.
[120] National Load Dispatch Center
[121] Turkish Electricity Transmission Company.
[122] Source: page 30 of the document "The Energy Sector: A Quick Tour for the Investor". Author: Deloitte Turkey. Published by the Investment Support and Promotion Agency of Turkey, November 2013.

- *Associations.* The major professional associations of the electricity industry are the Turkish Electricity Producers Union and the Turkish Electricity Industry Association.
- *Authorities.* The Energy Market Regulatory Authority (EPDK) is responsible for licensing new energy projects, including renewables. This authority is subordinated to the Ministry of Energy and Natural Resources of the Republic of Turkey.

Regarding the installed capacity of electricity generation
- the state owned EÜAŞ represents 44%,
- companies working under PPP (Public-Private Partnership) schemes[123] represent 16%
- and Private Sector represents 40%.

3.4.2. PCB containing equipment in the Turkish electricity sector

In the electricity sector the most costly SC Obligation is to register, decontaminate, phase out and replace the PCB-containing electrical equipment[124]. Polychlorinated biphenyl containing electrical equipment is used in every industrial and service sector, but the electricity generation and transmission industry is the primary user of equipment potentially containing significant amount of PCBs, such as large transformers and large capacitors[125]. The unique role of this sector in PCBs related pollution has been shown in several publications[126].

The following table gives an incomplete and aggregated overview about the inventory of PCBs containing equipment in Turkey. A separate enumeration of PCBs containing equipment in the electricity sector of Turkey is not possible.

Current PCBs Containing Equipment Number and Weight
Turkey, 2013, all sectors together[127]

Category/Use	N of equipment	Weight of equipment (tons)
Transformer	177	912
Capacitor	2 782	138
Other contaminated equipment	31	30
Other uses of PCB (as hydraulic, lubricant, plastic, sealant, printing ink)	Not known	Not known

[123] PPP firms work under the following legal arrangements: (a) BOT (Build-Operate-Transfer) Laws Nos: 3096, 3465, 3996, (b) BO (Build-Operate Law No: 4283) and (c) TOR (Transfer of Operational Rights Laws Nos: 4046, 5335, 3465, 3096).

[124] Turkey has already a PCB regulation in force, but its provisions have not been consequently enforced. ("By-Law on Control of Polychlorinated Biphenyls and Polychlorinated Terphenyls" published in the Official Gazette dated 27.12.2007).

[125] See e.g. the following quotation: "The local government or LEPC (Local Emergency Planning Committee), by working with the electric utility companies and/or other owners of PCB-containing electrical equipment in the community, might be able, in some cases, to remove the potential hazard by replacing or retrofilling existing PCB-containing electrical equipment." Source: Planning for Polychlorinated Biphenyl (PCBs)-Containing Disaster Debris. Published by USA EPA, June 2011.

[126] See e.g. the following quotation: "The most remarkable finding indicates the presence of a significant amount of PCB pollution in the transformer maintenance and repair facility belonging to the Turkish Electricity Distribution Corporation in Ankara." Quoted from "An Assessment of the Spatial Distribution of Polychlorinated Biphenyl Contamination in Turkey". By Kadir Gedik, Ipek Imamoglu. In: Clean 2010, 38 (2), 117–128.

[127] Source: NIP 2014: National Implementation Plan of Persistent Organic Pollutants (POPs) Management in Turkey. Ministry of Environment and Urbanization of Turkey. August 2014.

The 2012-2013 inventory of PCBs was based on various theoretical estimations, on a previous preliminary inventory and on a limited survey for PCBs especially used in energy generation/transmission industries[128]. In the near future, the national PCBs inventory will be updated, based on information received from PCBs owners. This is necessary, because according to the plans, in accordance with the existing PCB Bylaw,[129] in the coming years a large amount of PCBs, materials containing PCBs and PCBs containing equipment will be destroyed.

The legal framework of production, import and export, use, identification, labeling, removal, storage and disposal of PCBs and equipment containing PCBs is in force, but is not consequently enforced[130]. The proper implementation of Activity 3[131] of the 2014 NIP will significantly improve the situation: according to the plan outlined in this document[132], the usage of PCBs and PCB containing equipment in Turkey will cease as soon as possible, but no later than 2025.

3.4.3. Power plants: wider aspects of environment protection[133]

This chapter explains air pollution of power plants. It has no reference to POPs, which is the subject of the next chapter.

The energy industry and in particular, Large Combustion Plants (LCPs) can be regarded as the major target group for industrial air pollution prevention, both in terms of damage caused and expected compliance costs. Fuel combustion for electricity generating purposes is responsible for emitting almost two-thirds of SO_2 and about one third of NO_x. Since many LCPs are publicly owned, it can be argued that the public is the ultimate polluter in this case as user of electricity. The public however does face increased electricity prices in the future in order for LCPs to comply with the IED.

Large Combustion Plants in Turkey
Excerpt from the Inventory of IPPC installations of Turkey, 2013[134]

IPPC Annex I Activity	Number of IPPC installations
1.1 Combustion installations with a rated thermal input exceeding 50 MW	117

[128] NIP 2014: National Implementation Plan of Persistent Organic Pollutants (POPs) Management in Turkey. Ministry of Environment and Urbanization of Turkey. August 2014.
[129] "By-Law on Control of Polychlorinated Biphenyls and Polychlorinated Terphenyls" published in the Official Gazette dated 27.12.2007
[130] "By-Law on Control of Polychlorinated Biphenyls and Polychlorinated Terphenyls" published in the Official Gazette dated 27.12.2007, "By-Law on Control of Waste Oils" published in the Official Gazette dated 30.07.2008 and "By-Law on Incineration of Wastes" published in the Official Gazette dated 06.10.2010.
[131] Activity 3: Action Plans for manufacture, import, export, use, identification, labelling, removal, storage and disposal of PCBs and PCB containing equipment
[132] NIP 2014: National Implementation Plan of Persistent Organic Pollutants (POPs) Management in Turkey. Ministry of Environment and Urbanization of Turkey. August 2014.
[133] The main source of the chapter is the RIA of the IPPC Regulation in Turkey, 2013.
[134] Regulatory Impact Assessment (RIA) of introducing IPPC/IED to Turkey. Technical Assistance Service for IPPC – Integrated Pollution Prevention and Control in Turkey. Project Identification No: EuropeAid/129470/D/SER/TR. Contract No: TR0802.04-02/001. June 2013. Authors: Peter Futo, Iain McLean and Carlos Cisneros.

Environmental challenges of LCPs. The main environmental impacts generated by large combustion plants are emissions to air, water consumption, discharge of wastewater and waste management.

- *Air.* Regarding emissions to air, these are derived from the combustion process and are different depending on the fuel used. If coal used as fuel, the main pollutants are fine particles, sulfur dioxide, nitrogen oxides and carbon dioxide.
- *Water* is used in large quantities by LCPs, mainly in the cooling process, so the polluting effect of the discharge is the potential increase in temperature of the receiving medium. A large amount of wastewater, carrying large amounts of suspended matter, is generated by water leaking from coal stockpiles.
- *Waste.* Coal power plants generate substantial amounts of waste, mainly slag and ash.

A relatively recent study[135] has estimated the major gaseous emissions[136] generated by 17 lignite fueled plants of Turkey. These are installed near the regions where the lignite is mined. The study found that emission rates and specific emissions (per MWh) of pollutants depend predominantly on whether or not the particular plant has electrostatic precipitators and flue - gas desulphurisation systems.

Environment protection legislation for LCPs. The emission limit values that the power plants are obliged to fulfill in Turkey are indicated in the By-law on Large Combustion Plants[137]. In 2010 the Turkish Regulation[138] on "Large Combustion Plants" took effect as a transposition of LCP Directive (2001/80/EC). The regulation sets limits on emissions for PM, SO_2, CO and NO_x arising from combustion plants. New plants must comply with the ceilings laid down in the Regulation as soon as they come into operation, whereas a 9 - year transition period has been set for the existing plants. As of 08.06.2019, ceilings laid down in the regulation will become effective.

Specific air pollution regulation. There are also some provisions in relation to power plants in the By-law on Industrial Based Air Pollution Control[139], including the principles and procedures concerning the monitoring, validation and reporting of greenhouse gas emissions from the relevant installations. The list of GHG emitting installations is published in Annex 1 of the By-law on Monitoring of the Greenhouse Gas Emissions[140].

[135] Emissions estimation for lignite-fired power plants in Turkey. by: Nurten Vardar, Zehra Yumurtaci. Energy Policy (08 October 2009).
[136] E.g. sulfur dioxides, nitrogen oxides, carbon dioxide, and carbon monoxide, some various organic emissions (e.g. benzene, toluene and xylenes) and some trace metals (e.g. arsenic, cobalt, chromium, manganese and nickel)
[137] Official Gazette numbered 27605 and dated 08/06/2010
[138] Official Gazette: 08 June 2010, no 27605.
[139] Official Gazette numbered 27277 and dated 03/07/2009
[140] Official Gazette numbered 28274 and dated 25/04/2012

Pollution abatement technologies for LCPs in any country. A comprehensive description of the IPPC Best Available Technologies is given in the BREF for Large Combustion Plants[141]. In this report only the major and most costly technologies will be briefly mentioned. In case of thermal combustion plants, the major technologies of controlling emissions are as follows:[142]

- *Dust.* The major technologies of dust collection are (a) Gravitational, Inertial & Centrifugal Dust Collectors (e.g. by rotational settling of dust) (b) Scrubbing Dust Collectors (e.g. by spraying water on dust) (c) Filter Type Dust Separator (e.g. by bag filter) (d) Electrostatic Precipitator (e.g. by collecting dust on electrodes)
- *Sulphur.* The major technologies of Flue Gas Desulphurization (FGD) are (a) Wet type desulphurization (e.g. with limestone as adsorbent) (b) Dry type desulphurization (with activated carbon as adsorbent)
- *NO_x.* The major technologies of Flue Gas Denitrification, NO_x Abatement are (a) Flue gas recirculation (b) Installing Low NO_x burners (c) Installing staged burners (d) Selective catalytic reduction (e.g. by using ammonia as the reducing agent) (e) Selective non-catalytic reduction (e.g. by using urea to decompose NO_x into molecular nitrogen, carbon dioxide and water).

Pollution abatement strategies recommended for Turkish LCPs. The RIA of NECD[143] for Turkey[144] has recommended a wide range of pollution reduction measures and energy efficiency measures for LCPs through the application of IPPC Best Available Techniques. For natural gas fired power plants the installation of low- NO_x, pre-mix burners was recommended. For hard-coal fired power plants the installation of fluid gas desulphurization techniques (FGD), low- NO_x burners and staged-air supply. For exclusively fuel-oil fired power plants[145] the use of fuel oil having a sulphur content of less than 1.0%.

Cost assessment. Cumulated pollution abatement costs for the Turkish electricity sector for the period 2010 to 2025 is estimated to be somewhat over €18 billion at year 2010 prices.[146] Estimated annual expenditures amount to 0.1% - 0.2% of GDP.[147] It is to be expected that private ownership will bring better environmental performance under strict public scrutiny[148].

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[141] Integrated Pollution Prevention and Control. Reference Document on Best Available Techniques for Large Combustion Plants. July 2006.

[142] Source: Air Pollution Control Technology in Thermal Power Plants. Overseas Environmental Cooperation Center, Japan. With Ministry of Environment, Japan. March 2005.

[143] NECD = Directive 2001/81/EC of the European Parliament and the Council on National Emission Ceilings for certain pollutants.

[144] "Improving Emissions Control - NECD Emissions Management Strategies, Possible Emission Ceilings and RIA." Version 1 – 02 August 2012. By Russell Frost, Peter Newman, Chris Dore. Report by the Project EuropeAid/128897/D/SER/TR. Implementing Authority / Beneficiary: Ministry of Environment and Urbanisation. Service Contract Number: TR0802.03-02/001.

[145] Selective Catalytic Reduction (SCR) for of NOx emissions abatement was not recommended because its costs exceeded its likely benefits.

[146] This document calculates the expected expenditures of reducing emission levels of NOx, SO_2, NMVOCs (Non-methane Volatile Organic Compound) and NH3. It does not assess the cost of reducing POP emissions, but some of the techniques reducing the emission levels of the above pollutants bring the co-benefit of reducing POP emissions as well.

[147] For more details see the RIA of NECD in Turkey. "Improving Emissions Control - NECD Emissions Management Strategies, Possible Emission Ceilings and RIA." Version 1 – 02 August 2012. By Russell Frost, Peter Newman, Chris Dore. Report by the Project EuropeAid/128897/D/SER/TR. Implementing Authority / Beneficiary: Ministry of Environment and Urbanisation. Service Contract Number: TR0802.03-02/001.

[148] Value is calculated on the assumption that the investment should repay itself within next three years. Source: RIA of NECD in Turkey.

3.4.4. UPOPs emissions of power plants

In the electricity generation sector an important SC obligation is to reduce unintentional POPs emissions. The estimated share of the "Heat and Power Generation" sector in UPOP emissions of Turkey is between 7 and 8%. Two-third of emitted UPOP pollutes the air, while most of the remaining UPOP is emitted into the residues, e.g. in ash.

Estimated unintentional emission of POPs by the sector "Heat and Power Generation". Turkey, 2013[149]

Source categories	Production	Annual release				
	TJ/a	g TEQ/a	g TEQ/a	g TEQ/a	g TEQ/a	g TEQ/a
		Air	Water	Land	Product	Residue
Fossil fuel power plants	1 928 712	10.554	0	0	0	14.1
Biomass power plants	2 157	0.983	0	0	0	0.0
Landfill biogas combustion	1 050	0.008	0	0	0	0.0
Household heating and cooking – Biomass	100 655	10.066	0	0	0	0.5
Domestic heating - Fossil fuels	n.a.	38.862	0	0	0	16.6
Total of "Heat and Power Generation"		60.473	0	0	0	31.2

In large, well-controlled fossil fuel-fired power plants, the formation of dioxin, furan and other persistent organic pollutants is low, because combustion efficiency is usually high, the process is stable and the fuels used are generally homogeneous[150]. E.g. PCDD/Fs emissions from lignite-fired power plants have been reported in a range of 0.0002 to 0.04 ng I-TEQ/Nm^3.[151] But due to the large volumes of flue gases are emitted, even small concentrations of PCDD/Fs may result in the emission of significant masses of POPs. In smaller systems with poorer controls there exists the potential for emissions of POPs at greater concentrations, but this result in a smaller absolute number of the emitted volumes. One of the reasons, why furan formation in coal-fired power plants is low, is the presence of sulphur in fuel: sulphur inhibits PCDD formation, but it creates a different set of air pollution problems.

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

[150] SC BAT-BEP Guide.

[151] The N stands for Normal. It means it was measured at standard temperature and pressure

3.4.5. Impact assessment considerations

Cost of PCBs decontamination. In developed countries there are many firms offering environmental services that undertake "PCBs Transformer Recycling & Disposal" or "PCBs Oil and Chemical Destruction" services. The EPA of the USA publishes the "Commercially Permitted PCBs Disposal Companies" for every region of the USA[152]. Nevertheless, since the difficulty of this service depends on the local circumstances, it is not easy to find recent cost information about the decontamination and disposal of PCBs containing transformers. A private environmental service providing company[153] gives the cost of decontamination[154] and disposal per kilogram of the equipment as 2 US dollars, the price does not include the replacement of the transformer. This is very close to the calculation published in a document of the Secretariat of the Basel Convention:

Evaluation of the costs of management, treatment and elimination of PCBs transformers[155]

Evaluation of costs for a transformer - average weight 2 200 kg - estimated amount of PCBs (30%). 660 kg US $	US dollar
Technical control of an existing installation	350
Retrofitting (catch basin, DGPT9)	800
Servicing costs (four inspections every 12 years)	600
Handling and transport to the storage area	100
Storage costs (max. 1 year)	250
Costs of the transport and elimination of PCB liquids (660 kg at 2.5 US$ per kg)	1 650
Costs of the decontamination of contaminated equipment shells (1 540 kg at 0.8 US$ per kg)	1 232
Total	4 982
Total/tonnage of fittings	2 270

The major recommendation for Turkey is to increase competition in the field of environmental services, in particular in PCBs containing equipment collection and destruction. Electricity companies stockpile large amount of such equipment due to the fact that the fee of collection and destruction is high. Healthy competition of designated and controlled firms will reduce fee of this environmental service, and will facilitate the enforcement of the existing PCBs related regulations[156].

[152] http://www.epa.gov/wastes/hazard/tsd/pcbs/pubs/stordisp.htm

[153] http://www.chem.unep.ch/pops/pcb_activities/PCB_proceeding/Presentations/Dirk%20Neupert%20pp.pdf. File uploaded in 2004.

[154] By using the technique LTR2, i.e. „Low-Temperature Rinsing and Re-Use/Recovery"

[155] Source: Preparation of a national environmentally sound management plan for PCBs and PCB-contaminated equipment in the context of the implementation of the Basel Convention. Basel Convention Series/SBC No. 2003/01.

[156] Various publications and interviews show that Izaydas, the public hazardous waste incineration company has effectively a monopoly on the disposal of PCB containing equipment in Turkey. See e.g. page 34 of the document "International POPs Elimination Project. Fostering Active and Efficient Civil Society Participation in Preparation for Implementation of the Stockholm Convention. Country Situation Report on POPs in Turkey. By Sebnem Melis Yarman and Bumerang. Turkey, April 2006.
Source: http://ipen.org/sites/default/files/documents/5tur_turkey_country_situation_report-en.pdf

Context of UPOPs reduction in large combustion plants. During the next few years Turkish coal and lignite fuelled power plants must invest a considerable amount into pollution abatement techniques in order to comply with the requirements of the IPPC/IED regulation[157]. This investment will be facilitated by the ongoing privatisation of the sector. One of the positive collateral benefits (co-benefits) of this upgrading will be the reduction of UPOPs emission of large combustion plants.

3.5. Chemical Industry

3.5.1. Overview of the Turkish chemical industry

The Turkish chemical industry provides many basic and intermediate inputs to various industries. The industry employs more than 81 500 people in approximately 4 000 companies. The majority of existing chemical companies are small or medium size businesses[158]. The major companies are mainly concentrated in the following cities: Istanbul, Izmir, Kocaeli, Sakarya, Adana, Gaziantep and Ankara. The industry comprises 11 publicly quoted companies, with a total market capitalization of around USD 3.2 billion (August 2010). The largest company is Petkim Petrokimya Holding A.S. ("Petkim") with a market capitalization of USD 1 438 million (August 2010).

Statistical Overview of the Chemical Industry in Turkey[159]

Number of companies (95% SME)	13 118 companies
Production capacity per year	180 million tons
Turnover (2010)	123 billion USD
Added value (2007)	50 billion USD
Chemical sector added-value/NGDP	6%
Total export (2010)	13 billion USD
Total import (2010)	65 billion USD
Chemicals export as percentage of manufacturing industry export	27%
Chemicals import as percentage of manufacturing industry imports	47%

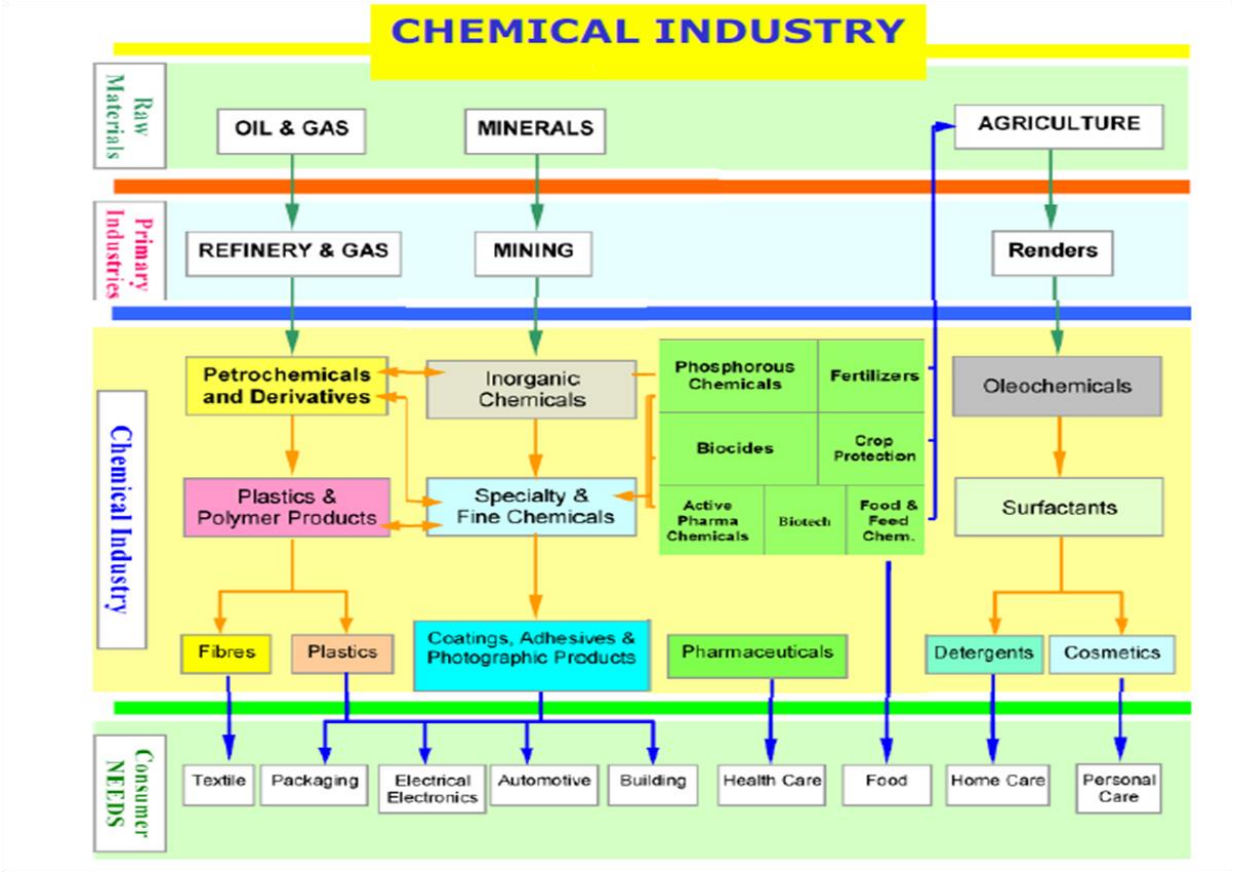
The chemical industry is closely connected with all other sectors of the economy through the supply chain.

[157] The Large Combustion Plants Directive of the EU has been merged with the IPPC Directive and its successor, the IED Directive.

[158] Turkish Chemicals Industry Report, Prepared by Deloitte. Published by the Investment Support and Promotion Agency of Turkey. Republic of Turkey Prime Ministry, August 2010

[159] Source: Turkish Chemical Industry. By Mr. Timur Erk, President of TCMA. The Union of Chambers and Commodity Exchanges of Turkey. Chemical Industry Sector Assembly of Turkey.

Supply chain of the chemical industry[160]



Some major sub-industries of the chemical sector: [161]

- *Petrochemicals.* The major firms are the following: (a) TÜPRAŞ (Turkish Petroleum Refineries Corporation) is an upstream producer which operates as the only integrated Refinery in Turkey with its 4 refineries in Izmit, Izmir, Kırıkkale and Batman. The company is Turkey's largest petroleum company with a crude processing capacity of 28.1 million tons per annum. It also owns a petrochemical production facility with an annual capacity of 50 000 tons. (b) PETKİM Petrokimya Holding A.Ş. is the only integrated petrochemical complex in Turkey, operates in Petkim-Aliağa complex in Izmir, producing a wide range of petrochemicals, including all common plastics. The total production of these petrochemicals meets about 30% of domestic demand.
- *Textiles.* Chemical and textile industries are closely interconnected: polymer production related to textiles and the production of textile chemicals have also developed simultaneously.
- *Fertilizer* production is concentrated in seven major companies: Tugsaş, Igsaş, Bagfas, Toros Gübre, Ege Gübre, Akdeniz Gübre and Gübre Fabrikalari, which are all private enterprises.
- *Pharmaceutical* companies in Turkey manufacture a wide range of pharmaceutical products, mostly generic formulas.
- *In the soap and detergent* industry there are many companies, about 15 of them being the major ones; among these there are multinational groups with worldwide reputations.

[160] Source: Turkish Chemical Industry's Responsible Care© Initiative. 16 years of implementation in Turkey, 1993-2009. PPT of 2009 by Dr. Caner Zanbak.
[161] Chemicals Industry. Published by the Republic of Turkey, Ministry of Economy, 2012.

- *The paints and coatings* industry has became one of the most dynamic sectors of the Turkish chemical industry: it produces about 800 000 tons/year of paints and coatings and is comprised of about 600 manufacturers, more than 20 of which are large-scale companies.
- *The largest soda factory* in the Middle East is Eti Soda A.Ş. with a total capacity of 750 000 tons/year.
- *Among chrome chemicals and chrome derivatives,* some of the most important are produced in Turkey.
- M*ost boron minerals and boron chemicals* are produced and exported by Eti Maden İşletmeleri Genel Müdürlüğü.
- *In sodium sulphate production*, Turkey ranks among the top producers in the world.

The following table is an excerpt from the IPPC inventory of the Turkish chemical industry, compiled in 2013.

Estimated IPPC installations of the chemical industry. Turkey, 2013[162]

IPPC Annex I Category / Activity	Number of IPPC installations
4.1. Chemical installations for the production of basic organic chemicals, such as: (a) simple hydrocarbons (linear or cyclic, saturated or unsaturated, aliphatic or aromatic), (b) oxygen-containing hydrocarbons such as alcohols, aldehydes, ketones, carboxylic acids,, esters, acetates, ethers, peroxides, epoxy resins, (c) sulphurous hydrocarbons, (d) nitrogenous hydrocarbons such as amines, , amides, nitrous compounds, nitro compounds, or nitrate compounds, nitriles, cyanates, isocyanates, (e) phosphorus-containing hydrocarbons, (f) halogenic hydrocarbons, (g) organometallic compounds, (h) basic plastic materials (polymers synthetic fibres and cellulose-based fibres), (i) synthetic rubbers, (j) dyes and pigments, (k) surface-active agents and surfactants	821
4.2. Chemical installations for the production of basic inorganic chemicals, such as: (a) gases, such as ammonia, chlorine or hydrogen chloride, fluorine or hydrogen fluoride,, carbon oxides, sulphur compounds, nitrogen oxides, hydrogen, sulphur dioxide, carbonyl, chloride, (b) acids, such as chromic acid, hydrofluoric, acid, phosphoric acid, nitric acid, hydrochloric, acid, sulphuric acid, oleum, sulphurous acids, (c) bases, such as ammonium hydroxide,, potassium hydroxide,, sodium hydroxide, (d) salts, such as ammonium chloride, potassium chlorate, potassium carbonate, sodium, carbonate, perborate, silver nitrate, (e) non-metals, metal oxides or other inorganic compounds such as calcium carbide, silicon,, silicon carbide	47
4.3. Chemical installations for the production of phosphorous-, nitrogen- or potassium-based fertilisers (simple or compound fertilisers).	46
4.4. Chemical installations for the production of basic plant health products and of biocides.	99
4.5. Installations using a chemical or biological process for the production of basic pharmaceutical products.	93
4.6. Chemical installations for the production of explosives.	28
Total of the above categories	1 134

[162] The numbers are estimations, they do not reflect the final count of IPPC installations. Source: "Regulatory Impact Assessment (RIA) of introducing IPPC / IED to Turkey". Technical Assistance Service for IPPC – Integrated Pollution Prevention and Control in Turkey. Project Identification No: EuropeAid/129470/D/SER/TR. Contract No: TR0802.04-02/001. June 2013. Authors: Peter Futo, Iain MacLean and Carlos Cisneros.

3.5.2. Dioxin / furan emission in the chemical industry[163]

Compared to combustion processes, which are considered to be important primary sources of PCDD/Fs, the chemical industry is not an important source of PCCD/Fs. Chemical processes where PCDD/Fs can be formed have either been stopped (e.g. PCBs) or best available techniques (BAT) are installed to drastically reduce their emissions into the environment. As a consequence, emissions from the chemical industry are much smaller than the emissions from, steel mills, combustion of coal (energy, fuel), iron and steel plants, non-ferrous metals operations and incineration of hospital wastes. This finding was based on the national emission inventories in European countries such as Germany, the UK, the Netherlands and Sweden.

Some examples from major processes of the chemical industry that have been identified as sources of dioxins formation are as follows. Some of the compounds identified below have been substituted by less harmful chemicals.

- Pentachlorophenol (PCP, a wood preservative, not produced any more)
- PCBs (dielectric fluids used in transformators, not produced any more)
- Chloroaniline (a precursor for dyes, but substitutes have been found since it was identified as a dioxins source)
- Chlorine production
- Ethylene dichloride (EDC, important intermediate in the chemical industry, in particular for PVC.)
- Chlorinated aliphatic compounds (e.g. dyes)

The SC BAT-BEP guidance[164] contains a detailed description on those chemical production processes that release POP chemicals listed in Annex C of the Stockholm Convention. The document describes the mechanisms of dioxin/furan formation, and the abatement techniques of by-product destruction, both in case of organic (e.g. chlorination technologies) and inorganic chemical processes (e.g. chloride process manufacture of titanium dioxide).

Some major BAT/BEP recommendations for plants of the chemical industry in the above document are as follows:

- Modify processes to reduce generation of chemicals listed in Annex C of the SC;
- Incorporate steps that treat impurities in raw materials, and use rigorous operational maintenance;
- Purify products by distillation where physical properties allow;
- Internally recycle inadvertently generated high-molecular-weight by-products as an integral part of the process
- Manage wastes appropriately taking full account of the potential release of chemicals listed in Annex C to air, water and land and avoid any inadvertent formation.

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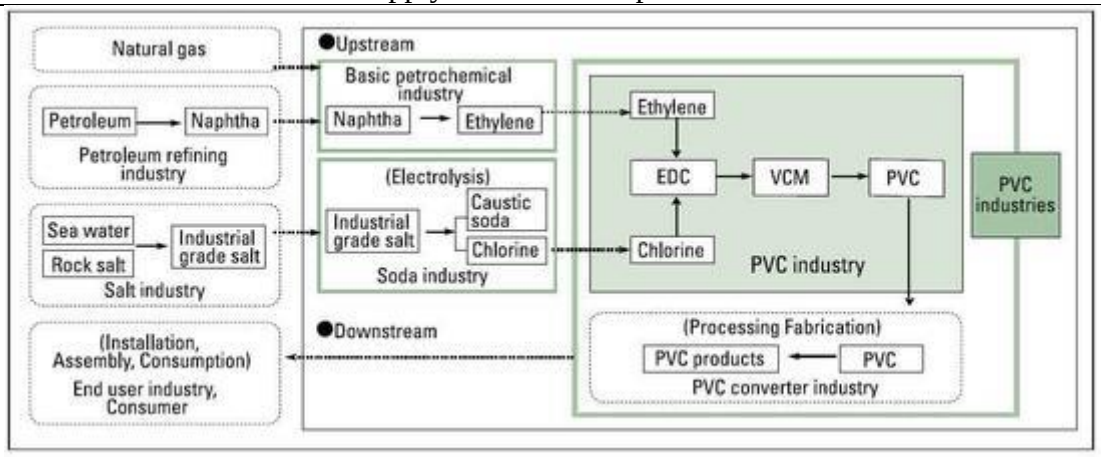
[163] Dioxins and Furans in the Chemical Industry. By Dr. Arseen Seys.
Source: http://www.chem.unep.ch/pops/POPs_Inc/proceedings/stpetbrg/seys.htm

[164] Guidelines On Best Available Techniques And Provisional Guidance on Best Environmental Practices relevant to Article 5 and Annex C of the Stockholm Convention on Persistent Organic Pollutants." Geneva May 2007. Part III Source category (f): Specific chemical production processes releasing chemicals listed in Annex C.

Dioxin emission from vinyl chloride production[165]

Let us see the example of vinyl chloride production, in which the following techniques are used and the following sector-specific BATs are recommended in order to reduce UPOPs.

The supply chain of PVC production[166]



Dioxin in off-gases of ethylene dichloride (EDC) production. In vinyl chloride (e.g. PVC) manufacturing the main portion of UPOP will be formed unintentionally during the phase of crude ethylene dichloride (EDC) production. These POPs are destroyed by thermal treatment. Sufficiently high temperature, turbulence, residence time and oxygen concentration are the keys to a complete destruction and the final dioxin level concentration in the off-gases. Typical temperatures of 1 100°C are used in combination with a residence time of 2 seconds and gas turbulence ensured by proper geometric design of reactive zone. Moreover, in order to avoid any further chemical transformation in the off-gases after the reactive zone, a quench column is provided to quickly cool the exhaust gases and allow the further treatments. The dioxin equivalent level obtained in the off-gases is lower than 0.1 ng TEQ/m³.

Dioxin in effluents of ethylene dichloride (EDC) production. The by-product of the EDC production is water, which may contain solids with adsorbed dioxin / furan. The reaction effluent is processed before being discharged outside the plant boundaries. Treatment facilities can include stripping[167], flocculation[168], settling, filtration of the effluent and biotreatment with activated sludge. The residues of the treatment processes are either incinerated as chemical waste or disposed of in controlled deposits. For emission into water, the self-regulatory Charter adopted by the European PVC industry includes dioxin emission guidelines based on Best Available Techniques[169]: it restricts dioxin content to a level of less than 1 microgram TEQ per ton of ethylene dichloride capacity[170].

Dioxin in wastes of EDC production. The main quantity of waste of the process will be

[165] Dioxins and Furans in the Chemical Industry. By Dr. Arseen Seys.
Source: http://www.chem.unep.ch/pops/POPs_Inc/proceedings/stpetbrg/seys.htm
[166] How is PVC made ? Source: http://www.pvc.org/en/p/how-is-pvc-made.
[167] Stripping is a physical separation process where one or more components are removed from a liquid stream by a vapour stream.
[168] Flocculation, in the field of chemistry, is a process wherein colloids come out of suspension in the form of floc or flake; either spontaneously or due to the addition of a clarifying agent
[169] Best Available Techniques recommended by the European Council of Vinyl Manufacturers (ECVM)
[170] ECVM Industry Charter for the Production of VCM and PVC. Source: http://www.pvcinfo.be/bestanden/S-PVC%20charter.pdf. Brussels, without date.

combusted as chemical wastes or disposed of in controlled deposits.

3.5.3. Unintentional POP emission by the Turkish chemical industry

Turkey has no UPOP emission inventory based on measurements. According to an estimation[171] prepared by using the internationally accepted methodology of UPOP calculation[172], the chemical industry contributes only 1.1 % to the total UPOP emission of Turkey. More than half of this amount is contained in the residues of chemical processes.

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

[172] Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases. United Nations Environment Programme, Edition 2.1, December 2005.

Estimated unintentional emission of POPs in the chemical industry. Turkey, 2013[173]

Rows extracted from Group 7 of pollution sources "Production and Use of Chemicals and Consumer Goods"

Source categories	Production	Annual release				
	t/a	g TEQ/a	g TEQ/a	g TEQ/a	g TEQ/a	g TEQ/a
		Air	Water	Land	Product	Residue
Chlorinated Inorganic Chemicals (e.g. Elemental chlorine production, Chloralkali production)	413 238	0.00	7.03	0.00	0.00	11.16
Chlorinated Aliphatic Chemicals (e.g. EDC[174], VCM[175] and PVC[176] production[177])	382 980	0.08	0.29	0.00	0.00	0.24
Chlorinated Aromatic Chemicals (e.g. Chlorinated Paraffins and Phthalocyanine dyes and pigments)	4 789	0.00	0.00	0.00	3.36	0.00
Other Chlorinated and Non-Chlorinated Chemicals (e.g. $TiCl_4$[178] and TiO_2[179])		0.00	0.00	0.00	0.00	0.00
Petroleum refining	2 495 000	0.06	0.07	0.00	0.00	0.00
Production of the chemical products of the above categories		**0.14**	**7.38**	**0.00**	**3.37**	**11.40**

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

[174] Ethylene dichloride

[175] Vinyl chloride

[176] Poly vinyl chloride

[177] The data in the table for the chlorinated aliphatic chemicals covers only the production of the main producer, i.e. PETKIM, which produces annually 133 510 tons of VCM, 116 610 tons of ECD and 132 860 tons of PVC.

[178] Titanium tetrachloride

[179] Titanium dioxide

3.5.4. Substitution of particular POP chemicals

What is substitution. Substitution can be defined as "the replacement or reduction of hazardous substances in products and processes by less hazardous or non-hazardous substances, or by achieving an equivalent functionality via technological or organizational measures"[180]. International organisations have repeatedly published guidelines on how to assess the feasibility and desirability of chemical substitution[181]. Substitution assessments are available for POPs such as PFOS, PBDEs, HBCD, PCB, Endosulfan, DDT and others. Decisions on substitutions require "trade-offs" to be made between improvements and deteriorations, costs and benefits, strengths and weaknesses. It is important to consider the length of time of implementation. Substitution can lead to human health and environmental economic benefits, and also to increased or decreased costs.

This chapter is a short overview of international substitution projects. The present document will go into more details on efforts made in Turkey to substitute the brominated flame retardant HBCD used in XPS isolation board and EPS packaging material.

There is a wide scope of international experiences about substituting specific POPs[182].

PFOS in textile industry. PFOS and related substances have been used to increase the oil and water repellence of textiles, to repel water, oil and dirt. Carpet production is responsible for over 90% of PFOS use in Europe[183]. Moreover, in smaller quantities, PFOS is used for surface coatings of leather, footwear, etc. A number of alternatives to PFOS and related substance are now available for these uses. Alternatives provide long-lasting water repellence, quick drying, waterproofness and breathability. However, the environmental persistence of some alternatives is uncertain and is the subject of ongoing research.

[180] Lißner et al. (2003): Substitution of Hazardous Chemicals in Products and Processes.

[181] See the following publications: (a) US EPA (2012): Alternatives Assessments for the Flame Retardants decaBDE and HBCDD (b) UNEP (2009): General guidance on considerations related to alternatives and substitutes for listed persistent organic pollutants and candidate chemicals, (c) OECD (2013): Current landscape of alternatives assessment practice: a meta-review.

[182] Source: "POPs in Articles and Phasing-Out Opportunities [DRAFT]". Stockholm Convention Regional Centre for Capacity-building and the Transfer of Technology in Asia and the Pacific (SCRCAP), Basel Convention Regional Centre for Asia and the Pacific (BCRC China). School of Environment, Tsinghua University, Beijing, 100084, China. Contact persons: Prof. Jinhui Li, Ms. Nana Zhao. June 2014.

[183] Study on waste related issues of newly listed POPs and candidate POPs". 26 August 2010. Authors: Consortium ESWI, BIPRO.

PFOS in Chromium Plating. Chromium Plating, which is an electrochemical surface layer building procedure. During the chemical process, a toxic mist of water and incompletely oxidised chromium is released from the bath, and PFOS can be used as mist suppressant. Non-fluorinated alternatives for hard chrome plating are available on the European market, other alternatives are still being tested. Alternatives to the PFOS derivatives are considered to be less stable and durable in the chrome bath than PFOS since they may not reach the necessary surface tension and additionally they degrade further through oxidation which is not the case for PFOS. A non-chemical solution is also available through the improvement of ventilation in chromium plating plants[184].

PFOS alternatives for paper impregnation. PFOS derivatives have been used in food contact applications including plates, food containers, popcorn bags, pizza boxes and wraps as well as in non-food contact applications such as folding cartons, containers, carbonless forms and masking papers. PFOS use for waterproof and greaseproof papers has been replaced, mainly by other fluorinated chemicals. Non-fluorinated alternatives of PFOS also exist: Grease-proof paper existed before PFOS technology was introduced to the market, and so it is clear that other technologies are available as substitutes.

PFOS in firefighting foam. PFOS is very effective for extinguishing highly flammable liquid fuel fires (e.g. at airports, oil refineries or storage facilities). Alternatives are available.

Alternative to PCB. PCBs have been used in closed applications as dielectric fluids in transformers and capacitors, heat transfer fluids and as hydraulic lubricants (primarily in the mining sector). Open applications of PCBs have included sealants, paints, speciality coatings, pesticide extenders, plasticizers, adhesives, dedusting agents, cutting oils, flame retardants and carbonless copy paper. Since widespread production bans in the late 1970s and early 1980s alternatives have been substituted for all uses of PCBs, but some of the substitutes need to be handled with great care as they may also present a risk to health and the environment.

Alternatives to Endosulfan. Chemical and non-chemical alternatives to the pesticide Endosulfan are available in many geographical situations both in developed and developing countries. Some countries want to continue to use Endosulfan to allow time for the phase-in of alternatives.

Alternatives to DDT. A range of countries are still using DDT: WHO recognises the need for DDT usage for disease vector control if done according to recommendations and guidelines, until locally appropriate and cost-effective alternatives are developed and implemented. Insecticide resistance is an advantage of DDT against malaria. There are potential alternatives to DDT under evaluation processes.

[184] For more details, pictures and information sources see the following Power Point publication: "Cost and benefit of substituting POPs with alternatives. Case study: HBCD in the XPS sector" By Peter Futo. Project - Technical Assistance for Implementation of the Persistent Organic Pollutants Regulation - EuropeAid/132428/D/SER/TR. 8th Training of Trainers, Sueno Hotel, Side, Antalya, Turkey, 20-24 October 2014

3.5.5. Substituting HBCD with alternatives in XPS and EPS in Turkey[185]

HBCD is used as an additive to a variety of materials as a flame retardant. It is used in expanded polystyrene foam (EPS) and extruded polystyrene foam (XPS) as well as textiles and in high-impact polystyrene (HIPS) in electronics housings. *XPS* is used in the construction industry as rigid insulation boards in constructions and in road and railway embankments to protect against frost damage and as thermal insulation. It is also used as insulation in sandwich constructions in vehicles such as caravans and lorries for cold or warm transport of goods. The main contents of XPS foam board are PS (polystyrene), chemical additives, blowing agents and HBCD. The XPS polystyrene isolation boards are manufactured with HBCD for attaining flame retardancy. Using HBCD chemical is not obligatory, but it is the most widely used chemical on the market as it is increases the fire performance of polystyrene.

Alternatives to HBCD exist, but they are still costly. Moreover, there are innovative isolation materials on the market which are less flammable than XPS[186].

Sectoral statistics: XPS production in Turkey is around 1.5 million m^3/year. There are around 15 companies producing XPS in Turkey. At the time of this investigation each Turkish XPS producing firm used only HBCD as flame retardant.[187]

The expected competition effects of banning or restricting HBCD are as follows. In Turkey, big global and big national companies can easily adapt themselves to the new regulatory conditions. But the competitiveness of small companies relies on cheap materials and they don't change their processes easily. Currently only 2 licensed companies offer HBCD-free fire retardant products and the cost of the products is around 5 times the cost of the HBCD as there is no competition. The formulation of XPS might probably change with the usage of these new products: new tests must be done to assess thermal resistance and the long term mechanical impacts of compression.

The main effects in terms of cost and benefits are as follows.

Cost of substitution: The unit cost impact on change to use of HBCD-free product for unit product of 30 kg/m^3, according to expert opinion is 5-8 Euro/m^3. The cost of substitution is 5 to 8 Euro multiplied by 1.5 million = approximately 10 million EUR per year plus the cost of changing the formulation through research and development.

[185] This chapter is based on an interview with the XPS Heat Insulation Manufacturers Association, Ankara. The memo of the interview is available in the Annex of this document.
[186] Flame Retardant Alternatives for Hexabromocyclododecane (HBCD). Draft for Public Comment. US EPA, September 2013.
[187] Source: Interview with XPS Heat Insulation Manufacturers Association, Ankara. For more details see the memo of the interview in the Annex of this document.

Cost of disposal. In the context of construction and demolition waste, already large volumes of HBCD are already "locked" in existing buildings. Treating all construction and demolition waste as hazardous due to HBCDD contamination would pose substantial costs to industry.

Benefit of substitution: using HBCD-free products has positive health and environmental impacts.

A potential ban of HBCD would strongly affect competition. Therefore a gradual, step by step reduction of HBCD usage is needed. A 5 year transition period is acceptable for the industry.

Use of HBCD in EPS. While XPS producers can buy flame retardants separately and apply them in the production process, EPS producers do not have this option, because HBCD (or any alternative of it) is incorporated as an integral and encapsulated component within the polymer. In Europe some 420 000 tons of EPS foam is used for construction applications. Additionally, packaging uses some 250 000 tons of EPS in Europe. The maximum concentration of HBCD in EPS beads is assumed to be 0.7 %.

3.5.6. Regulation and self-regulation of the chemical industry in Turkey

The Turkish Government aims to align local regulations to EU directives, especially in chemical substances area, with a fast adoption process being projected[188]. During the years 2008 and 2009, MoEF[189] prepared and issued regulations regarding the chemicals produced and imported to Turkey. These regulations are as follows: (a) Chemical Inventory and Control Regulation (C.I.C.R.) (b) Regulation on Authoring and Distribution of Safety Data Sheets for Hazardous Substances and Preparations (c) Regulation on Classification, Packaging and Labeling of Hazardous Substances and Preparations (d) Regulation on Restrictions for the Manufacture, Marketing and Use of Certain Dangerous Substances & Preparations. Additionally, preparatory work and progress has been made in introducing: (a) SEVESO II Directive[190] (b) CLP/GHS Regulation[191] (c) REACH[192] Regulation (d) Cosmetics Directive[193] (e) Detergents Regulation[194].

[188] Source: "Chemical Regulations in Turkiye; Today and Tomorrow" By Melih Babayigit, CRAD Regulatory Services.
[189] Ministry of Environment and Forestry
[190] Council Directive 96/82/EC of 9.12.1996 on the control of major-accident hazards involving dangerous substances.
[191] CLP/GHS regulation on Classification, labelling and packaging of substances and mixtures. Published in the Official Journal 31 December 2008
[192] Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH).
[193] Council Directive of 27 July 1976 on the approximation of the laws of the Member States relating to cosmetic products (76/768/EEC)
[194] Regulation (EC) No 648/2004 of the European Parliament and of the Council of 31 March 2004 on detergents.

Self-regulation of the industry: Responsible Care. Pollution prevention is one of the main aims of the "Responsible Care Initiative". This Initiative is a global, voluntary initiative developed autonomously by the chemical industry for the chemical industry. It stands for the chemical industry's desire to improve health, safety, and environmental performance. The Initiative runs in 52 countries including Turkey. In Turkey the Initiative is run by the Turkish Chemical Manufacturers Association which coordinates the Responsible Care initiative among its 65 member companies in Turkey since 1993[195].

Another European industrial self-regulation initiative is specialized on emission control of brominated flame retardants[196]. VECAP, the "Voluntary Emissions Control Action Programme" offers methodology, information exchange and a certification system for this purpose. Turkish associations of the chemical and textile industries should encourage their member firms to join this initiative.

3.5.7. Attitudes and opinions of Turkish chemical firms on POPs regulation

The Company Survey. In 2014 the POPs T.A. Project conducted a questionnaire based online survey among Turkish companies about their awareness of POPs, the associated pollution abatement technologies and costs, moreover about their expectations from the Government. The questionnaire and the full text of the responses of the five responding chemical firms are available in the Annex of this document.

The responding companies. Three out of the five companies employ more than 250 people while one is a medium and one is a small sized firm. The profile of the companies regarding to their products is very diverse: a number of chemicals are produced in these firms, such as hydrogen peroxide, chlorine, polyethylene waxes, ethylene, PVC, XPS.

POP usage and unintentional emission. The XPS producing respondent has stated that they use POP as input raw material, i.e. brominated fire retardant. This company stated that alternative raw materials should be assessed in order to reduce or eliminate POPs releases. The respondent of the big petrochemical firm has stated that there is a waste incineration plant in the company, in which dioxin-furan measurements are regularly done and the compliance with the limit values are checked constantly.

Best Available Techniques. Only one of the five firms is aware of BAT, but not from SC document, rather from IPPC documents. Only one firm installed BAT technology in the past (in 2000), but that was concerned with heavy metal (mercury) pollution abatement, not POP related.

[195] Turkish Chemical Industry's Responsible Care© Initiative. 16 Years of Implementation in Turkey, 1993-2009. Dr. Caner Zanbak, Environmental Advisor, Turkish Chemical Manufacturers Association, Sabancı Headquarters, Istanbul, Turkey, 9 June 2009.
[196] See e.g. : http://www.vecap.info/

The results of POP elimination. Only one of the five firms expects some additional income or advantage as a result of POPs reduction or POP elimination, due to increased sales or due to environmentally improved product quality and enhanced public image. Only one respondent thought that the technology used in the company has to be changed in order to satisfy more stringent pollution control requirements, but according to his opinion it is sufficient to apply some end of pipe technology for this purpose.

Expected impacts of the EU POPs Regulation. Typical chemical firms do not know what impact a future Turkish POPs regulation will have on their operations. In particular, no respondent firm has made calculations or assessment on whether the enforcement of the POPs regulation will have any influence on the competitiveness of their respective companies.

Guidance and training on POPs. Four companies think that more guidance in administrative and technological requirements on POPs should be provided, by the relevant governmental institutions and chambers, e.g. in form of practice oriented training courses.

Recommendations for the Turkish Government. According to one company the introduction of the EU POPs regulation should start when alternative raw materials will be available on the market. One firm recommends that companies related with POP emissions or production should be audited very seriously on a national basis. One company thinks that POPs regulation should start in 10 years from now, while the representative of the XPS firm stated that it needs only 2 to 4 years of preparation time.

3.5.8. Impact assessment considerations

The major cost item for the chemical industry is to reduce unintentionally emitted by-products (dioxin, furan, PAHs, etc.) of certain chemical processes, e.g. of PVC production. Cost will appear in waste management in the first place, because most UPOPs is emitted in the residues of the chemical processes. The Stockholm Convention's BAT/BEP procedures have been partly introduced in the sector, but further development is needed.

The major benefit items are connected with the research, development and sales of new alternative, POPs-free chemicals. Indeed, the need to replace intentionally produced industrial POPs in articles with alternatives is both a cost and a benefit for the chemical industry. In particular, the production of alternatives to brominated fire retardants in isolation materials (HBCD in XPS), packaging materials (HBCD in EPS) and firefighting foams (PFOS) will be a clear benefit for innovative companies producing or importing these alternatives, but it will be a cost burden for firms which will have to purchase and apply expensive alternative compounds in their products.

3.6. Cement industry

3.6.1. Capacities and production of the sector in Turkey

Cement production is a sub-sector of the of the building materials industry sector. Turkey is a major producer of basic construction materials such as cement, building steel, timber, bricks, PVC, polyethylene, glass, ceramic tiles and sanitary ware. Turkey is especially strong and competitive in producing construction steel, cement, ceramic and glass products[197].

Cement is produced by 66 companies in Turkey, out of which 62 are members of the Turkish Cement Manufacturers' Association. 48 cement plants are so-called integrated units which produce clinker, and fall under IPPC. The remaining 14 plants are performing only the grinding of purchased clinker and do not fall under IPPC[198].

There has been a steady increase of cement production of over the last years

Clinker & Cement Production in Turkey, 2005 - 2013

	Cement Production (million tons)	Clinker Production (million tons)
2005	42.8	36.4
2006	47.4	38.2
2007	49.3	41.6
2008	51.4	44.7
2009	54.0	46.2
2010	62.7	52.8
2011	63.4	54.3
2012	63.9	54.8
2013	71.3	60.2

[197] Building Materials Industry in Turkey. Published by the Ministry of Economy. Ankara 2012.
[198] Information obtained from the Turkish Cement Manufacturers' Association.

Installed capacity in cement factories in Turkey, 2011[199]

Region	Clinker[200]	Cement
Marmara	17 481 907	27 404 660
Aegean	5 997 123	8 491 200
Mediterranean	15 869 750	25 708 645
Black Sea	5 951 080	11 697 210
Central Anatolia	9 714 773	15 490 300
East Anatolia	3 977 000	7 386 640
South East Anatolia	6 137 000	10 306 503
TOTAL	65 128 633	106 485 158

Number of employees in cement factories in 2011[201]

	Manager		Engi-neer	Tech-nician	Offi-cer	Worker		Total	Out-sour-ced
Region	Technical	Admi-nistrative				Non-qualified	Quali-fied		
Marmara	95	79	52	111	273	531	929	2 070	797
Aegean	60	82	59	37	178	259	480	1 155	317
Mediterranean	59	61	82	115	277	353	871	1 818	970
Black Sea	60	54	47	66	184	411	518	1 340	437
Central Anatolia	92	53	46	74	150	198	894	1 507	860
East Anatolia	28	18	27	30	80	232	420	835	68
South East Anatolia	51	41	33	49	208	296	515	1 193	323
TOTAL	445	388	346	482	1 350	2 280	4 627	9 918	3 772

[199] Turkish Cement Manufacturers' Association, http://www.tcma.org.tr/

[200] In the manufacture of Portland cement, clinker is a material consisting of lumps of 3–25 mm diameter, which is produced in cement kilns by heating powdered limestone and alumino-silicate (clay).

[201]. Source: TCMA website www.tcma.tr. Includes only TCMA member companies.

Map of cement plants in Turkey[202]

[202] Source: Turkish Cement Manufacturers' Association, http://www.tcma.org.tr .

Cement export. In 2010 Turkey's export of cement ranked first in the world and Turkish cement industry reached an annual production of 62.7 million tons. The Turkish cement industry provides employment for more than 15 thousand employees. In 2011 the value of cement export was 914 Million USD. The major markets for Turkish cement exports were Iraq (25%), Syria (14%), Russia (6%), Israel (5%) and Brazil (4%).

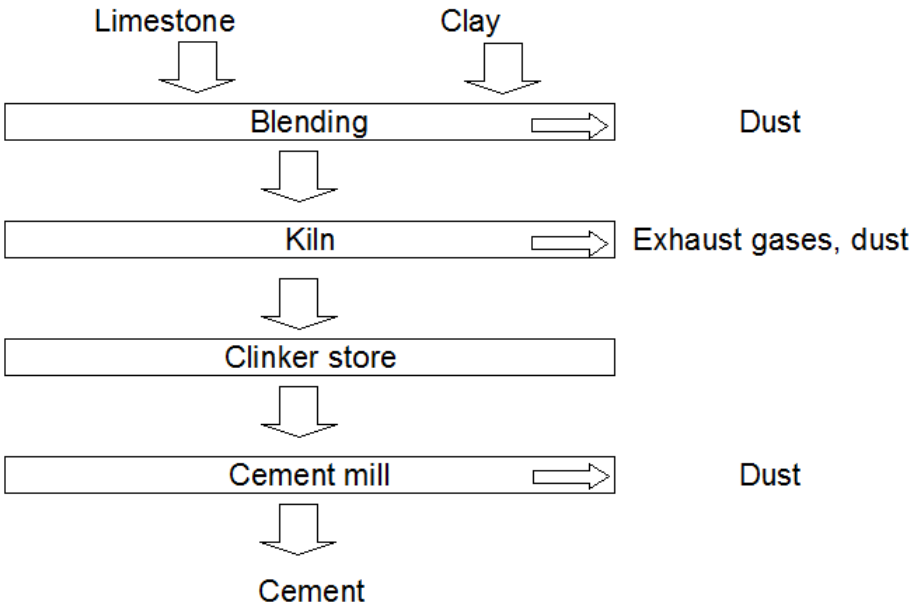
Stakeholders of the cement industry. The major professional organisation is the Turkish Cement Manufacturers' Association[203]. A full list of member plants is to be found on the website of TCMA[204].

Lime production data is given by Lime Producers' Association[205]. Annual lime production is 3 225 000 tons in 2010. According to a presentation of the association, 80 % of the production capacity is made by modern technologies with good dust control, while the rest is by conventional technologies that should be converted to modern ones[206].

3.6.2. Main environmental challenges of cement plants

Technology. A typical process of cement manufacture consists of three stages: (a) grinding a mixture of limestone and clay or shale to make a fine "rawmix" (b) heating the rawmix up to 1450 °C in a cement kiln (energy use accounts for up to 40% of production costs) (c) grinding the resulting clinker in a Cement mill to make cement.

Simplified flow chart of cement production and its environmental impacts[207]



[203] See www.tcma.org.tr .
[204] A full list of member plants of TCMA with availabilities is to be found on the following website: http://www.tcma.org.tr/ENG/index.php?page=icerikgoster&cntID=99
[205] Data is given at (http://kirec.org/images/10_istatistik.pdf) (in Turkish).
[206] Sector Report (http://www.kirec.org/images/file/KISAD%20-%20CEVRE%20BAKANLIGI%201%2020_06_2009son%20hali%20(SUNU).ppt) (in Turkish)
[207] Based on: http://www.understanding-cement.com/manufacturing.html

The wider[208] environmental impacts in the manufacture of cement are related to the following categories[209]: (a) dust (stack emissions and fugitive sources) (b) gaseous atmospheric emissions (NO_x, SO_2, CO_2, VOCs, others) (c) other emissions (noise and vibrations, odour, process water, production waste, etc.) and (d) resource consumption (energy, raw materials).

C*ompliance* with the IPPC Cement-BREF Document (BAT) can be achieved by investing into various pollution abatement technologies[210], such as the reduction of NO_x emission, reduction of dust emission and improving energy efficiency and flexibility in fuel procurement.

3.6.3. Waste co-incineration and pollution abatement of PCDD/Fs[211]

In the cement industry thermal processes, in particular in case of waste co-incineration, have the potential for comparatively high formation and unintentional release of dioxins, furans, HCB and PCBs as a result of incomplete combustion or chemical reactions. In this sector the major SC obligation is to reduce POPs emissions by waste co-incineration facilities in cement and lime kilns.

In 2014 in Turkey altogether 29 cement plants are licensed to co-incinerate. The estimated contribution of the cement and lime industry to total PCDD/Fs emitted in Turkey is only half percent. According to the UPOPs inventory, the emission of PCDD/Fs of these industries to water, land, product (i.e. cement and lime) and residues is negligible.

Estimated unintentional POPs emission of the cement and lime industry. Turkey, 2013.[212]

Source categories	Production	Annual release				
	t/a	g TEQ/a	G TEQ/a	g TEQ/a	g TEQ/a	g TEQ/a
		Air	Water	Land	Product	Residue
Cement kilns	67 228 083	3.36	0.00	0.00	0.00	0.00
Lime	3 225 000	6.63	0.00	0.00	0.00	0.00

[208] "Wider environmental challenges" in the context of this document means environmental challenges except and beyond the reduction of POPs emission.

[209] Based on several sources, e.g. (a) "Best Available Techniques" for the Cement Industry. A contribution from the European Cement Industry to the exchange of information and preparation of the IPPC BAT. Reference Document for the cement industry. December 1999. (b) Air Quality In The Marmara Region. Cement plants - implementation of BAT - Practical Example. By Konrad Mair, Dipl.-Ing. Government of Upper Bavaria, Munich. Power Point slides to Workshop "Industry Emissions and Air Pollution in the Marmara Region", Bursa, 12 April 2012

[210] Source: various interviews and the following publication: "Air Quality In The Marmara Region. Cement plants - implementation of BAT - Practical Example." By Konrad Mair, Dipl.-Ing. Government of Upper Bavaria, Munich. Power Point slides to Workshop "Industry Emissions and Air Pollution in the Marmara Region", Bursa, 12 April 2012

[211] This chapter is based on the following Power Point presentation: "Cement Industry - Co-processing and Guidance on POPs". By Arda Karluvali, Rast Engineering Services Ltd. Technical Assistance for Implementation of the Persistent Organic Pollutants Regulation EuropeAid/132428/D/SER/TR. 7th Training of Trainers, Hotel Ilıca Çeşme, İzmir, Turkey, 26-30/05/2014.

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

The most frequently used alternative fuels in Turkey are as follows

- Tyres
- RDF (refuse-derived fuel), SRF (Solid recovered fuel) (Plastic, Textile, Paper, Wood)
- Sewage sludge
- Solvents
- Waste Oil
- Oily waste
- Paint sludge

Legislation. The Turkish By-law on Waste Incineration stipulates that

- for hazardous waste with greater than 1% halogenated hydrocarbons expressed as chlorine, the operating temperature of the plant, after the last injection of combustion air should be greater than1 100°C for a residence time of at least 2 second.
- For all other wastes the temperature should be greater than 850°C for at least 2 seconds duration.

Moreover, quality control systems shall be applied to guarantee the characteristics of waste: in particluar, each waste load which is to be used as alternative fuels and raw material (AFR) shall be analyzed in order to ensure

- constant quality
- physical criteria, e.g. emissions formation, coarseness, reactivity, burnability, calorific value
- chemical criteria, e.g. chlorine, sulphur, alkali and phosphate content and relevant metals content (which may influence PCDD/F formation)

Pollution abatement techniques: primary measures. In order to minimise the possibility of PCDD/F formation, the following primary techniques are considered to be the most important:

- Carefully selecting and controlling of kiln inputs (fuels and raw materials), i.e. chlorine, copper and volatile organic compounds
- Limiting / avoiding the use of wastes which contain chlorinated organic materials
- Quick cooling of kiln flue-gases to lower than 200 ^{0}C and minimising residence time of flue-gases and oxygen content in zones where the temperatures range between 300 and 450 °C[213].
- Avoid the co-incineration of waste during start-up period and shutdown period of kiln operation.

If primary measures are properly implemented and dust is properly removed, cement kilns generally emit very low levels of PCDD/Fs. In particular, the primary measures mentioned above are sufficient to achieve an emission level much lower than the legally stipulated emission limit of 0.1 ng I-TEQ/Nm^3 in flue gases, both for new and for existing installations[214]. Due to the high temperatures involved in the cement production process, PCDD/Fs concentrations in solid residues are also low.

[213] Applicable to long wet kilns and long dry kilns without preheating. In modern preheater and precalciner kilns, this is an already built-in feature.

[214] For example, interviews made at Nuh Cement and Akçansa have revealed that dioxin/furan emission values are less than 0.01 ng I-TEQ/Nm^3

Secondary measures. If higher concentrations of PCDD/Fs occur, secondary measures are necessary, such as the further improvement of dust abatement and recirculation of dust, adsorption on activated carbon injection or selective catalytic reduction SCR[215] can be considered.

3.6.4. Summary of site visits in cement plants

In the framework of the T.A. project interviews were made in Turkish cement plants[216]. The interviewed environmental experts have confirmed that the Turkish cement industry fully complies with the requirements of the Bylaw on Waste Incineration, including the provisions on dioxin/furan emission, moreover with the requirements of the Bylaw on Control of Industrial Air Emissions and those of the Bylaw on Permits and Licenses that must be taken regarding Environmental Law.

Waste supply. Typical preferred alternative fuels are tyres, waste oil, Refuse-derived fuel (RDF)[217], Solid Recovered Fuel (SRF)[218] and dried sewage sludge (95% dry solid) because of their calorific value and organized supply chain of these materials. As a rule, no money is paid or taken for the waste supplies. Generally the analysis of waste is asked from supplier. Samples are taken to control the waste in laboratories. *W*aste related measurements include chlorine and phosphate content, calorific value, density, particle size etc. are measured.

Dust control. For removing particulates the following flue gas treatment systems are used in the interviewed plants: Cyclonic separation[219] and bag filters. In big and contemporary plants and in particular in case of kilns with co-incineration, Electrostatic precipitators (ESP)[220] are gradually being replaced with bag filters.

Burning conditions in the kilns must be stabilized in order to reduce pollution by NO_x and dioxin: in particular O_2 supply must be controlled in order to avoid the presence of residual O_2 and CO at the end of the kiln[221].

Measurements. In the companies visited dust, pressure, temperature, SO_2, NO_x, HF, HCl, TOC, CO and O_2 parameters are continuously measured and can be monitored by the authorities.

[215] Selective catalytic reduction (SCR) is a means of converting nitrogen oxides, also referred to as NOx with the aid of a catalyst into diatomic nitrogen (N_2), and water (H_2O). For more information see: BAT Guidance Note on Best Available Techniques for the Energy Sector (Large Combustion Plant Sector).
http://www.epa.ie/pubs/advice/bat/bat%20guidance%20note%20energy%20sector%20%28lcp%29.pdf
[216] See Annex of this document.
[217] Fuel produced by shredding and dehydrating solid waste (MSW) with a waste converter technology.
[218] Solid fuel prepared from non hazardous waste to be utilised for energy recovery in incineration and co-incineration plants
[219] Cyclonic separation is a method of removing particulates from flue gas by using gravity and the rotation of particles.
[220] Device for collecting and removing particulates from a flowing gas by using the force of an induced electrostatic charge.
[221] See SC BAT-BEP Guide on cement kilns.

3.6.5. Impact assessment considerations

The specific cost items attributable to UPOPs reduction in case of waste co-incineration technology are as follows: cost of

- ·pre-treatment processes of input material,
- ·organization of operational conditions for the complete destruction of organics
- ·and installing efficient flue gas treatment systems.

During the last decade the cement industry did a lot of investment for flue gas treatment especially for reduction of dust and NO_x parameters. As a side effect or collateral benefit, also POPs emissions are lowered. Therefore in the cement industry there is no need for investment of a special process for reduction of POPs related emissions as the emission values are very low regarding the limit values defined in By-law on Waste Incineration and By-law on Industrial Air Pollution Control.

In summary, there will be no additional compliance costs associated with POPs by-law for the cement industry due to current compliance with other existing legislation. The above statement is based on several interviews with environmental experts of the Turkish cement industry and on site visits.

3.7. Textile industry

3.7.1. Capacities of the textile industry in Turkey

Turkish textile industry in numbers. In terms of contribution to the national GDP (gross domestic product), to the employment generation and net exports, the Turkish Textile and Garment Industry is one of the most significant sectors in the country.

- *Production.* Textile production represented 10% of Turkish GDP and approximately 20% of manufacturing workforce in 2004. 17.5% of industrial production is related to the Textile Industry.
- *Export.* Turkey is one of the main players in the international textiles trade with a share of 3.7% in world trade of textile and garment and it is among the countries in terms of competitiveness of workforce, raw material and marketing. In 2007, the sector exported goods with a value of 22.7 billion USD[222].

SMEs are dominant in Turkish textile and apparel industry. Statistics indicates that in the textile sector there are 49 000 active SMEs accounting for 23% of total SMEs in manufacturing sector and 2.3 millions of employees[223].

The share of the Textile and Clothing Industry within the whole manufacturing industry[224]

Indicator	Textile Manufacturing Industry	Clothing Manufacturing Industry
Share regarding its total assets (%) (2008)	9.26	3.87
Share regarding its production value (%) (2008)	12.33	4.05

[222] UNIDO, TDF (2012): Analysis of environmental situation in Turkish textile industry with a special focus on target region

[223] Eda Kaya (2005): The Implementation of the IPPC Directive to SMEs in Textile Industry in Turkey

[224] Source: Turkish Industrial Strategy Document 2011-2014 (Towards EU Membership). Published in 2010 by the Ministry of Industry and Trade of the Republic of Turkey

Share regarding employment (%) (2008)	13.53	9.58
Share regarding its imports (%) (2008)	3.92	1.59
Share regarding its export (%) (2008)	10.02	10.06

According to a recent analysis[225], in the Turkish textile industry there is a total installed capacity of 1 350 000 tons for weaving; 2 250 000 tons for knitting; 400 000 tons for non-woven, rug and technical; that means a total capacity of 4 000 000 tons. By taking the capacity utilization ratio as 80 %, total textile production was estimated at 3 200 000 tons.

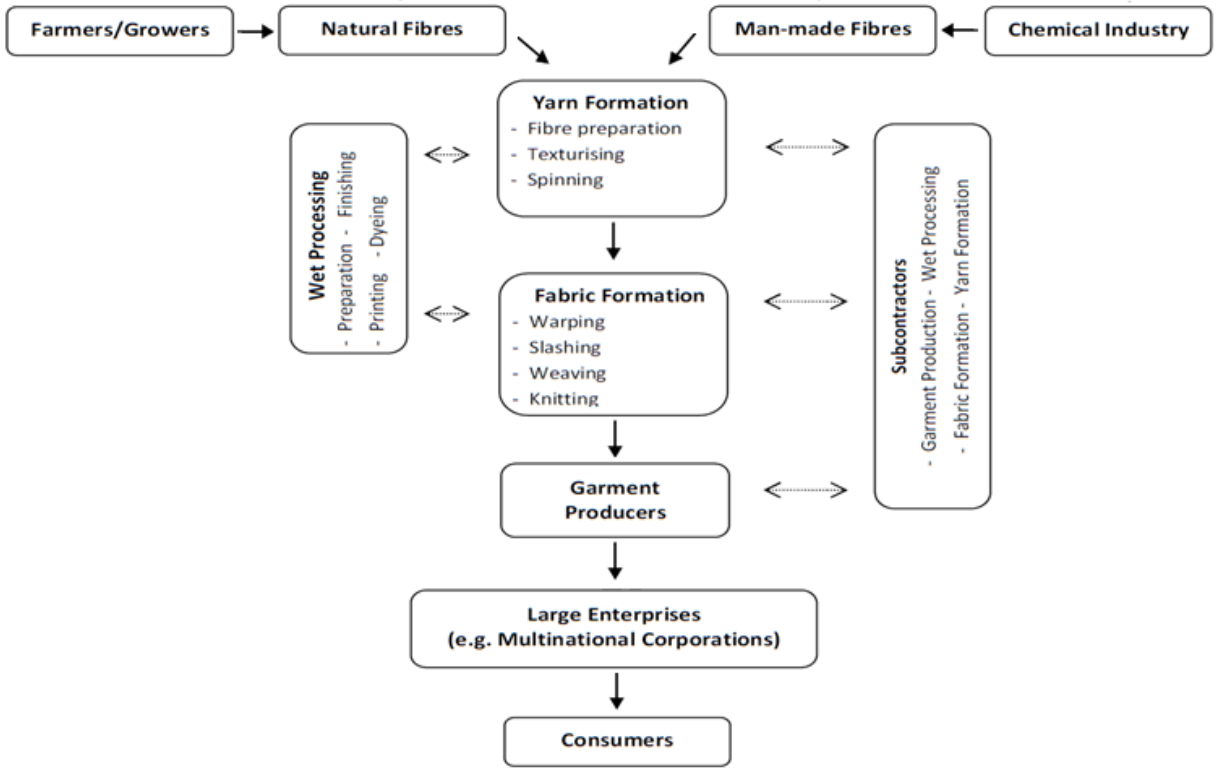
Production and trade flows of textile products. Turkey, 2011[226]

	Production	Import	Export	Remaining in Country
Amount (t)	3 150 000	2 496 270	1 171 090	4 475 180

3.7.2. Wider environmental concerns of the textile industry

Textile industry uses a large number of mechanical and chemical processes. Potentially each of these processes may cause pressure on the environment by the emission of certain harmful chemicals.

Supply chain of the textile industry[227]



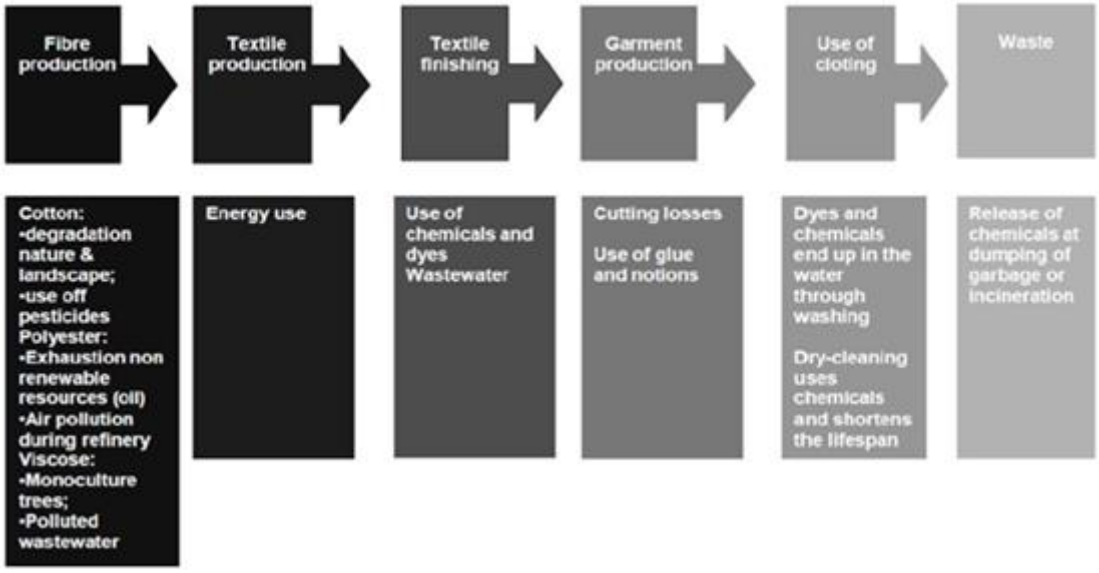
The environmental impacts of textile production depend on whether the fiber is the result of a natural or a synthetic production.

[225] "Analysis of Environmental Situation in Turkish Textile Industry with a Special Focus on Target Region". Final Report. Technology Development Foundation of Turkey (TTGV). Ankara, January 2012.
[226] Turkish national POPs inventory NIP Annex
[227] Source: UNIDO, TDF (2012): Analysis of environmental situation in Turkish textile industry with a special focus on target region.

- The wider environmental problems related to synthetic fibers are principally the high energy need during manufacturing and the production of toxic by-products.
- Environmental problems arising during the use of natural fiber - e.g. cotton - are different. Cotton is grown with the use of large amounts of pesticides and artificial fertilizers including toxic, persistent and bio-accumulative chemicals.
- The application of dyes and fire retardants may cause further environmental concerns, due to their potential POP content.

Accordingly, the biggest environmental challenges for textile industry are associated with the process of textile finishing, and the resulting chemical load carried by the resulting wastewater. The effluent may contain pollutants such as dissolved solids, dye residues and trace metals[228].

Environmental issues in the textile industry[229]



POPs in textile finishing. The aim of the finishing process is to achieve special characteristics for the textile, such as water, flame or wrinkle resistance. For this purpose, a variety of chemicals is used

- as *textile dyes*
- *as flame retardants* such as halogenated compounds (e.g. PBDEs) , or compounds containing heavy metals, raising safety issues at work in the textile industry, for the consumers of textiles and for the general population;

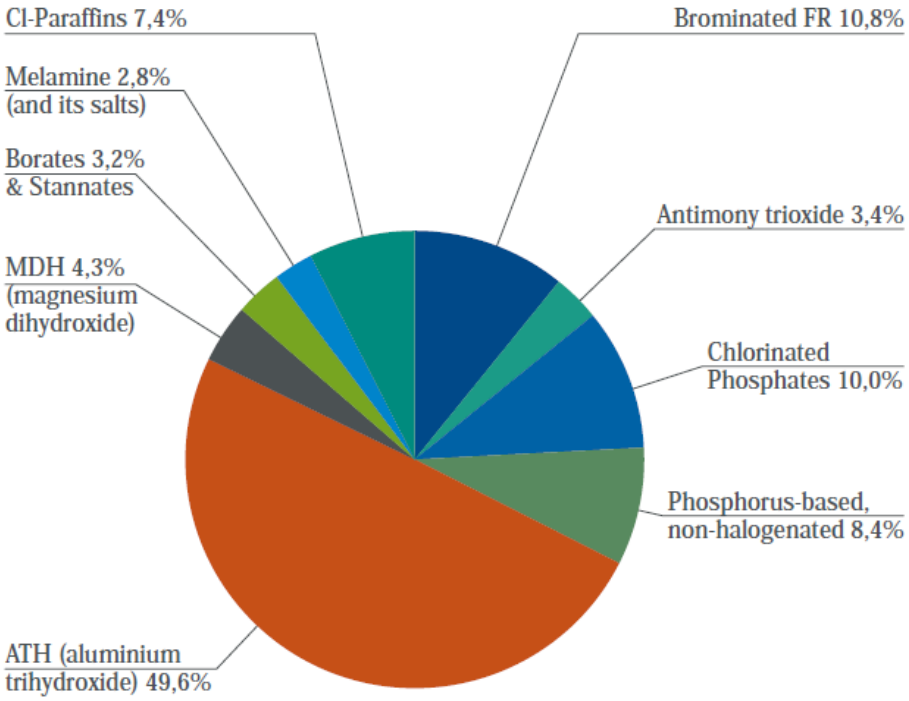
moreover, biocide (fungicide) chemicals are used as *fabrics preservatives* in order to prevent fungi such as mildew[230].

[228] UNIDO, TDF (2012): Analysis of environmental situation in Turkish textile industry with a special focus on target region
[229] Source: Analysis of environmental situation in Turkish textile industry. UNIDO-TDF 2012
[230] UNIDO, TDF (2012): Analysis of environmental situation in Turkish textile industry with a special focus on target region

3.7.3. Flame retardants in the textile industry

Flame retardants in general. In textile industry flame retardants are widely used in order to ensure fire safety of a wide range of materials. They are designed to minimise the risk of a fire starting or spreading, i.e. to slow down combustion. Among flame retardant chemicals, Brominated Flame Retardants (BFR) are very popular and have been used for several purposes such as upholstery fabrics, carpets, furniture, car seating, etc. for the last 30 years. Their main advantages are low costs and high effectiveness.

Structure of the flame retardants market in Europe in 2005[231]



However, flame retardants may be toxic in themselves, or may decompose into other toxic products: certain halogenated flame retardants could decompose and form polybrominated dibenzodioxins (PBDDs) and dibenzofurans (PBDFs) during their production and processing, and during their usage in case of fire or incineration.

PBDE flame retardants. One of the most frequently used group of flame retardants are Polybrominated diphenylethers (PBDEs). PBDEs are widely dispersed in the environment and in food chains (fishes have the highest concentrations). Another main exposure route to humans is dust emanating from carpets and upholsteries, whereby generally, outdoors the concentration of BFRs in dust is 10 to 100 times lower than indoors[232].

HBCDD flame retardants. HBCDD-containing polymers are frequently used for coating textiles (both for synthetic and cotton fibres) with them. These flame-retarded textiles treated with HBCDD are usually technical textiles and furniture fabrics.

[231] Flame Retardants: Frequently Asked Questions. By EFRA - The European Flame Retardants Association.. Published in 2007.
[232] Ministry of Environment and Urbanization(2014): National Implementation Plan of Persistent Organic Pollutants (POPs) Management in Turkey

3.7.4. Dioxins and furans in the textile industry

Dioxins and furans have very different sources in textile industry:

- Pentachlorophenol (PCP): it is an organochlorine compound that is used as a pesticide and as a disinfectant (e.g. as a biocide for cotton). PCP is frequently contaminated with PCDD/Fs which could end up in the raw materials and in the textile.
- PCDD/Fs contamination in textile dyestuffs (e.g. dioxazine (purple) and antraquinone (Red 177) dyes and Direct Blue 106 dye, Direct Blue 108 dye and Violet 23 dyes).
- From textile washing a huge amount of PCDD/Fs release is possible in the effluent water that goes into the environment.
- In products, new garments may contain PCDD/Fs in concentrations ranging from low to high contentrations (up to 300 ng/g)[233].

Textile dyes. There are more than 100 000 commercially available dyes in the market, and the production of dye-stuff is more than 7 000 tons in each year worldwide. The synthesis of colorants is a complex process involving a large group of input and intermediary chemicals. During this synthesis, the unintentional production of toxic, carcinogenic and persistent organic compounds can occur, especially if the colorant contains chlorine. Approximately 40% of globally used colorants have contents of organically bound chlorine. These colorants mean a significant source of dioxins and precursor compounds for the formation of dioxins and other persistent organic pollutants[234].

Impact mechanism. After these compounds appear in textile processing, they could have different transfer pathways from textiles to human bodies:

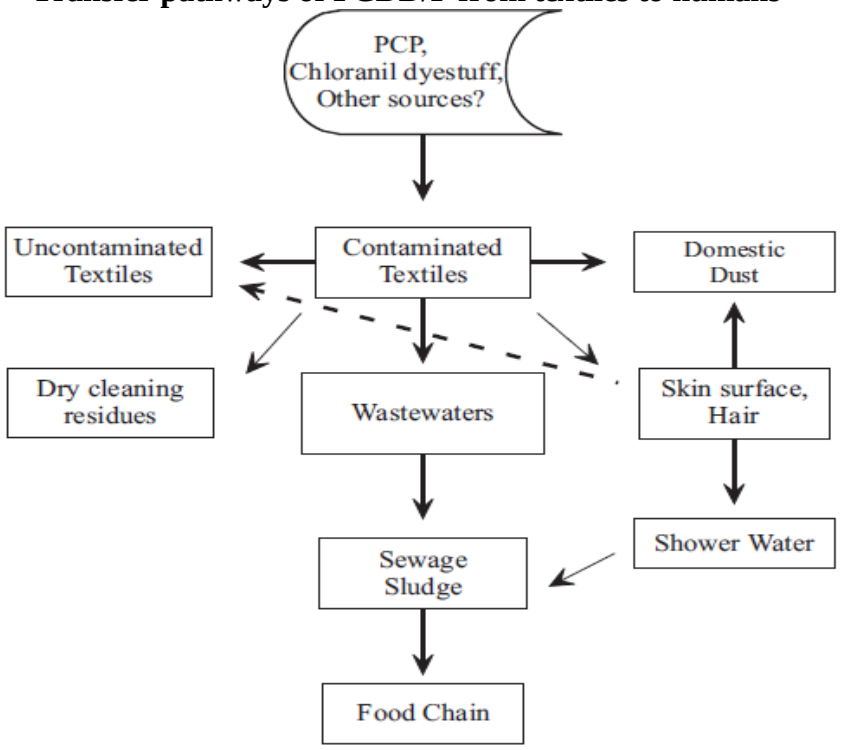
- Colorants could contain a considerable level of dioxins,
- During washing processes in sewage sludge (that is often used as an agricultural fertilizer),
- With direct transfer through human skin (only a small amount),
- After different incineration processes[235].

[233] Bostjan Krizanec, Alenka Majcen Le Marechal (2006): Dioxins and Dioxin-like Persistent Organic Pollutants in Textiles and Chemicals in the Textile Sector

[234] See Bostjan Krizanec, Alenka Majcen , Le Marechal, 2006.

[235] See Bostjan Krizanec, Alenka Majcen, Le Marechal, 2006.

Transfer pathways of PCDD/F from textiles to humans[236]



3.7.5. Pollution abatement technologies in textile industry

Best available techniques. The most efficient primary measure to prevent contamination of textiles with PCDD/Fs would be to leave dioxin-contaminated biocides and dyestuffs out of the whole production chain. If these chemicals are used, preference should be given to batches containing low concentration (e.g. distilled or otherwise purified chemicals). To the extent possible, burning of textile products and carpet should be avoided to prevent PCDD/Fs formation. In order to prevent (or minimize) formation and release of PCDD/Fs during wastewater sludge burning, best available techniques should be applied[237].

In the wastewater produced during textile processing a number of technologies could be used in order to reduce the pollution of the emitted water at the end of the technology:

- "Lagoon process": it is used by most textile companies for natural decomposition in so-called "Stabilization ponds". The technology itself involves a huge environmental risk since waste sludge containing textile dyes will be often washed into natural waters.
- BREF recommends wastewater treatment methods for textile industry such as oxidation methods (e.g ozonation), adsorption methods with the help of activated carbon or combined biological-physical and chemical treatments.

An increasing portfolio of brominated fire retardants can be substituted by less harmful compounds[238].

[236] Source: Bostjan Krizanec, Alenka Majcen Le Marechal (2006): Dioxins and Dioxin-like Persistent Organic Pollutants in Textiles and Chemicals in the Textile Sector

[237] Stockholm Convention (2006): Guidelines on best available techniques and guidance on best environmental practices

[238] POPs in Articles and Phasing-Out Opportunities. (Draft). June 2014. Stockholm Convention Regional Centre for Capacity-building and the Transfer of Technology in Asia and the Pacific (SCRCAP). Basel Convention Regional Center for Asia and the Pacific (BCRC China). Contact persons: Prof. Jinhui Li, Ms. Nana Zhao. Add: School of Environment, Tsinghua University, Beijing, 100084, China

Some POP-specific BATs and BEPs recommended by UNEP[239] are as follows:

- Replace chlorinated textile-protecting chemicals by alternative compounds
- Replace dioxin contaminated dyestuffs by alternative compounds
- Prefer batches containing low concentration (e.g. distilled or otherwise purified) of chlorinated textile-protecting chemicals and of dioxin contaminated dyestuffs
- Avoid burning of textile, upholstery, leather products and carpet to prevent PCDD/PCDF formation

3.7.6. Evidence on POPs emission and use in Turkish textile industry

Unintentionally emitted POPs. According to the estimation of the 2013 UPOPs inventory[240] for Turkey, the textile industry is responsible for the emission of annually approximately 32.3 g TEQ of dioxin/furan, which amounts to 2.5 % of the full amount of dioxin / furan emitted in Turkey.

Estimated quantity of unintentionally emitted POPs by the textile sector. Turkey, 2013[241]

	Source categories	Production	Annual release				
Class		t/a	G TEQ/a	g TEQ/a	g TEQ/a	g TEQ/a	g TEQ/a
			Air	Water	Land	Product	Residue
	Textile plants (ton produced)	3 200 000	Not known			32.29	Not known
1	Low-End Technologies	320 000				32.00	
2	Mid-Range, non-BAT Technologies	2 880 000				0.29	
3	High-End, BAT Technologies	-	-	-	-	-	-

For arriving to the above results, the classification of the technologies used in textile production with respect to environmental concern was made based on the classification of the textile companies given in the TTGV report[242]. This classification is assumed that: 90% of the production is made by "mid-range, non-BAT technologies", while 10% is by "low-end technologies".

[239] Stockholm Convention (2006): Guidelines on best available techniques and guidance on best environmental practices

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

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

[242] "Analysis of Environmental Situation in Turkish Textile Industry with a Special Focus on Target Region". Final Report. Technology Development Foundation of Turkey (TTGV). Ankara, January 2012.

PBDE. There is no data on the BFR or PBDE consumption of the textile industry. However, the total amount of PBDE used in the country can be estimated by taking into consideration the following. *In Turkey* the imported quantities of PBDE are the following:

- Directly: 177 tons of penta/tetra BDE was imported directly between 1996 and 2013
- Indirectly: 100 000 tons of c-Octa BDE contained in ABS (Acrylonitrile-Butadiene-Styrene)[243]

PFOS. There is only indirect information on the PFOS consumption of Turkey and no information about PFOS use in Turkish textile industry[244]. But it is to be assumed that similarly to other countries, carpet production is responsible for over 90% of PFOS use as flame retardant[245].

3.7.7. Impact assessment considerations

The primary sources of PCDD/Fs contamination in textiles and leather goods are the chemicals applied in the respective production or finishing stages of the respective production technology. In particular, fire retardants used for carpets and the chemicals used for bleaching and dyeing the final products and protecting them from fungi might be contaminated with POPs.

In the textile sector of Turkey the biggest environmental cost will be associated with the introduction of wastewater treatment facilities according to the IPPC BAT / BEP techniques specific for this sector[246]. Compared to the expected expenditures of the textile industry on wastewater treatment due to IPPC/IED, it will be somewhat less expensive to address the specific environmental concerns associated with POPs, i.e. to introduce pollution abatement technologies suitable for eliminating POP – PCDD/Fs emissions, and to substitute POPs brominated flame retardants with less harmful substances.

The Government should consider

- To introduce subsidy schemes for research and development projects of the textile industry facilitating the above aims
- To introduce environmental taxes on the use of POPs brominated flame retardants.
- To motivate Turkish textile companies to join the *EU industry voluntary scheme* called "Voluntary Emissions Control Action Programme" (VECAP), a scheme offering adjustments in BFR emission abatement working practices accompanied by training course and a certification system.

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

[244] Source: NIP 2014: National Implementation Plan of Persistent Organic Pollutants (POPs) Management in Turkey. Ministry of Environment and Urbanization of Turkey. August 2014.

[245] Study on waste related issues of newly listed POPs and candidate POPs". 26 August 2010. Authors: Consortium ESWI, BIPRO.

[246] A. Merve Kocabas, Hande Yukseler, Filiz B. Dilek, Ulku Yetis: "Adoption of European Union's IPPC directive to a textile mill: analysis of water and energy consumption." In: Journal of Environmental Management, 91 (2009), p.102-113.

4. Policy implications

4.1. Government activities, their cost and financing

In Turkey the authority concerning environmental matters are divided between the central and local government. The Ministry of Environment and Urbanization has the authority on chemicals management. Other institutions of the central government[247] also have responsibilities in relation to POPs.

Introducing the POPs Regulation implies the implementation of the 15 Activities of the Action Plan, which have been detailed in the NIP 2014 document[248]:

- Activity 1: Institutional and regulatory strengthening measures
- Activity 2: Annex A POP-Pesticides
- Activity 3: Manufacture, import, export, use, identification, labeling, removal, storage and disposal of PCBs and PCBs containing equipment
- Activity 4: Production, import and export, use, stockpiles, and wastes of brominated flame retardants
- Activity 5: Management of DDT
- Activity 6: Production, import and export, use, stockpiles, and wastes of PFOS, its salts and PFOSF (Annex B, Part III chemicals)
- Activity 7: Reduction, elimination and control of uPOPs
- Activity 9: Identification of contaminated sites (Annex A, B and C Chemicals and Annexes I, II and III) and remediation in an environmentally sound manner
- Activity 10: Facilitating or undertaking information exchange and stakeholder involvement
- Activity 11: Public awareness, information and education
- Activity 12: Assessment on effectiveness
- Activity 13: Reporting
- Activity 14: Research, development and monitoring
- Activity 15: Technical and financial assistance

Tasks to public stakeholders. A wide range of these Activities defined in the NIP Action Plan are to be implemented by, and on behalf of public stakeholders, such as the Government, subordinated Government agencies and municipalities. All of the main obligation categories[249] mentioned in the Action Plan Costs of the Stockholm Convention[250], are relevant for the Central Government, which will be responsible for drafting the legislation, implementing/enforcing the measures, consulting with the affected firms, developing institutions and governance mechanisms of the relevant chemical safety measure.

[247] Such as Ministry of Forestry and Water Affairs , Ministry of Science Industry and Technology, Ministry of Economy, Ministry of Energy and Natural Resources, Ministry of Food Agriculture and Livestock, Ministry of Customs and Trade, Ministry of Development, Ministry of Health, Ministry of Labour and Social Security, Ministry of Transportation, Maritime Affairs and Communications, Ministry of National Education,

[248] National Implementation Plan of Persistent Organic Pollutants (POPs) Management in Turkey. Ministry of Environment and Urbanization of Turkey. August 2014. Authors: Prof. RNDr. Ivan Holoubek, CSc., Assoc. Prof. İpek İmamoğlu, Ph.D., Gülün Egeli, M.Sc., Esra Şıltu, M.Sc. in co-operation with: Ms. Bursev Doğan Artukoğlu, Mr. Ahmet Daşkın, Mr. Mahmut Osmanbaşoğlu, Mr. Ertan Öztürk.

[249] Such as legislative, implementation and management tasks of the following 7 issues: (a)·POPs in Pesticides and Fungicides, (b) POPs in industrial chemicals, (c) Dioxine and furan emissions, (d) Stockpiles of POPs, (e) Waste management, (f) Trade of POPs, and (g) Articles / Products containing POPs.

[250] Guidance on Calculation of Action Plan Costs for Specific Persistent Organic Pollutants.

Tasks to private stakeholders Other Activities defined in the NIP Action Plan are to be implemented by private stakeholders such as firms. The Government must create the policy framework of motivating and facilitating the private sector to introduce the BAT/BEP recommendations of the SC, to co-operate in the elimination of stockpiles of POPs and in cleaning of sites polluted by POPs.

The cost items managing persistent organic pollutants for the Government follow directly from the "SWOT Analysis Table for POPs Management" and from the Action Plan of the NIP of 2014. The most significant future budgetary expenditures can be deduced from the "Weaknesses" and "Threats" cells of the SWOT Table. Accordingly, the Turkish Government shall

- Establish the legal framework, including the subordinate legislation of implementing the SC, CLRTAP[251]/POPs Protocol and EU POPs regulation;
- Develop a complex institutional framework for POPs management with sufficient infrastructure and administrative procedures of consultation: in particular to set up a specific inspection and permitting department dealing with POPs management.
- Facilitate and institutionalize intra-ministerial coordination/cooperation with special respect to co-operation with departments responsible for implementing IPPC/IED and LRTAP in Turkey.
- Facilitate and institutionalize inter-ministerial co-ordination with other Ministries and their subordinated Government agencies, collaboration with Competent and Relevant authorities and with non-Governmental stakeholders,
- Develop POPs related inventories[252] as permanent, ongoing processes.
- Implement awareness raising actions among stakeholders to enable the implementation of SC NIP measures;
- Continuously monitor and control of the implementation of the measures identified in NIP;
- Co-ordinate and support POPs-related research and development efforts

Scope of obligations and plans. The above measures should be extended

- to all POP compounds as listed and dynamically extended by the SC[253],
- to all sources, uses and wastes of POPs,
- to all locations of POP usage or emission[254]
- to all stages of POPs fate, with special respect to the food chain,
- and to every relevant policy area, with special respect to environment protection, food safety, research and development and education.

In particular, in case of the Ministry of Environment and Urbanization, a list of planned operative activities for each POP compound has been listed in the following Table.

[251] Convention on Long-range Transboundary Air Pollution
[252] including inventories of POP pollutants, POP-contaminated sites and POP stockpiles
[253] including old and new, unintended (e.g. dioxin and furan), agricultural (e.g. POP pesticides) and industrial (e.g. PCB, brominated and fluorinated flame retardant) POPs, and dynamically extended by compounds identified in the future as POPs.
[254] including production sites, POPs containing equipment, stores, deposits and loads and contaminated sites

Framework of operative activities of POPs management at MoEU [255]

	POPs (Grouped)	Usage	Legislation	Prevention (Reduction)	Inventory	Stockpiles (Disposal)	Waste	Contaminated Sites	Alternatives	Monitoring
1.	**Pesticides**	No usage	Banned. No need for extra legislation.	Not required. There exists registry and market surveillance.	No need for inventory.	HCH stockpile of company MERKIM will be disposed. The budget for disposal can be found.	No waste	Contaminated sites needs to be identified and remediated.	No need	Monitoring required, harmonised with E-PRTR activities.
2.	**HCB**	No usage, but should be confirmed.	Banned as pesticide, but can be used as industrial chemical.	Not required. There exists registry and market surveillance.	No need for inventory.	To confirm whether stockpiles of HCB as industrial chemical exist.	No waste	To confirm whether contaminated sites of HCB as industrial chemical exist.	No need.	Monitoring required, harmonised with monitoring of pesticides.
3.	**PCBs**	Still in use. Full inventory needed. To harmonise with PCB Action Plan, Waste Management Department.	There exists legislation: By-law on Control of PCB/PCT	Not required. As unintentional POP: BAT/BEP is same as in case of PCDD/Fs reduction.	Updated inventory exists only for transformers. To extend to all PCB containing equipment.	Stockpiles need to be mapped.	To confirm the cost of treatment, recovery and disposal of PCBs contaminated equipment.	Contaminated sites shall be identified and remediated.	No need. All usage will be definitely stopped till 2025.	Monitoring required.
4.	**PCDD/Fs**	No usage. Unintentionally produced.	There exists limit value in By-law on Control of Industrial Air Pollution. It will be harmonized with Industrial Emissions Directive.	Significant costs for reduction of PCDD/Fs via implementation of BAT/BEP. To examine subsectors. Enforce SC Annex C Part II and Annex C Part III	Inventory is required. Toolkit is used but more precise data on emissions needed.	There is no stockpile. There is no cost for disposal.	Action needed if PCDD/Fs analysis of sewage sludge indicates the need.	To confirm if contaminated sites exist and their number and remediation costs.	No need for alternatives.	Monitoring required, both of emissions (by industry) and of environment (by the state).

[255] This table has been compiled by the authors of the SIA report on the basis of an analogous table received from MoEU in August 2014.

	POPs (Grouped)	Usage	Legislation	Prevention (Reduction)	Inventory	Stockpiles (Disposal)	Waste	Contaminated Sites	Alternatives	Monitoring
5.	**PFOS**	Still in use.	To prepare legislation for banning and restriction.	Measures needed, based on a PFOS guidance of SC BAT/BET.	To compile PFOS inventory of use in registered restricted areas.	To compile inventory of PFOS stockpiles.	To enforce ban and disposal of PFOS containing equipment.	To compile inventory of PFOS contaminated sites..	To take into account the introduction of PFOS alternatives.	Monitoring required.
6.	**HBB**	Banned since 1993.	No need for legislation.	No need for precautions.	No need for inventory	No stockpiles	No wastes	No contaminated sites are known. Investigation is needed.	No need for alternatives.	Monitoring not required.
7.	**Tetra-penta BDEs**	Legislation exists for use as PUF in vehicles.	Legislation is required.	To take into account costs of reduction. See SC BAT / BEP on PBDEs.	Inventory is required. Registry is required for the limited usage areas.	Stockpiles are to be determined.	Waste of BDEs containing equipment serious problem. If banned, to take into account cost of disposal, substitution.	No information on contaminated sites. Investigation is needed.	To take into account the introduction of BDE alternatives..	Monitoring required.
8.	**Hexa-hepta BDEs**	Legislation exists for use as in CRT monitors.								
9.	**PeCB**	No usage, but can be produced unintentionally.	Legislation is required	Implementation of BAT/BEP for reduction of PCDD/Fs also covers PeCB.	No need for inventory.	No stockpiles.	No waste.	No information on contaminated sites, probably there is none.	No need for alternatives.	Monitoring required under same conditions as on PCDD/Fs.
10.	**HCBD**	Still in use.	Legislation is required.	No need for precautions.	Inventory is needed.	Probably there are stockpiles. They must be identified and disposed.	Waste of XPS and EPS containing this compound.	Contaminated sites not known. They should be identified.	To take into account the introduction of HBCD alternatives..	Monitoring required.
11.	**PAHs**	Unintentionally produced	Legislation exists.	Precautions are to be taken.	Inventory needed.	Not Applicable	No waste.	There might be contaminated sites.	Not Applicable	Monitoring required under same conditions as on PCDD/Fs.

Inspections[256]. The control of persistent organic pollution should be thoroughly co-ordinated with the existing inspection processes of MoEU. Generally the competent authorities for inspections are the Provincial Directorates, although in case of complex installations the central level of MoEU does some inspections upon request by the Provincial Directorates. As of now, inspection reports are not made publicly available, but a substantial range of installation-specific environmental data will be made public with the full implementation of the IPPC/IED Directive in Turkey through the "By-Law on Integrated Environmental Permits" [257].

POPs in inspections. Some POPs related changes to be implemented in the inspection system are as follows:

- *Planning.* Inspections and site visits are partly complaint-driven, and partly according to the annual plans of Provincial Directorates. Additionally, the planning of inspections should be based on concerns associated with POPs. The selection of installations to be visited should be based (a) on the existing and continuously developed inventories of stockpiles, production sites associated with POPs, (b) on the existing and continuously updated IPPC Inventory[258] and (c) on the EIA Database of MoEU[259].
- *Training.* It will be necessary to train selected members of the staff of the Provincial Directorates on inspection methods associated with POPs[260].
- *Co-operating.* POPs related inspections will have to be harmonized with the inspections to SEVESO installations and also will necessitate collaboration in the inspection of IPPC/IED installations[261], as soon as the "By-Law on Integrated Environmental Permits" enters into force[262].

[256] Estimates of the resources needed by the MoEU to implement an integrated environmental permitting and inspection system. Draft 1. Mission 1, 01-02-2013, Activity nr: 3.1. Experts: Michał Jabłoński, Joan Ramon Cabello. Document of the IPPC Twinning Project, Ankara, February 2013.

[257] For the current status of the draft of this By-law see:
http://www.csb.gov.tr/projeler/ippceng/index.php?Sayfa=sayfa&Tur=webmenu&Id=8973

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

[259] The Environmental Impact Assessment (EIA) Database contains about 40.000 records of application/permits/installations that fall under EIA procedure.

[260] According to calculations made in 2013, in the 81 Provincial Directorates the competent staff working with permits, inspection, licenses and EIA was 978 persons.

[261] IPPC/IED Inventory is a full list of Turkish industrial, agricultural and waste management installations that are under the scope of the IPPC/IED Directive. According to calculations made in 2013, there were 5991 IPPC / IED installations in Turkey.

[262] For the current status of the draft of this By-law see:
http://www.csb.gov.tr/projeler/ippceng/index.php?Sayfa=sayfa&Tur=webmenu&Id=8973

The cost of the above ambitious plans is high. The NIP Action Plan foresees to ensure a regular annual budget for inventories, disposal, monitoring, research and awareness rising. A significant part of the above activities can be financed by the ongoing GEF[263] Project on behalf of Turkey under the title "POPs Legacy Elimination and POPs Release Reduction Project". The Project is based on a GEF grant of USD 11.5 million, and will be additionally co-financed by other donors[264] up to the amount of 43.1 million USD[265]. As of the specific activities financed, the highest amount of subsidies is assigned to POPs stockpile elimination, followed by expenditures for UPOPs and PCBs management and finally by institution development of the policy area of chemical governance.

Selected major activities of the "POPs Legacy Elimination and POPs Release Reduction Project" implemented on behalf of Turkey, financed by GEF[266]

		Indicative grant, million USD	Indicative co-financing, million USD
1.	Elimination of Current POPs Stockpiles/Wastes	5.0	17.0
2.	Planning / Capacity Building for Environmentally Sound Management of Future PCBs Stockpiles.	1.7	7.0
3.	Reduce Release of Unintended POPs.	2	10.0
4.	Develop management capacity for POPs contaminated sites	1.0	6.0
5.	Institutional / Regulatory Capacity Strengthening for POPs and Sound Chemicals Management	0.5	2.0
6.	Monitoring and Evaluation (M&E); knowledge sharing and learning	0.1	0.3
	Project management costs	0.5	0.5

4.2. Benefits of POPs management

The planned policy actions are motivated by the expected benefits of such interventions.

Benefits in terms of health and environment. The benefits of compliance with the EU POPs regulation means that Turkey will improve its management of POPs and as a consequence, will better protect the health of its citizens, the environment in general and wildlife in particular. The need for such improvement has been outlined in a wide range of publications:

- Epidemiological assessments[267] made in Turkey have shown the presence of POPs in human milk, blood and fat of the Turkish population.

[263] The Global Environment Facility is a partnership for international cooperation where 183 countries work together with international institutions, civil society organizations and the private sector, to address global environmental issues.

[264] By the Turkish Government, by the private sector and by the international community

[265] For more details of the GEF project see http://www.thegef.org/gef/. This website contains all major documents on the above mentioned Project. For a summary of the GEF Project see the file of the following Power Point presentation: "Financial aspects of POPs management". Dr. Peter Futo, Sectoral Impact Assessment Expert. 8th Training of Trainers, Sueno Hotel, Side, Antalya, Turkey, 20-24 October 2014. Project - Technical Assistance for Implementation of the Persistent Organic Pollutants Regulation - EuropeAid/132428/D/SER/TR.

[266] Source: "POPs Legacy Elimination and POPs Release Reduction Project". Project Identification Form (PIF). Project Type: Full-Sized Project. Type of Trust Fund: GEF Trust Fund" downloaded from http://www.thegef.org/gef/.

[267] E.g. publications like (a) "Analysis of human milk to assess exposure to PAHs, PCBs and organochlorine

- Environmental surveys have shown the presence of various POPs in various environmental (e. g. soil, sediment, air, water) and biological (e. g. fish, mussel, adipose tissue, milk) media in Turkey[268].

While the general population will enjoy the benefits of improved POPs management, it will bear only indirect and marginal cost increases due to the enforcement of POPs regulation, Such cost increases may occur if some producers and service providers are able to pass on the costs of compliance to consumers. For example, it may be possible that waste management fees will somewhat increase due to improved pollution abatement techniques of municipal waste incineration.

There are specific population groups that are exposed to POPs to a greater extent. For the groups indicated below, the benefits of a consequent POPs management will be direct and immediate:

- workers in the chemical and metals processing industries;
- persons getting in close contact with unintentionally created POPs, such as farmers burning residual agricultural land
- others spending significant parts of their lives near sources of POPs;

Further tangible and intangible benefits of tackling the POPs challenge in Turkey are as follows: the measures

- will improve its access to overseas markets for Turkish products (with special respect to agricultural and food products),
- will improve Turkey's international image
- will improve its capacity to provide assistance to other states to tackle their challenges associated with POPs.

Benefits for the companies. In all industrial sectors, compliance with environmental legislation brings certain tangible and intangible benefits to the companies. Case studies have demonstrated that the introduction of pollution abatement technologies, especially the installation of clean technologies saves materials, water, improves energy efficiency, improves the image of the company, may increase the market share of the firm due to use of environmentally safe processes/products, and may improve its competitiveness on international markets. Moreover, retrofitting is a good occasion to gain a better overview of technological processes.

pesticides in the vicinity Mediterranean city Mersin, Turkey" Authors: Ismet Çok , Birgul Mazmanci, Mehmet A. Mazmanci , Cafer Turgut , Bernhard Henkelmann, Karl-Werner Schramm. (Environment International 40 (2012) 63–69) (b) "Polychlorinated Biphenyl and Organochlorine Pesticide Levels in Human Breast Milk from the Mediterranean city Antalya, Turkey". By Ismet Cok, C. Yelken, E. Durmaz, M. Üner, B. Sever, F. Satır. (Bull Environ Contam Toxicol (2011) 86:423–427)

[268] See e.g. the following meta-study on PCB: "An Assessment of the Spatial Distribution of Polychlorinated Biphenyl Contamination in Turkey". By Kadir Gedik, Ipek Imamoglu. In: Clean 2010, 38 (2), 117–128.

4.3. Policy options / regulatory alternatives

It is necessary to draft and implement a POPs bylaw of which the benefits will fully justify its costs. For this reason it will be necessary to compare the "business as usual" or "do nothing" option with various other policy alternatives. The full range of options/regulatory alternatives will evolve during the consultation with stakeholders.

Some possible alternatives regarding certain decisions are as follows:

1. Timing of transposition of EU POPs regulation:

- Transpose as soon as possible, uniformly for all firms
- Transpose gradually: first for new installation and for big firms, subsequently for small firms
- Transpose deferred / delayed uniformly for all firms

2. Gradually or immediately eliminate the substances that have been listed in Annex A of SC:

- Legislation may first only restrict these substances, and the ban can enter into force only later, at a suitable date
- Legislation may immediately ban these substances.

3. A further possibility for defining options is the complexity of administration associated with the enforcement of POPs. E.g. the Government may consider to simplify the reporting of emissions and pollution abatement operations for small firms, or for firms with low risk of emitting / using POPs.

4. Further room for maneuvering may exist in how to distribute certain subsidies for facilitating the aims of POPs management among firms. It is rational to channel these funds to industries representing the highest risk of POPs emission, but there might be other aspects as well, such as innovation, regional or sectoral preferences, or POPs related issues having the biggest international visibility.

Impact assessment is an instrument to assess comprehensively the impacts of alternative policy options in terms of costs and benefits. It is up to the policy makers to select the optimal alternatives available after considering the trade-offs.

5. Conclusions

5.1. The role of SIA in the POPs TA Project

Sectoral Impact Assessment was the first stage within the impact assessment activities of Project, which is followed by the ongoing RIA activities. The task of SIA was (a) to identify various sectors of the Turkish economy which will be significantly affected by the introduction of the POPs Regulation, (b) to demonstrate why POPs are relevant for these sectors and (c) to make inferences as to the expected impacts (e.g. compliance costs and benefits) in a sectoral breakdown. According to the Inception Report, SIA is of qualitative nature, i.e. it does not quantify the impacts.

Relevance of sectoral approach. It is expected that the bulk of compliance cost attributed to the POPs Regulation will be due to investment into Best Available Techniques detailed in the Stockholm Convention BAT Guide, and due to the maintenance and operation of these techniques. Best Available Technologies are presented in sectoral detail. The majority of such investments will be financed by the private sector, in particular by companies of those industries that were identified in the SIA Report.

The SIA Report is the closing document of the Sectoral Impact Assessment activity of the POPs TA Project.

Information sources and previous important project documents. The SIA Report is based on a wide range of documents, interviews, workshop comments and also on completed survey questionnaires. The Report relies heavily on the NIP 2014 document, which is the most important source on POPs policy in Turkey. In particular, the policy implications highlighted by the SIA Report are fully in line with the POPs Action Plan of NIP 2014, which has been summarised in Chapter 4.1 of the SIA Report. As of the specific tasks to be completed by environmental governance, they have been identified in tabular form by MoEU and demonstrated in Chapter 4.1 of the SIA Report.

Future use of the SIA Report in subsequent impact assessment activities.[269] The facts collected and the impacts highlighted by SIA will be subsequently used as inputs of a RIA Report. The RIA report will develop the information provided by SIA into on various scenarios up to 2030, by taking into consideration (a) sectoral growth projections, (b) current levels and anticipated improvements of pollution abatement techniques and (c) productivity improvements. RIA will estimate compliance costs associated with the proposed POPs legislation for POPs substances that are (a) unintentionally released (b) used intentionally in manufacturing processes and (c) used or having been used in agriculture as pesticides (d) persisting in landfilled waste, or (e) in contaminated land. RIA will specifically assess administrative burden costs to public bodies and private actors stemming from regulatory activities (e.g. permitting), monitoring, reporting and verification. Moreover, RIA will identify health and environmental benefits of implementing the proposed policy on POPs in Turkey.

[269] This paragraph is based on the Minutes of the Progress Meeting of the POPs TA Project of 18. September 2014.

5.2. Impacts of the POPs Regulation

Impacts of other regulations on POPs management. The introduction of the POPs Regulation has been preceded by other regulations that provide for the reduction of the emission of selected POPs. In particular, any impact assessment of the POPs regulation should take into consideration the PCB-specific and PCDD/F-specific legal measures that have been in force for some time in Turkey. Moreover the expected introduction of the IPPC / IED Bylaw will imply a wide range of investments by the affected industries, which will directly or indirectly reduce POPs emission as co-benefits. Therefore not every expenditure implemented for reducing POPs emission can be attributed to the introduction of the POPs Regulation.

POPs Sectoral Impact Table. The following Table summarizes in tabular form the impacts and policy implications of introducing the EU POPs Regulation in Turkey. The impacts are conceptualised, interpreted in terms of costs and benefits, and presented in a sectoral detail. The last column contains those tasks of the Government which are targeting predominantly the respective sector. The following Table does not replace previous documents of the POPs TA Project. In particular, additionally the Government has to implement the tasks detailed POPs Action Plan of NIP 2014 and also the tasks detailed in the Table "Framework of operative activities of POPs management at MoEU"[270]".

[270] See Chapter 4.1. of the SIA Report.

The impacts of introducing and enforcing the EU POPs Regulation in Turkey in sectoral breakdown

Major affected sectors	Major stakeholders affected	Major POP chemicals involved	Costs	Benefits	Sector specific policy implications under the Action Plan of the POPs NIP of 2014
Waste Management	Municipalities, public and private waste management companies. Municipalities and inhabitants in the immediate vicinity of waste incinerators.	1. Dioxin and furan emitted by waste incinerators. 2. PCB containing equipment.	1. Waste incinerating companies will have to invest substantially into POPs pollution abatement and decontamination measures by following BAT. The major cost items of dioxin reducing technologies in hazardous waste incinerators are the selection of raw materials, installation of activated carbon injection systems, activated carbon beds, bag filters. 2. Collecting and destroying PCB containing equipment by retrofilling, recycling and incineration. 3. Collecting and destroying brominated flame retardants in municipal waste, construction / demolition waste.	The enforcement of the POPs regulation has the potential to generate additional business and income for the environmental protection sector, in particular for waste management firms. Better relations with authorities, with immediate neighbors of plants due to health and environmental benefits	1. Further capacity development of environmental inspection work, improved monitoring and inspection procedures. 2. PCB collection: Facilitating competition among environment protection service provider firms by improved licensing and accreditation. 3. Monitoring and control of brominated flame retardants in municipal waste, construction / demolition waste.

Major affected sectors	Major stakeholders affected	Major POP chemicals involved	Costs	Benefits	Sector specific policy implications under the Action Plan of the POPs NIP of 2014
Agriculture, Fisheries and Food Processing	Agricultural firms, fish farms, food processing companies, consumers.	POP-pesticides as residues, stockpiles and contaminated areas Dioxin, furan, PCB and pesticide residues in food supply.	Since all POP-pesticides identified by the Stockholm Convention are banned in Turkey, an introduction of the EU POPs Regulation will not have substantial cost impacts on farming. Expected expenditures in the sector: • Identification of POPs residues, stockpiles and contaminated areas. • Improvement of food safety laboratory capacities for POPs measurement. • Monitoring of food supply for POPs residues by laboratories.	Lower levels of pesticides in fish species, human blood, human milk and human fat of the Turkish population. Health and environment related benefits in the food chains. Improved image of Turkey´s agricultural products.	Government oversight and inspection of identifying POPs residues, stockpiles and contaminated areas. Designation, accreditation and inspection of private laboratories for POPs measurement.

Major affected sectors	Major stakeholders affected	Major POP chemicals involved	Costs	Benefits	Sector specific policy implications under the Action Plan of the POPs NIP of 2014
Metallurgy	Ferrous and non-ferrous metallurgy companies	Dioxin and furan emitted by thermal processes.	Compared to other manufacturing industries, the metallurgy industry will have to invest significantly more into POPs pollution abatement techniques by following BAT. Major cost items: Control of raw materials, fume and gas collection, recirculation of waste gases, installing afterburners and quenching, introducing high efficiency dust removal.	Improved relations with authorities, improved prestige among immediate neighbors of plants and the general public due to health and environmental benefits	Further capacity development of environmental inspection work, improved monitoring and inspection procedures.
Electric Power Generation, Transmission and Distribution	Power plants, electricity transmission and distribution companies, both state owned and private ones.	1. Dioxin and furan emitted by thermal processes 2. PCB containing equipment.	1. Power plants, especially Large Combustion Plants (LCP) will have to invest heavily into pollution abatement according to BAT due to the imminent introduction of the Industrial Emissions Directive in Turkey. POPs pollution will be reduced as a side effect of the above-mentioned investments, especially as a co-benefit of dust removal measures. 2. Collecting and destroying PCB containing equipment by retrofilling, recycling and incineration.	Improved relations with authorities. Improved prestige among immediate neighbors of plants and the general public due to health and environmental benefits.	1. Consequent enforcement of IED and POPs regulations in power plants, irrespectively of state or private ownership. Ongoing privatization of power plants facilitates consequent enforcement of POPs and other environmental bylaws. 2. Increase competition in the field of environmental services, in particular in PCBs containing equipment collection and destruction.

Major affected sectors	Major stakeholders affected	Major POP chemicals involved	Costs	Benefits	Sector specific policy implications under the Action Plan of the POPs NIP of 2014
Chemical Industry	1. Chemical companies, with special respect to producers of chlorinated inorganic chemicals (e.g. chloralkali production) 2. Companies producing and using brominated flame retardants, PFOS and their alternatives.	1. Dioxin, furan and PAHs emitted by chemical processes, e.g. PVC production 2. Brominated flame retardants used in isolation materials, furniture and textiles. PFOS used in metal plating and many other sectors	1. The major cost item for the chemical industry is to reduce unintentionally emitted by-products (dioxin, furan, PAHs, etc.) of certain chemical processes, e.g. of PVC production by introducing BAT. Cost will appear in waste management in the first place, because most UPOPs are emitted into the residues of the chemical processes. 2. Substitution of brominated flame retardants and PFOS by POPs-free compounds and by non-chemical solutions.	1. Improved relations with authorities. Improved prestige among immediate neighbors of plants and the general public due to health and environmental benefits. 2. Additional income due to research, development and sales of alternative, POPs-free chemicals by innovative companies. E.g. production of alternatives to brominated fire retardants in isolation and packaging materials and firefighting foams.	1. Further capacity development of environmental inspection work, improved monitoring and inspection procedures. Encourage and facilitate the participation of Turkish chemical companies in voluntary schemes of chemical safety of the chemical industry. 2. Support Research and Development on POP alternatives.

Major affected sectors	Major stakeholders affected	Major POP chemicals involved	Costs	Benefits	Sector specific policy implications under the Action Plan of the POPs NIP of 2014
Cement Industry	Cement companies and local inhabitants living in the vicinity of cement plants.	Dioxin and furan emitted by waste co-incineration.	BAT of waste co-incineration implies expenditures into pre-treatment of input material, creating operational conditions for complete destruction of organics, installing efficient flue gas treatment systems. Cement companies introduced previously effective flue gas treatment technologies for reducing air pollution. UPOPs emission levels are lower than the legal threshold. No need to invest into further POP reduction techniques.	Previously introduced flue gas treatment technologies resulted low POP emission. Introducing POPs regulation will bring no impacts on the industry; no further benefits are expected.	Limit values on PCDD/F are already introduced to the industry by the By-law on Waste Incineration and By-law on Industrial Air Pollution Control. Monitoring and inspection capacities should be developed.
Textile Industry	Textile producing companies and inhabitants affected by water pollution.	1. Dioxin and furan unintentionally contained in textile raw materials, dyes, fungicides. 2. Brominated flame retardants (PBDE, HBCD) for fire safety of textile products (carpets, upholstery).	1. Large environmental expenditures of the textile sector are associated with environmental concerns wider than POPs: the industry must introduce wastewater treatment facilities according to IPPC BAT specific for this sector. It is less expensive to address the specific environmental concerns associated with POPs, in particular to introduce pollution abatement technologies suitable for eliminating POP – PCDD/Fs emissions. Examples of POPs related BATs include the replacement of chlorinated textile-protecting chemicals and dioxin contaminated dyestuffs by alternative compounds. 2. Substitution of POPs brominated flame retardants with less harmful substances.	1. Improved relations with authorities, improved prestige among immediate neighbors of plants and the general public. 2. Additional income due to research, development and sales of alternative, POPs-free chemicals by innovative companies.	(a) Introduce subsidy schemes for research and development projects of the textile industry facilitating the above aims (b) introduce environmental taxes on the use of POPs brominated flame retardants (c) motivate Turkish textile companies to join the EU industry voluntary scheme called "Voluntary Emissions Control Action Programme" (VECAP).

6. Annexes

6.1. Annex A: Method of the POPs Company Survey

6.1.1. Aims of the POPs Company Survey

The EU project[271] "Technical assistance for implementation of the EU Persistent Organic Pollutants Regulation[272]" prepared a Sectoral Impact Assessment of this Directive in Turkey. The Project is implemented on behalf of the Ministry of Environment and Urbanization.

Sectoral Impact Assessment (SIA) and Regulatory Impact Assessment (RIA) are processes that prepare evidence for political decision-makers on the advantages and disadvantages of possible policy options by assessing their potential impacts. Impact Assessment is a fact based assessment of costs, benefits, risks, competition effects and distributional effects of draft regulation, or of existing regulation already in force.

The impact assessment survey targeted a relatively small sample of those industrial installations/plants in Turkey that will be most affected by the regulation. Responses were collected from the following sectors:

- Environmental sector, including waste management
- Agriculture, fisheries and food processing sector
- Metallurgy
- Electric Power Generation, Transmission and Distribution
- Chemical Industry
- Cement and lime industry
- Textile industry

The Questionnaire has been disseminated by sectoral professional associations among their members. It was also uploaded on the website of the POPs T.A. project. Due to small sample size it was not a statistically representative survey.

The expected responses were intended to offer

- Case studies of BAT implementation and its impediments
- Overview about the present level of preparedness of the responding firms
- Information about expected investment costs and costs of ongoing compliance, e.g. administrative costs
- Information about expected benefits, e.g. due to opening up new markets , due to reducing risks or due to reducing material costs by reducing waste.
- Information about company attitudes, e.g. their readiness to comply with the regulation.

The POPs Company Survey was not a POPs inventory survey.

[271] Project - Technical Assistance for Implementation of the Persistent Organic Pollutants Regulation - EuropeAid/132428/D/SER/TR
[272] EC 850/2004

6.1.2. Introductory text to POPs Company Survey Questionnaire

Turkey has signed the Stockholm Convention with the aim of eliminating or severely restricting the production, use, trade and stockpiling of 23 Persistent Organic Pollutants (POPs) pollutants. Persistent organic pollutants (POPs) are organic compounds that are resistant to environmental degradation, persist in the environment, are capable of long-range transport, accumulate in human and animal tissues and have potentially significant negative impacts on human health and the environment. [273]

The EU project "Technical assistance for implementation of the EU Persistent Organic Pollutants Regulation" and the Ministry of Environment and Urbanization conduct a survey concerning the expected impacts of this Regulation among industrial and environment protection firms in Turkey. The responses of individual companies will not be published. Your responses will influence the way in which the Government will introduce IED and also the date of its introduction. You will receive the resulting impact assessment study with a summary of the responses.

[273] For the list of the initial 12 POPs of the Stockholm Convention see: http://chm.pops.int/TheConvention/ThePOPs/The12InitialPOPs/tabid/296/Default.aspx . For a list of new POPs see http://chm.pops.int/TheConvention/ThePOPs/TheNewPOPs/tabid/2511/Default.aspx .

6.1.3. Questions on awareness and challenges of POPs

Q1. Are you aware of Persistent Organic Pollutants? Yes ☐ No ☐

Q2. If yes, what is the source of your information? (1 or 2 sentence) _____

Q3. Does your firm have to deal with the problem of POPs? If yes, which POP and in what form?

Form --- POP	POP released by your company into air, water or soil, or as part of the product or as residue (waste)	As a basic material or ingredient of a product of your firm	As part of your technology or equipment	As a stockpile or as a contaminated site	As a pollutant endangering safety at work
Banned Pesticides or Fungicides[274]					
HBB[275]					
PCB[276]					
PBDE[277]					
PFOS[278]					
PCDD/F[279] Dioxin or furan.					
Other POPs defined by the Stockholm Convention					

[274] Aldrin, Chlordane, DDT, Dieldrin, Endrin, Heptachlor, Mirex, Toxaphene, Hexachlorobenzene (HCB)

[275] Hexabromobiphenyl, member of the brominated flame retardant group, used as flame retardant, added to plastics used in products such as home electrical appliances, textiles, plastic foams, laptop cabinets, etc. to make them difficult to burn-

[276] Polychlorinated biphenyl. Intentionally used e.g. as transformer oil or unintentionally emitted during thermal processes, e.g. metallurgy or cable burning.

[277] Polybrominated diphenyl ethers or PBDEs are used as flame retardant. Like other brominated flame retardants, PBDEs have been used in a wide array of products, including building materials, electronics, furnishings, motor vehicles, airplanes, plastics, polyurethane foams,[1] and textiles..

[278] Perfluorooctanesulfonic acid, used for electric and electronic parts, fire fighting foam, photo-imaging, hydraulic fluids, and textiles.

[279] Unintentionally emitted during thermal processes, e.g. waste incineration.

Q4. Please give details and explain, which POP creates what problem for your company (1 or 2 sentences) ._____

Q5. Please rate which POP releases / emissions of your firm are problematic and to what extent:

	Very problematic	Moderately problematic	Not a problem
Air:			
Water:			
Land (soil):			
Residue (including liquid, sludge, and solid waste):			

Q6. Please give details and explain, why (1 or 2 sentences).
_____

Q7. What kind of environmental investments are needed to reduce / eliminate POP releases of your firm? (1 or 2 sentences) _____

Q8. Are you aware of BAT (Best Available Techniques)? If yes, from what source? (1 or 2 sentences) _____

Q9. Which BAT is relevant for solving the POPs problem of your firm? (1 or 2 sentences)
_____

Q10. With regard to pollution control, what is the relationship of yur firm with environmental authorities? Did your firm ever had a problem with obtaining permits? Did your firm ever get a punishment? If there were such problems, was it connected to POPs? (1 or 2 sentences). _____

Q11. With regard to pollution control, have you ever had connections with legal courts? If yes, was it connected to POPs? (1 or 2 sentences)
_____

Q12. With regard to pollution control, have you ever had connections with environment protecting organisations? If yes, was it connected to POPs? (1 or 2 sentences).
_____

Q13. With regard to pollution control, have you ever had connections with chambers or industrial associations ? If yes, was it connected to POPs? (1 or 2 sentences).
_____

Q14. With regard to pollution control, have you ever had connections with the media (newspapers, TV, etc) ? If yes, was it connected to POPs? (1 or 2 sentences)
_____

Q7. Are there any products, produced / exported in your company for which your client wants a proof that either the product or the technology is environment friendly? (1 or 2 sentences) _____

6.1.4. Questions on expected impacts of regulation

Q15. Did your firm install BAT technology? What? When? What were the investment costs? What are the operating costs? (1 or 2 sentences)
_____

Q16. Does your firm plan to install in the future BAT technology? What? When? What will be the investment costs? What will be the operating costs? (1 or 2 sentences) _____

Q17. Please give an estimation about your yearly environmental investments (Capital expenditures only, here do not include yearly operating / maintenance expenditures) _____ (express in 1000 TL)

Q18. What is the approximate (not exact) structure / breakdown of the above sum?

	Proportion (%)
Protection of ambient air and climate	
Wastewater management	
Waste management	
Protection and remediation of soil, groundwater and surface water	
Noise and vibration abatement	
Protection of biodiversity and landscape and other	
Other	
Total	100%

Q19. Please comment the above estimation from the point of view of POPs elimination / reduction. (1 or 2 sentences) _____

Q20. Please give an estimation about your yearly operating expenditure (OPEX) on Environmental Protection? (OPEX includes labour costs of environmental administration /application, leasing payments, maintenance and labour costs for equipment and the treatment and disposal of waste. Here do not include capital expenditures, investments) _____ (express in 1000 TL)

Q21. What is the approximate (not exact) structure / breakdown of the above sum?

	Proportion (%)
Operation of pollution control abatement equipment	
In-house expenditures associated with environmental services	
Payments to external organisations for environmental services	
Other	
Total	100%

Q22. Please comment the above estimation from the point of view of POPs elimination / reduction. (1 or 2 sentences) _____

Q23. Do you expect additional incomes or advantages as a result of POPs reduction/elimination?

	Yes, relevant	Yes, but not relevant	Not relevant
Receipts (incomes) from by-products resulting from Environmental Protection activities:			
Energy or material savings due to more efficient processes and other productivity gains resulting from Environmental Protection activities:			
Reduced environmental charges and environmental taxes			
Subsidies received due to environment friendly actions / projects			
Increased sales due to environmentally improved product quality, enhanced public image, consumer trust in green products			
Transactions of tradeable emission permits			

Q24. Please explain the most important advantages. (1 or 2 sentences)_____

Q25. Do you think that the technology used in your firm has to be changed in order to satisfy more stringent pollution control requirements?

- Yes, to a large extent, by applying so-called "Clean Technologies" (e.g. input substitution, pollution prevention, product modification, production of a useful by-product, etc.) ☐
- Only to some extent, by applying so-called "End of pipe techniques" (e.g. filters, clean-up actions, etc.) ☐
- There is no need to change the technology just for environmental reasons ☐
- Don't know ☐

Q26. Please explain shortly how the technology used in your firm has to be changed in order to reduce / eliminate POPs releases (1 or 2 sentences) _____

Q27. What do you think, how will the enforcement of the POPs regulation influence the competitiveness of your firm? Very much decrease ☐ A little decrease ☐ Will not affect ☐ Will increase a little ☐ Will increase very much ☐

Q28. Please explain in some detail, detailing domestic sales and exports (1 or 2 sentences)_____

Q29. What do you think, how will the enforcement of the POPs regulation affect your company? (More than one responses possible)

- By compelling us to pay more environmental penalties / environmental taxes than before ☐
- By enabling us to pay less environmental penalties/environmental taxes than before ☐
- By compelling us to stop (phase out) some production activities ☐
- By compelling us to improve / innovate some of our technology ☐
- By compelling us to increase some of our prices ☐

- By compelling us to reduce the production of some of our products ☐
- By compelling us to change our product portfolio in favour of environmentally friendly products, i.e. indirectly by opening up new markets for us.
- By compelling us to hire external environmental consultants ☐
- By compelling us to hire / train employees to handle the administrative workload ☐
- By creating legal problems and having to go to judicial court ☐
- By compelling us to improve our Public Relations activity ☐
- By affecting negatively our competitors; therefore indirectly increasing our market share ☐
- By compelling us to invest into improving the safety of our production, into reducing certain risks. ☐
- By compelling us to introduce an EMAS system (Eco-Management and Audit Scheme). ☐
- By compelling us to introduce a ISO 14001: 2004 Environmental Management System. ☐
- By increasing our yearly environmentally related costs ☐ by _____(% increase)
- By decreasing our yearly environmentally related costs ☐ by _____(% decrease)
- By increasing our yearly environmentally related revenues ☐ by _____(% increase)
- By decreasing our yearly environmentally related revenues ☐ by _____(% decrease)

Q30. Please highlight and explain the most significant impacts. (1 or 2 sentences)_____

6.1.5. Questions to regulatory consultation

Q31. Do you think more guidance/training in administrative requirements on POPs should be provided for industry? Yes ☐ No ☐

Q32. Do you think more guidance/training in technological requirements should be provided for industry? Yes ☐ No ☐

Q33. Who should provide this guidance/training and how should it be delivered? (1 or 2 sentences) _____

Q34. Which environmental regulation (or which change of its enforcement, e.g. permitting procedure) has significantly affected the environmental strategy of your company regarding the reduction / elimination of POPs? _____

Q35. What is your recommendation for the Government as to the introduction of the EU POPs regulation? (1 or 2 sentences) _____

Q36. When to introduce EU POPs regulation? (1 or 2 sentences) _____

Q37. How long time should be the time given to companies for preparation? Why? (1 or 2 sentences) _____

Q38. How to compensate companies for additional environmental costs caused by EU POPs regulation (e.g. in form of subsidies)? (1 or 2 sentences) _____

Q39. What element / requirement of the EU POPs regulation should be introduced gradually? (1 or 2 sentences) _____

Q40. What groups of companies should be preferred when giving compensation (e.g. in form of subsidies) or giving longer transition period? (1 or 2 sentences) _____

6.2. Annex B: Responses of metallurgy firms to Company Survey

Question	Metallurgy firm No.1	Metallurgy firm No.2	Metallurgy firm No.3	Metallurgy firm No.4	Metallurgy firm No.5	Metallurgy firm No.6
Name	Çebitaş Demir Çelik End. A.Ş.	Ekinciler Demir Ve Çelik A.Ş.	Asil Çelik Sanayi ve Ticaret A.Ş.	YEŞİLYURT DEMİR ÇELİK END. VE LİMAN İŞLETMELERİ LTD. ŞTİ.	Yolbulan aştuğ Metalurji Sn. A.Ş.	PLATINUM DEMİR ÇELİK SAN. VE TİC. A.Ş.
What is your company's NACE code?	241005	2410	241001		2410	24 10 07
Please give a few examples to the products of your company.	Billet Steel Production, Construction Steel Production (Ribbed)	Ribbed Steel For Construction (6-50 Mm)	Alloy steel production	various sizes of steel billet	Billet, bloom	Billet iron production
Please specify the main production technologies used in your company.	Electric Arc Furnace, Reheating Furnace	Electric Arc Furnace, Ladle Furnace, Continuous Casting Machine, Reheating Furnace	Electric Arc Furnace	electric arc furnaces	Electric Arc Furnace, Ladle Furnace, Continuous Casting Machine	Induction Furnace
How many people are working in your company including paid and casual employees and owners and partners?	251 +	251 +	251 +	251 +	251+	51 - 250 people
Are you aware of Persistent Organic Pollutants (POPs)? If Yes, what is the source of your information?	No	Yes	yes	no	No	Yes
Yes:Are you aware of Persistent Organic Pollutants (POPs)? If Yes, what is the source of your information?		PCB-Dioxin,Furan	Ministry of Environment and Urbanisation			In the Official Gazette the Stockholm Convention on Persistent Organic Pollutants
POP released by your company into air, water or soil, or as part of the product or as residue (waste): PCDD/F (Dioxin ve furans):Does your company have to deal with the problem of POPs? If Yes, which POP			yes	yes		

and in what form?						
Please give details and explain, which POP creates what problem for your company (1 -2 sentences)			PCDD/Fs emissions during melting of scrap metal (values are within the legal limit.)			
Air: Please rate the extend of problems of POPs releases / emissions of your company.		No problem	no problem	no problem	No problem	No problem
Water: Please rate the extend of problems of POPs releases / emissions of your company.					No problem	No problem
Contaminated Soil:Please rate the extend of problems of POPs releases / emissions of your company.					No problem	No problem
Residues (including sludge, liquid and solid wastes): Please rate the extend of problems of POPs releases / emissions of your company.					No problem	No problem
Please give details and explain. (1 -2 sentences).			scrap metal melting			
What kind of environmental investments are needed to reduce / eliminate POP releases of your company? (1 - 2 sentences)		Quality Scrap Supply	Scrap washing, scrap preheating			
Are you aware of BAT (Best Available Techniques)? If Yes, from what source?	No	Yes	yes	no	No	No
Yes: Are you aware of BAT (Best Available Techniques)? If Yes, from what source?		BAT/2010 Publications	Ministry of Environment and Urbanisation			
Which BAT is relevant for solving the POPs problem of your company? (1 -2 sentences)		Dust Collection System (Bag Filter)	Scrap preheating (This measure may lead to increased inorganic chlorine-fluorine emissions.)			
With regard to pollution control, what is the relationship of your	No	Consultation with	Our company	No	Communicating	Necessary

company with environmental authorities? Did your company ever had a problem with obtaining permits? Did your company ever get a punishment? If there were such problems, was it connected to		the MoEU and the Provincial Directorate of Environment and Urbanization. Has Temporary Operating Certificate regarding environmental permit procedure and made application for Environmental Permit	has Environmental Permit. Administrative penalty has been applied, but this sentence was not related to POPs.		with the Provincial Directorate. Has Environmental Permit. Had no penalty before. previously impunity. Provincial Directorate of Environment carries out announced and unannounced inspections	precautions are taken for environmental problems being in contact with Provincial Directorate of Environment and Urbanisation. There has been no problem to take permits.
With regard to pollution control, have you ever had connections with legal courts? If Yes, was it connected to POPs?	No	No	no	no	No	No
With regard to pollution control, have you ever had connections with environment protecting organisations? If Yes, was it connected to POPs?	No	No	no		No	No
With regard to pollution control, have you ever had connections with chambers or industrial associations? If Yes, was it connected to POPs?	Yes, but not lrelated to POP	No	yes but not related with POPs			No
With regard to pollution control, have you ever had connections with the media (newspapers, TV, etc.)? If Yes, was it connected to POPs?	No	No	yes but not related with POPs			No
Did your company install BAT technology? What? When? What were the investment costs? What are the operating costs? (1 -2 sentences)	No	Yes. Dust collection system with bag filter is commissioned in 2008, 7 million dollar				
Does your company plan to install in the future BAT technology? What? When? What will be the investment costs? What will be the operating costs? (1 -2 sentences)	No	Depending on the legislations our investments will continue. For the moment, there no plan any				

		investment.				
Please give an estimation about your yearly environmental investments. (express in 1000 TL)	200 000		10.000.000 TL in last 10 years			
Protection of ambient air and climate:What is the approximate (not exact) structure / breakdown of the above sum?	10	50	80			
Wastewater management:What is the approximate (not exact) structure / breakdown of the above sum?	10	15	15			
Waste management:What is the approximate (not exact) structure / breakdown of the above sum?	60	30	5			
Protection of biodiversity and landscape and other:What is the approximate (not exact) structure / breakdown of the above sum?		5				
Operation of pollution control abatement equipment:What is the approximate (not exact) structure / breakdown of the above sum?		80				
In-house expenditures associated with environmental services:What is the approximate (not exact) structure / breakdown of the above sum?		15				
Payments to external organisations for environmental services:What is the approximate (not exact) structure / breakdown of the above sum?		5				
Receipts (incomes) from by-products resulting from Environmental Protection activities:Do you expect additional incomes or advantages as a result of POPs reduction / elimination?	No .	No .				
Energy or material savings due to more efficient processes and other productivity gains resulting from Environmental Protection activities:Do you expect additional incomes or advantages as a result of POPs reduction / elimination?	No .	No .				
Reduced environmental charges and environmental taxes :Do you expect additional incomes or advantages as a result of POPs reduction / elimination?	Yes, but in low rate	No .				
Subsidies received due to environment friendly actions / projects :Do you expect additional incomes or advantages as a result of POPs reduction / elimination?	Yes, in high rate	Yes, but in low rate				
Increased sales due to environmentally improved product quality, enhanced public image, consumer trust in green products:Do you expect additional incomes or advantages as a result of POPs reduction / elimination?	Yes, but in low rate	Yes, but in low rate				Yes, in high rate
Transactions of tradeable emission permits :Do you expect additional incomes or advantages as a result of POPs reduction / elimination?	Yes, in high rate	No .				

Please explain the most important advantages. (1 -2 sentences)		Increase of prestige in public with environmental investments, environmental organization profile.				
Do you think that the technology used in your company has to be changed in order to satisfy more stringent pollution control requirements?	Only to some extent, by applying so-called "End of pipe techniques" (e.g. filters, clean-up actions, etc.)	Don't know				
What do you think, how will the enforcement of the POPs regulation influence the competitiveness of your company?	will not affect	will decrease very much				Will not affect
Please explain in some detail, detailing domestic sales and exports (1 - 2 sentences)		No difference regarding product sales between companies that invest and not invest on POPs emissions reduction. Competitiveness of companies investing on POPs emission reduction systems will decrease (operation costs e				
By compelling us to stop (phase out) some production activities:What do you think, how will the enforcement of the POPs regulation affect your company?		Yes				
By compelling us to improve / innovate some of our technology: What do you think, how will the enforcement of the POPs regulation affect your company?	Yes					

By compelling us to increase some of our prices: What do you think, how will the enforcement of the POPs regulation affect your company?	Yes	Yes				
By compelling us to hire / train employees to handle the administrative workload: What do you think, how will the enforcement of the POPs regulation affect your company?	Yes	Yes				
By compelling us to invest into improving the safety of our production, into reducing certain risks: What do you think, how will the enforcement of the POPs regulation affect your company?	Yes					
By compelling us to introduce an EMAS system (Eco-Management and Audit Scheme): What do you think, how will the enforcement of the POPs regulation affect your company?	Yes					
By increasing our yearly environmentally related costs, by % increase: What do you think, how will the enforcement of the POPs regulation affect your company?	Yes, 40	Yes				
Please highlight and explain the most significant impacts. (1 -2 sentences)		Will reduce competitiveness. The factory will stop operation for implementation of investment, a decrease in product sales and profitability. An increase in carbon emissions due to an increase in energy usage.				
Do you think more guidance/training in administrative requirements on POPs should be provided for industry?	Yes	Yes		yes		Yes
Do you think more guidance/training in technological requirements should be provided for industry	Yes	No		yes		Yes
Who should provide this guidance/training and how should it be delivered?	Ministry of Environment and Urbanization should provide guidance	Ministry of Science, Industry and Technology; Ministry of Environment and Urbanization; TTGV(Turkish				Provincial Directorate of Environment and Urbanisation

			Technology Development Foundation), UNDP				
What is your recommendation for the Government as to the introduction of the EU POPs regulation? (1 -2 sentences)			There should be a transition period and time limit should be decided by agreement with sector representatives will be more effective.				
When to introduce POPs regulation? (1 -2 sentences)		2020					
How much time should be the time given to companies for preparation? Why? (1 -2 sentences)		6 Years	This should be decided by agreement with sector representatives				
How to compensate companies for additional environmental costs caused by EU POPs regulation (e.g. in form of subsidies)? (1 -2 sentences)			Incentives, grants				
What groups of companies should be preferred when giving compensation (e.g. in form of subsidies) or giving longer transition period? (1 -2 sentences)			This should be decided by agreement with sector representatives				
Sector		Metallurgy and Semi-finished casting products	Metallurgy and Semi-finished casting products	Metallurgy and Semi-finished casting products	Metallurgy and Semi-finished casting products	Metallurgy and Semi-finished casting products	Metallurgy and Semi-finished casting products
Technologies		Steel plant + Rolling Mill unit	Steel plant + Rolling Mill unit	Steel plant + Rolling Mill unit	Steel plant + Rolling Mill unit	Steel Plant, Scrap Yard, Electric Arc Furnace, Ladle Furnace, Continuous Casting Machine,	2-SET / 25 tons capacity 12 MVA powered induction Furnace, 25

						Oxygen Facility,Switchyard, Rolling Plant	tons capacity 5 MVA , powered Ladle Furnace, Continuous Casting Machine (CCM)
Products 1		Prime CONCAST STEEL Bars	Billets	Billets	Billets	Billets	Billets
Products 2		Ribbed Construction Iron Bars	Bars	Bars	Bars	Blooms	Blooms
Products 3				Surface Hardening Steels		Bars	Bars
Products 4				Quenched & Tempering Steels			
Products 5				Spring Steels			
Products 6				Cold and Hot Working Tool S.			
Products 7				Cementation Steels			
Products 8				Bearing Steels			
Products 9				Stainless Steels			
Products 10				Free Cutting Steels			
Products 11				Micro Alloy Steels			
Products 12				Constructional Steels			
Products 13				Wear Resistance Steels			
Products 14				Boron Steels			
Products 15				High Temperature Steels			
Products 16				Nitriding Surface Hardening Steels			

6.3. Annex C: Responses of chemical firms to Company Survey

Question	Chemical firm No.1	Chemical firm No.2	Chemical firm No.3	Chemical firm No.4	Chemical firm No.5
Name	AK-KİM KİMYA SAN. VE TİC. A.Ş.	AKDENİZ KİMYA SAN. VE TİC. A.Ş.	Petkim Petrokimya Holding A.Ş.	XPS Thermal Insulation Manufacturers Association	Sinerji Yalıtım İzolasyon İnşaat Enerji ve Yapı Malz. San. ve Tic. A.Ş.
Please give a few examples to the products of your company.	Hydrogen peroxide, sodium percarbonate, chlorine	PVC-based stabilization tribasic lead sulfate, calcium stearate, calcium laurate, barium stearate, barium laurate, liquid metal soaps (barium-zinc soap), zinc oxide, polyethylene waxes, oxidized polyethylene waxes	Ethylene, benzene, polyethylene, PVC	XPS	XPS(Extrude Polistiren Strypor)
How many people are working in your company including paid and casual employees and owners and partners?	251 +	251 +	251 +	1 - 10 People	11 - 50 People
As part of your technology or equipment:PCB (Polychlorinated biphenyl):Does your company have to deal with the problem of POPs? If Yes, which POP and in what form?		yes			
POP released by your company into air, water or soil, or as part of the product or as residue (waste): PCDD/F (Dioxin ve furans): Does your company have to deal with the problem of POPs? If Yes, which POP and in what form?			yes		
As a basic material or ingredient of a product of your company:Other POPs defined by the Stockholm Convention: Does your company have to deal with the problem of POPs? If Yes, which POP and in what form?				As a basic material or ingredient of a product	
Please give details and explain, which POP creates what problem for your company (1 -2 sentences)		there is no contamination or contact risk when there is no spillage	As there exists waste incineration plant in our company, dioxin-furan measurements are done		

		during maintenance	and our compliance with the limit values are checked constantly.		
Air:Please rate the extend of problems of POPs releases / emissions of your company.		no problem	no problem		No problem
Water:Please rate the extend of problems of POPs releases / emissions of your company.		no problem	no problem		No problem
Contaminated Soil:Please rate the extend of problems of POPs releases / emissions of your company.		no problem	no problem		No problem
Residues (including sludge, liquid and solid wastes): Please rate the extend of problems of POPs releases / emissions of your company.		no problem	no problem		No problem
Please give details and explain. (1 -2 sentences).		when there is spillage during maintenance			
Are you aware of BAT (Best Available Techniques)? If Yes, from what source?	No	No	yes	No	No
Yes:Are you aware of BAT (Best Available Techniques)? If Yes, from what source?			IPPC documents		
With regard to pollution control, what is the relationship of your company with environmental authorities? Did your company ever had a problem with obtaining permits? Did your company ever get a punishment? If there were such problems, was it connected to		No	Environmental authorities are constantly monitor our emission sources, relevant information transfer is done by us.		
With regard to pollution control, have you ever had connections with legal courts? If Yes, was it connected to POPs?		No	no		
With regard to pollution control, have you ever had connections with environment protecting organisations? If Yes, was it connected to POPs?		No	no		
With regard to pollution control, have you ever had connections with chambers or industrial associations? If Yes, was it connected to POPs?		membership to chemcial manufacturers association and Aegean Region Chamber of Industry. Not related to POPs.	no		
With regard to pollution control, have you ever had connections with the media (newspapers, TV, etc) ? If Yes, was it connected to POPs?		No	no		

Did your company install BAT technology? What? When? What were the investment costs? What are the operating costs? (1 -2 sentences)		No	In 1985, the plant was installed with mercury technology. In 2000, with budget of $ 43 million the membrane system was introduced.in the production of chlorine, which is considered BAT. With this technology, the electrical energy consumption reduced by 30% and CO_2 reduced.		
Please give an estimation about your yearly environmental investments. (express in 1000 TL)	100 000				
Protection of ambient air and climate:What is the approximate (not exact) structure / breakdown of the above sum?	30				
Wastewater management:What is the approximate (not exact) structure / breakdown of the above sum?	40				
Waste management:What is the approximate (not exact) structure / breakdown of the above sum?	20				
Protection and remediation of soil, groundwater and surface water:What is the approximate (not exact) structure / breakdown of the above sum?	5				
Other:What is the approximate (not exact) structure / breakdown of the above sum?	5				
Please give an estimation about your yearly operating expenditure (OPEX) on Environmental Protection. (express in 1000 TL)	450 000				
Operation of pollution control abatement equipment:What is the approximate (not exact) structure / breakdown of the above sum?	10				
In-house expenditures associated with environmental services:What is the approximate (not exact) structure / breakdown of the above sum?	15				
Payments to external organisations for environmental services:What is the approximate (not exact) structure / breakdown of the above sum?	25				
Other:What is the approximate (not exact) structure / breakdown of the above sum?	50				

Increased sales due to environmentally improved product quality, enhanced public image, consumer trust in green products: Do you expect additional incomes or advantages as a result of POPs reduction / elimination?				Yes, but in low rate	
Transactions of tradeable emission permits: Do you expect additional incomes or advantages as a result of POPs reduction / elimination?					
Please explain the most important advantages. (1 -2 sentences)					
Do you think that the technology used in your company has to be changed in order to satisfy more stringent pollution control requirements?	Only to some extent, by applying so-called "End of pipe techniques" (e.g. filters, clean-up actions, etc.)				
Please explain shortly how the technology used in your company has to be changed in order to reduce / eliminate POPs releases. (1 -2 sentences)				Alternative raw materials should be propsoed instead the the used ones. Subsidies should be given to the cost of compliance tests of the new raw materials with the process.	
What do you think, how will the enforcement of the POPs regulation influence the competitiveness of your company?					Will not affect
Please explain in some detail, detailing domestic sales and exports (1 -2 sentences)					
By compelling us to invest into improving the safety of our production, into reducing certain risks: What do you think, how will the enforcement of the POPs regulation affect your company?				Yes	
Do you think more guidance/training in administrative requirements on POPs should be provided for industry?	Yes		yes	Yes	Yes
Do you think more guidance/training in technological requirements should be provided for industry	Yes		yes	Yes	Yes

Who should provide this guidance/training and how should it be delivered?	Relevant governmental institutions and chambers present a practical form of education			It should be provided to private sector by the relevant Ministry.	
What is your recommendation for the Government as to the introduction of the EU POPs regulation? (1 -2 sentences)				The reduction should start when our industrialists find enough products in terms of alternative raw materials	On behalf of the establishment of the ecological balance, companies related with POP emissions or production should be subject to audit very seriously on a national basis.
When to introduce POPs regulation? (1 -2 sentences)	2024			Upon completion of the conversion of our industrialists investment.	2 years
How much time should be the time given to companies for preparation? Why? (1 -2 sentences)	10 years, Technology change			This sector should be investigated by starting an inventory study.	Defining a time range of 4 years would be appropriate, while inadequate infrastructure will slow down the process
How to compensate companies for additional environmental costs caused by EU POPs regulation (e.g. in form of subsidies)? (1 -2 sentences)					Government incentives
What groups of companies should be preferred when giving compensation (e.g. in form of subsidies) or giving longer transition period? (1 -2 sentences)					Plastic, thermal insulation materials, building materials
Sector	Chemical	Chemical	Chemical	Chemical	Chemical
Products 1	Basic Chemicals	Aksab:Metallic soaps based on Aluminium, Barium, Calcium,	Acrilonitrile products	XPS isolation boards	XPS isolation boards

		Magnesium and Zinc.			
Products 2	Textile Chemicals	Akstab:Metallic salts and soaps based on Lead, Co-Stabilizers, Secondary stabilizers.	Aromatics (e.g. Benzene, toluene)		
Products 3	Water Treatment Chemicals	Akropan:Solid one-pack and mixed metal compounds based on Ca/Zn and Pb in various forms as powder, flakes, granules and tablets.	Ldpe (low density polyethylene products)		
Products 4	Pulp and Paper Chemicals	Akstab L:Liquid Mixed Metal Stabilisers based on Ca/Zn, Ba, Ba/Zn, Sn and kickers based on Zn, Ba/Zn and K/Zn.	Eg (e.g. Monoethylene glycol products)		
Products 5	Cement Grinding and Concrete Admixtures	Aklub:PVC lubricants such as Ester waxes, Acid waxes, Polyethylene waxes, Oxidized polyethylene waxes, Hydrocarbon waxes, Glycerin esters.	Ethylene		
Products 6		PRO: Acrylic processing aids.	Polypropylene products		
Products 7		DMA: Acrylic impact modifiers.	PTA (pure terephthalic acid products)		
Products 8		AS:Acid Scavengers	PVC (polyvinyl chloride products)		
Products 9			HDPE (high density polyethylene products)		

6.4. Annex D: Method of the POPs Expert Survey

6.4.1. Potential respondents of the POPs Expert Survey

The Questionnaire has been disseminated among environmental experts of sectoral professional associations. It was also uploaded on the website of the POPs T.A. project.

6.4.2. Questions for cement industry experts

Q1. Please inform us about the yearly quantities of cement production in Turkey. (1 or 2 sentences). _____

Q2. Please estimate the number of cement plants and estimate the number of cement kilns using co-incineration technology in Turkey. (1 or 2 sentences) _____

Q3. Some BATs and BEPs are summarised in the following table[280]. How widely have they been introduced in Turkey?

Aim	Selected techniques	Technique has been introduced in what percentage of cement kilns? 1=Nowhere 2= Only in the most up-to-date plants, 3=Approximately in half of plants 4=Quite widespread 5= In every plant.
Waste quality control	Quality assurance systems to guarantee the characteristics of wastes and to analyse any waste that is to be used as raw material and/or fuel in a cement kiln for: I. constant quality II. physical criteria III. chemical criteria, e.g. chlorine content.	
	Quality assurance systems for each waste load.	
Waste feeding and burning in the kiln	To operate in such a way that the gas resulting from the co-incineration of waste is raised in a controlled and homogeneous fashion, even under the most unfavourable conditions, to a temperature of 850°C for 2 seconds	
	To raise the temperature to 1100°C, if hazardous waste with a content of more than 1 % of halogenated organic substances, expressed as chlorine, are co-incinerated	
Minimise/prevent diffuse dust emissions from dusty operations	Enclose/encapsulate dusty operations, such as grinding, screening and mixing, reduce air leakages and spillage points	
	Ventilate and collect dust in fabric filters.	
	Use water spray and chemical dust suppressors.	
Techniques of dry flue-gas cleaning	Electrostatic precipitators (ESPs)	
	Fabric filters	
	Hybrid filters	
	Activated carbon injection	

Q4. Please explain in some detail the use of BAT in the cement industry. (3 to 5 sentences)_____

[280] Guidelines On Best Available Techniques And Provisional Guidance on Best Environmental Practices relevant to Article 5 and Annex C of the Stockholm Convention on Persistent Organic Pollutants." Geneva May 2007.

Q5. Please estimate the necessary costs of introducing BAT (a) in selected typical cases and (b) for the industry as a whole. (3 to 5 sentences)_____

Q6. Below you can see a comparative list of various dioxin/furan end-of-pipe control systems[281].

- Cyclone
- Electrostatic precipitation
- Bag filter
- Wet scrubber
- Quenching (rapid cooling) and subsequent wet scrubber
- Afterburner
- Catalytic oxidation (selective catalytic reaction)
- Catalytic bag filter
- Adsorption with activated carbon
- Other

Please explain, which types of dioxin/furan end-of-pipe control system is the most widespread in the Turkish cement industry? Why? Please compare the investment and operating costs. (3 to 5 sentences)_____

6.4.3. Questions for metallurgy industry experts

Q7. Please inform us about the yearly quantities of iron, steel, copper, aluminum, zinc and lead. What proportion of metals is produced by sinter plants and what proportion by secondary metallurgy production?

Q8. Please estimate the number of plants producing of iron, steel, copper, aluminum, zinc and lead. What proportion of plants is sinter plant, and what is the proportion of secondary metallurgical plants?

[281] "Guidelines On Best Available Techniques And Provisional Guidance on Best Environmental Practices relevant to Article 5 and Annex C of the Stockholm Convention on Persistent Organic Pollutants." Geneva May 2007.

Q9. Please estimate, what percentage of metallurgy plants uses the following Best Available Techniques[282] in order to reduce dioxin/furan emission in Turkey by using the table below. Some BATs and BEPs are summarised in the following table[283]. How widely have they been introduced in Turkey?

Selected Best Available Techniques	Technique has been introduced in what percentage of plants? 1=Nowhere 2= Only in the most up-to-date plants, 3=Approximately in half of plants 4=Quite widespread 5= In every plant.					
	Ferrous (Iron and Steel) metallurgy			Non-Ferrous (copper, aluminum, zinc and lead) metallurgy		
	Basic Oxygen Furnace, BOF	Electric Arc furnace	Secondary metallurgy	Basic Oxygen Furnace, BOF	Electric Arc furnace	Secondary metallurgy
Minimization of feed materials contaminated with persistent organic pollutants or contaminants leading to formation of such pollutants						
Stable and consistent operation of the sinter plant, maintaining temperatures above 850°C,						
Fume and gas collection, recirculation of waste gases						
Afterburners with quenching (rapid cooling),						
Adsorption , e.g. with activated carbon						
High-efficiency dedusting, fabric filter dedusting						
Continuous parameter monitoring						

Q10. Please explain in some detail the use of BAT in the above mentioned industries. (3 to 5 sentences)_____

Q11. Please estimate the necessary costs of introducing BAT (a) in selected typical cases and (b) for the industry as a whole. Please justify your opinion. _____

Q12. Please explain, which types of dioxin/furan end-of-pipe control systems are the most widespread in the Turkish metallurgical industry? Why? Please compare the investment and operating costs. (3 to 5 sentences)_____

[282] The table contains a selection of BATs listed in the following source document: "COMMISSION IMPLEMENTING DECISION of 26 March 2013 establishing the best available techniques (BAT) conclusions under Directive 2010/75/EU of the European Parliament and of the Council on industrial emissions for the production of cement, lime and magnesium oxide (notified under document C(2013) 1728)"

[283] "Guidelines On Best Available Techniques And Provisional Guidance on Best Environmental Practices relevant to Article 5 and Annex C of the Stockholm Convention on Persistent Organic Pollutants." Geneva May 2007.

6.4.4. Questions for chemical industry experts

Annex C of the The Stockholm Convention applies toe the unintentional production of some persistent organic pollutants, such as

- Polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/PCDF)
- Hexachlorobenzene (HCB)
- and Polychlorinated biphenyls (PCB)

Q13. Some BATs and BEPs are summarised in the following table[284]. How widely have they been introduced in Turkey?

	Technique has been introduced in what percentage of plants? 1=Nowhere 2= Only in the most up-to-date plants, 3=Approximately in half of plants 4=Quite widespread 5= In every plant.								
Selected techniques	Petro-chemical industry	Fertilizer produc-tion	Pharma-ceutical	Soap and detergent industry	Paints and coatings industry	Soda produc-tion	Chrome chemicals and chrome derivatives	Boron chemicals	Sodium sulphate production
Modify processes to reduce generation of chemicals listed in Annex C;									
Incorporate steps that treat impurities in raw materials, and use rigorous operational maintenance;									
Purify products by distillation where physical properties allow;									
Internally recycle inadvertently generated high-molecular-weight by-products as an integral part of the process									
Manage wastes appropriately taking full account of the potential release of chemicals listed in Annex C to air, water and land and avoid any inadvertent formation.									

Q14. Please explain in some detail the use of BAT in the above mentioned industries. _____

Q15. Please estimate the necessary costs of introducing BAT (a) in selected typical cases and (b) for the industry as a whole. Please give a short justification of the estimation. _____

[284] "Guidelines On Best Available Techniques And Provisional Guidance on Best Environmental Practices relevant to Article 5 and Annex C of the Stockholm Convention on Persistent Organic Pollutants.". Geneva May 2007.

6.4.5. Questions to waste management experts

Q16. Please give an estimation on the yearly quantities (Weight in tons) of the following types of waste management (a) incineration of solid waste, (b) incineration of medical waste and (c) open burning of waste, including burning of landfill sites (d) Smouldering[285] of copper cables and (e) Shredding[286] of end-of-life vehicles

Q17. Please estimate the number of sites for (a) incineration of solid waste, (b) incineration of medical waste and (c) open burning of waste, including burning of landfill sites. (c) Sites of open burning of waste, including burning of landfill sites (d) Smouldering sites of copper cables and (e) Shredder plants of end-of-life vehicles.

[285] Smouldering (or smoldering) is the slow, low-temperature, flameless form of combustion.
[286] Reducing the size of scrap metal.

Q18. Some BATs and BEPs are summarised in the following table. How widely have they been introduced in Turkey?

	Technique has been introduced in what percentage of this type of waste management / waste incineration / burning sites? 1=Nowhere 2= Only on the most up-to-date sites, 3=Approximately in half of sites 4=Quite widespread 5= On every site.				
	Types of waste management				
Selected best environmental practices and best available techniques	Solid waste incineration	Incinerating medical wastes	Landfilling	Open burning of waste, smouldering of copper cables	Shredder plants for the treatment of end-of-life vehicles
Appropriate selection of site					
Proper waste control, handling, segregating different types of waste at the source					
Avoid waste loads containing high chlorine content, PCB-containing condensers, PCB- or chlorobenzene-contaminated waste oils or textiles, and polymers containing brominated flame retardants					
Avoid materials containing catalytic metals such as copper, iron, chromium and aluminium					
Apply appropriate techniques for combustion, e.g. by maintaining high temperatures, supplying sufficient air					
Treatment of solid residues, e.g. bottom ashes					
Treatment of effluents, leachates					
Treatment of flue gases by electrostatic precipitators (ESPs)					
Treatment of flue gases by fabric filters					
Treatment of flue gases by hybrid filters					
Treatment of flue gases by activated carbon injection					

Q19. Please explain in some detail the use of BAT in the above mentioned environmental industries. _____

Q20. Please estimate the necessary costs of introducing BAT (a) in selected typical cases and (b) for the environmental industry as a whole. Please give a short justification of the estimation. _____

6.4.6. Questions to textile industry experts

Contamination with PCDD and PCDF has been found in both textile and leather products. The occurrence of PCDD/PCDF in the textile and leather industries is due to use of chlorinated chemicals[287] in order to protect the raw material (e.g. cotton, wool or other fibres, leather); and use of dioxin-contaminated dyestuffs[288]. Smaller quantities of PCDD/PCDF may be formed during finishing, and during incineration of process-generated sludge.

Q21. Some BATs and BEPs are summarised in the following table. How widely have they been introduced in Turkey?

Selected best environmental practices and best available techniques	Technique has been introduced in what percentage of textile industry plants? 1=Nowhere 2= Only in the most up-to-date firms, 3=Approximately in half of plants 4=Quite widespread 5= In every plant.
Replace chlorinated textile-protecting chemicals by alternative compounds	
Replace dioxin contaminated dyestuffs by alternative compounds	
Prefer batches containing low concentration (e.g. distilled or otherwise purified) of chlorinated textile-protecting chemicals and of dioxin contaminated dyestuffs	
Avoid burning of textile, upholstery, leather products and carpet to prevent PCDD/PCDF formation	

Q22. Please explain in some detail the use of BAT in the textile industry and its wastewater management activities. _____

Q23. Please estimate the necessary costs of introducing BAT (a) in selected typical cases and (b) for the textile industry as a whole. Please give a short justification of the estimation. _____

[287] E.g. pentachlorophenol and chloronitrofen.

[288] E.g. dioxazines or phthalocyanines.

6.5. Annex E: Response of metallurgy expert to Expert Survey

Availability of dioxin / furan pollution abatement technologies in Turkish steel electro furnace plants

EF Facilities	2012 Production (ton)	PCDD / F measurement	Steel plant dust collection system	Afterburner chamber	Scrap preheating	Controlled burning of sucked gas	Scrap control, special scrap selection	Rapid cooling	Activated carbon injection before bagfilter
A	321 912	Yes, biannually	bagfilter dust collection system (97)	Absent	absent		yes (better quality scrap usage)	Trombone cooler and spark arrester	
B	296 055		bagfilter dust collection (100)	Yes	absent		yes		
C	114 480		bagfilter dust collection (99)	Absent	absent		yes (better quality scrap usage)		
D	2 604 534		bagfilter (95)	yes(96)	absent	yes	yes (better quality scrap usage)	Quenching	
E	1 393 415		jet-pulse (new)	yes(97.8)	absent	yes	yes		
F	995082		jet filtering system (100)	yes(>90)	absent	yes	yes	Quenching Tower	
G	940 790	Yes, biannually	bagfilter dust collection	Yes	yes	yes	routine scrap sorting	Cooling flue gas	
H	3 050 000		bagfilter (100)	yes(97)	yes	yes	yes		yes
I	4 083 100	Yes, biannually	bagfilter dust removal (99.9)	yes (>90)	absent	yes	yes	Quenching	
J	1 431 582		bagfilter (95.5)	yes(98)	absent	yes	yes	Quenching	yes
K	1 273 646		Bagfilter	yes (>90)	yes		routine scrap sorting		
L	1 375 745		bagfilter dust collection system	Yes	absent	yes	yes		
M	789 316		dust collection system	Absent	absent		yes (better quality scrap usage)		
N	1 103 058	Yes, biannually	Bagfilter	yes(99)	absent	yes	yes		
O	526 902		baghouse filtration system	Absent	absent		routine scrap sorting		
P-Induction Furnace	121 840		(Induction furnace) bagfilter		absent		yes (better quality scrap usage)		
S	538 382		bagfilter (95)	yes(>90)	absent	yes	routine scrap sorting	Quenching Tower	
T	1 563 293	Yes, biannually	bagfilter (new facility)	Yes	absent	yes	yes (better quality scrap usage)		

EF Facilities	2012 Production (ton)	PCDD / F measurement	Steel plant dust collection system	Afterburner chamber	Scrap preheating	Controlled burning of sucked gas	Scrap control, special scrap selection	Rapid cooling	Activated carbon injection before bagfilter
U	1 061 668		bagfilter (97)	yes(95)	yes		yes		
V	625 292		Bagfilter	Absent	absent		routine scrap sorting		
Y	1 513 988		bagfilter dust collection	Yes	absent		yes		
EAF total	25 724 080								
Integrated plants total	9 325 012								
TOTAL	35 049 092								

6.6. Annex F: Response of chemical expert to POPs Expert Survey

Question: Annex C of the The Stockholm Convention applies toe the unintentional production of some persistent organic pollutants, such as

- Polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/PCDF)
- Hexachlorobenzene (HCB)
- and Polychlorinated biphenyls (PCB)

Some BATs and BEPs are summarised in the following table[289]. How widely have they been introduced in Turkey?

Technique has been introduced in what percentage of plants?
1=Nowhere 2= Only in the most up-to-date plants, 3=Approximately in half of plants 4=Quite widespread 5= In every plant.

Selected techniques	**Paints and coatings industry**	**Soda production**	**Chrome chemicals and chrome derivatives**	**Boron chemicals**	**Sodium sulphate production**
Modify processes to reduce generation of chemicals listed in Annex C;	2	2	3	3	3
Incorporate steps that treat impurities in raw materials, and use rigorous operational maintenance;	4	5	4	5	4
Purify products by distillation where physical properties allow;	3	4	4	4	3
Internally recycle inadvertently generated high-molecular-weight by-products as an integral part of the process	4	3	3	4	3
Manage wastes appropriately taking full account of the potential release of chemicals listed in Annex C to air, water and land and avoid any inadvertent formation.	3	4	4	4	4

[289] Guidelines on Best Available Techniques and Provisional Guidance on Best Environmental Practices relevant to Article 5 and Annex C of the Stockholm Convention on Persistent Organic Pollutants." Geneva May 2007.

6.7. Annex G: Waste Management interviews

6.7.1. ISTAC Istanbul Environmental Protection and Waste Processing Corp

Company / Association Name: ISTAC
Company Website: http://www.istac.com.tr/en
Date of Meeting: 07.03.2014 (10:00 – 11:30)
Place of Meeting: Paşa Mah. Piyalepaşa Bulvarı No:74 Şişli-İSTANBUL

Contact Person: Senol YILDIZ (Technical Deputy General Manager)
Contact Person email: syildiz@istac.com.tr

Participants:

- Mr. Senol Yildiz (Technical Deputy General Manager)
- Mr. Vahit Balahorli (Project Reseach Manager)
- Mr. Volkan Enc (R&D Supervisor)
- Dr Peter Futo . Consultant, POPs T.A. project
- Mr Arda Karluvali, Consultant, POPs T.A. project

Minutes of Meeting

Istac operates a medical waste incineration plant with 24 tons/day capacity. Except ISTAC's, there exists no other medical waste incineration plant in Turkey. Typical system in Turkey is to sterilize the medical waste with autoclave and landfill it. In these cases no dioxin is produced. However, according to new legislation, after 2014 municipalities producing more than 10 tons/day of medical waste must install an incineration plant. The planning is still in a preliminary phase.

Cost of dioxin reducing technologies in hazardous waste incinerators

- *Active carbon injection system*. In its medical waste incinerator ISTAC installed an *active carbon injection system* for control of dioxin/furan. The investment cost was 100 000 € and the operation cost is around 10 000 €/year.
- Active carbon bed. Another technology used in industry for dioxin/furan emissions is *active carbon bed*. The investment cost would in that case around 300 000 – 400 000 € and the operation costs 50 000 €/year.

- *Bag filter*. The investment cost of *bag filter*, which is installed for catching dust emissions, is around 500 000 € and the operation cost is 5€/m^3 of medical waste. It is necessary to apply bag filters even in the absence of POPs, therefore this cost can not be justified by preventing POP. On the other hand, in the presence of dioxin / furan, the capacity of the bag filter shall be increased. In this case the estimated additional investment cost for is 200 000 € (100 000 for increasing the capacity of the bag filter and 100 000 for installing an active carbon injection system) and the operation cost is 30 000 €/year.
- *Fly ash* from bag filters is landfilled in the hazardous waste landfill of ISTAC. This includes the injected active carbon filled with dioxin/furan. (The bottom ash of the incinerator does not contain hazardous compounds and can be sent to municipal landfill.)

Measuring dioxin / furan emission. The emission of dioxin/furan controlled every 6 months. The sampling job is outsourced and the measurements are done at Tubitak. The measurement range is around 0.02- 0.06 ng/Nm^3, which is slightly less than 0.1 ng/Nm^3 limit value. If wet scrubbers were installed, the measurement values could be improved down to 0.001 ng/Nm^3.

Various waste streams and their relevance for POPs

- *Landfilling.* Furniture may contain PBDE and PFOS: as of now, waste furniture is being shredded and used in RDF[290] production to be used as alternative fuel in cement kilns. Turkish legislation does not require the monitoring of PCB or other POPs in leachate[291] flowing from landfills. It is to be assumed that the POPs concentration of the fluid is low.
- *Composting.* In the EU agricultural waste is not mixed with other waste types, because legislation forbids to produce compost from mixed waste and use it in agriculture. Therefore EU there are not many control parameters of compost in the EU legislation. However, in Turkey there is no separate collection, and as a rule, agricultural waste may contain other types of waste as well. Therefore a stricter regulation is needed for composting with more control parameters, which might include some limit values regarding POPs as well. If this will be the case, this might bring some additional waste management costs. Right now in Turkey, only stabilization level of compost is controlled.
- *Waste incineration.* The planned new municipal waste incineration plant of Istanbul is under tendering procedure. It will comply with the requirements of the Bylaw on waste incineration, which has already been harmonized with EU directives. Therefore, it is to be assumed that introducing the POPs regulation will bring no extra cost for operators of waste incinerators.
- *Construction waste and demolition waste.* Turkey implements an urban regeneration program which involves the demolition of a large amount of buildings. There will be asbestos, PVC and eventually products containing POPs (e.g. PFOS impregnated carpets, textiles) in the demolition waste. If the legislation will be extended to the selective treatment of these materials, this will have a certain cost as well.

[290] Fuel produced by shredding and dehydrating solid waste (MSW) with a waste converter technology
[291] Leachate in this context is water or any other liquid that passed through the landfill.

6.7.2. MSG-MESS Integrated Recovery and Energy Co.

Name of company: MSG (MESS Integrated Recovery and Energy Co.)
MSG "MESS Entegre Geri Kazanım ve Enerji San. ve Tic A.Ş"
Name of parent association: MESS (Turkish Employers' Association of Metal Industries)
Company Website: http://www.mess.org.tr/ and http://www.msgenerji.com/
Date of Meeting: 0.03.2014 (14:30 – 16:30)
Place of Meeting: Merkez Mah. Geçit Sokak No:2 34381 Şişli-İSTANBUL
Contact Person: Mr Cavit VARDARLILAR (General Manager of MSG)
Contact Person email: cvardarlilar@msgenerji.com

Participants:

- Mr Cavit Vardarlilar (General Manager of MSG)

- Mr İsmail Erimis (Marketing Manager of MSG)
- Dr Peter Futo . Consultant, POPs T.A. project
- Mr Arda Karluvali, Consultant, POPs T.A. project

Minutes of Meeting

MSG is a subsidiary of MESS Turkish Union of Metal Industrialists. MESS has almost 300 industrial affiliates with 150.000 employees. MSG was established in 2009 by a decision of by MESS at its 40th Extraordinary General Assembly. The main purposes of MSG is to organize industrial waste logistics.

Hazardous waste incineration plant project. MSG is in the course of implementing a project of hazardous waste incineration plant that will be located in Tavsanli, Kutahya. The project is in the last step of EIA procedure. In this plant MSG will invest approximately 50 million € for a flue gas treatment system with a bag filter. The installation of an active carbon system costs around 5 million €. It is not possible for cement plants, which are accepting hazardous waste as alternative fuel, to invest this amount for FGT.

Dioxin emission problems are frequently connected with the quality of the coal, because coal may contain chlorine and sulfur. Dioxin emission can be substantially reduced by installing a contemporary flue gas cleaning system and by using high quality coal. . Erdemir, which is the largest steel manufacturer[292] uses basic oxygen furnace. Erdemir invested more than half a million EUR for flue gas treatment in 2007. Dioxin emissions are negligible in case of metallurgy companies using electric arc furnace, as many of their member companies do, such as ERDEMIR, Ictas, Kroman, Basir Celik and most of the steel producers.

[292] Website: http://en.erdemir.com.tr/

PCB. There is no state of art infrastructure in Turkey for recovery of PCB oil containing transformers. In Turkey the only company ready to collect this type of hazardous waste is Izaydas[293]. Electricity companies possess large quantities of phased out PCB oil containing transformers and face a great challenge when storing these. The fee of disposal to be paid by companies to Izaydas is very high. Collected specimen are transported to European waste disposal facilities.

POPs in household waste, e.g. in electrical equipment. Municipal household wastes are sorted by hand by workers in sorting plants for recycling like in ISTAC [294]and ITC[295]. There is no other separation unit.

Cost aspects of POPs related action plans. There is a GEF project in a preliminary phase with the aim of reducing POPs emissions in Turkey with a budget of 10 million €. MSG was invited to the meeting as a stakeholder company, which might want to install the infrastructure for disposal of POPs.

Follow-up of meeting. MSG is ready to disseminate the questionnaires of the POPs T.A. project among the member companies of MESS. If needed, they also help us to organize meetings with metallurgy companies. MSG expects to receive a summary report on the POPs T.A. project.

[293] İzmit Purifying, Incinerating and Recycling Of Wastes And Residues Inc. Website: http://www.izaydas.com.tr . Annual Report in English: http://www.izaydas.com.tr/files/IZAYDAS%20Annual%20Report%202010.pdf.

[294] Istanbul Environmental Protection and Waste Processing Corp. (İSTAÇ Corp.), a municipal company. Website: http://www.ibb.gov.tr/en-US/Organization/Companies/Pages/ISTACAS.aspx

[295] ITC Invest Trading & Consulting AG, a private waste management company. Website: http://www.itcturkiye.com/index.aspx?pid=1 and http://www.itcgreenpapers.com/Waste.aspx

6.8. Annex H: Food safety interview

6.8.1. Turkish Food Safety Association

Name: Turkish Food Safety Association, Gıda Güvenliği Derneği, GGD
Website: http://www.ggd.org.tr
Date of Meeting: 05.03.2014 (15:00 – 16:30)
Place of Meeting: Kalite Sistem Grubu Değirmen Sok. Ar Plaza B Blok No :16 Kozyatağı – İstanbul
Contact Person: Muhteber Ersin (Communication and Administrative Affairs Responsible)
Contact Person email: muhteber.ersin@ggd.org.tr

Participants:

Mr. Samim Saner
President of GGD Turkish Food Safety Association
Director of Kalite Sistem Group , a private food laboratory, academy and audit service.

- Dr Peter Futo . Consultant, POPs T.A. project
- Mr Arda Karluvali, Consultant, POPs T.A. project

Minutes of Meeting

On GGD. Turkish Food Safety Association (TFSA) was established in 2004 as a non-governmental organization to provide communication on food safety issues between consumers, food industries, government, academicians and food safety employees. The Board of directors is comprised of members and professionals, the TSFA constitutes an Advisory Board, Consumer Assembly, Working Group and Committees. TSFA is the representative of International Association of Food Protection (IAFP) in Turkey.

Legislation. The pesticides given in Stockholm Convention are all banned in Turkey. Turkish legislation defines MRL (Maximum Residue Level) for various chemicals for different kinds of food especially like meat, fish, egg, milk products and baby food. POPs have affinity to dissolve in fat and oil. The Annex of this document contains the table of MRL for various foods given in Turkish Food Codex Contaminants regulation (date: 29.12.2011; no: 28157), in which dioxin and PCB residues are explicitly mentioned. Turkish chemical and food safety legislation on POPs is satisfactory, almost fully harmonized with EU. The problem lies in implementation.

Black market of pesticides. It is very likely that there is some smuggling and illegal use of pesticides like dialdrin, aldrin, etc. The main reason is they are very potent and very cheap.

Monitoring and measurement of contaminants in food. Food safety monitoring in Turkey is weaker than in the EU. However, When compared with Greece and Bulgaria, the system in Turkey is much more developed. There is a market surveillance system of food safety. The major laboratory is the reference laboratory of Ministry of Food, Agriculture and Animal Husbandry (MFAH). A serious problem of the monitoring practice is that there is no transparent reporting system. The individual measurements are not publicly available and the stakeholders do not learn the results of monitoring activities. So they can not see the magnitude of problem and can not make any comments on solution of the problem. The Ministry has a plan for monitoring pollution(in particular dioxin) in foods, which is not public. [296]

Contaminants found in food. It is recommended to check the website of the EU's Rapid Alert System for Food and Feed (RASFF) about contaminants in food imported from Turkey. According to this source, Turkey's record if compared with other countries could be and should be substantially improved.

Measuring pesticides in food. When residues of POPs are measured in the soil, it is not possible to identify the date of application, as these chemical compounds are persistent. However, when measurements made on the surface of food (e.g. leaves of vegetables), it can be concluded that some of the phased out pesticides are applied recently.

Measuring dioxin in food. Measurement of dioxin in food is very costly , because the MRL level is very low for food and at this level the measurement is difficult.. There is a need for improving the laboratory capacity for measuring dioxin in food. The market of dioxin measurement is not accessible for private labs in Turkey. Private laboratories do not receive subsidies from the Government. There are authorized labs for import and export activities but not for market surveillance. A healthy competition between public and private laboratories would decrease the cost of measurement.

Expected impacts. The direct impacts of consequently enforcing the POPs regulation in Turkey could be felt in trade issues. Indirect effects would be the reduction of POPs related cancer morbidity.

[296] If needed, it can be obtained from Dr Neslihan Alper in MFAH by referring to Mr Samim Saner.

Maximum Limits of Dioxin and PCB in food

Source: Food Codex Contaminants regulation of Turkey. No: 28157. Date:29.12.2011.

Food		Maksimum Limit		
		Dioksinlerin toplamı (WHO/PCDD/F-TEQ) ([32])	**Dioksinler ve dioksin benzeri PCB'lerin toplamı (WHO/PCDD/F-PCB-TEQ) ([32])**	**PCB28, PCB52, PCB101, PCB138, PCB153 ve PCB180 (ICES – 6) toplamı ([32])**
5.1.	Meat and meat products (8) (excluding edible offal) □ bovines and sheep, goats □ Poultry — □ Pigs	2.5 pg/g yağ ([33]) 1.75 pg/g yağ ([33]) 1.0 pg/g yağ ([33])	4.0 pg/g yağ ([33]) 3.0 pg/g yağ ([33]) 1.25 pg/g yağ ([33])	40 ng/g yağ ([33]) 40 ng/g yağ ([33]) 40 ng/g yağ ([33])
5.2.	Liver and their products (8) (Section 5.1 of the specified land-living animals) .	4.5 pg/g yağ ([33])	10.0 pg/g yağ ([33])	40 ng/g yağ ([33])
5.3.	Fish, meat, fishery products and products manufactured from them (23), (34) and crustaceans. Except for the following: □ Eel □ freshwater fish Fish liver and their products □ Oils derived from seafood □ Maximum limits; crustaceans, excluding the main body portion is applied to the abdomen and abdominal extension muscle meat. In the crab and crab-like crustaceans (Brachyura and Anamura) is applied to the appendages muscle meat	3.5 (pg/g yaş ağırlık)	6.5 (pg/g yaş ağırlık)	75 (ng/g yaş ağırlık)
5.4	Freshwater fish and their products (migrating from the sea to freshwater fish caught in freshwater and products excluded)	3.5 (pg/g yaş ağırlık)	6.5 (pg/g yaş ağırlık)	125 (ng/g yaş ağırlık)
5.5.	Eel meat (Anguilla anguilla) and products	3.5 (pg/g yaş ağırlık)	10.0 (pg/g yaş ağırlık)	300 (ng/g yaş ağırlık)
5.6.	Fish liver and products thereof (Section 5.7, except as provided)	—	20.0 ([35]) (pg/g yaş ağırlık)	200 ([35]) (ng/g yaş ağırlık)

5.7.	Oils obtained from marine products (for human consumption of fish oil, fish liver oil and other oils obtained from marine animals)	1.75 pg/g yağ	6.0 pg/g yağ	200 ng/g yağ
5.8.	Milk and milk products (8) (including butter)	2.5 pg/g yağ ([33])	5.5 pg/g yağ ([33])	40 ng/g yağ ([33])
5.9.	Chicken eggs and egg products (8)	2.5 pg/g yağ ([33])	5.0 pg/g yağ ([33])	40 ng/g yağ ([33])
5.10.	The fats obtained from animals following - bovines and sheep, goats - Poultry — - Swine	2.5 pg/g yağ 1.75 pg/g yağ 1.0 pg/g yağ	4.0 pg/g yağ 3.0 pg/g yağ 1.25 pg/g yağ	40 ng/g yağ 40 ng/g yağ 40 ng/g yağ
5.11.	Mixed animal fats	1.5 pg/g yağ	2.5 pg/g yağ	40 ng/g yağ
5.12.	Vegetable oils and fats	0.75 pg/g yağ	1.25 pg/g yağ	40 ng/g yağ
5.13.	Supplementary foods for infants and young children (4)	0.1 (pg/g yaş ağırlık)	0.2 (pg/g yaş ağırlık)	1.0 (ng/g yaş ağırlık)

6.9. Annex I: Chemical and textile industry interviews

6.9.1. Fatsa Chemicals (Fire Fighting Foam Manufacturer)

Company Name: Fatsa Kimya
Company Website: http://www.fatsachemicals.com/
Date of Meeting: 03.04.2014 (14:00 – 15:00)
Place of Meeting: İstanbul Deri Organize Sanayi Bölgesi 9.Yol B6 Parsel | Orhanlı - TUZLA / İSTANBUL
Contact Person: Burak TURCAN (Chemist & Environmental Engineer)
Contact Person email: burak@fatsachemicals.com
Participants:

- Burak Turcan
- Arda Karluvali

Minutes of Meeting:
Fatsa Chemicals is one of the biggest fire fighting foam manufacturers in Turkey. Besides, the company has an accredited "Fire Extinguishing Performance Laboratory ".

25 L samples are sent from foams that will be imported according to EN 1568 and checked by Fatsa in order to assess the fire extinguishing performance of foams.

They are not checking the PFOS content of imported foams in their laboratory as it is not requested.

Mr. Turcan does not have full awareness regarding PFOS as neither Fatsa Chemicals nor other Turkish factories are using PFOS for manufacturing of foams (see the ingredients table below taken from MSDS[297]). Also he does not remember any time that PFOS was used. The resources that Fatsa Chemicals using are coming from US and EU. So their product has no restricted ingredient, although earlier it was used. He also claims that there can not be a stockpile problem. Fire brigades are continuously running drills so they purchase foam every year. These foams have lifetime of around 2 years. Companies probably pouring the foam liquid into sewers diluting with water as it has mainly more or less the same ingredients with soap.

Although he does not know whether the Chinese foams contain PFOS, he does not think that would be also problem. For starters, up to now he does not remember any Chinese foam that manage to pass the extinguishing performance test. So it is not possible to find these cheap quality foams in the market. He checked the MSDS[298] of the one the Chinese samples. There wasn't any section depicting the ingredients.

[297] Material safety data sheet
[298] Material safety data sheet

Ingredients of AR[299]-AFFF[300] of Fatsa Chemicals

Cas No	Material	Risk[301]	Safety[302]	% by wt
7732-18-5	Water	-		70-90 %
112-34-5	2-(2-Butoxyethoxy) ethanol	R36[303]	S25, S26	5-10%
Mixture	Hydrocarbon surfactants	-	-	2-10%
161278-39-3	Fluorotelomer surfactant	R36, R37[304], R38[305]	S24[306], S25[307], S26[308], S28	1-5%
11138-66-2	Polymer	-	-	1-5%

6.9.2. Turkish Chemical Manufacturers Association

Association Name: Turkish Chemical Manufacturers Association, Türkiye Kimya Sanayicileri Derneği TKSD
Website: http://www.tksd.org.tr
Date of Meeting: 05.03.2014 (10:00 – 12:00)
Place of Meeting: Değirmen Sokak Şaşmaz Sitesi No:19 Duran Bey Apt. Kat:3 D:9 34742 Kadıköy - İstanbul
Contact Person: Erkan BAYKUT (Asst. General Secretary)
Contact Person email: erkan.baykut@tksd.org.tr
Participants:

- Mr. Erkan Baykut (Asst. General Secretary)
-
- Mr. Caner Zambak (Environmental Adviser)
- Dr Peter Futo . Consultant, POPs T.A. project
- Mr Arda Karluvali, Consultant, POPs T.A. project

[299] AR = Air Rescue
[300] AFFF = Aqueous Fire Fighting Foam
[301] R-phrases (short for Risk Phrases) are defined in Annex III of European Union Directive 67/548/EEC: Nature of special risks attributed to dangerous substances and preparations. The list was consolidated and republished in Directive 2001/59/EC, where translations into other EU languages may be found. These risk phrases are used internationally, not just in Europe, and there is an ongoing effort towards complete international harmonization. For more information see the Eurostat page under: http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Glossary:Risk-phrase.
[302] S-phrases are defined in Annex IV of European Union Directive 67/548/EEC: Safety advice concerning dangerous substances and preparations. The list was consolidated and republished in Directive 2001/59/EC, where translations into other EU languages may be found. The list was subsequently updated and republished in Directive 2006/102/EC, where translations to additional European languages were added. These safety phrases are used internationally and not just in Europe, and there is an ongoing effort towards complete international harmonization.
[303] R36 = Irritating to eyes
[304] R37 = Irritating to respiratory system
[305] R38 = Irritating to skin
[306] S24 = Avoid contact with skin
[307] S25 = Avoid contact with eyes
[308] S26 = In case of contact with eyes, rinse immediately with plenty of water and seek medical advice

Minutes of Meeting

Mr Baykut has participated at the POP TOT courses, but Mr Zambak did not attend it.

TKSD has members from diverse sectors of the chemical industry, including PVC producers (PETKIM), pesticides (Bayer), organic and inorganic chemicals (Akkim) and others.

Environmental performance of big vs. small chemical firms. TKSD confirms that big chemical companies comply with every requirements of existing nationwide and local environmental regulations. Otherwise it would not be possible for them to continue manufacturing. On the other hand, there exist approximately 20.000 companies in chemical sector. 99.5% of these are small and medium sized enterprises. Also 88.5% of this number is also considered as micro-enterprise. Monitoring of the environmental compliance in these small enterprises is difficult and its results are uncertain.

Evaluation of the stockpiling problem. According to TKSD's opinion the existing studies over-exaggerate the problem of stockpiling in Turkey. Except some few examples, there aren't many stockpiles in Turkey, as Turkey was one of the first countries in the world that banned the production of persistent pesticides. TKSD is aware of the stockpile problem in company MERKIM[309].

For chemical products considered as POP, TKSD experts could not give an explicit explanations, as they do not have certain information. In order to check the situation in Turkey, they asked for examples, case studies or best practices of finding alternatives, which were done in EU. If they receive such information, they will be ready to check the Turkish equivalents.

An advice for POPs inventory. It is not easy to identify the quantity export and import of those chemical products that are POPs (or contain POPs, e.g. PFOS or PBDE). This may be done in two phases. In the first phase one has to identify the GTIP Codes (Customs Tariff Statistics Position) of the particular product which is POP (or contains POP). In the second phase, with the help of these GTIP codes it is possible to check the import and export figures by using an online service of TurkStat. TKSD offered that they can also check whether these chemicals are used, exported or imported by their members.

A possible conflict of interest. As of now, in Turkey the same institution is giving the environmental permits and also performs the environmental monitoring the companies. For better environmental management, the responsibility of these two tasks should be given to two different institutions.

Offer of help for SIA research. If needed, TKSD will help to disseminate POPs related questionnaires among its member firms. However, they are not optimistic about the response rate.

6.9.3. Elsan Elyaf Sanayi A.S., polypropylene based textile company

[309] Owner: Ibrahim Arici

Company Name: Elsan Elyaf Sanayi A.S.
Company Website: http://www.elsanelyaf.com.tr
Date of Meeting: 04.09.2014 (11:00 – 13:30)
Place of Meeting: Muradiye Mah. Gölyolu Cad. No:71 16800 Orhangazi Bursa / TURKEY
Contact Person: Cem Baki SİNAL (General Manager)
Contact Person email: cem.sinal@elsanelyaf.com.tr
Participants:

- Cem Baki Sinal
- Mustafa Yücel
- Dr. Peter Futo
- Arda Karluvali

Minutes of Meeting :
Elsan Elyaf is producing PP fibers, carpets and hand knitting yarns. Their main processes are mainly weaving, extruding and knitting of fibers. The factory has no coloring process. They buy the masterbatch and mix it with raw materials.

Their main waste stream is CaCO3. There exists a chemical and biological wastewater treatment plant for treatment of adhesive mixed water.
They don't use fire retardant chemicals in their products. Only, 1 time they made a trial to use with a mineral based compound.

They don't use dioxin contaminated dyestuff or chlorinated textile protection chemicals. They have no relevant information regarding persistent organic pollutants. The general manager depicted that ITKIP (Istanbul Tekstil ve Konfeksiyon İhracatçı Birlikleri, Istanbul Textile and Apparel Exporters' Association) should have more information as they a laboratory also.

A phone conversation was made with Mr. Uğur (expert in carpet manufacturing department at ITKIP). As general information, there is no flammability problem in PP carpets and no fire retardants are applied to acrylic carpets. He has not heard about the chemicals related with POP regarding carpets. Other departments at ITKIP should be contacted for more detailed information.

6.9.4. XPS Heat Insulation Manufacturers Association

Association Name: XPS HEAT INSULATION MANUFACTURERS ASSOCIATION
Association Website: http://www.xpsturkiye.org/
Date of Meeting: 05.09.2014 (15:00 – 16:30)
Place of Meeting: Şerifali Çiftliği, Hendem Cad. Kıble Sok. No:33 Kat:3 Daire:2 Ümraniye / İstanbul
Contact Person: Meltem YILMAZ (General Coordinator)
Contact Person email: meltem.yilmaz@xpsturkiye.org
Participants:

- Meltem Yılmaz
- Gökhun Kurt
- Dr. Peter Futo
- Arda Karluvali

Minutes of Meeting :
The main problem with XPS is usage of HBCD for flame retardancy. Using HBCD chemical is not obligatory, but it is the most used chemical on the market. According to the regulations (EN 13501- 1), in order to use the materials in the buildings, the construction product must have minimum fire performance of Class E (Euroclasses for fire performance for construction product). Normal produced XPS foamboard is Class F. By using the HBCD, the fire performance class is increased to E.

The main contents of XPS foam board are: PS (polystyrene), chemical additives, blowing agents and HBCD.

It is not easy for sector to change to HBCD-free products easily. The main reasons are:

- Right now there are only 2 licensed companies that are offering HBCD-free fire retardant products. The cost of the products is around 5 times the cost of the HBCD as there is no competition. These products should be available by many different companies. Sector needs to wait for product availability.
- The formulation might probably change with the usage of these new products. If the formulation changes, product specifications and performance declarations must be changed. New tests must be done to assess thermal resistance, compressive strength and compressive creep. These tests and trials will take long time before putting the product on the market. For example; the test for determination of compressive creep takes 250 days.
- HBCD is only covers 1-3% of the products. On the other hand, even this could affect the properties of the product like density. If the density is deteriorated, the cost of the product changes also.

The sector needs smooth transition period. If incentives and funds are offered, the transition period can be shorter. Right now, it is estimated that the sector needs at least 5 years of transition period.

For Turkey, there is also another problem. The big global and national companies can easily adapt themselves to the new conditions. On the other hand, small companies find cheap materials and don't change their processes easily. This is affecting the competitiveness in the market and this creates a gap in the market prices. So step by step reduction is needed, so every company can reduce the usage at the same time. This situation happened when the blowing agents are changed with more environmental friendly ones.

The blowing agents used are CO_2 or HFCs[310].

Because of REACH, in Europe the usage of HBCD will be restricted in 2015. According to the information of XPS Association, the draft By-law harmonising REACH in Turkey allows an extension of HBCD use up to 2018.

The HBCD content of the products changes according to different XPS producers. The normal usage quantity changes according to the density of the product. If the blowing agent is flammable then the HBCD quantity must also be increased.

[310] Hydrofluorocarbons, organic compounds that contain fluorine and hydrogen atoms.

XPS production in Turkey is around 1.5 million m^3/year. According to the calculations of the XPS Association, the unit cost impact on change to use of HBCD-free product for unit product of 30 kg/m^3, according to expert opinion is 5-8 Euro/m^3. The only benefit of using HBCD-free products is environmental concern.

Not all XPS producers are members of this association. There are around 15 companies producing XPS, and only 6-7 of them are their member. It is estimated that the members of this association covers 60 % of total production.

XPS foam boards are plastic. So the wastes are recycled or disposed as non-hazardous waste.

For EPS the situation is different.[311] The market volume is much bigger, around 5 million m^3 per year. Also the HBCD is not mixed later like in case of XPS, but the raw material of PS (polystyrene) pellets already contains the necessary HBCD. The processes of raw material suppliers must definitely change.

6.10. Annex J: Cement industry interviews[312]

6.10.1. Akçansa Cement

Company / Association Name: Akçansa Cement
Company Website: http://www.akcansa.com.tr
Date of Meeting: 04.03.2014 (10:00 – 11:30)
Place of Meeting: Akçansa HQ
Kısıklı Caddesi No:38 34662 Altunizade Üsküdar / İstanbul

Contact Person: Sezgi Kumbaracibasi (Environmental Executive)

Contact Person email: sezgi.kumbaracibasi@akcansa.com.tr

Participants:

- Ms Sezgi Kumbaracibasi
- Dr Peter Futo . Consultant, POPs T.A. project
- Mr Arda Karluvali, Consultant, POPs T.A. project

Minutes of Meeting

Akçansa has 3 cement factories in Turkey: in Istanbul : 3 kilns, in Çanakkale: 2 kilns, and in Samsun (Ladik): 1 kiln. Total production is around 70 million per year in total for 3 factories. This quantity is approximately 7-8% of total cement production in Turkey. All procedures regarding ISO 9001, ISO 14001 and ISO18000 are followed in these plants.

[311] To get information regarding EPS, Mr Erdem should be contacted from the firm Basaş Ambalaj ve Yalitim Sanayi A.Ş.
[312] The interviews were made in Istanbul and Kocaeli, March –Sept 2014. Prepared by Dr Peter Futo . Consultant, POPs T.A. project and by Mr Arda Karluvali, Local Consultant, POPs T.A. project.

Co-incineration and its advantages. Akcansa co-incinerates in its plants, i.e. it recovers the energetic content of waste as a substitute fuel, and as raw material. In the Büyükçekmece (Istanbul) plant, 12% of heat release is coming from waste. Mainly tyres, waste oil, Refuse-derived fuel (RDF)[313], Solid Recovered Fuel (SRF)[314] and domestic sludge are preferred because of the calorific value and organized supply chain of these materials. Not every waste is appropriate for co-incineration, because the possible contamination with certain compounds impacts the the emission parameters and the quality of cement. Due to co-incineration, Akcansa saves yearly the cost of 70 000 ton coal. No money is paid or taken for the waste supplies. As a rule, the municipality offering the waste pays for the transportation of sludge.

Legal environment of co-incineration. Akcansa complies with all environmental regulations. The main regulations for co-incineration in Turkey are as follows:

- Bylaw on Waste Incineration
- Bylaw on Control of Industrial Air Emissions
- Bylaw on Permits and Licenses that must be taken regarding Environmental Law (Without license it is not possible to co-incinerate. In order to take license all requirements regarding trial burning, emissions, wastewater discharge must be satisfied)

Measurements of input waste. Tubitak is the official laboratory detecting whether a sample of waste is hazardous or not. Generally the analysis of waste is asked from supplier as it is a cost issue. Samples are taken to control the waste. Also visual check is done.

Dust control. The flue gas treatment system of Akcansa for removing particulates is Cyclonic separation [315] and bag filters. Previously, as many cement factories in Turkey, Akcansa used to have Electrostatic precipitator (ESP)[316] for dust control. In case of kilns with co-incineration, the firm replaced ESPs with bag filter. Right now the dust emissions are far below the limit values (50 mg/m^3). Recently many plants have replaced their ESPs with bag filter systems. The cost of replacing ESP to bag filter for 3 kilns in Akcansa's Büyukcekmece plant was 15 million TL.

Dioxin/furan. The selection of waste, in particular the non-admission of chlorine containing plastics is crucial for avoiding dioxin/ furan emission. Burning conditions in the kiln must be stabilized in order to reduce pollution by NO_x and dioxin: in particular O_2 supply must be controlled in order to avoid the presence of residual O_2 and CO at the end of the kiln.[317] This pollution prevention technology is an important cost factor. Accredited companies as described in the Bylaw on Waste Incineration periodically measure Dioxin/furan. The limit value is 0.1 ng/Nm^3. The average emission values of Akcansa are around 0.01 ng/Nm^3. According to expert opinions in the cement sector, almost all cement factories in Turkey satisfy the emission limits in regulations including dioxin/furan.

[313] Fuel produced by shredding and dehydrating solid waste (MSW) with a waste converter technology.
[314] Solid fuel prepared from non hazardous waste to be utilised for energy recovery in incineration and co-incineration plants
[315] Cyclonic separation is a method of removing particulates from flue gas by using gravity and the rotation of particles.
[316] Device for collecting and removing particulates from a flowing gas by using the force of an induced electrostatic charge.
[317] See SC BAT-BEP Guide on cement kilns.

NO_x. The company considers to install selective non catalytic reduction (SNCR) for lowering NO_x values. The investment cost of SNCR is not high but the operational cost is relatively high due to the continuous supply of ammonia. Up to now only one cement plant in Turkey installed SNCR.

Measurements of product quality. Each factory has its laboratory for measurements related with quality of cement. There is only 1 central laboratory for waste related measurements, where especially chlorine and phosphate content, calorific value, density, particle size etc. are measured.

6.10.2. Nuh Cement

Company Name: Nuh Çimento Sanayi A.S.
Company Website: http://www.nuhcimento.com.tr/
Date of Meeting: 17.04.2014 (10:00 – 11:30)
Place of Meeting: Hacı Akif Mahallesi D-100 Karayolu Cd.No:92 Hereke-Körfez / Kocaeli
Contact Person: Yasin YIGIT (Environment and Waste Management Chief
Contact Person email: yasin.yigit@nuhcement.com.tr
Participants:

- Yasin Yigit
- Dr. Peter Futo
- Arda Karluvali
- Engin Turan

Minutes of Meeting :
Nuh Cement has 4 400 000 ton/year clinker and 4 775 100 ton/year cement production capacity. The factory has 3 kilns and 7 dust filters. All 3 kilns have separate licenses for co-incineration.THe company mainly feed the alternative fuels to the kiln with largest production capacity (7 500 ton clinker production /day)

The ESP dust filters have recently changed to bag filters regarding environmental concern and to have better relations with the local people. The total cost of the change from ESP to bag filter was 7 Million Euro in total for 7 filters with different capacities.
The main fuel of factory is coal having calorific value of 6 000 kcal/kg. Dried sewage sludge (95% dry solid) having 3 000 kcal/kg calorific value is used as alternative fuel. Also RDF is used as alternative fuel with defined parameters: 3 000 kcal/kg calorific value, maximum 1% Cl content and maximum %20 moisture content. The cost of installation of RDF feeding system to the kiln was 2 Million Euro. Coal, sludge and RDF are never mixed with each other prior to feeding.

The factory installed a sewage sludge drying plant 6 years ago with 250 tons/day sludge drying capacity. Sludge is coming from 7 treatment plants located in Kocaeli province with 20% dry solid content. The belt dryer system working with waste heat. The investment cost of drying system was 15 Million Euro. It is expected that the cost of system is amortized in 7-8 years. The drawbacks of sludge co-incineration are control of odor coming from deposited sludge on site and the high investment cost of drying plant.

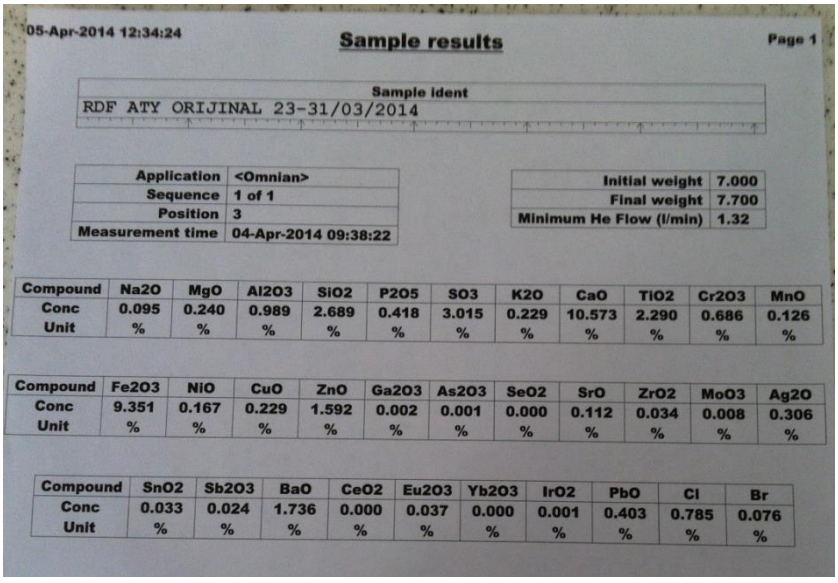
The company has also waste heat recovery plant with installed capacity of 18 MW that can power 40.000 homes. Waste heat is also used for air conditioning of office building.

The company has a special environmental laboratory for checking the parameters of sludge. Cl, F and sulphate content are very important for product quality. Moisture content and calorific value are directly affecting burning conditions. All heavy metals defined in regulations can be measured via X-ray Fluorescence Analyzer. Estimated price: 500 Thousand Euro (see the figures below for x-ray analysis results of RDF and its ash), Dioxin/furan emissions are measured every 3 months per year by accredited laboratories. Average dioxin/furan emission values are less than 0.01 ng/Nm^3, which is 1-2 digits less than 0.1 ng/Nm^3 limit value.

Dust, pressure, temperature, SO_2, NO_x, HF, HCl, TOC, CO and O_2 parameters are continuously measured and can be monitored by Ministry, Provincial Directorate instantly via standard online system. The system has 3 step control: Only certified analyzers are used, accredited laboratories can calibrate the analyzers and Nuh Cement is continuously checking whether the analyzers are properly working. The investment cost of system including analyzers, software, etc. was around 500 Thousand Euro.

Nuh Cement is planning to install SNCR system for NO_x reduction. The investment cost is around 250 Thousand Euro. Although this cost seems gradually low, actual cost to company is to be continuous supply of ammonia to the system, which is produced only by two companies in Turkey (Igsaş and Gübretaş). There is an estimated figure like the ammonia supply will increase the cost of production 1$ per ton clinker.

Cement Industry has been doing a lot of investment for flue gas treatment especially for reduction of dust and NO_x parameters. As a side effect also POP emissions are lowered. There is no need for investment of a special process for reduction of POP related emissions as the emission values are very low regarding the limit values defined in By-law on Waste Incineration and By-law on Industrial Air Pollution Control.
According to the regulations (after 2005), the company prepares an environmental report every year and submit to authorities.



05-Apr-2014 12:34:24 **Sample results** Page 1

Sample ident
RDF ATY ORIJINAL 23-31/03/2014

Application	<Omnian>
Sequence	1 of 1
Position	3
Measurement time	04-Apr-2014 09:38:22

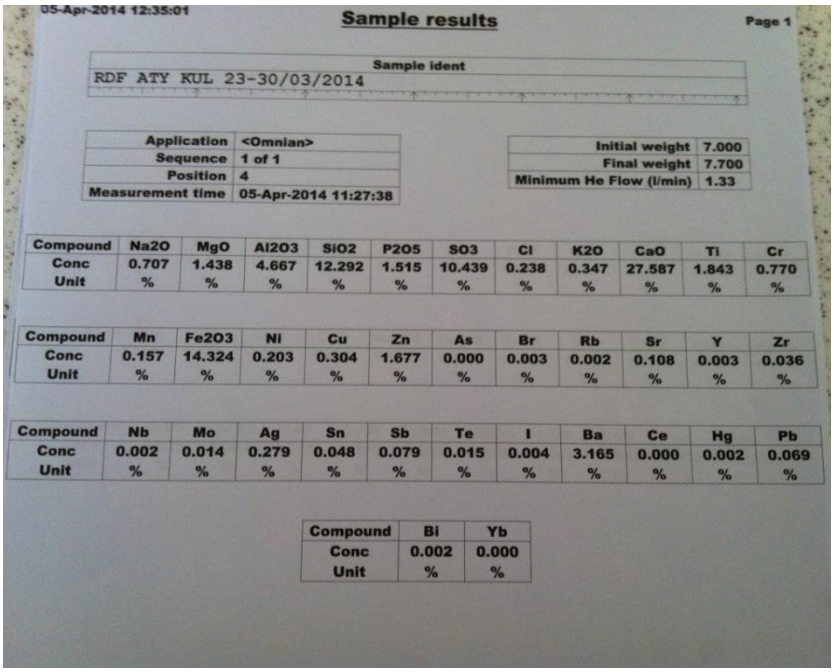
Initial weight	7.000
Final weight	7.700
Minimum He Flow (l/min)	1.32

Compound	Na2O	MgO	Al2O3	SiO2	P2O5	SO3	K2O	CaO	TiO2	Cr2O3	MnO
Conc	0.095	0.240	0.989	2.689	0.418	3.015	0.229	10.573	2.290	0.686	0.126
Unit	%	%	%	%	%	%	%	%	%	%	%

Compound	Fe2O3	NiO	CuO	ZnO	Ga2O3	As2O3	SeO2	SrO	ZrO2	MoO3	Ag2O
Conc	9.351	0.167	0.229	1.592	0.002	0.001	0.000	0.112	0.034	0.008	0.306
Unit	%	%	%	%	%	%	%	%	%	%	%

Compound	SnO2	Sb2O3	BaO	CeO2	Eu2O3	Yb2O3	IrO2	PbO	Cl	Br
Conc	0.033	0.024	1.736	0.000	0.037	0.000	0.001	0.403	0.785	0.076
Unit	%	%	%	%	%	%	%	%	%	%

Figure 1. Analysis Results of Raw RDF



05-Apr-2014 12:35:01

Sample results

Page 1

Sample ident
RDF ATY KUL 23-30/03/2014

Application	<Omnian>
Sequence	1 of 1
Position	4
Measurement time	05-Apr-2014 11:27:38

Initial weight	7.000
Final weight	7.700
Minimum He Flow (l/min)	1.33

Compound	Na2O	MgO	Al2O3	SiO2	P2O5	SO3	Cl	K2O	CaO	Ti	Cr
Conc	0.707	1.438	4.667	12.292	1.515	10.439	0.238	0.347	27.587	1.843	0.770
Unit	%	%	%	%	%	%	%	%	%	%	%

Compound	Mn	Fe2O3	Ni	Cu	Zn	As	Br	Rb	Sr	Y	Zr
Conc	0.157	14.324	0.203	0.304	1.677	0.000	0.003	0.002	0.108	0.003	0.036
Unit	%	%	%	%	%	%	%	%	%	%	%

Compound	Nb	Mo	Ag	Sn	Sb	Te	I	Ba	Ce	Hg	Pb
Conc	0.002	0.014	0.279	0.048	0.079	0.015	0.004	3.165	0.000	0.002	0.069
Unit	%	%	%	%	%	%	%	%	%	%	%

Compound	Bi	Yb
Conc	0.002	0.000
Unit	%	%

Figure 2. Analysis Results of RDF Ash

6.11. Annex K: Milestones of SIA Activity

SIA activities were implemented by the following persons:

- Dr. Peter Futo, Senior Short Term Expert, 60 working days
- Mr. Arda Karluvari, Local Expert, 60 working days

SIA activities were implemented in close co-operation with the Team Leader, Prof. Dr. Ivan Holoubek and Local Expert Professor Ipek Imamoglu.

The SIA activity has delivered the following outputs:

- Industry Questionnaires (April 2014)
- Methodological Report and Guideline about how to implement SIA was disseminated in April 2014.
- Expert interviews, company visits and stakeholder interviews were conducted from March 2014 onwards
- Participation at workshops of the POPs T.A. Project
- Company Questionnaires and Expert Questionnaires were uploaded on the Internet and chambers and professional associations were asked to motivate their members to respond on these Questionnaires (May 2014)
- SIA Training Course was held in Cesme, May 2014.
- Lectures held at RIA Training Course, Antalya, October 2014.
- Preparation and defense of the SIA Report. (Late October 2014)

6.12. Annex L: Abbreviations

BAT	Best Available Technique
BDE	Polybrominated Diphenyl Ether
BEP	Best Environmental Practice
BFR	Brominated Flame Retardants
BREF	BAT (Best Available Techniques) Reference Document
CBA	Cost-Benefit Assessment
CLRTAP	Convention on Long Range Transboundary Air Pollution
DDT	Dichlorodiphenyltrichloroethane"
EIS	Environmental Information System
EPS	Expanded Polystyrene Foam
FGT	Flue Gas Treatment
GEF	Global Environmental Facility
HBB	Hexabromobiphenyl
HBCD	Hexabromocyclododecane
HW	Hazardous Waste
IED	Industrial Emissions Directive
IPPC	Integrated Pollution Prevention and Control
LCP	Large Combustion Plant
MESS	Metal Sanayicileri Sendikasý (Turkish: Metal Industrialists' Union)
MSDS	Material safety data sheet
MSW	Municipal Solid Waste
NIP	National Implementation Plan
PAHs	Polycyclic aromatic hydrocarbons

PBDEs	Polybrominated diphenyl ethers
PCBs	Polychlorinated biphenyls
PCDD	Polychlorinated dibenzo-p-dioxins
PCDF	Polychlorinated dibenzofurans
PCTs	Polychlorinated Terphenyls
PFOS	Perfluorooctane Sulfonates
POPs	Persistent Organic Pollutants
RDF	Refuse Derived Fuel
RIA	Regulatory Impact Assessment or Regulatory Impact Analysis
SC	Stockholm Convention
SIA	Sectoral Impact Assessment
SNCR	Selective Non Catalytic Reduction
SSC	Secretariat of the Stockholm Convention
SWOT	Strengths – Weaknesses – Opportunities – Threats
TA	Technical Assistance
TCMA	Turkish Cement Manufacturers' Association
TOC	Total Organic Carbon
ToR	Terms of Reference
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organization
UNITAR	United Nations Institute for Training and Research
UPOPs	Unintentionally Produced Persistent Organic Pollutants
XPS	Extruded Polystyrene Foam

6.13. Annex M: Lists of experts and stakeholder organisations

6.13.1. Authors of the NIP 2010 Report

Environment, Health, Pesticide Task Team Coordinators

- Kemal Kurusakız,
- Dr. Meral Yeniova,
- Dr. Pelin Aksu

PCBs and PCB Containing Equipments Task Team Coordinator

- Mehmet Düzgün

Emission Research and Monitoring Task Team Coordinator

- Dr. Sönmez Dağlı

National Project Coordinator

- Prof. Dr. Altan Acara

Environment, Health, Pesticide Task Team

- Kemal Kurusakız, Coordinator, Ministry of Environment and Forestry
- Dr. Meral Yeniova, Coordinator, Refik Saydam Hygiene Center Poison Research Department, Ministry of Health
- Dr. Pelin Aksu, Coordinator, Ministry of Agriculture and Rural Affairs
- Neşe Çehreli (Ministry of Environment and Forestry)

- Dr. Alev Burçak (Ministry of Agriculture and Rural Affairs)
- Dr.Menekşe Keski (Ministry of Environment and Forestry)
- Nur Ergin (Refik Saydam Hygiene Center Poison Research Department)
- Ergün Cönger (Ministry of Agriculture and Rural Affairs)
- Prof.Dr. Dürdane Kolankaya (Hacettepe Unıversity Faculty of Science Department of Biology)
- Deniz Türkoğlu MD. (Refik Saydam Hygiene Center Poison Research Department)
- Dr.Rukiye Doğanyiğit (Ministry of Environment and Forestry)
- Kemal Kurusakız (Ministry of Environment and Forestry)
- Prof.Dr. Altan Acara (National Project Coordinator)

PCBs and PCB Containing Equipments Task Team

- Mehmet Düzgün, Coordinator, Ministry of Energy and Natural Resource, EUAS
- Erol Albostan (Ministry of Energy and Natural Resource, TEDAS)
- Hüseyin Çavdar (Ministry of Energy and Natural Resource, TEDAS)
- Cemal İnce (Ministry of Energy and Natural Resource, TEDAS)
- Nuri Kandemir (Ministry of Energy and Natural Resource, TEIAS)
- M. Kemal Kumtepe (Ministry of Energy and Natural Resource, TEIAS)
- N. Osman Çalışkan (Ministry of Energy and Natural Resource, BEDAS)
- Yaşar Çetin (Ministry of Energy and Natural Resource, TEIAS)
- Murat İlkkahraman (Ministry of Energy and Natural Resource, TEIAS)
- Ayten Tuygun (Directory General for Turkish Electricity Generation and Transmission Corp.)
- Dr.Menekşe Keski (Ministry of Environment and Forestry)
- Dr.Rukiye Doğanyiğit (Ministry of Environment and Forestry)
- Neşe Çehreli (Ministry of Environment and Forestry)
- Kemal Kurusakız (Ministry of Environment and Forestry)
- Prof.Dr. Altan Acara (National Project Coordinator)

Emission Research and Monitoring Task Team

Dr. Sönmez Dağlı, Coordinator, STRCT-MRC

- Fehim İşbilir (STRCT-MRC)
- Kemal Kurusakız (Ministry of Environment and Forestry)
- Dr.Menekşe Keski z (Ministry of Environment and Forestry)
- Dr.Pelin Aksu (Ministry of Agriculture and Rural Affairs)
- Taylan Kıymaz (State Planning Organization)
- Derya Şahin (Ministry of Environment and Forestry)
- İzaydaş A.Ş.
- Türkiye Çimento Müstahsilleri Birliği
- Donkasan
- Kocaeli Sanayiciler Odası
- Prof.Dr. Altan Acara (National Project Coordinator)

6.13.2. Chambers of Industry with environmental / waste departments

The major industrial interest representation in Turkey is the The Union of Chambers of Commerce, Industry, Trade and Commodity Exchange of Turkey (TOBB).

In some of the City Chambers affiliated with the Union of Chambers and Commodity Exchanges of Turkey, there are departments of environment working on the environmental issues. These are:

Istanbul Chamber of Industry http://www.iso.org.tr/
Bursa Centre of Environment http://www.bcm.org.tr/
Adana Chamber of Industry www.adaso.org.tr
Ankara Chamber of Industry http://www.aso.org.tr
Denizli Chamber of Industry www.dso.org.tr
Aegean Regional Chamber of Industry www.ebso.org.tr
Eskisehir Chamber of Industry www.eso.org.tr
Gaziantep Chamber of Industry www.gso.org.tr
Istanbul Chamber of Commerce www.tr-ito.com
Kayseri Chamber of Industry www.kayso.org.tr
Kayseri Chamber of Commerce www.kayserito.org.tr
Kocaeli Chamber of Industry www.kosano.org.tr
Konya Chamber of Industry www.kso.org.tr
Konya Chamber of Commerce www.kto.org.tr

6.13.3. Relevant sectoral and scientific professional associations

- Turkish Electricity Producers Union
- Turkish Electricity Industry Association.
- Turkish Cement Manufacturers' Association
- Turkish Chemical Manufacturers Association
- Turkish Powder Metallurgy Association
- Turkish Employers' Association of Metal Industries (MESS).
- Federation of Turkish Food and Beverages Industry Associations
- Turkish Society of Toxicology
- Steel Producers Association Website: www.dcud.org.tr
- Rolling Mills Union of Turkey. Website: www. haddecilerdernegi.org
- Turkish Steel Pipe Manufacturers Association. Website: www.cebid.org.tr
- Metal Heat Treatment and Manufacturers Association. Website: www.misad.org.tr